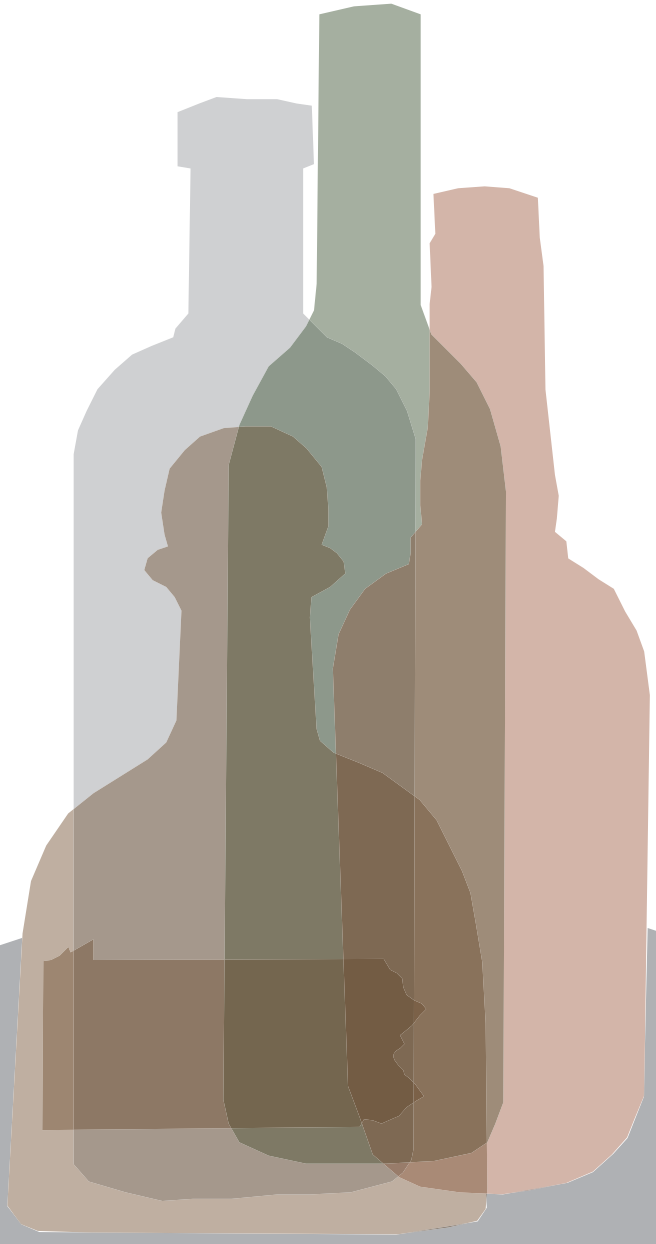
The Road Less Traveled:

States That More Tightly Control the Sale and Distribution of Alcohol Have Lower Alcohol-Related Fatalities



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Overview

What impact would the privatization of Pennsylvania's retail and wholesale alcohol operations have on the number of alcohol-related traffic fatalities each year? This should be a critical question for state policymakers to answer as they consider proposals to privatize Pennsylvania's state-operated wine and spirits system.

Following a comprehensive review of state-level data, we find that states with tighter control over the sale and distribution of alcohol have lower rates of alcohol-related traffic deaths than states that take a more hands' off approach.

Our findings are consistent with those of a panel of 21 public health experts[1] who concluded that the privatization of retail alcohol sales and distribution leads to increases in per capita alcohol consumption, creating a greater risk of alcohol abuse and its associated social costs.[2] Those findings were published by The Task Force on Community Preventive Services (Task Force), a panel appointed by the director of the Centers for Disease Control and Prevention (CDC), in the April edition of the peer-reviewed *American Journal of Preventive Medicine* (Hahn et al, 2012).[3]

Economists John Pulito and Antony Davies, in research released by two self-described "free market" think tanks, reached a very different conclusion. Their research found that states with tighter control of the sale and distribution of alcohol, in some instances, have higher rates of alcohol-related fatalities.[4]

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[1] The names and affiliations of the Task Force are available online at http://www.thecommunityguide.org/about/task-force-members.html

[2] http://www.thecommunityguide.org/alcohol/RRprivatization.html

[3] Available online http://www.ajpmonline.org/article/S0749-3797(12)00025-6/abstract. Also published in April in the same journal was a commentary by Cook (2012) and available online http://www.ajpmonline.org/article/S0749-3797(12)00024-4/abstract. Cook's data analysis is broken into two parts with the first part focusing on per capita wine sales in seven states that privatized the sale of wine between 1970 and 1985 and the second part on what is known about the effects of privatizing liquor sales in the U.S. which is the case of Iowa in 1987. With respect to the privatization of wine, Cook concludes there is evidence that the privatization leads to a "notable increase in consumption." With respect to Iowa, Cook found again evidence of rising wine consumption but not of liquor.

[4] John Pulito and Antony Davies, *Does State Monopolization of Alcohol Markets Save Lives?* Dr. Davies provided us with an updated version of this paper on July 21, 2011. This version is available at http://ow.ly/aV4bA. As of January 2012, a previous version (*State Control of Alcohol Sales As A Means of Reducing Traffic Fatalities: A Panel Analysis*) of the paper could be found on line at http://www.antolin-davies.com/research/alcohol.pdf. The findings were also summarized in a Mercatus Center Working paper: Antony Davies and John Pulito, *Binge Thinking: A Look at the Social Impact of State Liquor Controls*, Mercatus Center Working Paper No. 10-70, November 2010 available online at http://goo.gl/n8qA1

This policy brief replicates Pulito and Davies' analysis and then demonstrates that their results are reversed once you account for two variables excluded from the Pulito-Davies analysis but key to understanding the differences in alcohol-related motor vehicle fatality rates among the states — average vehicle miles traveled and average per capita income. Once these variables are included, states that more heavily control the sale and distribution of alcohol *do* have lower alcohol-related fatality rates for adults than either states that do not regulate or only lightly regulate alcohol sales. (Heavy control states are defined as maintaining control over the sale of at least two types of alcohol at the retail level and at least one type of alcohol at the wholesale level.)

All else equal, Pennsylvania has an estimated 58 fewer alcohol-related traffic deaths among adults each year than it would have if the state had no controls over the distribution of alcohol.

We find no difference in fatality rates for youth ages 15 to 19 according to the degree of state control over the distribution and sale of alcohol. Among youth under the age of 15, a group Pulito and Davies do not analyze, we find lower fatality rates for alcohol-related car accidents in states that exercise heavy control over the distribution and sale of alcohol.

Although the full technical explanation is complex, there are straightforward reasons for including vehicle miles traveled and per capita income in this analysis. First, both variables have an impact on alcohol-related fatalities and, therefore, belong in a comprehensive analysis of variations in fatality rates across states. Second, control states tend to be ones in which people drive further and are lower income. Therefore, when the two variables are excluded, some of the higher fatalities that should be attributed to driving further and having lower incomes are wrongly attributed to state alcohol controls.

This policy brief is not intended for the benefit of researchers on alcohol distribution and consumption, such as the public health experts on the Task Force. They do not need this policy brief to know that they can confidently ignore the Pulito and Davies research. Rather, this brief is intended to set the record straight in the public policy debate on liquor privatization in Pennsylvania. The Pulito-Davies research has been used repeatedly by policymakers and others—including in testimony before the legislature—to muddy the water regarding the negative social impacts of privatizing alcohol distribution.

As our findings and those of the Task Force show, the water remains clear on this topic: privatization brings with it potential negative social impacts, including increased alcohol-related traffic fatalities. These negative social impacts should be taken into account by lawmakers as they consider proposals to privatize Pennsylvania's wine and spirits stores.

The Pulito and Davies Study

Pulito and Davies have produced a series of research papers that have been published by free-market think tanks such as Pennsylvania's Commonwealth Foundation for Public Policy Alternatives and George Mason University's Mercatus Center. In July 21, 2011, Dr. Davies provided us with the most recent version of the authors' analysis, which addresses some problems in earlier versions.[5] Our critique here focuses on the recent version of their analysis, which is available at http://ow.ly/aV4bA, although the same basic critique applies to earlier versions.

Pulito and Davies (2012) classified 49 states into four categories according to degree of control each state has exercised over the sale and distribution of beer, wine and spirits (See Appendix B for a list of the states in each category and Appendix D for analysis using the alternative two-category classifications of Control and License).[6] To include in their statistical analysis of state variations in alcohol-related fatalities, Pulito and Davies also collected data on whether states have the following alcohol-related regulations: a minimum drinking age, a mandatory seat belt law, a blood alcohol limit of 0.08, a zero tolerance law, a keg registration law, a preliminary breath test, an open container law, and dram shop law (laws that establish the legal liabilities of establishments that serve alcohol). Controlling for these regulations, Pulito and Davies ask whether the degree of state control over the distribution and sale of beer, wine and spirits leads to differences in alcohol-related motor vehicle fatalities.[7]

They find that heavy control states (a group which includes Pennsylvania) had fatality rates for adults that were no different than states that did not regulate the retail and wholesale distribution of alcohol (see Table 1).[8] They also find a higher rate of "alcohol-involved" fatalities (deaths from a traffic accident in which someone involved has a high blood alcohol content) in

[5] We thank Dr. Davies for his professional courtesy in clarifying with us some of the technical issues in Pulito and Davies' research and for the updated version of his paper.

[6] The authors classified heavy states as those that maintain monopoly control over sales of at least two types of alcohol (beer, wine and liquor) at the retail level and at least one type of alcohol at the wholesale levels. Moderate states are those that maintain monopoly control over sales of one type of alcohol at the retail level and at least one at the wholesale level. Light states maintain monopoly control over no sales at the retail level and at least one type at the wholesale level. No control states are the control group, and those are states that do not maintain monopoly control over sales of any alcohol at either retail or wholesale level. See also Table B1 in Appendix B.

[7] The authors merged data on the regulation of alcohol by state from 1982 to 2002 with federal data on fatality rates by state for motor vehicle accidents that involved alcohol. The full list of controls include whether a state has a minimum drinking age, a mandatory seat belt law, a blood alcohol limit of .08, a zero tolerance law, a keg registration law, a preliminary breath test, open container law, and a dram shop law. Fatality rates can be calculated on a population basis or on a miles-traveled basis; Pulito and Davies use population-based fatality rates.

[8] They did find that states which maintain monopoly control over no sales at the retail level and at least one type at the wholesale level (light control) had a higher adult fatality rate than states that exercised no control at either the retail or wholesale level. They also find a lower alcohol-impaired adult fatality rate in moderate control states.

heavy control states for underage drinkers, but no difference in "alcohol-impaired" fatality rates (deaths of someone in a car as a result of a traffic accident in which a driver has a high blood alcohol content) for underage drinkers.[9] In light control states, those that maintain monopoly control over at least one type of alcohol at the wholesale level, the authors find higher fatality rates for both adults and youth 15 to 20 relative to states with no controls.

As Box 1 explains, Pulito and Davies use a methodology different than the approach favored by the Task Force for addressing the impact of the liquor distribution privatization. Rather than studying actual privatization events, they rely on a "panel" or "time series, cross-section" study that includes information over time (time series) and for the 49 states (a cross section). When using such a data set, moreover, analysts should include all variables that have an impact on the independent variable (in this case, alcohol-related fatalities). As noted above, Pulito and Davies use only two kinds of variables: control of liquor distribution and state regulations of alcohol use. Many other factors also potentially impact alcohol-related fatalities, such as the density of establishments (bars and restaurants) licensed to sell alcohol on premises and cultural factors (religious and ethnic). When factors that impact the dependent variable are omitted, it creates the potential for what statisticians call "omitted variable bias." Included variables (such as state control of liquor distribution) that are correlated with the missing omitted variables are estimated wrongly and "pick up" some of the influence of the omitted variables.

Box 1.

Limits of Panel Studies of State Alcohol Control and Alcohol-Related Traffic Fatalities

As described in this briefing paper, Pulito and Davies study the impact on traffic fatalities of state control of liquor distribution using data that include 49 states over a 21-year period (1982 to 2002).

The Task Force of national public health experts that recently studied the social impacts of retail alcohol distribution, however, used as primary evidence only studies that evaluated the effects of an actual privatization (or re-monopolization) of retail alcohol distribution. The Task Force found 12 research papers that analyzed 21 privatization "events" (some papers analyzed more than one event).[10]

[9]The full definition of an alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl. The full definition of an alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl.

[10] For the Task Force description of why it selected these 12 papers, and a list of studies, see

One advantage of such "before-and-after" natural experiments over panel data sets that include many states over time is that it is easier to separate out the impact of privatization from all of the other factors that impact alcohol consumption and health and social impacts, including alcohol-related traffic fatalities. The many factors that influence alcohol consumption and alcohol-related traffic fatalities include religious, ethnic, and other cultural differences, the density of bars or restaurants that serve alcohol on premises, the average distance between businesses that serve alcohol on premises and people's homes, the availability of public transit, vehicles miles traveled, and per capita income. Consistent data across states and over time on all of these variables that impact alcohol consumption and alcohol-related traffic fatalities are difficult or impossible to find. This means that in panel studies, many of these variables must be omitted, even though it is well known that this leads to errors in estimates of the impact on consumption and fatalities of included variables such as state control of alcohol distribution.

In studies of privatization experiments, by contrast, it is often reasonable to assume that, over short periods of time before and after the privatization, these other variables do not change a lot. Thus, changes in alcohol consumption, traffic fatalities, or other social impacts before and after privatization can more reasonably be attributed to the impact of privatization.

In exploring how much omitted variables biased the Pulito and Davies' analysis, we focus here on two missing variables known to influence alcohol-related motor vehicle fatality rates and for which state-level data are readily available over the time period covered by Pulito and Davies: vehicle miles traveled and per capita income. Previous studies document that miles traveled and incomes both help explain differences between states in traffic fatality rates (Ponicki et al. 2007).

http://www.thecommunityguide.org/alcohol/supportingmaterials/ISprivatization.html.

Table 1

Alcohol Related Traffic Fatalities

	Legal Age Traffic Fatalities		Traffic Fatality Rates for Youth Aged 15 to 20	
	Alcohol Involved	Alcohol Impaired	Alcohol Involved	Alcohol Impaired
Heavy Control	0.007	0.007	0.005*	0.004
Moderate Control	-0.006	-0.008**	0.001	-0.001
Light Control	0.037***	0.034***	0.015***	0.013***

Note. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. The coefficients on alcohol sales and use controls are omitted here; those controls include: Minimum Drinking Age, Mandatory Seat Belt, BAC Limit, Zero Tolerance, Keg Registration, Preliminary Breath Test, Open Container, Dram Shop. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl.

Source. John Pulito and Antony Davies, *Does State Monopolization of Alcohol Markets Save Lives?* 2011, online at www.keystoneresearch.org

The more people drive, the greater the risk they will be involved in an accident, including a lethal accident involving alcohol. In fact, based on data indicating that fatalities are roughly proportional to miles traveled, the Department of Transportation typically reports alcohol-related motor vehicle fatalities on a per 100 million miles traveled basis.[11] Pulito and Davies nonetheless conduct their analysis using population-based fatality rates (deaths per 1,000 people), making a special request for these unpublished rates from the U.S. Department of Transportation.

Incomes also influence the chances of death while driving, partly because incomes impact people's capacity to buy safer (or newer) cars. The higher a state's average income is, the lower the chances that car accidents, including those involving alcohol will result in a death. However, Pulito and Davies did not include incomes among their controls.

Figure 1 and 2 plot, for 2002, the relationship by state between alcohol-involved legal age traffic rates used by Pulito and Davies and, respectively, per capita vehicle miles traveled and

[11] Appendix C reports results from analysis that uses fatality rates per miles traveled as the dependent variable; this is an alternative to adding vehicles miles traveled to the independent variables in the Pulito and Davies' regression. The qualitative result from this alternative approach is the same as adding the variable to their regression: control states have fewer fatalities.

inflation-adjusted per capita income.[12] Figure 3 and 4 plot the same two variables against alcohol-involved traffic fatalities among youth ages 15 to 20.

In each figure, the 49 states in Pulito and Davies's analysis are divided into two color-coded groups. States that control (heavy, medium and light) the distribution and sale of alcohol are shown in blue and states that have no controls in red. Across all states, the more miles traveled in a state, the more alcohol-related adult and underage fatalities per 1,000 people there are. The lower per capita income is in a state, the higher alcohol-related adult and underage fatality rates will be.

A color-coded line is also fitted to each group of states. The fitted blue line in Figure 1 and 3 lies above the red line indicating that, in 2002 (the most recent year in Pulito and Davies' data), per capita miles traveled were higher in control states than in non-control states.

The fitted blue line lies below the fitted red line in Figure 2 and 4 indicating that control states on average in 2002 had lower per capita incomes than states that do not control the distribution and sale of alcohol.

As Table 2 illustrates, over the whole period (1982 to 2002), per capita vehicle miles traveled were on average higher in moderate- and light-control states compared to no-control states. Per capita incomes on average were lower in all categories of control states (Heavy, Moderate, Light) than in non-control states. Failing to take into account the effect of systematically lower vehicle miles traveled and higher per capita incomes in non-control states erroneously attributes the lower traffic fatality rates that result from fewer vehicle miles and higher incomes to the lack of controls on the sale and distribution of alcohol in those states.

[12] Data on vehicle miles traveled was graciously provided and compiled by Bill Ponicki (bponicki@prev.org) and are based on US Department of Transportation, Federal Highway Administration Highway Statistics. Per capita vehicle miles were calculated using population counts from the Bureau of Economic Analysis. Per capita income was obtained from the Bureau of Economic Analysis. Per capita incomes were adjusted to 2002 dollars based on the research series of the Consumer Price Index.

Table 2.

Per capita vehicle miles traveled and per capita income by degree of control of the sale and distribution of alcohol

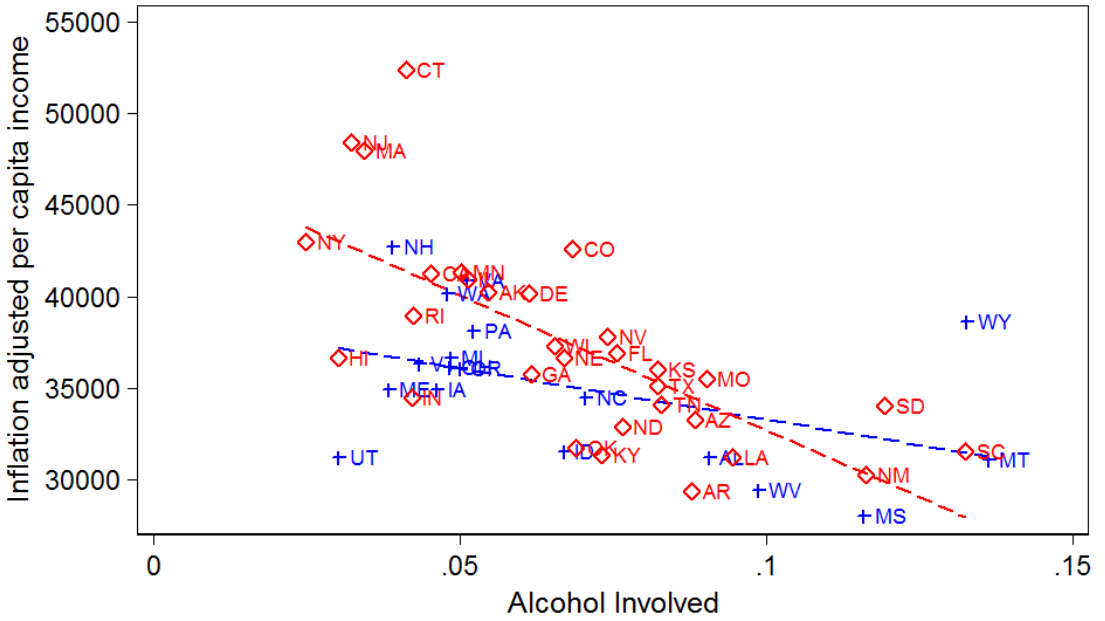
Degree of Control	Per Capita Vehicle Miles Traveled	Per Capita Income
Heavy	8,609	$27,642
Moderate	9,435	$30,417
Light	10,753	$28,192
No Control	8,875	$31,533

Source. Keystone Research Center

Figure 1. Legal Age Traffic Fatalities: Alcohol Involved 2002

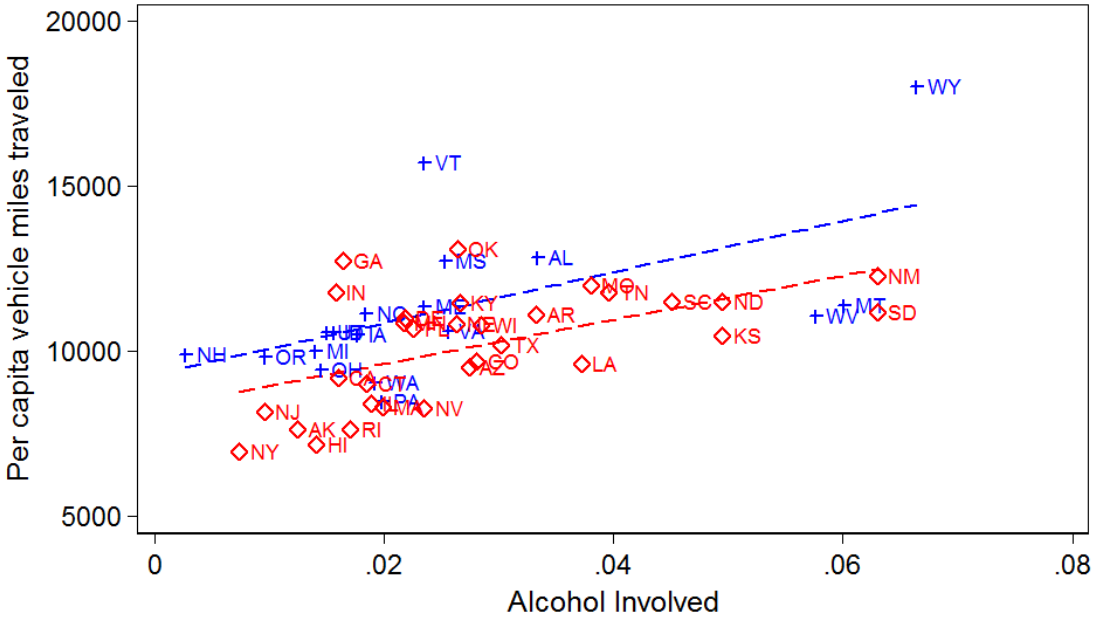
Source: Keystone Research Center

Figure 2. Legal Age Traffic Fatalities: Alcohol Involved 2002



Source: Keystone Research Center

Figure 3. Underage Traffic Fatalities: Alcohol Involved 2002



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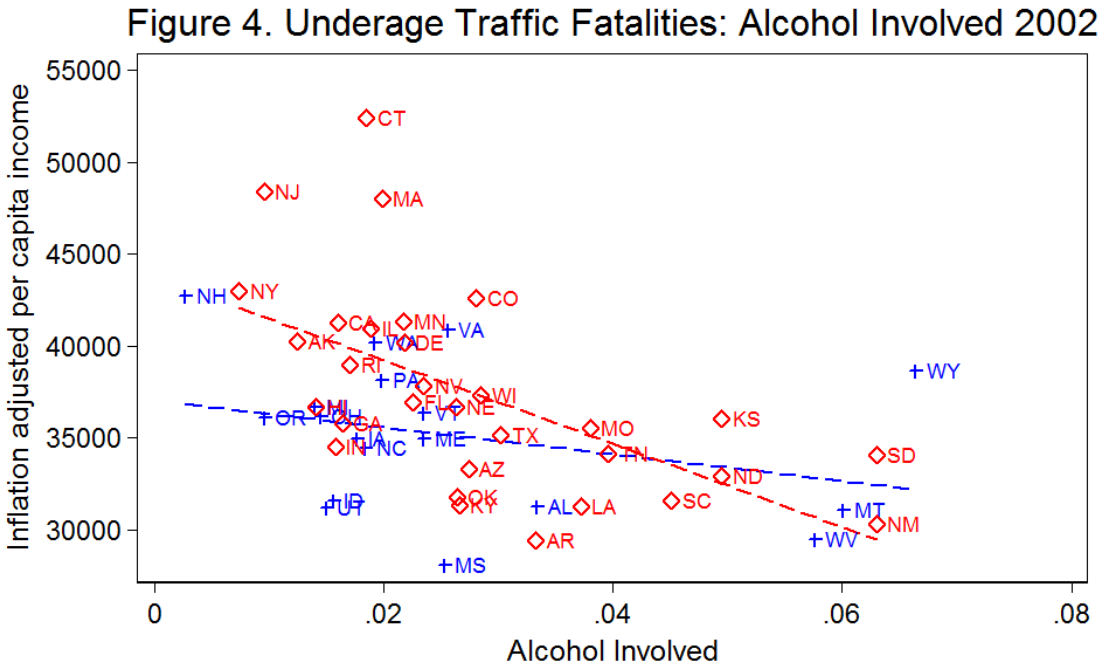

Table 3

Alcohol Related Traffic Fatalities After Including Controls for Per Capita Income and Per Capita Miles Traveled

	Legal Age Traffic Fatalities		Underage Traffic Fatality Rates			
			15 to 20 years of age		Under 15†	
	Alcohol Involved	Alcohol Impaired	Alcohol Involved	Alcohol Impaired	Alcohol Involved	Alcohol Impaired
Heavy Control	-0.007***	-0.005**	0.001	0.001	-0.004***	-0.004***
Moderate Control	-0.006***	-0.007***	-0.002	-0.002**	-0.002**	-0.001**
Light Control	0.007**	0.006**	0.001	0.000	0.000	0.001
Per Capita Miles Traveled	0.084***	0.075***	0.036***	0.028***	0.011***	0.009***
Per Capita Income	-0.071***	-0.063***	-0.025***	-0.021***	-0.018***	-0.014***

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Per capita miles traveled and incomes have been log transformed. Standard errors robust to disturbances autocorrelated with AR(1). The coefficients on alcohol sales and use controls are omitted here, those controls include: Minimum Drinking Age, Mandatory Seat Belt, BAC Limit, Zero Tolerance, Keg Registration, Preliminary Breath Test, Open Container, Dram Shop. See Table 1 for a description of the difference between Alcohol involved and Alcohol impaired fatality rates. See Tables A1 to A6 for full list of results. †No data on fatalities for children under 15 were reported for North Dakota in 1991.

Source. Keystone Research Center

Table 3 presents the results from rerunning the Pulito and Davies' panel regression including per capita vehicle miles traveled and inflation-adjusted per capita incomes as controls. (See Appendix A for complete results.)

As expected, the more vehicle miles people drive in a state, the greater the alcohol-related motor vehicle fatality rate. In addition, the lower per capita incomes in a state, the higher the fatality rate.[13] Both these relationships are significant at the 1% level.

In contrast to Pulito and Davies' original findings, both alcohol-involved and alcohol-related motor vehicle fatalities are now negatively related to a state being a heavy-control state and statistically significant. (Heavy control states are defined as maintaining control over the sale of at least two types of alcohol at the retail level and at least one type of alcohol at the wholesale level.)

When you include vehicle miles traveled and per capita income, Pennsylvania has an estimated 58 fewer alcohol-related traffic deaths among adults each year than it would have if the state had no controls over the distribution of alcohol.[14]

Adults in moderate-control states also have fewer alcohol-involved and -impaired traffic fatalities than states with no controls. Consistent with Pulito and Davies, we find that light control states have fatality rates higher than fatality rates in states that do not control the distribution and sale of beer, wine and spirits. Light-control states include Mississippi and Wyoming over the whole period from 1982 to 2002 and Iowa since 1988, West Virginia since 1991 and Michigan since 1997. Iowa, West Virginia and Michigan were each classified as heavy-control states prior to being reclassified by Pulito and Davies as light-control states.

Among 15-to-20 year olds, only alcohol-impaired fatality rates in moderate-control states were lower than in states with no controls. We could find no difference between fatality rates in heavy- or light-control states compared to states with no controls.

Pulito and Davies limit their analysis of alcohol-related fatalities to youth ages 15 to 20. The U.S. Department of Transportation, however, provides population-based fatality rates among youth under the age of 15, making it possible to apply their model to this subpopulation. Unlike the previous age groups, no data on fatalities for children under age 15 were reported for North Dakota in 1991. Consistent with our findings for adults, alcohol-involved and alcohol-impaired fatality rates among youth under the age of 15 are lower in both heavy- and moderate-control

[13] The coefficient on vehicle miles traveled is positive. The more per capita miles traveled in a motor vehicle in a state, the higher the alcohol-related traffic fatality rate. The coefficient on per capita income is significantly negative, indicating that the higher incomes are in a state, the lower fatality rates are.
[14] This is the predicted difference in fatalities assuming the average of per capita miles traveled, per capita income and adult alcohol-involved fatality rate in Pennsylvania between 1982 and 2002.

states than in states that do not control the distribution and sale of alcohol. Unlike our findings for adults, we could find no difference in fatality rates for youth under the age of 15 between states with no controls and states that exert light control.

Conclusion

We find that the results of Pulito and Davies' research are driven by the exclusion of variables that impact alcohol-related fatalities in states. Their central finding – that states with tighter control over retail alcohol sales and distribution experience no difference in alcohol-related traffic fatalities than those that exercise no control – can be reversed by including these key variables – average vehicle miles traveled and per capita income.

Using the Pulito-Davies model, supplemented by these two variables, we find that state control of alcohol distribution is associated with lower alcohol-related traffic fatalities. All else equal, a state with characteristics like Pennsylvania, which maintains monopoly control over the sale of at least two types of alcohol at the retail level and at least one type of alcohol at the wholesale level, has 58 fewer adult deaths per year from alcohol-related traffic accidents than it would have if the state had no controls over the distribution of alcohol.

The Task Force on Community Preventive Service, in its systematic review of available research on the effects of privatization of retail alcohol sales, identified 12 studies of 21 "privatization events" that were considered "primary evidence" of the impact of privatization. The Task Force also identified 16 panel studies that met its criteria to be considered as secondary evidence. While Pulito and Davies' study contradicted the Task Force's main conclusion that privatization produces negative social impacts, none of their studies met the criteria for inclusion as secondary evidence in the Task Force's review. One reason for this is that the studies were not published in academic, peer-refereed journals.

Our analysis confirms rather than confounds the broader conclusion from the research literature that the privatization of alcohol distribution has potential negative social impacts. Pennsylvania legislators, considering whether the state should privatize wine and spirits distribution in the state, should take these negative social impacts into account as they weigh the pros and cons of privatization.

Appendix A

Tables A1 to A4 present the coefficients and standard errors reported by Pulito and Davies alongside our own. The results in each table reported in the column labeled WPH 1 represent our replication of the Pulito and Davies results presented in the first column. The coefficients reported in the column labeled WPH 2 are our results after adding additional controls (results summarized in Table 3 of the main body of the paper).[15] Table A5 and A6 report our analysis of fatality rates for youth under the age of 15, a group Pulito and Davies did not include in their analysis.

While not identical to the most recent results of Pulito and Davies, Tables A1 to A4 do have very similar results for the impact of state control of liquor on alcohol-involved traffic fatalities. Specifically:

- Table A1 shows that in WPH 1 that the coefficients on each of the control variables (Light, Moderate, and Heavy) has the same sign as in the Pulito & Davies column. Moreover, in both columns only the Light Control coefficient is significant and the size of the coefficient in WPH 1 is virtually identical to that in Pulito & Davies.

- Table A2 shows that the control-variable coefficients in WPH 1 have the same sign as in the Pulito & Davies column. In addition, the Heavy Control variable is not significant in either column and the Light Control variable is significant at the 1 percent level in both columns and the coefficient has a very similar size (0.34 and 0.31). (One difference between the results: the Moderate Control variable is significant in Pulito & Davies regressions but not in our attempted replication.)

- Table A3 shows that the coefficients in WPH 1 have the same sign as in the Pulito & Davies column. In addition, the coefficients for Heavy Control are significant in the first column at the 5 percent level and in the second column at the 10 percent level. The coefficients on Heavy Control are also similar in the two columns. The coefficients for Moderate Control are not significant in either column and equal almost zero in both cases. The coefficients for Light Control are significant at the same level in the two columns and have similar-sized coefficients.

- Table A4 shows that the coefficients in WPH 1 have the same sign as in the Pulito & Davies column and are significant only for Light Control states.

[15] Based on Mundlak (1978) and Wooldridge (2002) pages 290-291, we selected a fixed effects panel regression. We detected first-order autocorrelation in a test proposed by Drukker (2003). We used the stata procedure xtregar to estimate standard error estimates robust to disturbances being autocorrelated with AR(1).

Table A1

Alcohol Involved Legal Age Traffic Fatalities

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	-0.001	-0.002	-0.001
	(0.001)	(0.002)	(0.001)
Mandatory Seatbelt Law	-0.002	-0.003	0.004
	(0.002)	(0.003)	(0.003)
BAC 0.08 Law	-0.003	-0.007**	-0.008***
	(0.002)	(0.003)	(0.002)
ZeroTolerance Law	-0.003	-0.015***	-0.009**
	(0.002)	(0.004)	(0.003)
Keg Registration Law	-0.002	0.007**	-0.001
	(0.003)	(0.003)	(0.002)
Preliminary Breath Test Law	-0.010***	-0.017***	-0.007***
	(0.002)	(0.002)	(0.002)
Open Container Law	-0.008***	-0.002	-0.004**
	(0.002)	(0.002)	(0.002)
Dram Shop Law	-0.003	-0.016***	-0.007***
	(0.002)	(0.003)	(0.002)
Heavy Control	0.007	0.003	-0.007***
	(0.006)	(0.003)	(0.003)
Moderate Control	-0.006	-0.000	-0.006***
	(0.005)	(0.003)	(0.002)
Light Control	0.037***	0.035***	0.007**
	(0.005)	(0.004)	(0.003)
Per Capita Income			0.084***
			(0.006)
Per Capita Miles Traveled			-0.071***
			(0.007)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl.

Sources. Pulito and Davies, *Does State Monopolization of Alcohol Markets Save Lives?*; and Keystone Research Center

Table A2

Alcohol Impaired Legal Age Traffic Fatalities

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.001)
Mandatory Seatbelt Law	-0.001	-0.002	0.004*
	(0.001)	(0.003)	(0.002)
BAC 0.08 Law	-0.003	-0.007***	-0.008***
	(0.002)	(0.003)	(0.002)
ZeroTolerance Law	-0.001	-0.013***	-0.007**
	(0.002)	(0.004)	(0.003)
Keg Registration Law	-0.001	0.007**	0.000
	(0.002)	(0.003)	(0.002)
Preliminary Breath Test Law	-0.010***	-0.015***	-0.006***
	(0.002)	(0.002)	(0.002)
Open Container Law	-0.006***	-0.001	-0.003*
	(0.002)	(0.002)	(0.001)
Dram Shop Law	-0.003	-0.013***	-0.006***
	(0.002)	(0.002)	(0.002)
Heavy Control	0.007	0.003	-0.005**
	(0.005)	(0.003)	(0.002)
Moderate Control	-0.008**	-0.002	-0.007***
	(0.003)	(0.003)	(0.002)
Light Control	0.034***	0.031***	0.006**
	(0.005)	(0.003)	(0.003)
Per Capita Income			0.075***
			(0.005)
Per Capita Miles Traveled			-0.063***
			(0.006)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl.

Sources. Pulito and Davies, *Does State Monopolization of Alcohol Markets Save Lives?*; and Keystone Research Center

Table A3

Alcohol Involved Traffic Fatalities for Youth Age 15 to 20

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	-0.0003	-0.002**	-0.001**
	(0.0007)	(0.001)	(0.001)
Mandatory Seatbelt Law	-0.0008	-0.004***	-0.002
	(0.0015)	(0.002)	(0.001)
BAC 0.08 Law	-0.0025	-0.006***	-0.006***
	(0.0016)	(0.001)	(0.001)
ZeroTolerance Law	-0.0033**	-0.006***	-0.004**
	(0.0016)	(0.002)	(0.002)
Keg Registration Law	0.0041**	0.006***	0.003***
	(0.0020)	(0.001)	(0.001)
Preliminary Breath Test Law	-0.0016	-0.004***	-0.000
	(0.0013)	(0.001)	(0.001)
Open Container Law	-0.0023	-0.002	-0.002***
	(0.0015)	(0.001)	(0.001)
Dram Shop Law	-0.0036**	-0.006***	-0.002
	(0.0015)	(0.001)	(0.001)
Heavy Control	0.005*	0.004**	0.001
	(0.003)	(0.002)	(0.001)
Moderate Control	0.001	0.000	-0.002
	(0.002)	(0.001)	(0.001)
Light Control	0.015***	0.011***	0.001
	(0.002)	(0.002)	(0.002)
Per Capita Income			0.036***
			(0.003)
Per Capita Miles Traveled			-0.025***
			(0.003)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl.

Sources. Pulito and Davies, *Does State Monopolization of Alcohol Markets Save Lives?*; and Keystone Research Center

Table A4

Alcohol Impaired Traffic Fatalities For Youth Age 15 to 20

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	-0.001	-0.001**	-0.001**
	(0.0006)	(0.001)	(0.001)
Mandatory Seatbelt Law	-0.001	-0.003***	-0.001
	(0.0012)	(0.001)	(0.001)
BAC 0.08 Law	-0.0019	-0.005***	-0.005***
	(0.0013)	(0.001)	(0.001)
ZeroTolerance Law	-0.0026**	-0.005***	-0.003**
	(0.0014)	(0.002)	(0.001)
Keg Registration Law	0.0044***	0.005***	0.003***
	(0.0017)	(0.001)	(0.001)
Preliminary Breath Test Law	-0.0011	-0.003***	-0.000
	(0.0011)	(0.001)	(0.001)
Open Container Law	-0.0007	-0.001	-0.001*
	(0.0012)	(0.001)	(0.001)
Dram Shop Law	-0.0017	-0.004***	-0.001
	(0.0015)	(0.001)	(0.001)
Heavy Control	0.004	0.003**	0.001
	(0.002)	(0.001)	(0.001)
Moderate Control	-0.001	-0.001	-0.002**
	(0.002)	(0.001)	(0.001)
Light Control	0.013***	0.009***	0.000
	(0.002)	(0.001)	(0.001)
Per Capita Income			0.028***
			(0.003)
Per Capita Miles Traveled			-0.021***
			(0.003)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl.

Sources. Pulito and Davies, *Does State Monopolization of Alcohol Markets Save Lives?*; and Keystone Research Center

Table A5

Alcohol Involved Traffic Fatalities Youth Under 15† Years of Age

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	NA	0.000	0.000
	NA	(0.000)	(0.000)
Mandatory Seatbelt Law	NA	-0.000	0.001
	NA	(0.001)	(0.001)
BAC 0.08 Law	NA	-0.001	-0.001*
	NA	(0.001)	(0.001)
ZeroTolerance Law	NA	-0.002**	-0.001
	NA	(0.001)	(0.001)
Keg Registration Law	NA	0.002***	0.001
	NA	(0.001)	(0.001)
Preliminary Breath Test Law	NA	-0.003***	-0.002***
	NA	(0.001)	(0.000)
Open Container Law	NA	-0.001*	-0.001***
	NA	(0.001)	(0.000)
Dram Shop Law	NA	-0.003***	-0.002***
	NA	(0.001)	(0.001)
Heavy Control	NA	-0.002***	-0.004***
	NA	(0.001)	(0.001)
Moderate Control	NA	-0.001	-0.002**
	NA	(0.001)	(0.001)
Light Control	NA	0.005***	0.000
	NA	(0.001)	(0.001)
Per Capita Income	NA		0.011***
	NA		(0.002)
Per Capita Miles Traveled	NA		-0.018***
	NA		(0.002)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl. †No data on fatalities for children under 15 were reported for North Dakota in 1991.

Source. Keystone Research Center

Table A6

Alcohol Impaired Traffic Fatalities Youth Under 15† Years of Age

	Pulito & Davies	WPH 1	WPH 2
Minimum Drinking Age	NA	0.000	0.000
	NA	(0.000)	(0.000)
Mandatory Seatbelt Law	NA	-0.000	0.001
	NA	(0.001)	(0.001)
BAC 0.08 Law	NA	-0.001	-0.001
	NA	(0.001)	(0.001)
ZeroTolerance Law	NA	-0.002*	-0.001
	NA	(0.001)	(0.001)
Keg Registration Law	NA	0.002**	0.001
	NA	(0.001)	(0.001)
Preliminary Breath Test Law	NA	-0.003***	-0.002***
	NA	(0.000)	(0.000)
Open Container Law	NA	-0.000	-0.001
	NA	(0.000)	(0.000)
Dram Shop Law	NA	-0.003***	-0.001***
	NA	(0.001)	(0.001)
Heavy Control	NA	-0.002***	-0.004***
	NA	(0.001)	(0.001)
Moderate Control	NA	-0.001*	-0.001**
	NA	(0.001)	(0.001)
Light Control	NA	0.005***	0.001
	NA	(0.001)	(0.001)
Per Capita Income	NA		0.009***
	NA		(0.002)
Per Capita Miles Traveled	NA		-0.014***
	NA		(0.002)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl. †No data on fatalities for children under 15 were reported for North Dakota in 1991.

Appendix B

Table B1.

States according to Alcohol Market Control Classification

Heavy	Moderate	Light	No Control	
Iowa*	Alabama	Mississippi	Alaska	Minnesota
Maine	Idaho	Wyoming	Arizona	Missouri
Michigan*	New Hampshire		Arkansas	Nebraska
Montana	North Carolina		California	Nevada
Pennsylvania	Ohio		Colorado	New Jersey
Utah	Oregon		Connecticut	New Mexico
West Virginia*	Vermont		Delaware	New York
	Virginia		Florida	North Dakota
	Washington		Georgia	Oklahoma
			Hawaii	Rhode Island
			Illinois	South Carolina
			Indiana	South Dakota
			Kansas	Tennessee
			Kentucky	Texas
			Louisiana	Wisconsin
			Massachusetts	

Notes.

Heavy Control states maintain monopoly control over sales of at least two types of alcohol (beer, wine and liquor) at the retail level and at least one type of alcohol at the wholesale levels.

Moderate Control states maintain monopoly control over sales of one type of alcohol at the retail level and at least one type of alcohol at the wholesale level.

Light Control states do not control sales at the retail level but do maintain monopoly control over at least one type of alcohol at the wholesale level.

No Control states are those that do not control the sale of alcohol at either the wholesale or retail level.

*Iowa was Heavy Control until 1987 and Light Control starting in 1988. West Virginia was Heavy Control until 1990 and Light Control Starting in 1991. Michigan was Heavy Control until 1996 and Light Control starting in 1997.

Source. Table 5 and 6 in Pulito and Davies, *Does State Monopolization of Alcohol Markets Save Lives?*

Appendix C

In this section we change the "dependent variable" in our analysis from alcohol-related fatalities per 1,000 people to alcohol-related fatalities per 100 million vehicle miles traveled. We examine how this change in independent variable influences the estimated statistical impact of state control states of alcohol distribution on traffic fatalities.

In column 1 in Table C1, we report results not taking into account differences in incomes across states (but we include vehicle miles traveled in the dependent variable). We find that alcohol-involved fatality rates in Heavy and Moderate control states appear to be no different from those in states without controls. Including a control for per capita incomes in column 2, we find alcohol-related fatality rates are lower in both heavy- and moderate-control states. In light-control states, alcohol-involved fatalities are higher in states without controls in column 1 and no different than states without controls in column 2.

With respect to alcohol-impaired fatality rates, we find in column 3 that heavy-control states have a higher fatality rate than states without controls. Once per capita income is added to the model, there is no difference in fatality rates in heavy control states relative to the reference group. In moderate-control states, there is no difference in fatality rates until after adding a control for per capita incomes. Light control states have higher fatality rates than states without controls in both column 3 and 4.

Table C1

Alcohol Involved Traffic Fatalities

Dependent variable = fatalities per 100 million vehicle miles traveled	Alc. Involved		Alc. Impaired	
	1	2	3	4
Minimum Drinking Age	-0.028*	-0.022	-0.028**	-0.022*
	(0.016)	(0.015)	(0.013)	(0.012)
Mandatory Seatbelt Law	0.002	0.049*	-0.014	0.023
	(0.031)	(0.029)	(0.025)	(0.023)
BAC 0.08 Law	-0.069**	-0.073***	-0.081***	-0.085***
	(0.030)	(0.027)	(0.023)	(0.021)
ZeroTolerance Law	-0.131***	-0.110***	-0.101***	-0.087***
	(0.042)	(0.039)	(0.033)	(0.030)
Keg Registration Law	0.025	-0.005	0.034	0.012
	(0.028)	(0.026)	(0.022)	(0.020)
Preliminary Breath Test Law	-0.093***	-0.062***	-0.077***	-0.053***
	(0.020)	(0.018)	(0.016)	(0.014)
Open Container Law	-0.022	-0.035*	-0.015	-0.027*
	(0.020)	(0.019)	(0.016)	(0.015)
Dram Shop Law	-0.120***	-0.087***	-0.098***	-0.072***
	(0.026)	(0.024)	(0.020)	(0.019)
Heavy Control	0.040	-0.056*	0.051**	-0.021
	(0.030)	(0.029)	(0.024)	(0.023)
Moderate Control	-0.032	-0.043*	-0.035	-0.038*
	(0.028)	(0.026)	(0.022)	(0.020)
Light Control	0.193***	0.041	0.174***	0.057**
	(0.037)	(0.036)	(0.029)	(0.028)
Per Capita Income		-0.868***		-0.702***
		(0.066)		(0.052)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita income has been log transformed. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl.

Source. Keystone Research Center

Appendix D

In this section we analyze alcohol-involved and -impaired traffic fatalities substituting a single binary variable (control) for the three binary variables (heavy, medium, and light) developed by Pulito and Davies and used in the main body of the paper. Table D1 identifies which states are control states and which are license states.

Table D1.

Control and license states as defined by the National Alcohol Beverage Control Association

control (monopoly)	license (open)	
Alabama	Alaska	Nebraska
Idaho	Arizona	Nevada
Iowa	Arkansas	New Jersey
Maine	California	New Mexico
Michigan	Colorado	New York
Mississippi	Connecticut	North Dakota
Montana	Delaware	Oklahoma
New Hampshire	Florida	Rhode Island
North Carolina	Georgia	South Carolina
Ohio	Hawaii	South Dakota
Oregon	Illinois	Tennessee
Pennsylvania	Indiana	Texas
Utah	Kansas	Wisconsin
Vermont	Kentucky	
Virginia	Louisiana	
Washington	Massachusetts	
West Virginia	Minnesota	
Wyoming	Missouri	

Source. National Alcohol Beverage Control Association (NABCA)

For simplicity, Table D2 presents just the coefficient on the variable control (the coefficients on the rest of the variables included in the model are available upon request). In the absence of per capita vehicle miles traveled and per capita incomes, alcohol-involved and -impaired fatalities among adults and teens ages 15 to 20 are higher in control states than in license states. However, as in the main body of the paper, after adding both these variables (Table D3)

to the model, alcohol-involved and -impaired fatalities are actually lower for adults and children under the age of 15 (there is no difference in impaired and involved fatality rates for teens aged 15 to 20).

Table D2

Alcohol Involved/Impaired Traffic Fatalities In Control States

	Legal: Involved	Legal: Impaired	15 to 20: Involved	15 to 20: Impaired	<15: Involved†	<15: Impaired†
Control	0.009***	0.008***	0.004***	0.003***	-0.000	-0.000

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). The coefficients on alcohol sales and use controls are omitted here, those controls include: Minimum Drinking Age, Mandatory Seat Belt, BAC Limit, Zero Tolerance, Keg Registration, Preliminary Breath Test, Open Container, Dram Shop. †No data on fatalities for children under 15 were reported for North Dakota in 1991.

Source. Keystone Research Center

Table D3

Alcohol Involved/Impaired Traffic Fatalities In NABCA States

	Legal: Involved	Legal: Impaired	15 to 20: Involved	15 to 20: Impaired	<15: Involved†	<15: Impaired†
Minimum Drinking Age	-0.002	-0.002	-0.001**	-0.001**	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Mandatory Seatbelt Law	0.004	0.004*	-0.002	-0.001	0.001	0.001
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
BAC 0.08 Law	-0.009***	-0.009***	-0.006***	-0.005***	-0.002**	-0.001**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
ZeroTolerance Law	-0.009***	-0.008***	-0.004**	-0.003**	-0.002	-0.001
	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Keg Registration Law	-0.002	-0.001	0.003**	0.003***	0.001*	0.001*
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Preliminary Breath Test Law	-0.006***	-0.005***	-0.000	-0.000	-0.001***	-0.001***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
Open Container Law	-0.005***	-0.004**	-0.002***	-0.001**	-0.002***	-0.001**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Dram Shop Law	-0.006***	-0.005**	-0.002	-0.001	-0.002***	-0.001**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Control	-0.004**	-0.004**	-0.000	-0.001	-0.002***	-0.002***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Per Capita Income	0.088***	0.077***	0.036***	0.028***	0.013***	0.011***
	(0.006)	(0.005)	(0.003)	(0.003)	(0.002)	(0.001)
Per Capita Miles Traveled	-0.073***	-0.067***	-0.027***	-0.023***	-0.017***	-0.013***
	(0.006)	(0.006)	(0.003)	(0.003)	(0.002)	(0.002)

Notes. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively. Standard error estimates are robust to disturbances being autororrelated with AR(1). Per capita miles traveled and incomes have been log transformed. An alcohol-involved traffic fatality is one in which a person, who is either a driver, a vehicle occupant, or a non-motorist, is killed within 30 days of a motor vehicle accident in which at least one person (driver, passenger, or non-motorist) had a BAC of at least 0.01 g/dl. An alcohol-impaired traffic fatality is one in which a person, who is either a driver or a vehicle occupant, is killed within 30 days of a motor vehicle accident in which at least one driver had a BAC of at least 0.08 g/dl. †No data on fatalities for children under 15 were reported for North Dakota in 1991.

Source. Keystone Research Center

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