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The impact of state level behavioral regulations on traffic fatality rates

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ABSTRACT

Introduction: A state by year panel is analyzed to simultaneously explore the statistical correlation between state level traffic fatality rates and state level behavioral regulations regarding teen licensing, seat belt use, and driving under the influence (DUI) in a model that also controls for other correlates. *Method:* By including measures of all three of these policies, the estimated policy effects should not be overstated due to underspecification bias. The panel includes the 48 contiguous U.S. states for the time period from 1999 through 2003. State fatality rates are measured as fatalities per million miles traveled. Measures of state policies regarding traffic safety related behavior are based on information gathered by the Insurance Institute for Highway Safety. Estimates are calculated via a time fixed effects model that uses the double-log form to allow for interaction effects between the independent variables. *Results:* Least squares estimates indicate that, on average, more restrictive graduated teen licensing and DUI policies significantly reduce traffic fatality rates, while stricter seat belt enforcement policies have a statistically insignificant negative impact on fatality rates.

1. Introduction

More than 41,000 fatalities and 2.4 million injuries occur each year as a result of traffic crashes in the United States (National Highway Traffic Safety Administration [NHTSA], 2008). This breaks down to more than 13.6 fatalities per 100,000 U.S. residents, and more than 1.3 persons killed per 100 million vehicle miles traveled (VMT). While these nationwide totals and ratios illustrate why traffic safety is a major national public health concern, they do not illuminate the degree to which traffic fatality risk varies across U.S. states and is therefore a much bigger problem in some states than it is in others. For instance, in 2007, state fatality rates per 100 million VMT ranged from a low of .76 in Massachusetts to a high of 2.45 in Montana. On a per capita basis, traffic fatalities ranged from 6.47 per 100,000 residents in Massachusetts to 28.92 per 100,000 residents in Montana (NHTSA, 2008).

Collectively, numerous studies have identified many factors that are statistically correlated with state traffic fatality rates and therefore help explain the variation in fatality rates across states. These factors consist of a wide array of state level socio-economic, driving environment, and policy characteristics such as: economic conditions; speed limits and other traffic laws; traffic law enforcement; the mix of road types; traffic congestion levels; the urban to rural vehicle mileage ratio; weather conditions; and alcohol consumption (Evans, 2004). Based in part on the knowledge developed by this research, states have fashioned policies seeking improved traffic safety. Among these policy efforts have been several that have targeted the behavior of those who use the roads. Over the past 10 to 20 years, individual U.S. states have implemented laws aimed at inducing safer behavior of drivers and passengers via the imposition of seatbelt use mandates and teen driving restrictions as well as further strengthening of DUI policies (Highway Loss Data Institute, 1996-2009; Shope, 2007; Tippetts, Voas, Fell, & Nichols, 2005; Shultz, Nichols, Dinh-Zarr, Sleet, & Elder, 2004). The impacts of these three types of policy changes have been analyzed by many scholars with the general consensus being that these policies have had a beneficial impact on traffic safety. The purpose of this study is to augment the existing academic analyses of these recent policies with estimates of the concomitant impact of all three policy types in a single model that allows for their interaction in impacting traffic safety. In so doing, estimates of policy impacts are less likely to suffer from underspecification bias due to the exclusion from an econometric model of one or two policy changes that occur concurrently with another policy change that is included in the model. Such a bias may overstate the impact of policy shifts.

As mentioned above, states have increasingly cited teen driving as a leading source of traffic safety problems and have developed laws designed to improve traffic safety by reducing crashes caused by teen drivers. Traffic crashes are the leading public health threat for teenagers (Insurance Institute for Highway Safety, 2008). Teenagers are more likely to be involved in fatal traffic crashes because they lack experience and maturity. They are not able to handle dangerous situations as well as more experienced drivers and they may underestimate the impact of careless or reckless driving (Jonah & Dawson, 1987). As a result, states have become interested in imposing greater regulations on teen driving. Since the advent of state drivers' licensing, there have been many cross-state

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differences in learners permit age requirements and drivers license age requirements. Then, beginning in the mid-1990s individual states began introducing graduated driver licensing laws. In general, these laws consist of some temporary combination of adult supervision, nighttime driving restrictions, and passenger limits for drivers under the age of 18. These laws aim to reduce the frequency of crashes by restricting the exposure that young novice drivers have to relatively unsafe driving conditions such as nighttime driving, or the distractions caused by passengers until they get more experience behind the wheel. By the early 2000's, nearly every state had adopted some form of these laws, and some states have increased teen licensing restrictions beyond the levels they initially implemented. Many studies have evaluated the impact of graduated teen licensing laws. Two articles (Shope, 2007; Shope & Molnar, 2003) collectively surveyed 27 studies that evaluated the impact of graduated driver licensing regulations, concluding that despite variations in study goals, methodology, time periods, and jurisdictions, the results consistently indicated that such regulations have a positive impact on traffic safety. Baker, Chen, and Li (2007) evaluated the differences in fatality and injury crash involvement rates among 16-year-old drivers between states with and states without graduated driver licensing laws, finding that such laws have a statistically significant beneficial impact on the dependent variable. Williams, Ferguson, and Wells (2005) estimated the impact that graduated licensing laws had on the differential between 16-year-old drivers and drivers of other age groups, finding that the laws significantly reduced fatal crash involvement among 16 year olds relative to all other age groups.

Two studies of graduated teen licensing laws have used state by year panel data similar to that used for this analysis. Dee, Grabowski, and Morrisey (2005) evaluated state by year panel data and concluded that graduated driver licensing regulations reduced teen traffic fatalities by 5.6% relative to other age cohorts. Morrisey, Grabowski, Dee, and Campbell (2005) used Insurance Institute for Highway Safety ratings of the level of restrictiveness of graduated licensing regulations in each state, concluding that the states with the most restrictive regulations experienced the largest reductions in young driver fatalities, but the regulations had only minimal impact on total daytime traffic fatalities and on passenger fatalities.

The second area of behavioral regulation pursued widely by states has been in the form of reduced tolerance of drinking and driving. Policies that have been instituted by states in an effort to reduce driving while under the influence of alcohol include controls of alcohol sales, increases in the minimum drinking age, reductions in the defined legal blood alcohol content (BAC) limit, as well as increased penalties. Most recently, many states have renewed their focus on reductions on the BAC limit and the penalties imposed on violations of DUI laws. Penalties can consist of license suspension, fines, imprisonment, as well as vehicle impoundment or forfeiture for multiple offenses. Tippetts et al. (2005) conducted a meta-analysis of 19 independent evaluations of the introduction of .08 BAC limits, finding that the reduced BAC limit resulted in significantly (14%) fewer drinking drivers involved in fatal crashes. Wagenaar, Maldonado-Molina, Ma, Tobler, and Komro (2007a) evaluated the impact of differences in the BAC limit in 28 states from 1976 to 2002, finding that stricter limits significantly reduced both single-vehicle nighttime crashes and reductions in the BAC levels for drivers in fatal alcohol related crashes. Wagenaar and Maldonado-Molina (2007) found that state mandated automatic license suspensions for DUI convictions similarly impacted the BAC levels for drivers in fatal alcohol related crashes. Additionally, Wagenaar, Maldonado-Molina, Ma, Tobler, and Komro (2007b) studied the impact of mandatory minimum fines and jail penalties for first time offenders of DUI laws. Their findings indicated that minimum mandatory fines reduced fatal crash involvement by drivers with a high BAC level (.08 or higher), and that minimum jail terms reduced fatal crash involvement by drivers with a low BAC level (between .01 and .08) and also reduced nighttime single vehicle fatal crashes by drivers with low as well as high BAC levels. The effects of these policies on crashes of other combinations of time of day, driver BAC level, and number of vehicles involved was statistically insignificant. Freeman (2007) generated differences-in-differences estimates of a state by year panel, which indicated that the .08 BAC limit was ineffective at reducing fatality rates while administrative license revocation was effective. Carpenter and Harris (2005) evaluated self-reported alcohol related behavior surveys conducted between 1999-2003 and concluded that the primary source of reduced fatality rates following the imposition of the .08 BAC limit is reductions in drinking by moderate drinking males, primarily older college educated married men.

The third form of behavioral regulations mentioned above as having significantly increased in the past 20 years is mandatory seat belt laws. These laws were first implemented by some states in the mid-1980s, but shortly after 1990 most states moved to introduce some form of mandatory seat belt legislation. By 1996, every state except New Hampshire had at least one mandatory seat belt use law. At this juncture, most states allowed only secondary enforcement in which drivers could only be cited after having been stopped by law enforcement officers for another traffic violation. Beginning in 1993, individual states began adopting primary enforcement (also known as standard enforcement) of seat belt laws in which officers can stop and ticket drivers solely for not using a seat belt. These laws aim to improve traffic safety by reducing the severity of traffic crashes. Shultz et al. (2004) surveyed 13 studies that evaluated primary enforcement laws and seven studies that evaluated increased enforcement of existing seat belt laws. The authors concluded that there was a consensus in the research literature indicating that both primary enforcement laws and increased enforcement significantly reduced traffic fatalities and increased seat belt use. In an analysis of the impact of switching from secondary to primary enforcement, Houston and Richardson (2006) used a 1991-2003 state by year panel and concluded that state seat belt use rises by 10 percentage points on average when states make the switch. Cohen and Einav (2003) used state by year panel data for the period 1983-1997 to evaluate mandatory seat belt laws, concluding that as these laws are implemented and as enforcement changes from secondary to primary, seat belt usage rises and traffic fatalities are reduced. Farmer and Williams (2005) compared fatality rate trends between states that had primary enforcement laws with those that had secondary enforcement laws and found that primary enforcement reduces annual state driver fatality rates by 7% on average relative to states that maintained secondary enforcement.

This study extends the many analyses of the correlations between recent changes in teen driving regulations, DUI laws, seat belt laws, and differences in traffic fatalities by using a state by year panel from the 48 contiguous states over the period from 1999-2003 in a double-log model that allows for interaction effects between the above public policies as well as other independent variables to be accounted for in the estimates. The model also includes measures of economic conditions, per capita alcohol consumption, the percentage of vehicle miles driven on urban highways and on interstate highways, average state temperatures and precipitation, hospital availability, law enforcement spending, drinking and driving penalties, and highway speed limits. The following section provides a description of the econometric model used and Section 3 describes the data used in the analysis, while the resulting estimates are provided and discussed in Section 4. The article is concluded in Section 5 with a discussion of policy implications and suggestions for further research.

2. Model Specification

A time fixed effects model is estimated using the 48 state by five year panel in order to evaluate the cross-state effects. As mentioned above, a key differentiating feature of this analysis is the inclusion of individual measures of graduated teen licensing policy, seatbelt use policy, and DUI policy in a single model of state fatality rates. Doing so