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The Effects of Alcohol Regulation and Legislation on Traffic Fatalities in the United States: A Quantitative Analysis

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Recently the University of Tennessee's campus newspaper, *The Daily Beacon*, published a front-page story on the debate over the state of Tennessee's existing open alcohol container law. Revocation of this law, which would be consistent with the law forty-three states, would ban open alcoholic beverages in vehicles (DUI Foundation 2009). The question sparking controversy is: would this type of regulation actually have an impact on the number of traffic accidents and fatalities that occur annually, or would its execution be insignificant in reducing alcohol related tragedies and instead create other issues?

According to the article, legislation that would change Tennessee's existing open container law has been under consideration for nineteen years with no avail. Proponents of the open container ban claim that its implementation would save approximately twenty lives in the state annually, and therefore the law is necessary. Adversaries insist the legislation would have a negative impact on designated driving because sober drivers would not want to deal with passengers who become unruly when asked to dispose of alcoholic beverages before entering a vehicle (Hall 2009).

These types of issues are increasingly prevalent in the campaign to reduce alcohol-related traffic fatalities. According to the Department of Health and Human Services Centers for Disease Control and Prevention (CDC) the cost of alcohol-related crashes is over $51 billion a year (CDC 2008). In 2007, over thirty percent of auto fatalities involved at least one person with a blood alcohol content (BAC) of 0.08 or greater (MADD 2009). So what policies are most effective in reducing the prevalence of drunk driving and as an extension, alcohol-related traffic fatalities? Are there means of deterrence and prevention that are more effective than others? By examining these issues we may gain a better understanding of why some states experience higher rates of overall traffic fatalities and traffic fatalities caused by alcohol.

While alcohol-impaired driving was a factor in roughly one-third of fatalities in 2007, the number of alcohol related fatalities that occur annually has decreased approximately fifty percent since 1980 (MADD 2009). Could the dramatic decrease in fatalities be the result of a shift in recent history that has changed attitudes about driving impaired? Perhaps there is now an increased social stigma associated with being guilty of driving under the influence (DUI), or maybe more people have been exposed to the personal damage driving drunk can result in through advertising and public service announcements. It is essential that policy makers understand what caused the decrease in traffic fatalities and what steps should be taken to reduce these numbers even further. The decline, as will be explored in this paper, could be correlated with harsher penalties for drunk driving offenses and restrictive laws pertaining to alcohol consumption.

Alcohol can be regulated through means like manufacturing and distribution laws, retail sale and transaction limitations, taxation and pricing, restrictions on advertising, and legislation and penalties for crimes committed involving alcohol, the concerns of this study (APIS 2009). The federal government grants most power in establishing laws related to alcohol to states. States may then choose how much of this power to allocate to local governments who can then determine laws concerning the sales and distribution of alcohol (APIS 2009).

Two major legislative actions were passed in the early 1980s that set the tone for a new, more critical attitude about drunk driving. First, the Federal Alcohol Traffic Safety Act of 1983 encouraged "easing the standards required for arresting and convicting drunk drivers, more severe and certain penalties for conviction of drunk driving, and the increased allocation of resources for apprehending drink drivers" in each state by providing financial incentives (Galanter 1998). The second federal action was the Uniform Drinking Act of 1984 that withheld federal funds from states that refused to increase the minimum drinking age to twenty-one, which is now the national legal age (Grabowski and Morrisey 2001). As a result, over the last two decades state laws have evolved in an attempt to better contain drunk driving. Several acts of legislation related to driving while under the influence of alcohol include: roadside breathalyzer tests, minimum mandatory jail time or community service sentences for DUI violations, dram-shop laws, license suspension or revocation for those who refuse to submit to alcohol testing, ignition locks, vehicle forfeiture, open container laws, maximum legal BAC levels, and zero tolerance BAC laws for those under the age of twenty-one (Grabowski and Morrisey 2001).

Patterns that point to a specific group of drivers that are more frequently involved in alcohol related accidents can also be helpful in designing effective and targeted strategies to eradicate this problem. Currently, males involved in traffic fatalities are twice as likely to be intoxicated as female drivers, and approximately nineteen percent of traffic fatalities involving sixteen to twenty year old were a result of drunk driving (CDC 2008). It is difficult to imagine how a state could implement gender specific laws to decrease the number of males who drink and drive, but identifying these trends could lead to increased education and awareness about the consequences of driving under the influence specifically targeted at males. Increased funding for alcohol-related education programs and establishing strict mandatory licensing penalties for under age offenders could also help reduce the percentage of young adults involved in traffic fatalities due to alcohol.

An analysis is necessary to identify what factors significantly impact the likelihood of being involved in a traffic fatality. With such significant costs it is imperative that lawmakers find the most effective ways to prevent more alcohol fatalities in order to save lives as well as money. What I hope to contribute to the issue through this analysis is a better understanding as to which policies are most effective in deterring drunk driving and traffic fatalities in the United States through the application of more recent data than other publications. In addition, this paper will use two models, one to measure the effectiveness of selected variables on overall traffic fatality rates and a second that evaluates the same set of variables in respect to traffic fatality rates involving drivers with a BAC level at 0.08 or above. The analysis will study the relationship between impaired driving and traffic fatalities using state-level panel data from 1998-2002.

Literature Review

Since the passage of the Federal Alcohol Traffic Safety Act (FATSA) and the Uniform Drinking Act (UDA) in the 1980s, several papers have been published on the topic of alcohol regulation and legislation and traffic fatalities in the United States. Many of these papers examine statistical relationships across states for selected time periods taking into account additional factors relating to socioeconomic variables, population traits, and variations in state laws.

A decade after the implementation of FATSA and UDA an analysis was conducted concerning alcohol regulation and legislation with results claiming beer taxes and severe one-year license action as the most effective policies in discouraging alcohol abuse and driving (Chaloupka, Saffer, and Grossman 1993). In the authors' research the following laws were examined: implied-consent, minimum legal drinking ages, illegal and administrative per se laws, preliminary breath tests, open container laws, mandatory minimum penalties, dram-shop laws, plea-bargaining standards, and alcohol taxes. Covering a time period from 1982 to 1988, a time series of state cross sections of the contiguous United States is used in this study. Actions proving to have negative impact on fatalities were mandatory one-year minimum administrative penalties, a minimum legal drinking age of twenty-one, breathalyzer tests, dram-shop laws, high mandatory minimum fines of $500, no-plea-bargaining, and a mandatory one-year licensing action. Deterrents with no significant effects in the analysis were mandatory jail sentences, community-service laws, and open container laws (Chaloupka, Saffer, and Grossman 1993)

A study by Benson, Rasmussen, and Mast (1999) studied thirteen laws related to drunk driving. The authors found that effective deterrents to drunk driving were higher legal drinking ages, dram-shop laws, and open container restrictions (Benson, Mast, and Rasmussen 1999). The authors attempted to replicate a previous model published by Chaloupka, Saffer, and Grossman (1993) using panel data for the contiguous United States from 1984 to 1992. The study also asserted that another effective means of reducing traffic fatalities related to drunk driving is increased “direct law enforcement…(and) policies implemented to produce systematic persistent, and consistent increases in proof of being stopped and arrested for drunk driving” (Benson, Mast, and Rasmussen 1999). This statement seems to be rather intuitive. Not many people would argue against the idea that increased and persistent enforcement of drunk driving polices would effectively reduce traffic fatalities. The issue that arises is finding the resources to enhance law enforcement and create a persistent environment of policy implementation in a cost effective manner.

In 2000 an analysis was published on the relationship between motor-vehicle fatalities and alcohol taxes, prices, and various drinking laws based on the contiguous United States from 1982 to 1990 (Young and Likens 2000). The report finds an insignificant relationship between taxes and total fatalities. Variables that did show significant relationships included minimum drinking age and dram-shop laws. In this report, fatality rates were set up as a function dependent upon beer taxes or prices, socioeconomic characteristics, and dummy variables for each state’s traffic and alcohol laws. Young and Likens did find that unemployment rates and real per capita income were significantly related to alcohol fatalities. However, the results for mandatory minimum penalties, administrative per se penalties, and fines did not show promising impacts on reducing fatalities (Young and Likens 2000).

The issue of 0.08 BAC laws is addressed along with additional fatality reducing initiatives, including a graduated licensing program and the effect of chapters of Mothers Against Drunk Driving (MADD) in each state in a study by Eisenberg (2003). Eisenberg used data from all fifty states and the District of Columbia from 1982 to 2000.

Employing a weighted least squares regression with state and year fixed effects, the author found that states with open container laws, dram-shop regulations, and seat belt laws saw a reduced fatality rate of approximately five percent. Results also credited beer taxes in reducing fatalities by 0.8 percent for every ten-cent increase and cited zero tolerance laws a 4.7 percent drop in deaths. The most significant result of the paper presented a drop in the BAC limits from 0.10 to 0.08, the limit currently in place for all states, as resulting in a reduction in fatal crashes of 3.1 percent (Eisenberg 2003).

The Drunk Driving Foundation provides information regarding the history of BAC implementation and the effects of alcohol at various blood concentration levels. The first country to introduce the method of determining an individual's intoxication level by testing BAC was Norway in 1936 (DUI Foundation 2009). This approach was widely considered to be less subjective, and fair, relative to depending solely on a police officer's opinion of a driver's level of intoxication. BAC is measured as the amount of grams of alcohol per one hundred grams of blood in the system. When an individual's BAC is between 0.03 and 0.059 they begin feeling the effects of alcohol resulting in a more relaxed attitude, increased socialization, and slight impairments in motor skills. From a BAC level of 0.06 to 0.10 the effects of alcohol are intensified causing problems in vision, depth perception, and sensory feelings-factors that impair ones ability to operate a motor vehicle (DUI Foundation 2009).

A potential problem with a standardized level of BAC is that according to the Drunk Driving Foundation, two individuals with identical BAC levels may have completely different experiences and levels of impairment. This is where roadside sobriety testing and an officer's examination are still essential. The combination of BAC testing and officer interaction allows for dependable and reasonably just accusations of alcohol related driving offenses.

A study of the relationships between alcohol price, consumption, and traffic fatalities was published in 2006 expressing fatality rates as a function of alcohol prices, socioeconomic characteristics, legal environment, and fixed effects per state and year (Young and Bielinska-Kwapisz 2006). Statistics from 2006 showed that alcohol was involved in approximately forty percent of traffic fatalities in the United States (Young and Bielinska-Kwapisz 2006). The authors worked with data from across the United States during the time period of 1982-2000. The laws related to alcohol that were estimated include: open container laws, preliminary breath test laws, dram-shop laws, illegal BAC levels of at least 0.1, mandatory licensing action upon first DUI conviction, and administrative per se laws. The publication also examines the hypothesis that alcohol consumption would be negatively affected by the price of alcohol. This hypothesis would make economic sense, as one would expect the demand or consumption of a good to decrease with increases in its price. Therefore, the authors tested whether or not an increase in the price of alcohol actually reduced fatalities. The results showed little relationship between BAC laws of 0.08 and dram-shop regulation on expected fatalities. The study also found that effective measures of reduction were increases in the minimum drinking age and that increases in the price of alcohol, including beer taxes, did have a significant negative impact on the number of traffic fatalities (Young and Bielinska-Kwapisz 2006).

The results of the literature review on the subject of alcohol related traffic fatalities provides some consistency in fatality reducing initiatives, but at the same time also sends mixed messages about the effectiveness of policies like beer taxes. In a 1999 publication studying the effectiveness of state alcohol policies in reducing teenage drinking and driving employing data from 1977 to 1992, it was shown that beer taxes were not significant in reducing teen drinking (Dee 1999). Instead, the author of this paper pointed to minimum drinking age laws as an efficient tool of fatality reduction among young people (Dee 313). However, it does not seem as feasible to apply the findings specifically relating to underage drivers to explain fatalities rates for the entire driving population. Another report from the same year using panel data from 1985-1992 linked published studies' dependence on alcohol taxes as a significant fatality-reducing factor to missing variable biases (Benson, Mast, and Rasmussen 1999). The subject of the publication points to the neglect of alternative determinants of consumption, drinking age, or other drinking factors for creating this bias (Benson, Mast, and Rasmussen 1999). Differences among published results are most likely due to the utilization of different time periods for data collection, varying means of model creation, and use specific of variables.

Conceptual Framework

In this paper, the relationship between traffic fatalities and factors that can affect the likelihood of being involved in an auto fatality will be explored through econometric models utilizing state-level data for the years 1998-2002. Total traffic fatalities and total traffic fatalities specifically involving a driver with a BAC level of 0.08 or greater are set up as a function of factors relating to alcohol laws, socioeconomic variables, law enforcement information, traffic laws, and population data.

The variables relating to alcohol utilized in the analysis include: BAC laws, beer taxes, and a set of dummy variables if states implemented licensing suspension or revocation laws for first DUI offenses, pre-sentencing investigation laws (PSI), allowed open containers in vehicles, prohibited alcohol consumption in vehicles, and administered breathalyzer tests to register driver BAC levels.

Other variables used in the model not specifically relating to alcohol consumption or impaired driving are unemployment rates, income per capita, population density, the number of police officers for every 100,000 people in the population, and a dummy variable if a state implemented a primary seatbelt law.

Examining the impact of licensing actions for first offenses will determine whether a state's decision to suspend or revoke a license makes a difference in deterring drunk driving. There are significant variances in penalties for first infractions regarding licensing. Many states require mandatory suspensions of thirty days to one year, some require revocation for extended periods, and still other states issue temporary licenses or have punishments not involving license forfeiture.

Laws pertaining to BAC will reveal if states that allowed a higher legal BAC level did in fact experience more traffic fatalities related to alcohol. From 1998 to 2002 states maintained a legal BAC of either 0.08 or 0.10. Today every state has a mandated BAC of 0.08 (MADD 2009). Examining this variable's relationship to the fatalities could show how effective this national legal level is and why it was an effective implementation or not.

Open container laws could explain if allowing another passenger in the car to have alcohol increases a driver's likelihood to cause an accident. A standard argument is that allowing other people in the car to possess alcohol or drink in the vehicle leads to the driver also consuming alcohol while operating a vehicle. If the analysis reveals a significant inverse relationship in regards to the dummy variable representing states that have open container laws, it can concluded that the debate mentioned in *The Daily Beacon*'s front-page article can be settled with the effective implementation of container laws. Similarly, the analysis of anti-consumption laws could reveal if allowing anyone in a vehicle to consume alcohol effects the likelihood of individuals to be involved in a fatal traffic accident.

Preliminary breath test laws allow for the use of breathalyzer devices in DUI investigations. An officer may ask an individual to blow into a breathalyzer to register their BAC. These devices may be effective deterrents in the fight against drunk driving because the driver will be aware that their BAC can be tested on site and used against them in a court of law.

Primary seatbelt laws are also investigated in this paper. In this model a dummy variable will be created that equals one if a state has a primary seatbelt law and zero if a state has only a secondary law. The difference between primary and secondary seatbelt laws is simple. Primary laws allow officers to pull over a vehicle if they see an occupant covered by legislation that should be restrained not wearing a seatbelt. Secondary laws let officers issue citations to vehicles pulled over for non-restraint related offenses if they see occupants that are required by law to wear seatbelts unrestrained (MADD 2009). Primary laws may be more effective in preventing automobile fatalities because drivers who know they can be pulled over for not wearing a seat belt will probably be more likely to use a restraint.

Pre sentencing investigation (PSI) laws allow for an investigation into the life and circumstances of an individual convicted of a DUI. The investigation takes place after conviction and prior to a defendants sentencing and is intended to influence the sentencing decision of the court (LawInfo 2009). These laws could work in favor or against a driver convicted of a DUI. Someone who has never been convicted of a crime or DUI could be granted leniency in sentencing versus a repeat offender whose PSI might render a more sever punishment.

Some additional laws relating to alcohol regulation and legislation were initially investigated and entered into the models of this paper. The statistical software employed to evaluate the coefficients and significance of variables relating to annual traffic fatalities subsequently dropped them. Upon further examination of the data, it was discovered that there was no change in any state corresponding to administrative per se laws, dram-shop laws, and zero tolerance BAC levels for drivers under the age of twenty-one for the time period investigated. Therefore, these variables were excluded in the fixed effects results.

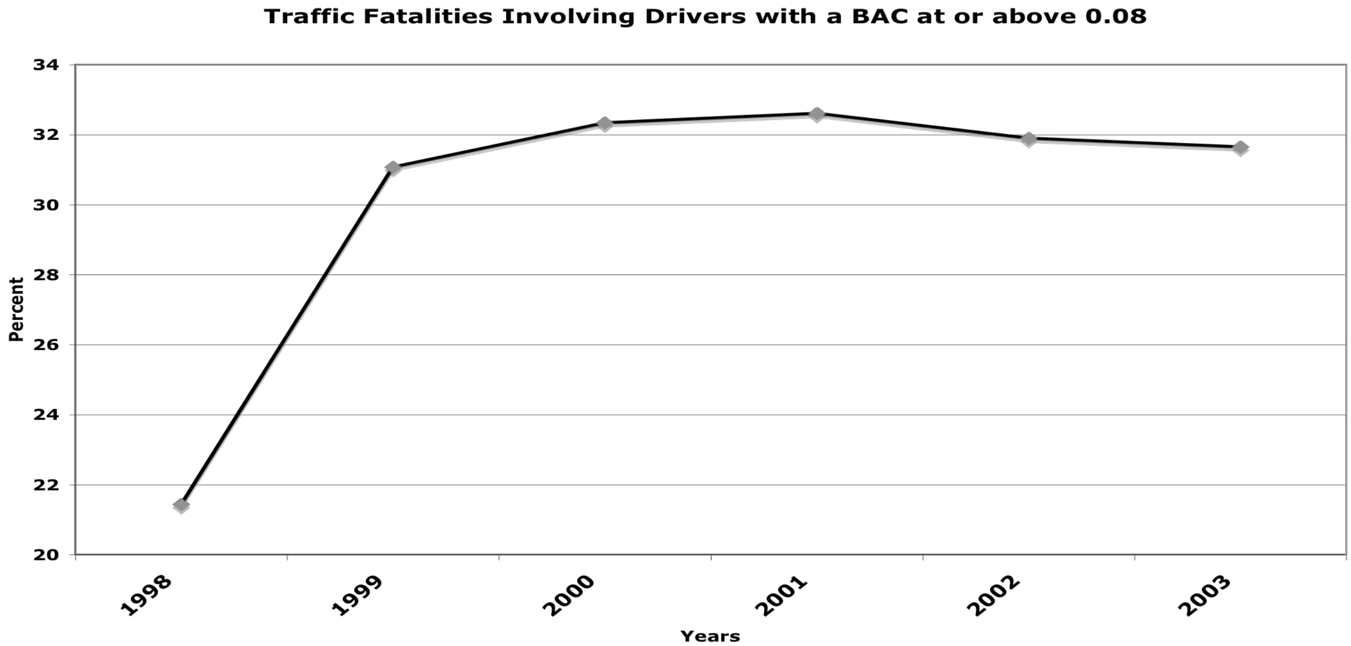
Factors outside of laws and regulations strictly targeted at reducing impaired driving also need to be included in the analysis. Socioeconomic data on per capita income and unemployment rates are used for each state. Per capita income was chosen because it can reflect an individual’s purchasing power, their ability to spend earned income on alcohol, or suggest an inverse relationship where relatively lower income leads to more consumption of alcohol and operation of vehicles while under the influence.

A similar relationship is to be explored with unemployment rates. If high unemployment rates result in more traffic fatalities, one could conclude that those who are unemployed may drink and drive more because of personal issues or because they have nothing better to do. Low unemployment leading to alcohol related fatalities could mean that those with work and more income could spend more on alcohol, need vices to cope with work, or other correlated factors.

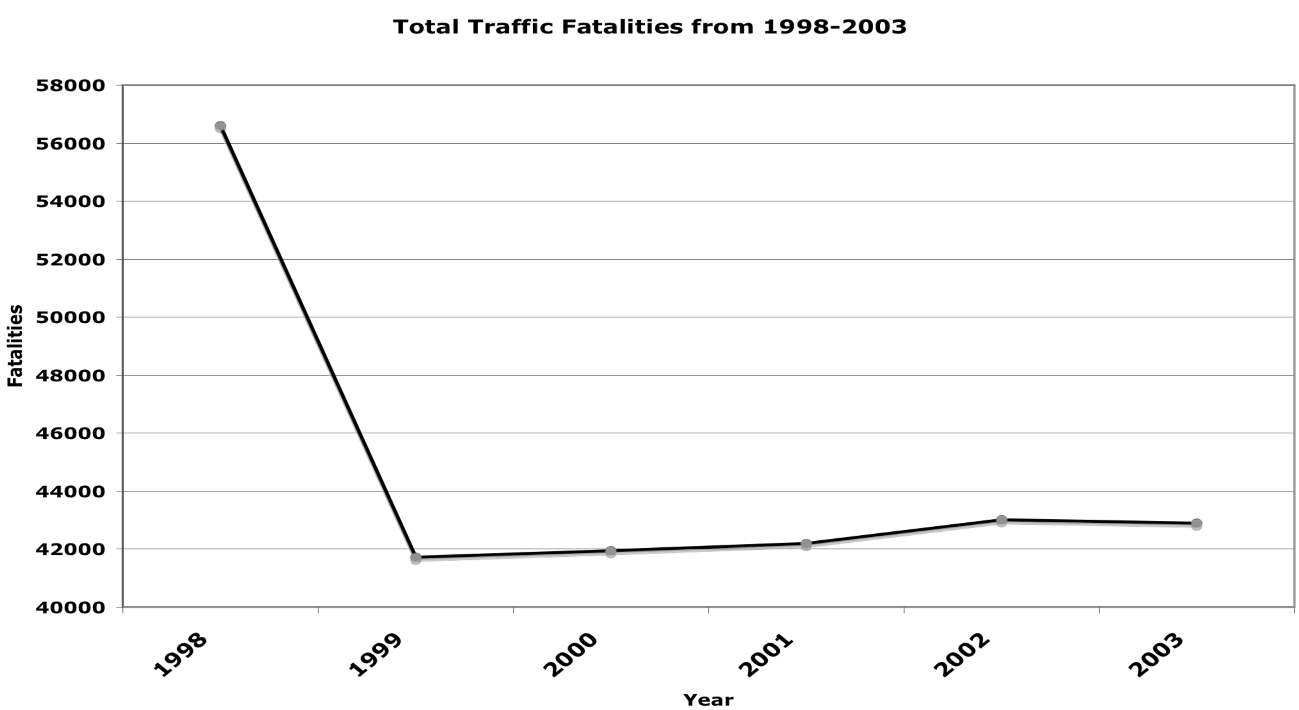
Population density was also included in the model. The model could provide insight as to whether or not states with more people residing per square mile experience a higher rate of traffic fatalities. Results pointing to a positive relationship between population density and traffic fatalities could influence states with greater densities to implement tougher DUI laws or set up things like sobriety check points in high traffic areas. Decreased traffic fatalities in states with lower densities could be a result of fewer people being on the road with intoxicated drivers and less congested areas in which to drive.

The number of police officers employed per 100,000 people in the population was also utilized. This variable is investigated to determine whether or not having more officers per capita has a significant impact on the number of traffic fatalities and drunk driving incidents in each state. Intuitively, one would think that increased police forces per capita would have an affect on drunk driving by causing people to reconsider operating a vehicle impaired due to increased police presence, or more officers being able to catch drunk drivers before they cause a fatal accident.

The graph below represents the proportion of traffic fatalities involving a driver with a BAC of 0.08 or greater. The results are interesting considering the next chart, which depicts the total traffic fatalities in the United States for the same time period.



The graph above shows the changing values of the proportion of traffic fatalities in the United States that involved drivers with a BAC level above 0.08. There is a steep increase from 1998 to 1999, but then the results seem to level off and hover around thirty-one to thirty-two percent.
*Data collected from the Fatality Analysis Reporting System Encyclopedia



The graph above shows total traffic fatalities in the United States from 1998 to 2002. There is a steep drop off from 1998 to 1999 and then fatalities level out between 42,000 and 43,000.
*Data collected from the Fatality Analysis Reporting System Encyclopedia

Above is a graph that shows a significant drop in total fatalities from 1998 to 1999. When the two charts are compared it seems curious that a much lower percentage of overall traffic fatalities were caused by alcohol in 1998 versus 1999, and yet the total number of traffic fatalities in 1998 is much higher than the following year.

Econometric Models and Estimation Methods

In this analysis I am using panel data and need to control for state-specific effects that may be correlated with the other variables in use in the model. Controlling for state-specific effects helps contain unique, unobserved factors that may affect fatalities in each state consistently over the time period in place (Young and Likens 2000). A fixed effects model will allow for the incorporation of differences across states by assigning each state an intercept that remains constant over time (Halcoussis 2005). This estimation method creates greater degrees of freedom, strengthening the results. The variation in intercepts takes into account the differences between states while allowing the other variable coefficients to remain the same.

I will estimate regression models that express overall fatality rates and fatality rates involving drivers with a BAC of 0.08 or greater as functions of legal variables, socioeconomic factors, population and law enforcement characteristics, and state fixed effects.

Model: $$y_{it} = q'_{it}\beta + r'_{it}\,\Gamma + u_i + \xi_{it}$$

The dependent variable y_{it} is the traffic fatality rate for state *i* in year *t* per 100,000 members of the population found by dividing total traffic fatalities and traffic fatalities involving alcohol by total population. The first independent factor of the model, q'_{it}, represents a vector of socioeconomic variables including: natural log of income, unemployment rates, population density, and police enforcement per capita. The policy variables which include BAC laws, pre sentencing investigation regulations, open container laws, anti-consumption restrictions, suspension and revocation penalties, preliminary breath tests, beer taxes, and seatbelt laws fall under the vector r'_{it}. State effects are included in the model by u_i, and ξ_{it} is an error term that embodies any serial correlation and heteroskedastic issues.

The primary difference between the models is the dependent variable. In model one, total fatalities are used as the dependent variable to show the effects of alcohol regulation and legislation on traffic fatalities overall. Model 2 analyzes the independent variable's relationship to traffic fatalities specifically involving an impaired driver. The results of the two regressions are listed in Table 2.

The Data

The data for this model was collected from numerous sources. Most of the information employed was found using government databases and widely published statistics.

Per capita income for each state can be found at the U.S. Bureau of Economic Analysis webpage under their "Personal Income and Employment Interactive Map." The unemployment data used in this analysis is located on the Bureau of Labor Statistics site under "Geographic Profile of Employment and Unemployment." The United States Census Bureau provided information regarding state population density and population through two annual publications: "Statistical Abstract of the United States: Population Change and Distribution" and "Population Estimates for the U.S., Regions, Divisions, and States by 5-year Age Groups and Sex: Annual Time Series Estimates."

Information regarding laws and regulations surrounding alcohol were located on the Alcohol Policy Information System website, which includes data from the National Highway Traffic Safety Administration's (NHTSA) Alcohol-Highway Safety Digest, and the Bureau of Justice Statistics' Sourcebook of Criminal Justice Statistics. For alcohol laws including BAC limits, PSI, open container, anti-consumption, administrative per se laws, and first violation licensing actions by state from 1998 to 2002, the NHSTA annual report "Highway Safety Digest Topics" was utilized. The Sourcebook of Criminal Justice Statistics was used for data on dram-shop laws and preliminary breath test legislation.

Information on primary and secondary seatbelt restrictions was located on the NHTSA website under "States with Primary Safety Belt Laws" and "States with Secondary Safety Belt Laws" which was published in 2004.

Police officers per 100,000 residents was found by dividing the data on employed officers from the U.S. Department of Justice's Office of Justice Programs Bureau of Justice Statistics published work on "Justice Expenditure and Employment Extracts" by state populations.

A history of state beer taxes can be located on the Tax Foundation webpage as well as in "A Factbook on State Beer Taxes," published by the Center for Science in the Public Interest.

Lastly, the Fatality Analysis Reporting System (FARS) provides detailed data on traffic fatalities that occur in each state annually. On the FARS webpage, information on fatalities specifically involving drivers with a BAC at or above 0.08 can be collected under "Persons Killed by State and Highest Driver BAC in the Crash."

Table 1-Variable Descriptions

Variable Name (expected sign)	Description	Sample Mean (standard deviation)
Fata100pop Dependent Variable (1)	Rate of traffic fatalities per 100,000 people in the population	17.960 (6.933)
Alcfata100 Dependant Variable (2)	Rate of traffic fatalities per 100,000 people in the population involving a driver with a BAC of 0.08 or greater	5.283 (2.259)
Income (-)	Per capita income measured in dollars	28154.84 (4700.93)
Unemployment (+)	Percentage of labor force out of work and actively seeking employment	0.045 (0.011)
BAC Law (+)	Maximum legal blood alcohol concentration allowed to operate a vehicle	0.092 (0.010)
PSI (-)	A dummy variable that equals one if the state has pre-sentencing investigation laws	0.724 (0.448)
Opencontainer (-)	A dummy variable that equals one if the state has a law against open alcoholic beverages in a vehicle	0.682 (0.466)
Anticonsump (-)	A dummy variable that equals one if the state has a law against consumption of alcohol in a vehicle	0.808 (0.395)
Suspenrevoc (-)	A dummy variable that equals one if the state implements a policy of license suspension or revocation for first DUI offenses	0.812 (0.392)
Prelimbreath (-)	A dummy variable that equals one if the state utilizes a breathalyzer device to register BAC when a driver is pulled over for suspected intoxication	0.600 (0.491)
Seatbelt (-)	A dummy variable that equals one if the state enforces a primary seatbelt law	0.341 (0.475)
Beertax (-)	Amount of tax per gallon of beer measured in dollars	0.233 (0.171)
Popdensity (+)	Number of inhabitants per square mile in a state	352.936 (1247.714)
Policerate (-)	Number of police officers per 100,000 people in the population	324.388 (87.003)

Above, Table 1 gives a description of variables used in the model along with their means and standard deviations.

Table 2-Model Results

Variable	Model 1 Results-Coefficient Values	Model 2 Results-Coefficient Values
ln_income	-5.465 (3.295)	0.614 (0.524)
Unemployment	-4.0263 (22.294)	2.717 (6.456)
BAC Law	19.658 (36.214)	-1.554 (11.776)
PSI	0.546 (1.260)	-0.256 (0.277)
Opencontainer	-0.842 (0.651)	-0.218 (0.174)
Anticonsump	-1.304* (0.486)	0.154 (0.303)
Suspenrevoc	-6.877* (2.128)	0.991 (0.645)
Prelimbreath	-2.174 (1.437)	-0.628* (0.304)
Seatbelt	-3.358 (1.939)	-0.090 (0.212)
Beertax	0.524 (2.481)	1.235 (0.674)
Popdensity	-0.003 (0.002)	0.0002 (0.0004)
Policerate	-0.050* (0.021)	0.003 (0.003)
Constant	98.847* (33.559)	-2.465 (6.430)
# observations	250	250
R^2	0.1419	0.0255
F-statistic	1.61	4.92
Robust standard errors in parenthesis * Denotes statistical significance at the 5% level		

The sample size for this model includes all fifty states and the District of Columbia over 1998, 1999, 2000, 2001, and 2002. Only 250 observations were used in the regression since Utah had to be dropped from the set because no information about pre sentencing investigation laws could be located for the state.

Cluster robust standard errors were employed in the fixed effects models of this paper to help control for any issues of heteroskedasticity and autocorrelation that may result from unknown factors in the model (Arellano 1987).

Discussion of Model 1

The estimation results for Model 1 concerning overall traffic fatality rates show the anti-consumption laws, suspension and revocation regulations, and police per 100,000 people in the population as being statistically different than zero at a five percent significance level.

The coefficient result on anti-consumption translates into an expected reduction in traffic fatalities of 1.304 persons per 100,000 members of the population if a law against the consumption of alcoholic beverages in a vehicle is enacted. This shows that allowing people to consume alcohol in a car does lead to more tragic accidents and that legislation against this action is effective.

The next significant result from the model involves the suspension and revocation of the license of first time DUI offenders. This result showed the biggest impact on total fatality rates with a suggested decrease of seven people. According to these results, residing in a state that has statutes in place to either suspend or revoke a drunk driver's license the first time they are pulled over for a DUI does deter people from driving impaired. This result makes sense considering that living in a state in which a DUI could mean losing your license for any length of time might deter an individual from driving drunk versus living in an area where no such penalty exists.

Not surprisingly, higher ratios of police officers to population resulted in a negative coefficient relating to traffic fatalities. Each additional increase in police force per one hundred thousand residents results in a decrease of the rate of automobile traffic fatalities of 0.05 people per 100,000 in the population. More police officers per capita may make it possible to either enforce traffic laws with greater ease or discourage illegal behavior with greater presence in a community.

The remaining variables tested in the regression did not prove to be significant, but still require interpretation to understand their impacts on traffic fatality rates.

The coefficient on the natural log of income was on the cusp of being statistically different from zero at a ten percent significance level and indicates that for each additional one percent increase in a state's average per capita income there is a decrease in the traffic fatality rate per 100,000 people of 5.46. This result would suggest that states with higher per capita income should experience less traffic fatalities. Perhaps this decrease would be due to people earning higher levels of income typically being more educated or socially responsible than those with lower incomes.

Interestingly, increases in the unemployment rate per state are expected to decrease traffic fatality rates by 4.03 individuals. This result may mean that people in areas of less employment opportunities are less likely to drink and drive, drive recklessly, or drive period.

BAC law resulted in the expected coefficient sign. The model result suggests that for every increase in the maximum BAC allowed to operate a vehicle, states should see an increase in traffic fatality rates of 19.66 per 100,000 people. Although insignificant in the utilization of the panel data from 1998 to 2002, the national decrease in maximum legal BAC to 0.08 has likely had significant positive impacts in reducing overall traffic fatalities.

The dummy variable on pre sentencing investigation laws showed no real impact on traffic fatality rates, but its coefficient was positive suggesting that the implementation of PSI laws would lead to an increase in fatality rates of 0.55. While PSI laws are set up to investigate an individual after their DUI conviction and prior to their sentencing, they may work for or against those guilty of DUI offenses. Someone who has never been convicted of a DUI or any other crime may get off with a much more lenient sentence than someone who has a long prior record. Therefore, the law might discourage repeat offenders from drinking and driving but have no real effect on those with no criminal history.

The coefficient on open container laws suggested a decrease in fatalities per 100,000 people of 0.84. While the variable was not significant, it shows that prohibiting other people in a vehicle besides the driver to have and consume alcohol can lead to more fatalities overall.

Primary seatbelt laws were insignificant in reducing traffic fatality rates across states in this model. However, the variable would have proved to be important if the model was being tested under a ten percent significance level. As mentioned before, primary restraint laws allow police officers to stop vehicles if they see an occupant that is required by law to wear a seatbelt unrestrained. Implementing these primary laws results in a decrease of overall traffic fatality rates of 3.36 people per 100,000. This result may support the idea that people residing in states that use primary seatbelt restrictions are more likely to wear their seatbelts for fear of being pulled over, especially if intoxicated, and if they do cause an accident a seatbelt may save their life.

The influence of beer taxes in this model was not what was expected in the analysis. The regression showed that for every increase in tax per gallon of beer there is an increase in the traffic fatality rate of 0.52 people per 100,000 in the population. Perhaps beer taxes are not an effective means of decreasing traffic fatalities as has been suggested by several previous papers, but since the result is not statistically different from zero all that can be said is that for the time period in place beer taxes did not have an effect on the fatality rate.

Population density resulted in an unexpected coefficient sign suggesting that traffic fatalities are less likely to occur in areas that are more densely populated or congested. Perhaps it is the case that living in a more congested area means there are more options for public transportation or that people need to drive less resulting in less traffic fatalities annually.

Discussion of Model 2

The second model analyzed in this paper implementing fatalities rate specifically involving intoxicated drivers resulted in some different significant variables. In this model a preliminary breath test was the only variable statistically different from zero at a five percent significance level.

Implementing a preliminary breath test to register the BAC of a driver suspected of being impaired is expected to reduce traffic fatality rates involving illegal levels of alcohol by 0.63 people per 100,000 in the population. If drivers are aware that their BAC level can be chemically tested immediately after being pulled over, they may be less inclined to drive impaired or have one last drink for the road.

Many of the other variable coefficients of this regression had different signs than in the initial model, however as in the discussion of Model 1, all coefficients in Model 2 need to be addressed.

In this model the coefficient on the natural log of income suggested an increase in alcohol related fatality rates for every one percent increase in income per capita. This value is slightly baffling considering the results of the first regression. This coefficient would indicate that for increases in income people drink and drive more often; perhaps this is a result of having more disposable income or not having to depend on public transportation for mobility. In addition, unlike the first model, the resulting coefficient on unemployment rates is positive in the second regression implying that for every increase in the unemployment rate, there is an expected decrease in the traffic fatality rate involving alcohol of 2.72 people per 100,000.

The coefficient on BAC law in Model 2 showed that for every increase in the maximum legal BAC there would be a decline in alcohol fatalities of 1.55 per 100,000 members of the population. This result makes absolutely no sense, as allowing people to drive at higher levels of impairment should in no way reduce alcohol involved traffic fatality rates. However, since the result is not statistically different from zero, it has no significant impact in this model.

The coefficient on pre sentencing investigation laws pointed to PSIs decreasing traffic fatality rates involving alcohol by approximately 0.25 people. While this result makes sense in terms of it decreasing alcohol fatalities, as would be its purpose, it does not seem as though it would be a likely deterrent for someone who is deciding whether or not to drink and drive. PSI laws only come into play after someone has been convicted of a DUI and there is no way to tell what the sentencing outcome will be on a case-by-case basis.

The impact of open container laws in Model 2 was similar to that of Model 1. The implementation of an open container law was expected to reduce alcohol fatality rates by 0.22 people. Anti-consumption regulation was a different story. In the alcohol model, enacting an anti-consumption law would result in the increase in traffic fatality rates of 0.15 per 100,000 in the population.

Suspension and revocation laws in this case do not provide a logical coefficient. The model suggested that license laws actually increased the alcohol involved traffic fatality rate by 0.99. This result is highly suspect considering the outcomes of Model 1 and the fact that it points to license suspension and revocation laws as factors that increase alcohol related fatalities.

Primary seatbelt laws and beer taxes were consistent with the results from the first model. The enforcement of primary versus secondary restraint laws led to a reduction in the alcohol traffic fatality rate of 0.09. While beer taxes once again showed an interesting impact on traffic fatalities with an expected increase in fatality rates for each increase in tax per gallon of beer.

As in Model 1 population density has a very small affect on fatality rates, however, in this case, more densely populated areas would expect to see an increase in alcohol related fatality rates of 0.0002 people per 100,000 members of the population. According to this result, maybe living in a more densely populated area results in more traffic congestion and traffic on the roads leading to more opportunities for fatalities involving alcohol.

Finally, in Model 2, an increased number of police officers per capita did not result in a decrease in alcohol fatalities. The impact of this variable was small and insignificant suggesting an increase in fatality rates involving alcohol of 0.003. This positive coefficient could be attributed to areas of higher crime, like big cities, being staffed with more police officers that may not make the issue drunk driving a top priority.

Conclusions

Model 1 of this paper addresses the overall impact of socioeconomic factors and legal environment on traffic fatality rates in the United States. Based on the model created to analyze the factors likely involved in overall traffic fatality rates, it appears that the implementation of anti-consumption laws, license suspension or revocation laws for first DUI offenses, and increased police force per capita are affective means of decreasing fatal traffic accidents. These results share similarities with significant reduction variables found by Chaloupka, Saffer, and Grossman (1993) who claimed licensing actions as a significant means of reducing fatalities. This was the only similar relationship among policy variables that could decrease traffic fatalities. However the findings, as in other reviewed papers, vary greatly considering the combination of significant variables. These new outcomes are likely due to the time period established for the analysis, and the unique combination of independent variables used in each model. As in the publications by Young and Bieliinska (2006), BAC laws were insignificant, and beer tax laws had no affect on reducing fatalities which was also case in Young and Liken's work (2000). No study I reviewed showed the number of police officers per capita as being significant, nor implicated anti-consumption laws in reducing fatalities.

Now that the significant coefficients and variables have been established, it is important to realize the implications of implementing suspensions and revocation laws for first offenses, enforcing anti-consumption legislation, and increasing police per capita.

Increasing police force per capita is a costly endeavor in the fight to prevent automobile fatalities. States would need to conduct a cost benefit analysis to determine the feasibility of hiring more officers for a slight decrease in fatalities annually. Individually, states must determine how much they are willing to pay and sacrifice to achieve this decrease. Though it is difficult to put a price on the value of a human life, decisions must be made to implement the most effective and cost efficient means of deterrence.

While increasing law enforcement could prove a costly and inefficient expenditure, creating new legislation that would result in a drunk driver's license being revoked or suspended provides a less expensive and very effective way to decrease fatalities. It seems strange that not all states implemented suspension or revocation polices for first time DUI offenders. Obviously, if you take driving privileges away from those who abuse alcohol and drive impaired you take drunk drivers off the road.

A similar story can be told for implementing an anti-consumption law. This legislation could be an inexpensive and effective means of reducing traffic fatalities. At least this action would prevent people from increasing their BAC levels while operating a vehicle and keep them from literally drinking and driving.

Model 2 specifically address the impacts of socioeconomic characteristics and legal factors on alcohol-related traffic fatalities. The only variable statistically different from zero in this regression was preliminary breath tests. Breathalyzer tests showed the same negative impact in reducing fatalities in the publication of Chaloupka, Saffer, and Grossman (1993). Similarities among significant variables ends here considering there was only one statistically significant result in the model.

Instituting preliminary breath tests would be a more costly venture than just passing legislation that increases license penalties or prohibits alcohol consumption in a vehicle. States without breathalyzers would have to purchase the devices and train officers to use them correctly. However, the use of these devices, as mentioned earlier, make it easier to identify those that are driving impaired immediately after they are pulled over before their BAC level can start to decline do to time lapse.

Driving in the United States is a privilege. There are age restrictions, tests to take, requirements to meet, and minimums to maintain for a reason. When someone gets behind the wheel of a car they are taking their life, the lives of their passengers, and the lives of other drivers traveling in the same vicinity into their hands. People that choose to drink and drive do not take these responsibilities seriously, and that is why states have to enact a variety of laws designed to recognize, punish, and deter drunk driving. The challenge we face today, is finding the most effective and efficient means of deterrence.

Though the last few decades have seen a decline in the number of traffic fatalities involving alcohol, it still remains, and will still remain, a significant problem facing everyone whether you are a motorist, pedestrian, or just the family member or friend of someone involved in a drunk driving fatality.

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