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The short-term impact of economic uncertainty on motor vehicle collisions

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ABSTRACT

Stress and anxiety lead to attention loss and sleep deprivation and may reduce driving performance, increasing the risk of motor vehicle collision. We used evidence from a natural experiment to examine whether daily changes in economic uncertainty, potentially leading to attention or sleep loss, are associated with collisions in Great Britain. Daily data from the economic policy uncertainty index, derived from analysis of daily UK newspapers, were linked to the daily number of motor vehicle collisions in Great Britain over the period 2005–2015, obtained from the Department for Transport. Exploiting daily variations in economic uncertainty, we used a GARCH approach to model daily rates of motor vehicle collisions as a function of economic uncertainty, controlling for month and day of the week, monthly unemployment rates and weekly unleaded petrol prices. A spike in the daily economic uncertainty index was associated with an immediate increase in the number of motor vehicle collisions. Results were robust to various sensitivity analyses. Overall, daily increases in economic uncertainty are associated with short-term spikes in motor vehicle collisions. Preventive and traffic control measures may need to increase during periods of economic uncertainty.

1. Introduction

Motor vehicle collisions have risen to the top ten causes of death and are the leading cause of death at ages 15–29 years globally, with 1.25 million fatalities occurring every year (WHO, 2015). In Great Britain, there has been a downward trend in collisions over the last years, with the number of those involving injury decreasing by 30% from 2005 (198,735 collisions) to 2015 (140,056 collisions) (Fig. 1). Similarly, the number of fatal collisions decreased by 45% over the same period, from 2913 (3201 fatalities) in 2005 to 1616 (1730 fatalities) in 2015 (UK Department for Transport, 2016a; UK Department for Transport, 2016b). While much discussion focuses on road traffic control and safety standards, little is known about how the social and economic environment might influence the short-term risk of motor vehicle collisions.

There are humans behind the wheel (at least for the time being), and their mistakes, misjudgements or traffic violations can lead to collisions. Cognitive distraction, which refers to thoughts that absorb the driver's attention and compromise their ability to drive safely, are believed to be a major cause of collisions (Young and Regan, 2007; Beanland et al., 2013). Factors linked to cognitive distraction and that can lead to collisions include stress and anxiety (Beanland et al., 2013; Cartwright et al., 1996; Dula et al., 2010; Shahar, 2009), anger and frustration (Nabi et al., 2005; Dahlen et al., 2005; Deffenbacher et al., 2001; Underwood et al., 1999) and sleep deprivation (Beanland et al., 2013; Harrison and Horne, 2000; Smolensky et al., 2011; Horne and Reyner, 1995; Gold et al., 1992; Williamson and Feyer, 2000). Such factors can be more common in the presence of economic problems (Hyyppä et al., 1997; Burgard et al., 2012). Furthermore, stressful situations may lead to increased alcohol drinking (Park et al., 2004; Frone, 1999), which constitutes a major collision risk factor (Beanland et al., 2013; Philip et al., 2001; Richter et al., 1986).

Economic uncertainty has recently reached very high levels compared to the past. Since the Global Financial Crisis of 2008, economic policy uncertainty has averaged about twice the level observed over the last 23 years (Economic Policy Uncertainty Index, 2017). While several studies have shown that deaths from collision decline during economic downturns (Stuckler et al., 2012; Stuckler et al., 2009; Ruhm, 2000; Stuckler et al., 2011; Ruhm, 2015; Karanikolos et al., 2013), few studies have examined whether daily fluctuations in economic uncertainty can be a source of stress and distraction that can lead to temporary increases in the risk of collision. Existing evidence, however, suggests a potential causal link. For example, a recent study showed that the number of motor vehicle collisions increased during the first and second day following the announcement of austerity measures in Greece, before returning to previous levels (Vandoros et al., 2014). Thinking

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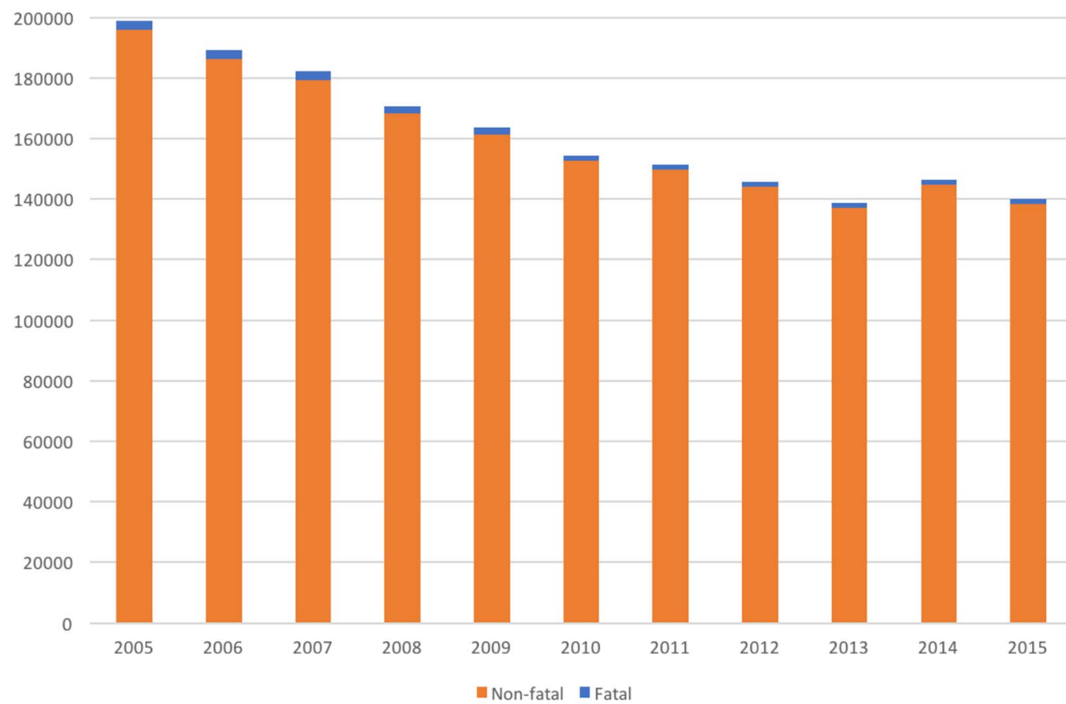

Fig. 1. Annual number of collisions (total, non-fatal and fatal), Great Britain, 2005–2015.
Source: The authors, from Road Safety Data, Department for Transport, 2016a.

about money and income inequality can also reduce social cohesion (Kawachi et al., 1997) and prompt individuals to think more selfishly (Vohs et al., 2006). Consequently, drivers worried about finances in periods of economic uncertainty may demonstrate less regard for pedestrians and other vehicles on the road.

This paper examines the impact of daily changes in economic uncertainty on the rates of collisions in Great Britain. Using a quasi-experimental design, we exploit daily changes in a novel measure of economic uncertainty, the daily UK Economic Policy Uncertainty Index (UK daily Economic Policy Uncertainty Index, 2017). While there is a general downward trend in collisions in the UK, we examine whether increased uncertainty can lead to any short-term deviations (spikes) from this general trend. To our knowledge, this is the first study documenting how changes in economic uncertainty influence the risk of collision.

2. Methods

2.1. Data

We used the daily number of motor vehicle collisions in Great Britain (England, Scotland, Wales), over the 2005–2015 period, obtained from 'Road Safety Data', which are published by the UK Department for Transport (UK Department for Transport, 2016a). The data include collisions on public roads that involved injury and were reported to police (data exclude damage-only collisions). To capture economic uncertainty, we used the Economic Policy Uncertainty Index, as constructed and published by Economic Policy Uncertainty (UK daily Economic Policy Uncertainty Index, 2017). This daily index is compiled based on terms included in UK newspapers daily, based on digital archives of the Access World News NewsBank service covering over 650 UK newspapers, ranging from large national to small local newspapers across the UK. Such reports in the media capture or affect people's expectations on what lies ahead in terms of their finances, thus making them stressed (if the news is bad or involves uncertainty) or distracting them (regardless of whether the reports are positive or negative). For a detailed description of how the data are collected and the index compiled, see Baker et al., (2016) and Economic Policy Uncertainty (UK daily Economic Policy Uncertainty Index, 2017). Monthly unemployment rates for the same period were obtained from the Office for National Statistics (2017), because of the evidence on the impact of unemployment and recessions on collisions (Stuckler et al., 2012; Stuckler et al., 2009; Ruhm, 2000; Stuckler et al., 2011; Ruhm, 2015; Karanikolos et al., 2013). Weekly unleaded petrol prices were provided by the Department for Business, Energy and Industrial Strategy (Department for Business, Energy and Industrial Strategy, 2017). We control for petrol prices because higher prices may affect total traffic volume by making people drive less due to higher costs. This can have two opposite effects on collisions. On one hand, fewer cars on the road means fewer cars at risk of crashing; on the other hand, this might mean less congested streets and an opportunity to speed, thus increasing the chances of collision.

2.2. Analytical approach

We used econometric methods to estimate how daily changes in economic uncertainty relate to daily changes in collisions. An ordinary least squares (OLS) approach was initially selected to examine the relationship between economic uncertainty and collisions. However, autocorrelation can often pose problems with daily series of data. This was confirmed by the Durbin-Watson test [Durbin-Watson statistic = 0.95], and the correlogram of residuals presented in Fig. A1 in the Online Appendix. In addition, an ARCH-LM test indicates the presence of ARCH effects [$F = 353$; $p = 0.000$]. Adding lags to the OLS model may help address autocorrelation problems, but ARCH effects persisted [$F = 9.492$; $p = 0.000$]. In order to address autocorrelation and ARCH effects, we also followed a GARCH (Generalized Autoregressive Conditional Heteroscedasticity) approach (also including lags of the dependent variable), developed by Bollerslev (1986), who extended the model of Engle (1982). The GARCH(1,1) is deemed the preferable (and most parsimonious) model (Bollerslev, 1986; Hansen and Lunde, 2005). Before employing the GARCH approach, we checked whether our series are stationary. Indeed, the Augmented Dickey-Fuller test indicates that the collisions series is stationary [$Z = -31.088$; $p = 0.000$]. In order to

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