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# Accepted Manuscript

The association between economic uncertainty and suicide in the short-run

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# The Association between Economic Uncertainty and Suicide in the Short-Run

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### Abstract

*Rationale:* Previous research has shown that uncertainty can affect mental health, and that unemployment and economic recessions are associated with increased suicide rates.

*Objective:* The objective of this article was to examine whether daily fluctuations in economic uncertainty can result in short-term spikes in the number of suicides. While existing evidence has focused on medium- and long-term effects of economic conditions on suicide, this study examined immediate daily deviations from the background general trend.

*Methods:* We used daily suicide data from England and Wales that were matched to a daily economic policy uncertainty index over the period 2001-2015. We followed an econometric approach to examine the impact of uncertainty on suicides, controlling for unemployment rates.

*Results:* We found that a spike in daily economic uncertainty leads to an immediate, yet short-lived, impact on suicides. A one-day lag also has a positive effect, but there is no effect on subsequent days. The impact appears to be stronger for males than for females. Results are robust to different empirical approaches and model specifications.

*Conclusions:* Overall, our study suggests that economic uncertainty may lead to an increase in the risk of suicide. This immediate effect indicates that uncertainty acts as a trigger, and is unlikely to be the sole cause of suicide, which reflects existing evidence on the impulsive nature of some suicides. This highlights the need to reduce 'access to means', and the importance of the timing of suicide prevention measures.

*Keywords:* Suicide; economic uncertainty; daily variation

## 1. Introduction

Suicide is the second most common cause of death at ages 15-29 years and the eleventh cause of death overall, with approximately 800,000 suicides globally every year (WHO 2018). In England and Wales alone, there are more than 4,000 suicides annually (Office for National Statistics 2017).

Existing literature has examined the link between economic conditions and health or health-related behaviours. Some studies have provided evidence on the negative effects of expansions (Gerdtham and Ruhm 2006; Ruhm 2000; Tapia Granados 2005; Neumayer 2004), while others have shown that health may deteriorate during downturns or when income decreases (Ettner 1996; Stuckler et al. 2009; Vondra et al. 2013). The effects are often mixed and vary by setting or type of outcome, and they may also depend on the length of the business cycle (Ruhm 2000). To some extent, behaviours can explain changes in health. For example, alcohol consumption decreases during downturns, possibly due to an income effect, which appears to outweigh any increases due to stress (Ettner 1996; Ruhm and Black 2002). Similarly, reduction in smoking and physical activity is also reported during expansions (Ruhm 2005), while evidence on weight and BMI is mixed (Böckerman et al. 2007; Jónsdóttir and Ásgeirsdóttir 2014; Charles and DeCicca 2008).

While there is often conflicting evidence on the impact of recessions on physical health or health-related behaviours, the evidence on mental health appears to be clearer, with most studies reporting that economic downturns have a negative effect particularly on mental health (see for example Riumallo-Herl et al. 2014; Gili et al. 2013; McInerney and Mellor 2012). Such mental effects, that can be attributed, among others, to exposure to economic stress and a worsening of relative income, are often more prevalent for those with worse employment prospects (Charles and DeCicca 2008).

Suicide is an important health outcome of fluctuations in economic conditions. Extensive literature studies whether and to what extent the risk of suicide is linked to unemployment and economic recessions. During the recent financial crisis, areas in England with high increases in unemployment also demonstrated large increases in suicide rates (Barr et al. 2012). Similarly, Coope et al. (2014) argue that economic hardship and unemployment in England and Wales led to an increase in suicides for males, but did not find a similar effect for females. A number of studies have shown a similar impact in other EU countries, especially in EU countries that recently experienced serious financial challenges. Using an interrupted time series approach, Lopez Bernal et al. (2013) and Branas et al. (2015) showed that suicides increased during economic downturns in Spain and Greece, respectively. Such a link was also reported in Italy (De Vogli et al. 2013). In Ireland, another country that experienced serious financial difficulties, there was an increase in suicides and self-harm (Corcoran et al. 2015). Antonakakis and Collins (2015) examined the impact of fiscal austerity on suicide mortality in Greece, Ireland, Italy, Spain, and Portugal. They report a causal effect, which is observed in the short, medium, and long term. According to their findings, the effects vary by gender, age, and time. Furthermore, a study of 20 EU countries showed that job loss affected the number of male suicides during recessions (Reeves et al. 2015), which is largely confirmed by a recent review (Margerison-Zilko et al. 2016). Nevertheless, there is evidence that unemployment safety nets and social capital can protect from these negative effects (Norström and Grönqvist 2015; Reeves et al. 2015; Stuckler et al. 2009). According to findings from the US, suicides demonstrate counter-cyclical trends (Ruhm 2000), with suicides often increasing with unemployment rates (Reeves et al. 2012) or as a result of foreclosures (Houle and Light 2017). Suicides also constitute an important exception with regards to increased overall mortality during expansions (Tapia Grandos 2005). However, in a recent study, Harper and Bruckner (2017) showed that there is little

evidence the Great Recession affected suicide trajectories in the US, which is in line with Harper et al. (2015) who found limited evidence of any strong effect of economic downturns on suicide mortality. These are not the only studies that did not report a strong positive link between recessions or unemployment and suicides (Neumayer 2005; Saurina et al. 2013; Blasco-Fontecilla et al. 2012).

Apart from the link between recessions or unemployment and worse mental health outcomes (Jofre-Bonet et al. 2018; Bijlsma et al. 2017; Riumallo-Herl et al. 2014; Martin-Carrasco et al. 2016), the existing literature has also extensively covered how *fear* of job loss (i.e. job insecurity) can lead to mental health problems (Caroli and Godard 2016; Green 2011; Burgard et al. 2009; Ferrie et al. 2005), which suggests that there is a link between mental health and economic uncertainty. Even job insecurity of one's partner can affect mental health (Bünnings et al. 2017; Siegel et al. 2003), an effect that is stronger in single-income households (Bünnings et al. 2017). Becoming unemployed can be related to fear of social stigma and loss of social networks or social role (Gathergood 2005; Clark 2003; Jahoda 1981), and empirical evidence suggests that stress related to maintaining social status can lead to suicide (Kerr 2008).

Over and above the robust correlation between economic recession and suicide (which happens over a time scale of many months or even years), suicidality might also include an element of impulsivity. According to the WHO, "many suicides happen impulsively in moments of crisis" (WHO 2018). Indeed, there is evidence in the literature on the important role of impulsivity in suicides (Baca-Garcia et al. 2005; Baca-Garcia et al. 2001; Yen et al. 2004; Zouk et al. 2006). A quarter of nearly-lethal suicide attempt survivors made their decision within five minutes (Simon et al. 2001), and more than 90% of people who attempt suicide and survive eventually die of other causes (Miller and Hemenway 2008).

The immediate impact of negative financial news can have various effects on people's health-related behaviour. For example, suicides were negatively correlated with economic activity in New York City, but not with stock market volatility (Nandi et al. 2012); while the number of motor vehicle collisions increased on the first and second day after the announcement of austerity measures (Vandoros et al. 2014). In terms of the impact of uncertainty, a previous study suggests that increased levels of economic uncertainty are associated with a spike in motor vehicle collisions, an effect attributed to distraction, stress, and sleep deprivation (Vandoros et al. 2018). Whether such short-term increases also apply to suicide has not yet been examined.

Overall, the literature has shown that financial turbulence can lead to deterioration of mental health; that suicides increase during recessions; that job insecurity can affect mental health; that suicides can often happen impulsively; and that daily fluctuations in economic uncertainty can affect other health-related behaviours. It is therefore reasonable to hypothesise that daily fluctuations in economic uncertainty may be associated with suicide.

In light of this background, the objective of this study is to study the *immediate* impact of economic uncertainty on suicide. While previous studies have examined medium- and long-term effects of economic conditions on suicide (Barr et al. 2012; Coope et al. 2014; Antonakakis and Collins 2015; Norström and Grönqvist 2015; Ruhm 2000; Reeves et al. 2012; Harper and Bruckner 2017; Harper et al. 2015), this study examines immediate daily deviations from the background general trend. In other words, can suicide be triggered by daily fluctuations in economic uncertainty?

This article contributes to the literature by (a) examining the immediate effect of economic uncertainty on suicides; (b) examining the impact of uncertainty rather than actual negative events that have already materialised (such as unemployment or recessions) that is often the focus of existing studies; (c) studying particular daily effects rather than long-term

fluctuations, the start point of which is often difficult to identify; (d) understanding the factors that contribute to suicide, its timing and trigger and (e) helping design and implement prevention strategies by identifying periods with higher risk of suicide and highlighting the importance of reducing ‘access to means’. Our study thus adds to previous studies that found a link between fear of job loss and deterioration of mental health (Caroli and Godard 2016; Bünnings et al. 2017; Green 2011; Burgard et al. 2009; Ferrie et al. 2005).

## 2. Data and Methods

We obtained detailed data on the daily number of suicides for England and Wales stratified by gender and year over the period 2001-2015 from the Office for National Statistics (ONS) following a data request. Uncertainty was captured by a daily Economic Policy Uncertainty Index, which is compiled and published by Economic Policy Uncertainty (2018). This index shows the daily level of economic uncertainty in the United Kingdom and is compiled based on the digital archives of the Access World News NewsBank service, using terms and key words mentioned in UK newsarticles. This database covers over 650 newspapers, including large national and small local newspapers across the UK. According to the academics who constructed the index, they take into account three sets of terms. The first set of terms relates to the economy, the second relates to uncertainty, and the third relates to spending, deficit, taxes, etc. Figure 1 shows how the uncertainty index fluctuates over time, including the study period. For a detailed explanation of how the index is created see Baker et al. (2016), and Economic Policy Uncertainty (2018).. We also collected data on the unemployment rate in England and Wales (provided by the Office for National Statistics [2018a] and reported monthly, and total population, also provided by the Office for National Statistics [2018b]). None of the variables used had any missing observations.

With regards to the empirical approach, we first tested the appropriateness of a time series AR or GARCH model (see Section 3) and concluded that an ordinary least squares (OLS) regression analysis would be suitable for this analysis.

Equation (1) presents the empirical OLS model:

$$\begin{aligned} suicide = & \beta_0 + \beta_1 \ln uncertainty + \beta_2 unemployment + \beta_3 population + \sum_{k=4}^{10} \beta_k day \\ & + \sum_{m=11}^{22} \beta_m month + \sum_{q=23}^{37} \beta_q year + \varepsilon \quad (1) \end{aligned}$$

The dependent variable, *suicide*, is the number of suicides per day. The main explanatory variable, *lnuncertainty*, is the natural logarithm of the daily uncertainty index. We controlled for population (variable *population*) and the monthly unemployment rate (variable *unemployment*) due to the previously reported relationship between unemployment and suicide in England and Wales (Barr et al. 2012; Coope et al. 2014). We also included day of the week, month, and year dummy variables to account for daily patterns, seasonality, and year trends.  $\varepsilon$  is the error term.

We made the assumption that the population does not habituate to the sustained stressor, and that a week  $t$  with high uncertainty has no influence on the risk of suicide in the following week  $t+1$ . This is in line with our assumption that suicide is unlikely to be the result of economic uncertainty alone, and uncertainty acts as a trigger instead. This is underpinned by the often impulsive nature of suicide (WHO 2018), the short time period of a few minutes within which many suicide survivors made their decision (Simon et al. 2001), and that 90% of survivors eventually die of other causes (Miller and Hemenway 2008). Nevertheless, we checked whether counts of suicide deviate from their expected value when economic uncertainty deviates from its expected value, to see whether our previous assumption is reasonable. We therefore ran separate regressions per year, to see whether the effect is existent or high in years with high levels of uncertainty, and low/non-existent in

years of low uncertainty. Indeed, there is no consistent pattern of the effect being more evident in high-uncertainty years, so we found no evidence against our assumption that the population does not habituate to the sustained stressor. Results of this check can be found in Section 3.

There is at least one male suicide per day throughout the study period, but there are some days in the sample with zero female suicides. Therefore, for female suicides, we also considered Poisson, negative binomial and tobit models that account for zero truncation (results are presented in Section 3).

[Insert Table 1 about here]

[Insert Figure 1 about here]

### 3. Results

Summary statistics are presented in Table 1. There were on average 9.99 male and 3.23 female suicides per day, with a total of 13.22. The economic uncertainty index ranged from 0 to 1,645, illustrating the large variation in economic uncertainty over the study period.

Due to the times series nature of the data, we first considered following a time series AR or GARCH approach, but basic time series analysis indicated that this was not necessary. The Durbin-Watson statistic of the baseline model was 1.92, indicating that there were no first order autocorrelation problems in the residuals, and the correlogram (Figure A1 in the Online Appendix) confirmed that there were no higher-order autocorrelation issues, as the coefficients of the autocorrelation and partial autocorrelation functions are statistically insignificant. Importantly, according to the ARCH-LM test, there are no ARCH effects present ( $F$ -stat=0.74;  $p$ -value=0.73), so a GARCH model was not necessary. We therefore followed an ordinary least squares (OLS) econometric approach.

Results of the baseline model are presented in Table 2. We first estimated a model with only uncertainty as an explanatory variable (column 1) and subsequently estimated models controlling for day of the week, month, and year (column 2), as well as unemployment rate and population (column 3). Across all three models, the coefficient of the natural logarithm of uncertainty is positive and statistically significant at the  $\alpha=1\%$  level. The coefficient of the model with only uncertainty as an explanatory variable is 0.07, suggesting that an increase in the economic uncertainty index by 1% is associated with an increase in the number of suicides per day by 0.0007 (column 2). When adding day of the week, month, and year dummies, the coefficient becomes smaller (0.049), but still strongly statistically significant. Results suggest that an increase in the economic uncertainty index by 1% is associated with an increase in suicides by 0.00049 per day. The coefficient of the uncertainty variable remains the same when controlling for unemployment and population (column 3). The coefficients of population and the unemployment rate are statistically insignificant.

[Insert Table 2 about here]

Table 3 presents results by gender. While both male and female suicides are affected by economic uncertainty, the size of the effect varies significantly by gender. For females, the coefficient of the main explanatory variable is about 0.015 and statistically significant at the 1% level in all three specifications. The magnitude for males is more than double that of females, ranging between 0.034 and 0.054 depending on the specification. Males account for three quarters of all suicides in our sample and largely drive the overall increase in suicides associated with increased economic uncertainty. The coefficients of the unemployment rate and population are again statistically insignificant.

[Insert Table 3 about here]

Furthermore, individuals may learn about something reported in the news late in a day, or even the day after. To capture this, we also introduced a model with seven lags, to explore whether the effects of uncertainty can have a lasting effect over the first few days, up to a week. Results are reported in Table 4, where the coefficient of a one-day lag of uncertainty is positive and statistically significant. Interestingly, the magnitude of the effect of a one-day lag of uncertainty is not much smaller than that of the same day's uncertainty (0.049 and 0.045 on the same day and following day, respectively). However, the coefficients of lags 2 to 7 are statistically insignificant, indicating that the effect of uncertainty on suicide lasts up to a day. We further explored the effect of lagged uncertainty by considering each lag in separate equations (Table 5). Once again, only the coefficient of a one-day lag is statistically significant. All other models that include lags 2 to 7 have insignificant coefficients.

[Insert Table 4 here]

[Insert Table 5 here]

In sensitivity analyses, we considered a log-log model, where both uncertainty and suicides enter the model in logarithmic form (Table A1 in the Online Appendix). The uncertainty index is positive and statistically significant, as in the other models. Another functional form, where uncertainty and suicides enter the model in levels (rather than logarithmic form) also confirm the results of the baseline model (Table A2 in the Online Appendix).

As discussed in Section 2, we ran separate regressions per year, to see whether the effect is existent or high in years with high levels of uncertainty, and low/non-existent in years of low uncertainty. The results of all 15 regressions are summarised in Table A3 in the

Online Appendix. Columns 2 and 3 show the average and maximum uncertainty, respectively, in each year, which is an indication of whether there was unusually high uncertainty. Column 4 shows the coefficient of the explanatory variable for each year, which is the logarithm of uncertainty. The dependent variable is again the number of suicides. Indeed, we did not find any consistent pattern of the effect being stronger in high-uncertainty years compared to other years. For example, 2008 and 2011 demonstrated high levels of economic uncertainty, but the coefficient of uncertainty is statistically insignificant. Likewise, 2006, 2015 and 2015 demonstrated a statistically significant relationship between uncertainty and suicides, even though uncertainty was relatively low in those years. We thus do not find evidence that only unexpected increases in economic uncertainty correspond with a rise in suicides.

Female suicides include observations that take the value of zero on some days in the sample, so we also considered count models. Results of the Poisson, negative binomial and tobit models are presented in Tables A4, A5, and A6 respectively, in the Online Appendix. There were 239 observations with the value of zero, that accounted for 4.36% of observations, so zero-inflated models were unnecessary.

The coefficient of the natural logarithm of uncertainty was positive and statistically significant in the Poisson model (coef. = 0.005;  $p$ -value=0.063). The deviance goodness of fit chi-squared was 6063.05 ( $p$ -value=0.000), but the Pearson goodness of fit was 5551.24 ( $p$ -value=0.1521), so it is not clear whether the Poisson model was appropriate. We therefore tested a negative binomial regression. A likelihood ratio test does not provide any evidence that the negative binomial model is preferable to the Poisson model (chibar-squared = 0.55;  $p$ -value=0.230). Comparing the fit of the Poisson and negative binomial approaches, there are negligible differences in the Akaike Information criterion (*AIC*) (Poisson: *AIC*=21707; *BIC*=21931. Negative binomial: *AIC*=21708; *BIC*=21940). In any case, the results of the

negative binomial and Poisson models are practically identical (coef=0.005;  $p$ -value=0.062 in both cases) and results hold the same interpretation. The Tobit model also demonstrates a positive relationship between uncertainty and female suicides ( $p$ -value=0.053). The *AIC* and *BIC* are larger for the OLS and Tobit models compared to the Poisson and negative binomial ones (OLS: *AIC*=22104; *BIC*=22329. Tobit: *AIC*=22166; *BIC*=22397). This indicated that the latter two may provide a better fit. In any case, the three count models and the OLS model suggest that there is a positive association between economic uncertainty and female suicides. The main difference is that the  $p$ -value of the coefficient is just below the 5% level in the OLS model and just over this level in the count models. Therefore, regardless of which model we choose to trust, the interpretation remains largely the same.

#### 4. Discussion

Results from this study suggest that there is an association between daily economic uncertainty and suicides in England and Wales. This association is short-lived and is limited to the same and next day only. On average, a 1% increase in the economic policy uncertainty index is associated with 0.00049 more suicides per day. Although the magnitude of the effect of economic uncertainty on suicide may initially look small, in practice, uncertainty fluctuations can have a sizeable effect on suicides when considering the great scale of variability of the uncertainty index, as seen in Figure 1. The index fluctuates between 0 and 1645.01 over the study period, and multi-fold increases in uncertainty (say by 500% or more) are not unusual. An increase in economic uncertainty by one standard deviation from the mean is expected to lead to an additional 11 suicides in England and Wales per year, while a five-fold increase would mean an additional 1.7 suicides per week, or 89 more suicides per year. Economic uncertainty is of course just one of many factors associated with suicide, and

thus only partly explains its variation. Nevertheless, our results show that the link between the two is robust and strongly statistically significant, despite the small magnitude.

Our results show that the effect of uncertainty on suicides is short lived and appears to be limited to the same day and the day after only, and there is no effect on subsequent days. This short-lived effect indicates that uncertainty acts as a trigger and is unlikely to be the sole cause of suicide, which echoes existing evidence on the impulsive nature of some suicides (Baca-Garcia et al. 2005; Baca-Garcia et al. 2001; Yen et al. 2004; Zouk et al. 2006; Simon et al. 2001; Miller and Hemenway 2008). Furthermore, the effect of the same-day's uncertainty is not much larger than that of the following day's uncertainty. There are a couple of plausible explanations for this. The first reason is that there may be a lag in news reaching people. The second reason is related to sleep: Worries triggered by economic uncertainty might keep someone up at night, causing sleep deprivation which is a suicide risk factor (Bernert et al. 2017; Cukrowicz et al. 2006); although it might not always be clear whether this would be a short-term or exclusively long-term risk factor. These findings are in line with previous studies on the impact of economic uncertainty and bad financial news on road traffic accidents that have also shown that the effect is limited to the first two days (Vandoros et al. 2018; Vandoros et al. 2014). Our findings add to this literature and further demonstrate that increases in suicides as a result of financial concerns can happen in the very short-term.

We found a positive effect of uncertainty on both female and male suicides, but the magnitude is higher for males, who also have much higher suicide rates (3:1 male to female ratio in our sample). However, we do not have information on suicide attempts, which is important to better understand any gender differences. Existing evidence suggests that males are more likely to resort to lethal means of suicide (Värnik et al. 2008), while there are more female than male suicide attempts (Schmidtke et al. 2004). Previous research has also shown that males are more impulsive than females (Simon et al. 2001), which may also partly

explain the larger magnitude that we found for males. Overall, women might be more susceptible to short term uncertainty, but their behaviour may not be fully captured by our data, which only include completed suicides but not attempts.

It is worth noting that the impact of the unemployment rate on suicides is statistically insignificant. While there are many studies linking worse economic conditions to suicide (Barr et al. 2012; Coope et al. 2014; Antonakakis and Collins 2015; Norström and Grönqvist 2015; Ruhm 2000; Reeves et al. 2012), not all studies have reported a countercyclical suicide mortality. According to Harper and Bruckner (2017) there is not much evidence that the Great Recession in the US affected suicide trends, while another study found limited evidence of any strong effect of recessions on suicides (Harper et al. 2015). Furthermore, Neumayer (2004) reports that suicide mortality decreased during recessions in Germany. Evidence from England shows no overall statistically significant increase in suicides during the 2008-2010 recession, but a positive association in some regions, when considering them separately (Saurina et al. 2013). A cross-country analysis demonstrates that suicides might be positively correlated, negatively correlated, or uncorrelated with GDP per capita, depending on the country (Blasco-Fontecilla et al. 2012). The effect of unemployment on risk of suicide appears to be mitigated by mental health services, public health interventions, and other preventive measures. According to lessons from the literature, the insignificant relationship between economic uncertainty and suicide in our study might have been a result of employment protection policies (Stuckler et al. 2009; Norström and Grönqvist 2015). This could also be the result of conducting the analysis at the country level, and a significant effect might have been present in particular regions. However, daily suicide data are not available at small geographic area levels, and economic uncertainty is reported at the UK level.

These results add to existing evidence on a link between financial conditions (such as unemployment and recessions) and suicide (Barr et al. 2012; Coope et al. 2014; Antonakakis

and Collins 2015; Norström and Grönqvist 2015; Ruhm 2000; Reeves et al. 2012; Harper and Bruckner 2017; Harper et al. 2015) or other health-related behaviours such as increased substance and alcohol use (Mattei et al. 2017; Dom et al. 2016), which can be related to mental health issues. They also add to previous studies on the relationship between economic conditions and health in general (Gerdtham and Ruhm 2006; Ruhm 2000; Tapia Granados 2005; Ettner 1996; Stuckler et al. 2009).

This short-term effect is similar to that in previous research that demonstrates the immediate and short-lived effect of negative financial news on health-related behaviour (Vandoros et al. 2014) and how accidental mortality also responds to immediate economic uncertainty shocks (Vandoros et al. 2018). While existing studies often focus on the effects of actual bad financial developments (such as unemployment and recessions) on health, our study examines the impact of uncertainty on suicide, adding to previous studies that found a link between fear of job loss and deterioration of mental health (Caroli and Godard 2016; Bünnings et al. 2017; Green 2011; Burgard et al. 2009; Ferrie et al. 2005).

#### *4.1 Limitations*

A limitation of the study is that the aggregate nature of the data (total number of suicides per day) does not allow us to examine whether any particular groups are at higher risk. Furthermore, we do not have information on detailed circumstances leading up to each suicide (as one would get in a coroner's report). A proportion of other deaths (such as fatal car crashes) might, in fact, be suicide, implying potential misclassification. However, misclassification of the outcome is unlikely to fluctuate daily and thus may not bias the relationship between daily uncertainty index suicide counts. In addition, other determinants of suicide might not be included in the model. While we do capture economic factors at the country level, we do not have any information on individual-specific conditions that might

lead to suicide. Such factors include separation (Wyder et al. 2009), divorce (Yip et al. 2015), bereavement (Pitman et al. 2014), post-traumatic stress (Conner et al. 2014), bullying (Mueller et al. 2015), and others; these cannot be captured by our model that focuses on the total number of suicides per day. In order to avoid the possibility of anyone being identified in the dataset, the data source does not include individual characteristics such as age, which is yet another limitation of the lack of individual-level data. Finally, the lack of information on attempts restricted our analysis to completed suicides only.

#### *4.2 Policy Implications*

There are a number of suicide prevention strategies available (Conwell 2014), and suicide surveillance efforts can even take advantage of real-time internet data (Bruckner et al. 2014). According to previous research, investing in labour market participation programmes helps reduce suicides (Stuckler et al. 2009), and unemployment protection can play a similar role (Norström and Grönqvist 2015). Other labour market interventions can also help prevent mental health problems (Reeves et al. 2017). In order to optimally design interventions, it is important to understand the factors that contribute to suicide, its timing, and trigger effects. This article underlines the trigger effects of financial uncertainty and helps understand the etiologic period of suicide. Negative financial news is unlikely to be a sole cause of suicide, but may instead act as a triggering factor for individuals who may or may have not considered suicide for a longer period. However, this immediate effect of uncertainty underlines the need to reduce ‘access to means’. For example, recent evidence indicates that regulation of the pesticide paraquat in South Korea, where ingestion of pesticides accounts for one-fifth of suicides, is associated with a reduction in pesticide-associated suicides (Cha et al. 2016). Other strategies such as firearms control (Miller and Hemenway 2008; Lewiecki and Miller 2013; Grossman et al. 2005) may also provide a compulsory cooling-off period

before guns can be purchased. Finally, small nudges like packaging paracetamol tablets individually instead of loose packaging in bottles (Hawton et al. 2013) may cause delay and thus contribute to reducing suicide rates.

With regards to economic uncertainty specifically, prevention strategies can be implemented during times of acute economic uncertainty. During such periods, campaigns by public health services can intensify via advertisements and social media, reaching out to people to encourage them to seek help and make them aware of helplines and other support provided by health and community services. Being aware that some suicides might be more likely to occur on such days can help reallocate the intensity of some campaigns to match times that are more crucial, and thus maximise the expected effect of each such activity – making such strategies more efficient and cost-effective.

## 5. Conclusions

This article examined the short-term association between economic uncertainty and the daily number of suicides in England and Wales. Results show that an increase in economic uncertainty is associated with an immediate yet short-lived increase in the number of suicides on the same and next day. We found a positive effect of uncertainty on both female and male suicides, but the magnitude is higher for males. Our results add to existing evidence on the impact of economic conditions on suicide, and on the link between uncertainty and mental health. As economic uncertainty is unlikely to be the only cause of suicide, this might act as a trigger in moments of crisis. Our findings therefore highlight the importance of access to means and shed light on the timing of preventive measures.

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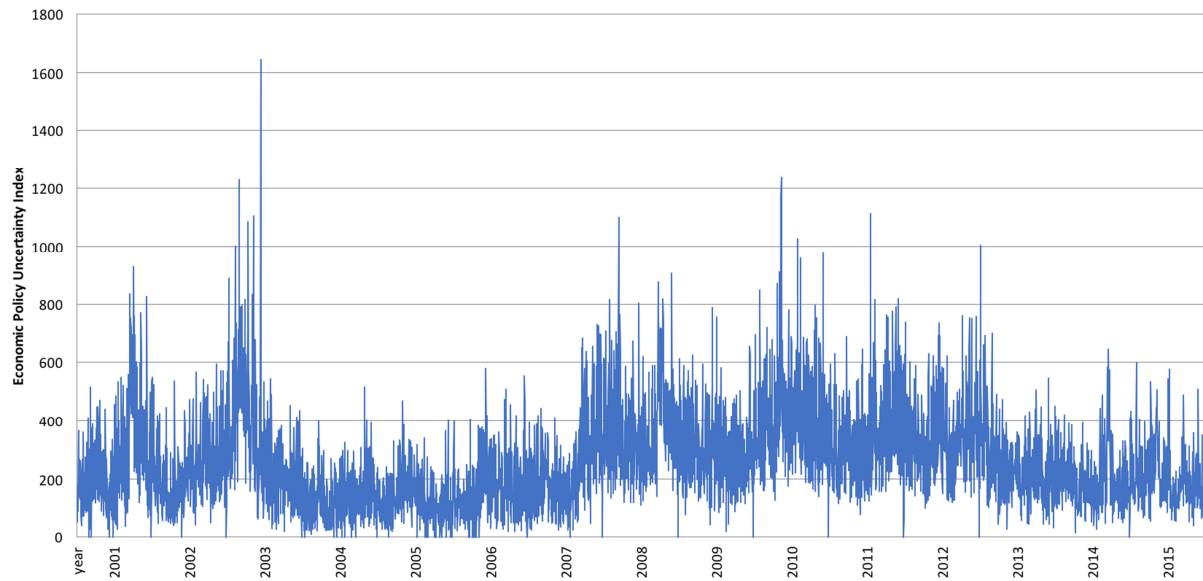


Figure 1 – Daily Economic Policy Uncertainty Index, 2001-2015

**Fig. 1.** Daily Economic Policy Uncertainty Index, 2001-2015. *Source:* The authors, from data provided from “Measuring Economic Policy Uncertainty”, 2016, by Scott R. Baker, Nicholas Bloom and Steven J. Davis at [www.PolicyUncertainty.com](http://www.PolicyUncertainty.com).

Table 1. Summary Statistics, 2001-2015

Variable ( <i>N</i> =5478)	Mean	Std. Dev.	Min	Max
Suicides per day, total	13.215	3.878	2	30
Suicides per day, females	3.225	1.838	0	12
Suicides per day, males	9.990	3.354	1	28
Daily uncertainty index	261.690	160.905	0	1645.01
Unemployment rate	6.139	1.272	4.7	8.5
Population (thousands)	54,900	1,759	52,400	57,900

**Table 2.** The impact of the logarithm of the economic uncertainty index on the number of suicides in England & Wales, 2001-2015.

Dependent variable: Number of suicides

	(1)	(2)	(3)
ln(uncertainty)	0.070*** [0.015]	0.049*** [0.015]	0.049*** [0.015]
unemployment rate			-0.147 [0.218]
population			0.013 [0.050]
day of week dummies	no	yes	yes
month dummies	no	yes	yes
year dummies	no	yes	yes
Constant	12.859*** [0.091]	12.933*** [0.292]	12.981*** [2.778]
Observations	5,478	5,478	5,478
$R^2$	0.003	0.074	0.074
$F$	21.92	13.50	13.14

*Note.* Robust standard errors in brackets. Column numbers refer to different specifications. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 3.** The impact of the economic uncertainty index (log) on the number of suicides by gender in England & Wales, 2001-2015.

Dependent variable: Number of suicides

	(1)	(2)	(3)	(4)	(5)	(6)
	Females	Females	Females	Males	Males	Males
ln(uncertainty)	0.016**	0.015**	0.015**	0.054***	0.034***	0.034***
	[0.008]	[0.007]	[0.007]	[0.012]	[0.012]	[0.012]
unemployment rate			0.020			-0.167
			[0.108]			[0.185]
population			-0.016			0.029
			[0.025]			[0.044]
day of week dummies	no	yes	yes	no	yes	yes
month dummies	no	yes	yes	no	yes	yes
year dummies	no	yes	yes	no	yes	yes
Constant	3.144***	3.123***	3.851***	9.715***	9.811***	9.130***
	[0.046]	[0.140]	[1.395]	[0.073]	[0.256]	[2.409]
Observations	5,478	5,478	5,478	5,478	5,478	5,478
$R^2$	0.001	0.032	0.032	0.002	0.060	0.060
$F$	4.345	5.686	5.514	21.43	10.43	10.17

Note. Robust standard errors in brackets. Column numbers refer to different specifications. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 4.** The impact of lagged economic uncertainty index (in logs) on the number of suicides in England & Wales, 2001-2015. All lags in the same equation.

Dependent variable: Number of suicides	
ln(uncertainty) 1-day lag	0.045*** [0.016]
ln(uncertainty) 2-day lag	-0.008 [0.017]
ln(uncertainty) 3-day lag	0.000 [0.018]
ln(uncertainty) 4-day lag	0.008 [0.019]
ln(uncertainty) 5-day lag	0.020 [0.019]
ln(uncertainty) 6-day lag	0.011 [0.018]
ln(uncertainty) 7-day lag	-0.029 [0.022]
unemployment rate	-0.136 [0.217]
population	0.003 [0.051]
day of week dummies	yes
month dummies	yes
year dummies	yes
Constant	13.547*** [2.797]
Observations	5,471
$R^2$	0.074
$F$	11.13

*Note.* Robust standard errors in brackets. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 5.** The impact of lagged economic uncertainty index (log) on the number of suicides.

	Lag period						
	1 day	2 days	3 days	4 days	5 days	6 days	7 days
ln(uncertainty)	0.044*** [0.015]	-0.007 [0.017]	0.002 [0.018]	0.008 [0.019]	0.020 [0.018]	0.013 [0.018]	-0.025 [0.022]
unemployment rate	-0.145 [0.218]	-0.138 [0.218]	-0.137 [0.218]	-0.137 [0.218]	-0.138 [0.218]	-0.136 [0.218]	-0.128 [0.218]
population	0.012 [0.051]	0.012 [0.051]	0.009 [0.051]	0.008 [0.051]	0.008 [0.051]	0.006 [0.051]	0.005 [0.051]
day of week dummies	yes	yes	yes	yes	yes	yes	yes
month dummies	yes	yes	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes	yes	yes
Constant	13.111*** [2.784]	13.287*** [2.786]	13.446*** [2.785]	13.473*** [2.789]	13.394*** [2.792]	13.557*** [2.793]	13.741*** [2.800]
Observations	5,477	5,476	5,475	5,474	5,473	5,472	5,471
R-squared	0.073	0.072	0.073	0.073	0.073	0.073	0.073
F-statistic	13.02	12.73	12.77	12.76	12.79	12.76	12.81

Robust standard errors in brackets. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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**Ethics approval:** The study did not involve human subjects, so ethics approval was not required.

**Highlights**

- Previous studies have examined long-term effects of economic conditions on suicide.
- We studied the association between daily economic uncertainty and suicides.
- Uncertainty is associated with immediate suicide increases in England and Wales.
- Results highlight the role of access to means and the timing of preventive measures.