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Has the great recession and its aftermath reduced traffic fatalities?

Robert B. Noland*, Yuhan Zhou

Alan M. Voorhees Transportation Center, Edward J. Bloustein School of Planning and Public Policy, Rutgers University, New Brunswick, NJ 08901, United States

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ABSTRACT

An analysis of state-level data from 1984 to 2014 provides evidence on the relationship between economic recessions and US traffic fatalities. While there are large reductions associated with decreases in household median income, other policy variables tend to have additional and in some cases, larger effects. An increase in the inequality of the income distribution, measured by the Gini index, has reduced traffic fatalities. Graduated licensing policies, cell phone laws, and motorcycle helmet requirements are all associated with reductions in fatalities. Other factors include a proxy for medical technology, and access to emergency medical services (based on the percent of vehicle miles traveled in rural areas); reductions in the latter accounted for a substantial reduction in fatalities and is likely another indicator of reduced economic activity. Changes in the road network, mainly increases in the percent of collector roads has increased fatalities. Population growth is associated with increased traffic fatalities and changes in age cohorts has a small negative effect. Overall, results suggest that there has been a beneficial impact on traffic fatalities from reduced economic activity, but various policies adopted by the states have also reduced traffic fatalities.

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1. Introduction

Traffic-related fatalities in the US have declined dramatically since about 2007. Previous research has demonstrated that this effect is partially due to the economic recession that began about that time (Noland and Sun, 2015). The US is not the only country that has experienced substantial declines in traffic fatalities during this time period. Studies have found a correlation in European countries (Yannis et al., 2014) and evidence exists of a similar effect in Great Britain (Lloyd et al., 2016). As the economy has slowly recovered, there is a concern that traffic fatalities may increase to previous levels, and despite the recent reduction the US continues to trail other developed countries that have achieved large reductions in traffic fatalities since the 1970's (Evans, 2014). Adding additional years of data to the previous analysis in Noland and Sun (2015), the impact of economic conditions is evaluated while controlling for other policies and demographic trends that can affect traffic-related fatalities.

These other policies include a range of vehicle safety regulations, safety belt laws, greater enforcement and stiffer penalties for driving while intoxicated, improved emergency management systems, and more recently graduated licensing and cell phone laws (Noland, 2003b; Shope, 2007). Traffic fatalities and crashes have long followed the business cycle, and fatalities have recently increased in line with an improving economy. Early estimates from NHTSA are that 2015 will see an increase in traffic fatalities of 7.7% (NHTSA, 2016a) and the National Safety Council is estimating about a 9% increase for 2016 (National Safety Council, 2016). Despite this, there has been an overall downward trend in fatalities since the peak year of 1972 when 55,000 traffic fatalities occurred.

A negative-binomial panel model is developed with key control variables, including measures of the economy, demographic variables, infrastructure variable, proxies for medical technology, and a set of dummy variables for when key policies were implemented in each state. This allows us to examine the effectiveness of policies implemented during this time period and to isolate the effect of the economy on traffic fatalities. This work is similar to the earlier work of Noland (2003b) and also extends the analysis presented in Noland and Sun (2015) with additional years of post-recession data.

* Corresponding author.
E-mail address: rnoland@rutgers.edu (R.B. Noland).

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2. Background and hypotheses formulation

2.1. Theoretical formulation

Policies designed to reduce traffic fatalities must consider the behavior of drivers and how they interact with the road environment. This can be considered in a utility framework that provides a trade-off between the mobility and safety desires of individuals (Noland, 2013). For a given level of technology and policy enforcement, drivers will maximize their utility with this trade-off in mind, along with other potential costs associated with travel. This may involve decisions on speed choice, whether to travel or not, and the conditions under which one decides to travel (e.g. in adverse weather or when fatigued). There is a large body of literature that examines these issues, as reviewed by Noland (2013) and going back to the work of Peltzman (1975) and Wilde (1982), commonly referred to as either risk compensation or risk homeostasis, but also described as behavioral adaptation.

In analyzing trends in traffic fatalities, it is important to consider how these trade-offs might affect actual outcomes of policies. While Peltzman (1975) argued that crash outcomes could worsen in response to various regulatory policies, this view has largely been supplanted by a more nuanced perspective that sees behavioral adaptation as an off-set in risk reduction, from a strictly deterministic and inelastic calculation of the likely benefits. For example, while one might be able to estimate that airbags will save a fixed number of lives, based on the physical properties of the human body and the characteristics of certain crash types, this would not account for how drivers may change their driving behavior because those crashes are now less dangerous, perhaps leading to a slight reduction in the safety benefits of the policy. As indicated by Noland, (2013) there may still be a mobility benefit from safety policies that result in behavioral adaptation, in addition to reduced crashes or crashes with less severe outcomes.

This theoretical formulation can help to inform the hypotheses associated with the effect of various policies. In general, it is important to consider how various safety policies may also affect mobility, perhaps leading to less reduction in fatalities than anticipated. Some have also argued that economic recessions will influence risk taking behavior, such as a reduction in speeding and driving while intoxicated (Lloyd et al., 2016). The mix of drivers on the road may also change. This was analyzed by Maheshri and Winston (2016) using insurance data for the state of Ohio and they found that riskier drivers drove less during the recent economic downturn, compared to safer drivers. With these theoretical issues in mind, the key policies and factors hypothesized to be associated with traffic fatalities are discussed below, and linked to measures that can best proxy these effects in a regression analysis.

2.2. Economic factors

The relationship between national income and traffic crashes and fatalities is well known and has been shown to be statistically significant in national crash models (Noland, 2003b). Most studies have typically measured economic activity with broad measures of Gross Domestic Product (GDP) or per-capita income (Kopits and Cropper, 2005; Noland, 2003b). However, these may not be good measures for picking up the actual impacts of the economy on individuals and in states, mainly because of increasing disparities in income (Frank, 2009; Piketty and Saez, 2001). While we cannot directly measure how income disparities in the population affect travel behavior there are some possible reasons. Households may defer new vehicle purchases and use and maintain older (and presumably less safe) vehicles for longer periods of time. They may also find it necessary to commute longer distances to find suitable employment if income levels are lower (Maheshri and Winston, 2016). We control for income and income disparities using average median income and a measure of state-level Gini coefficients.[1]

One factor associated with economic activity may be that the type of vehicles using the road network change during a recession. Freight transportation (by truck) decreases; seasonally-adjusted truck tonnage declined by 15% between January 2008 and April 2009, based on the truck tonnage index.[2] According to NHTSA (2013) there were 3921 fatalities associated with heavy-duty trucks in 2012; this is about 11.6% of all fatalities, thus one would expect reductions in truck traffic to lead to reduced fatalities. This is controlled for in our data by a rough measure of the percent of trucks registered in each state.

2.3. Policy variables

2.3.1. Graduated licensing

Graduated licensing programs have been enacted in almost every state since implementation incentives were put in place in 1998.[3] Graduated licensing aims to protect younger drivers by conditionally restricting various riskier driving behaviors. Typical restrictions include not driving with other teenage passengers, forbidding nighttime driving (usually after midnight but with some exceptions if driving to a job), and the requirement to have no citations for at least 12 consecutive months (NHTSA, 2004). States have enacted these with large degrees of variation in the specific rules and conditions.

The effectiveness of graduated licensing in reducing traffic fatalities is largely acknowledged. A review by Shope (2007) concluded that these programs have generally led to a reduction of 20–40% in the crash risk of the youngest drivers. A review of some early programs, including in New Zealand, found 7–8% reductions in crash injuries of teenagers (Foss and Evenson, 1999). Restrictions on nighttime driving and carrying passengers reduce the risk of nighttime crashes and those with large groups of teenagers in the car; research has also found a 23-25% percent reduction in injury and fatalities due to night time restrictions (Foss and Evenson, 1999; McKnight and Peck, 2002; Williams, 2007). Graduated licensing can also decrease the benefits that younger people obtain from driving, and some have found that the increased impediment to driving reduces the mobility of teen drivers (Ralph et al., 2014), consistent with the theoretical framework that reduced mobility can improve safety.

To control for the implementation of these programs in different states, we use data on when states implemented both passenger and nighttime driving restrictions.[4] We do not control for the variation in program design, such as age limits, provisional time limits, or hours in which restrictions are in effect, among others.

2.3.2. Cell phone laws

An emerging issue in road safety is the use of cell phones, either for phone calls, texting, tweeting, or email and how this increases the risk of crashes. Research has found a slowing of reaction time associated with cell phone use, whether hand-held or hands-free (Caird et al., 2008; Charlton, 2009). The relative risk of cell phone users compared to those who do not use them is higher (Laberge-

[1] The Gini coefficient measures the distribution of income of the residents of a country, state, or other region for which income data is available. It varies between 0 (all incomes are equal) and 1 (complete inequality).

[2] Based on US Department of Transportation, Bureau of Transportation Statistics data available at: http://www.transtats.bts.gov/osea/seasonaladjustment/?PageVar=TRUCK

[3] Incentives were mandated by the Transportation Equity Act for the 21st Century (TEA-21) of 1998.

[4] For each law that we use as a policy variable, we count the year implemented if the law was in effect for at least half the year.

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