

Estimating the Relationship between Alcohol Policies and Youth Violence

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Sara Markowitz
Emory University and NBER

Erik Nesson
Emory University

Eileen Poe-Yamagata
IMPAQ International, LLC

Curtis Florence
Centers for Disease Control

Tracy Roberts
IMPAQ International, LLC

Sarah Beth Link
Centers for Disease Control

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Abstract

Violence is one of the leading social problems in the United States, and the development of appropriate public policies to curtail violence is confounded by the relationship between violence and alcohol. In this paper, we estimate the propensity of alcohol control policies to reduce the incidence of violence among youth. The alcohol control policies we examine include the retail price of beer, drunk driving laws and penalties, keg laws, and serving and selling laws. We estimate a reduced form model of violence along with demand equations for binge drinking. Our results provide evidence that alcohol prices and restrictions on availability are negatively associated with binge drinking and with fighting. Regulations on kegs and penalties for drunk driving are also effective in reducing these outcomes. However, other alcohol control policies that are considered restrictive are not effective in reducing youth drinking and violence.

I. Introduction

Violence is one of the leading social problems in the United States. Reducing violence in the lives of young people is a critical mission outlined in the Healthy People 2020 agenda (USDHHS 2010). Alcohol consumption among youth is also a significant social problem that may be a contributing factor to acts of violence. Estimates from the 2007 Youth Risk Behavior Survey (YRBS) show that despite being under the legal drinking age, 45 percent of high school students drink and 26 percent binge drink in a given month. As for violence, rates among youth are much higher than those of any other age groups. According to the Centers for Disease Control's National Center for Injury Prevention and Control, youth ages 15-19 and 20-24 reported non-fatal injuries from assaults at rates of 1,200 and 1,414 per 100,000 population, respectively, in 2009. This is compared to rates of 540 per 100,000 population for adults ages 25 and up (CDC WISQARS 2011).

The development of appropriate public policies to curtail youth violence is confounded by the complex relationship between alcohol and violence. The correlation between the consumption of alcoholic beverages and the incidence of violence has been well-documented in the U.S. and in various countries throughout the world (WHO 2004). However, despite the close association of alcohol and violence, a question remains as to whether the relationship is truly causal. Many theories propose that the properties of alcohol cause people to become more violent or more vulnerable to victimization; however, it could also be true that people with violent tendencies self-medicate with alcohol or use alcohol as an excuse for their behavior, thereby lowering the potential penalties associated with violence. Moreover, the observed relationship between alcohol and violence could be spurious and the two outcomes could be related via a third factor, such as personality or environment.

In this paper, we circumvent the causality issue and directly estimate the propensity of alcohol control policies to reduce the incidence of youth violence. We use the reduced form policy analysis method of Cook and Tauchen (1982). This procedure exploits the well-established relationship between alcohol consumption and the exogenous determinants of demand, such as prices and alcohol control policies. By examining the effects of alcohol policies in reducing measures of violence, we can provide evidence for or against a causal relationship between consumption and violence, and more importantly, provide policy makers guidance on potential ways to reduce violence through alcoholic beverage control.

The reduced form method has been used extensively by researchers in the past to examine the direct impact of alcohol taxes and other control policies on various types of violence, including assault, rape, robbery, intimate partner violence, child abuse, and suicide (Saffer 2001; Markowitz 2005; Markowitz et al. 2003; Markowitz and Grossman 1998, 2000; Markowitz 2000; Cook 2007; Carpenter 2007). However, the bulk of this previous literature was conducted using data from the 1980s and 1990s, with only a few studies using data from beyond 2000. Also, most of this literature examines only a few alcohol control policies, mainly excise taxes, with some attention paid to drunk driving laws and availability measures. This is despite a plethora of policies currently used by states to control alcohol. In the analyses below, we describe and use twenty-one different alcohol control policies in conjunction with very recent data on violence committed by and against youth.

We expand on the existing literature on the relationship between youth alcohol consumption and violence in a number of ways. First, we use data from the Youth Risk Behavioral Surveillance Survey (YRBS) spanning 1991-2007, which encompasses a long period during which states were implementing new and stronger alcohol control policies. Second, we

examine the effectiveness of a broad range of alcohol control policies on measures of youth violence and drinking. Many of these policies have not yet been analyzed in the literature. We conduct our analyses paying attention to the dual problems of omitted variable bias and multicollinearity. Our results indicate that increases in alcohol prices are negatively associated with binge drinking and fighting among teenagers. Regulations regarding the sale of kegs are also effective in reducing these outcomes. However, other alcohol control policies that are considered restrictive are not effective in reducing youth drinking and violence.

II. Background

The literature on the effectiveness of strict alcohol control policies in reducing violence among youth is fairly limited. In one of the earliest studies, Markowitz and Grossman (2001) examine the question of whether higher prices of beer decrease the incidence of violence among college students. The measures of violence include: getting in trouble with the police, residence hall, or other college authorities; damaging property or pulling a fire alarm; getting into an argument or a fight; and taking advantage of another person sexually or having been taken advantage of sexually. The results show that the incidence of each of these four acts of violence is inversely related to the price of beer in the state in which the student attends college. More outlets licensed to sell alcohol are also generally associated a higher incidence of violence. In a similar study of high school students, Markowitz (2001) finds that higher beer taxes lower the probability of being in a physical fight but not of weapon carrying.

Saffer (2001) uses data from the 1991 National Household Survey on Drug Abuse to examine the effects of higher beer taxes on measures of crimes committed by youth ages 12-20 and all individuals ages 12 and up. He finds that higher beer taxes are associated with reductions in property crimes, property damage, and arrests for any type of crime for both age groups.

However, this study is limited in that Saffer only examines one year of data and cannot account for some of the unobserved state-level factors that may confound the relationships.

In a study on crimes, Carpenter (2007) examines the effectiveness of the “zero tolerance” drunk driving laws, which are laws that prohibit youth under the age of 21 from driving with any measurable amount of alcohol in their blood. Carpenter finds that the presence of these laws in states are associated with reductions in arrests of 18-20 year olds for property crimes, public drunkenness, disorderly conduct, and vandalism, but are not associated with arrests for violent crimes.¹

There is a larger literature on the effects of alcohol control policies on adult crimes and violence, but much of this literature was conducted using data prior to 2000 and the results may not be applicable to the current regulatory environment. Carpenter and Dobkin (2010) have an in-depth discussion of this literature. Of particular interest, a number of studies find higher beer prices associated with reductions in arrests for violence crimes and in violent victimizations (Chaloupka and Saffer 1992, Cook and Moore 1993, Desimone 2001, Markowitz 2005, Matthews et al. 2006).

There is also some evidence from the adult literature that crime rates may rise with a higher density of outlets licensed to sell alcohol. Scribner et al. (1995) and Gyimah-Brempong (2001) show that that violent crime rates increase with higher alcohol outlet densities in Los Angeles County and Detroit, respectively. Scribner et al. (1999) show that a higher outlet density is associated with a higher homicide rate in New Orleans. Other studies have examined the effects of closing times or allowed day of sale on crimes and found reductions in hours are associated with reductions in criminal violence (Olsson and Wikstrom 1982, Chikritzhs and

¹ There is also a large literature evaluating the effects of increases in the minimum legal drinking age on various outcomes, including crime, but the current policy relevance of this literature is limited.

Stockwell 2002 and Biderman et al. 2010). Much of this research, however, focuses on small geographic areas or examines unique policy changes with limited generalizability.²

The previous literature gives us insights into the relationship between alcohol control policies and measures of violence among youth. However, most of this research is based on data sets that are ten to twenty years old, or more. Since the time of this work, real alcohol prices have been falling as states and the federal government have chosen not to raise alcohol taxes in recent years (see Figure 1). Most of the new alcohol regulation that has occurred has taken different forms, primarily that of restrictions to youth access and incentives against drunk driving. In this paper, we revisit the question of whether alcohol control policies can be used to influence violence among youth. We use the most recent data available and analyze a comprehensive series of alcohol regulatory variables.

III. Data

The data used in this paper come from a variety of sources. We use the biennial Youth Risk Behavioral Surveillance Survey (YRBS) as the main source for analysis, and we supplement this with area-level alcohol policy information as described below.

The biennial YRBS is an ongoing nationally representative sample of high school students in grades 9-12 and is currently available for 1991 to 2007. Each survey year, the YRBS surveys a different sample of students. The advantage to this data is that the survey has a long time span and covers the periods when many states were phasing in or changing alcohol control policies. The measure of violence in this survey pertains to physical fighting. In every survey year, respondents are asked about the frequency of fights with the question, “During the past 12

² In a study using data from 1984-1995, Sloan et al. (2000) analyze a comprehensive set of alcohol control variables, such as open container laws, dram shop laws, and social host laws. They estimate demand for alcohol equations and a reduced form model of traffic fatalities and find some of these laws to be effective in altering binge drinking and fatalities. Sloan et al. do not consider violent outcomes.

months, how many times were you in a physical fight?” Possible responses are 0 times, 1 time, 2 or 3 times, 4 or 5 times, 6 or 7 times, 8 or 9 times, 10 or 11 times, 12 or more times. When a range is given, we code the responses at the bottom of the range so the possible values are 0, 1, 2, 4, 6, 8, 10 and 12. This variable is treated as a count variable and is analyzed accordingly.

The socioeconomic and demographic characteristics of the respondents are very limited in the YRBS in that only age, gender, and race are consistently reported in all surveys. All of these variables are included in each model. Two additional measures, which may help control for the respondent’s unobserved traits are also included. The first is an indicator of whether the respondent’s age is greater than the average for the grade while the second is an indicator of whether the respondent’s age is less than the average for the grade. The former will help identify teens who have been held back a grade while the later will help identify teens who have skipped grades.

Since the set of individual characteristics is very limited in these data, we also include the state-level real income per capita and the unemployment rate. State fixed effects will account for the time-invariant factors unique to each state. Year indicators will account for secular trends in the data. Data on real income come from the Bureau of Economic Analysis and unemployment figures come from the Bureau of Labor Statistics.

The first alcohol control policy of interest is the price of alcohol, which can be manipulated through legislated excise tax changes. We do not use the alcohol taxes in this project because very few states changed their excise taxes during the late 1990s and into the 2000s. Indeed, no state changed its tax between 2004 and 2008. Our methodology requires sufficient variation in the taxes for proper identification of the true effects, and this variation is simply not present. Instead we rely on the retail price of beer from the quarterly ACCRA Cost of

Living Index. Beer is chosen because it is the most popular beverage in terms of consumption of pure ethanol per capita. State level prices are generated by using a population weighted average of the cities represented in each state. Real prices are generated by deflating by the BLS's annual Consumer Price Index.

Variables that represent the availability of alcohol include the number of outlets licensed to sell liquor per 1000 state residents and the percent of a state's population that resides in counties that are "dry" for all types of alcohol. Researchers at IMPAQ International collected the data on dry counties from the *Brewers' Almanac*, and supplemented this information with data from state legislative documents, state officials, and publications by state governments and private organizations. Data on licensed outlets come from the *Adams Liquor Handbook*.

We include a host of other alcohol control policies gathered from the Alcohol Policy Information System (APIS). These data are available online through the National Institute on Alcohol Abuse and Alcoholism (NIAAA). For the years that were not available online, IMPAQ International researched state statutes and contacted state officials to provide a continuous time series for these data from 1991-2007. From this source, we collected eighteen policy variables within different policy areas, as shown and described in Table 1 below. These laws can be broadly grouped into the following: Laws pertaining to the purchase of kegs, open container laws, drunk driving laws, laws pertaining to serving and selling alcohol, Sunday sales, and miscellaneous laws pertaining to underage drinking. To create the analytical sample, we merged all of the policy data sources with the violence data, based on state of respondents' residence and year of the survey.

Since the degree of enforcement of liquor laws in a state may contribute to the overall policy environment, we include in all models a variable counting the number of arrests for

alcohol-based violations among youth under age 21 per the under 21 population. Arrests include those for public drunkenness, violation of liquor laws, and driving under the influence. These data are from the FBI's Uniform Crime Reports. A few states in certain years do not report these arrest data. These are represented with an indicator variable for missing data.

IV. Methods

The analytical framework starts with the proposition that violence is related to alcohol consumption. Considering the drinking habits and personal characteristics of both the potential criminal and victim gives the following equation for violence:

$$1) \quad V=v(A_i, A_j, X_i, X_j, U_i, U_j).$$

Equation 1, termed the structural violence equation, shows that an act of violence (V) is a function of the alcohol consumption of the individual (A_i) who is the potential victim, the alcohol consumption of other individuals (A_j) who are the potential perpetrators, and other observed characteristics of individuals (X_i, X_j) which affect the propensity towards violence or victimization such as age, gender, income, and employment status. Unobserved individual-level or state-level factors (U_i, U_j) which influence the violence are also considered.

Alcohol consumption by the potential victim (A_i) and the potential perpetrator (A_j) can be expressed by similar demand functions:

$$2) \quad A_i=a(P_A, E, X_i, U_i),$$

$$2a) \quad A_j=a(P_A, E, X_j, U_j),$$

where P_A is the full price of alcohol, E are law enforcement variables which may affect consumption through the enforcement of alcohol-related laws, and X and U are individual or area-level characteristics that may determine consumption. These sets of characteristics may be

the same ones which determine violence. Given that the violent acts examined in this study require personal contact, the victim and the perpetrator will be located in close proximity and thus face the same full prices and law enforcement variables. The full price of alcohol reflects both the monetary price and other costs of obtaining the substance, such as time and travel costs.

Substituting equations 2 and 2a into equation 1 gives a reduced form violence equation:

$$3) \quad V=v(P_A, E, X_i, X_j, U_i, U_j).$$

Equation 3 can be fully estimated empirically only when the characteristics of both the potential victim and perpetrator are observed. Unfortunately, most available data sets do not have full information on both. In light of this, a modified version of equation 3 serves as the basis for estimation when only limited characteristics are observed:

$$4) \quad V=v(P_A, E, X, e),$$

where e is an error term that contains the unobserved characteristics of either the perpetrator or victim. Including state-level fixed effects will account for some of the time-invariant, unmeasured characteristics in the error term. Note that omitting individual characteristics will not be problematic so long as these are uncorrelated with the components of the full price of alcohol and the alcohol-related laws, the variables of interest in this study.

In this paper, we estimate both the reduced form equation (equation 4) and a demand equation (equation 2). The estimation of the reduced form equation is particularly relevant to policy because the alcohol policy coefficients will show the propensity of increases in the full prices of alcohol to reduce violence. A negative coefficient on the beer price, for example, indicates that raising the price of beer is associated with reductions in violence, while a zero or positive coefficient shows that increasing the price will not reduce violent crime.

The dependent variable is best analyzed using a negative binomial regression model. We include state fixed effects to account for unobserved sentiment that may be correlated with violence and alcohol control policies. In all models, standard errors are corrected for correlation among individuals living in the same state according to Huber (1967).

The task of including and accounting for the variety of alcohol control policies is rather daunting, given that we have collected a variety of different policies. We approach the problem in ways that are designed to minimize the potential for both omitted variable bias and multicollinearity. First, we specify a base equation that includes the price of beer, the number of liquor outlets per capita and the percent of the state's population living in dry counties. These variables are chosen following from the previous literature, and because they represent the most popular regulations among states with the most variation across states and time. All models also include the arrests for alcohol related violations per population under age 21 to account for the degree of enforcement of the laws. These violations include those for liquor laws, drunk driving and public drunkenness.

We subsequently add policy variables to the base models. The policy variables are described in Table 1, along with some summary statistics. Not all variables collected and shown in Table 1 are presented in the subsequent tables of results, although these additional results are available upon request. The models shown are those specifications that include policies related to keg purchases, drunk driving, selling and serving, Sunday sales, and a count of the number of exceptions to underage laws.

The specific variables included in each model were chosen to minimize the potential for collinearity between the variables. However, these models may suffer from omitted variable bias, and we therefore developed alternative methods to include the alcohol policy variables.

First, we generated an index that sums the dichotomous variables representing a restriction on alcohol and subtract the variables that represent a lack of restriction. In an alternative specification we test the sum of the restrictions and the sum of the lack of restrictions as separate indexes. However, none of these indices proved to be statistically significant predictors of violence and are therefore not shown in the tables of results.

Our second alternative method of including the alcohol control policy variables is through the use of tetrachoric principal component analysis (TPCA). This procedure is a type of principal component analysis (PCA) designed for binary variables. As with standard PCA, the TPCA is a variable reduction method that extracts principal components as linear combinations of optimally-weighted observed variables. We conducted this analysis using the time period corresponding to the YRBS, and generated new variables containing the extracted factors, the number of which depending on the resulting cumulative proportion of the explained variation (using 0.75 as a cutoff value). The factors are then included as variables in the regression models.

We show a variety of models with the constructed factors. The first set contains the factors from drunk driving laws, keg/open container laws, and selling and serving laws. The second set contains a broader grouping of variables and represents the restrictive variables and exceptions to laws. The actual variables and their loading factors are shown in Table 2. The generated factors have low correlations with each other so including the factors from the different groupings of variables is not problematic.

V. Results

Table 3 contains the means of the variables from the YRBS data and select alcohol policy variables shown in the regressions. Additional policies shown in Table 1 were analyzed but are

not shown for brevity. The average respondent in the YRBS was engaged in about one fight in the past year. About 45 percent of respondents report drinking any amount in the past 30 days and of these drinkers, the average number of days on which the respondent binge drinks is 2.5.

Table 4 shows the results for the number of fights. The models are estimated using negative binomial regression, so the coefficients have a straightforward interpretation of semi-elasticities when the variable is continuous in nature. That is, the coefficients show the percent change in the number of fights from a one unit change in the independent variable. To get a semi-elasticity for the dichotomous indicators, a transformation of the coefficients ($\exp(B)-1$) is necessary (not shown). The results in Table 4 indicate that beer prices are negatively related to the number of fights, and these estimates are statistically significant across all models. The magnitudes are fairly small with a one dollar increase in beer prices associated with a 10 to 13 percent reduction in the number of fights. Higher numbers of outlets per capita licensed to sell liquor are positively related to fights, with every additional outlet per 1000 population associated with an 11 to 13 percent increase in the number of fights.

Only a few of the other alcohol control policies are statistically related to the number of fights. The indicator variable requiring purchaser's information for sale of a keg is negatively associated with fights, as is the dollar amount of the deposit required for kegs. The coefficient on the indicator for a penalty of loss of drivers license until age 18 or 19 is also negative and statistically significant. None of the other policy variables are statistically related to fighting.

These results are confirmed by the TPCA shown in Table 5. Here, the beer price coefficients are still negative and statistically significant, the liquor outlet coefficients are positive and statistically significant, and the only factors that are significant are those for the keg laws. As shown in Table 2, the first factor loads fairly equally on all the keg variables, while the

second factor loads mostly on the presence of a deposit for kegs. The negative sign on the factors confirm the negative signs on the policies themselves in the models in Table 4.

What is of more interest in the TPCA analyses is that the alcohol policy laws that are generally considered restrictive and those that provide exceptions to laws are all statistically insignificant. This indicates that these alcohol policies as a group are ineffective in reducing violence. Only the keg laws appear to matter, along with the beer price and licensed outlets.

The YRBS also provides information on the respondent's drinking behaviors. In order to believe the results of the reduced form models of violence, it is important to show that drinking also responds to the policies. We focus on measures of binge drinking since it is the heavy alcohol consumption that is likely to be related to violence. In the YRBS, respondents are asked, "During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row...". Responses include 0, 1, 2, 3 to 5, 6 to 9, 10-19, or 20 or more days. We recode these to represent the rounded midpoint of the range and analyze this with a negative binomial count model similar to that of the number of fights presented above. In the first set of models, the zero responses indicate both abstainers and drinkers who do not binge drink. However, because the determinants of the decision to drink may be different than quantity decisions, we also analyze a second set of models where the sample is restricted to those respondents who report drinking any positive amount. In this case, the zero values for binge drinking represent only respondents who drink but who do not binge drink.

The results for the binge drinking equations are presented in Table 6. Only select alcohol control policies are shown for brevity. The coefficients on the policies not shown are statistically no different from zero but are available upon request. For the most part, the results here confirm the results from the reduced form equation. Binge drinking is negatively associated with

the real beer price, however, the coefficients are statistically significant only in the models where the sample is restricted to drinkers. In these models, a one dollar increase in beer prices associated with a 7 to 10 percent reduction in the number of binge drinking days. These translate to a binge drinking elasticity of -0.3 to -0.4.

The coefficients on liquor outlets are positive, but for the most part, not significant at conventional levels. However, the other availability measure, the percent of the state population living in dry counties, does show a significant relationship with binge drinking in all models. Here, states with larger dry counties are associated with lower counts of binge drinking among respondents. Among drinkers, other variables that are associated with reductions in binge drinking include higher deposits on kegs and a penalty of loss of a drivers license for drunk driving.

VI. Conclusion

This paper provides new evidence of the negative relationship between alcohol prices and youth violence. Using both a reduced form violence equation and a demand equation for binge drinking, we find consistent evidence that increased alcohol prices are associated with decreases in binge drinking and violence among youth. We find every dollar increase in the beer price is associated with about a 10 to 13 percent decrease in the number of fights and a 7 to 10 percent reduction in the number of binge drinking days.

We also find some evidence that other alcohol policies are associated with lower violence, including fewer alcohol outlets, keg registration controls, and the penalty of loss of a drivers license for drunk driving. However, policies that are generally restrictive in nature, as a set, do not predict violence or binge drinking. Policies that provide exceptions to laws, and are therefore less restrictive, also are not predictors of violence or binge drinking.

Our results provide important guidance for policy makers in identifying policies for reducing the incidence of alcohol involved youth violence. In particular, the evidence provided by this research corroborates earlier studies linking increases in the price of alcohol with reductions in violence among youth.

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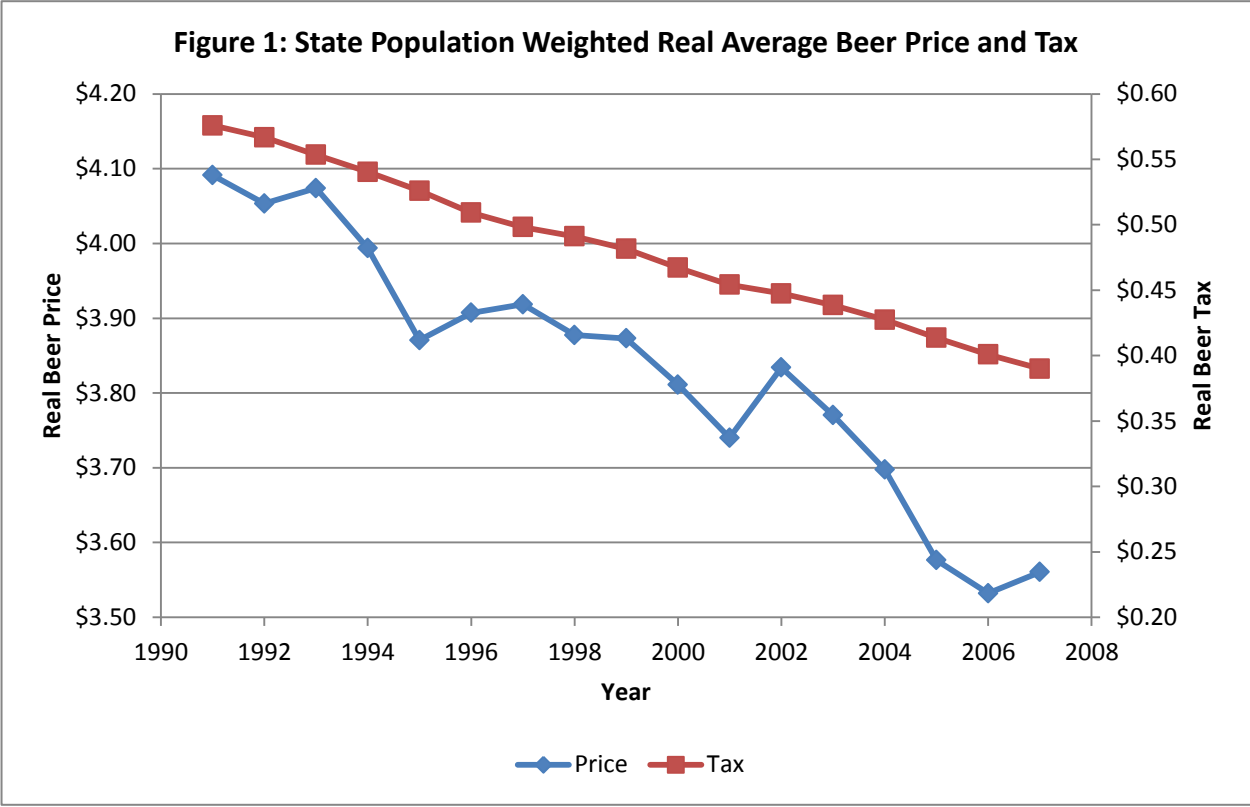


Table 1: Alcohol Policy Descriptions (N=51)

	Definition	Mean in 1991	Mean in 2007
Price and availability			
Real beer price	ACCRA price of a six pack of beer in 1982-1984 dollars	4.26	3.64
Liquor outlets	Number licensed liquor outlets per 1000 pop.	1.26	1.26
Percent dry	Percent of state population living in dry counties	4.27	3.47
Keg and open container laws			
Keg info required	State requires information regarding purchaser's id or location before purchase of keg	0.20	0.58
Keg deposit*	Keg deposit in dollars (range = 0 to \$75)	1.67	5.59
Prohibit unlabeled keg	State prohibits possession of an unlabeled keg or destroying the label on a keg	0.12	0.30
Open container federal standard	State open container laws conform to federal standard	0.25	0.77
Drunk Driving Laws			
BAC .08	Blood alcohol content level of 0.08	0.09	1.00
Drivers license loss age 18 or 19	State penalty for underage drinking and driving is loss of drivers license until age 18 or 19	0.27	0.24
Drivers license loss age 21	State penalty for underage drinking and driving is loss of drivers license until age 21	0.32	0.54
Serving and Selling Laws			
Count of fake ID supports*	Number of support provisions for retailers for identifying fake ids (range=0 to 4)	1.65	2.24
Age 21 to serve or sell	State specifies a minimum age of 21 to sell or serve alcohol	0.22	0.22
Mandatory training	State requires mandatory beverage service training for employer or server	0.06	0.35
Incentives for voluntary training	State provides incentives for voluntary beverage service training	0.16	0.35
Sunday Sales			
Sunday ban	State bans sale of all types of alcohol on Sunday	0.33	0.24
Sunday local	States with Sunday bans have local sales option	0.14	0.06
Underage laws			
Possession exception	State has exceptions to underage possession laws	0.40	0.61
Furnishing exception	State has exceptions to furnishing to minors laws	0.51	0.61
Hosting exception	State has exceptions to hosting laws	0.14	0.32
Count of exceptions	Count of number of exceptions to underage laws (range=0 to 3)	1.06	1.53
Hosting policy	State has a policy on hosting underage parties	0.24	0.46

*Variable dichotomized for TPCA analysis.

Table 2: Scoring Coefficients for TPCA

	Factor 1	Factor 2	Factor 3	Factor 4
Drunk Driving Laws	Driving 1	Driving 2		
BAC .08	0.015	0.987		
Drivers license loss age 18 or 19	-0.706	0.122		
Drivers license loss age 21	0.708	0.102		
Serving and Selling Laws	Selling 1	Selling 2	Selling 3	
Fake ID support: 1 provision	-0.095	-0.745	-0.001	
Fake ID support: 2 provisions	0.522	0.300	-0.505	
Fake ID support: 3 or 4 provisions	-0.426	0.447	0.507	
Age 21 to serve or sell	0.393	-0.193	0.561	
Mandatory training	0.255	0.334	0.189	
Incentives for voluntary training	-0.564	0.081	-0.373	
Keg Laws	Keg 1	Keg 2		
Keg info required	0.654	-0.108		
Presence of keg deposit	0.482	0.822		
Prohibit unlabeled keg	0.583	-0.559		
Restrictive Policies	Restrictive 1	Restrictive 2	Restrictive 3	Restrictive 4
Age 21 to serve or sell	-0.391	0.377	0.185	0.201
Mandatory training	0.248	0.142	0.109	0.618
Incentives for voluntary training	0.166	-0.284	-0.473	-0.334
Sunday ban	-0.312	-0.227	0.321	0.027
Hosting policy	0.415	-0.071	-0.363	0.350
Open container federal standard	0.287	0.106	-0.018	0.312
Prohibit unlabeled keg	0.487	0.050	0.339	-0.298
Keg info required	0.404	0.122	0.517	-0.263
Drivers license loss age 21	0.042	-0.559	0.309	0.280
Drivers license loss age 18 or 19	0.063	0.600	-0.130	-0.095
Exceptions	Exception 1	Exception 2		
Possession exception	0.446	0.512		
Furnishing exception	0.437	0.537		
Hosting exception	0.629	-0.292		
Sunday local	-0.463	0.603		

Notes: Number of extracted factors based on the cumulative proportion of the explained variation, using 0.75 as a cutoff value.

Table 3: Summary Statistics for YRBS Data (N=120,021)

	Mean	Standard Deviation
Number of fights	1.065	(2.32)
Number of binge drinking occasions (N=119,644)	1.154	(2.99)
Number of binge drinking occasions conditional on drinking (n=54,320)	2.500	(4.01)
Real beer price	3.914	(0.54)
Liquor outlets per capita	0.973	(0.53)
Percent dry	3.562	(8.75)
Alcohol laws arrest rate	163.022	(113.65)
Alcohol laws arrest rate missing	0.063	(0.24)
Keg info required	0.290	(0.45)
Keg deposit	0.051	(0.22)
BAC .08	0.564	(0.50)
Drivers license loss age 18 or 19	0.178	(0.38)
Drivers license loss age 21	0.563	(0.50)
Age 21 to serve or sell	0.084	(0.28)
Mandatory training	0.108	(0.31)
Incentives for voluntary training	0.405	(0.49)
Count of fake ID supports	2.123	(0.77)
Sunday ban	0.243	(0.43)
Sunday local	0.072	(0.26)
Count of exceptions	1.206	(0.87)
Female	0.511	(0.50)
Age	16.196	(1.22)
Black	0.245	(0.43)
Hispanic	0.250	(0.43)
Other race	0.122	(0.33)
Age greater than grade	0.068	(0.25)
Age less than grade	0.003	(0.05)
Real state per capita income	15.991	(2.44)
State unemployment rate	5.506	(1.31)

Table 4: Number of Fights
Negative Binomial Regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real beer price	-0.123 (-3.22)	-0.130 (-2.88)	-0.106 (-2.37)	-0.117 (-2.85)	-0.123 (-3.24)	-0.118 (-3.02)	-0.114 (-2.94)	-0.123 (-3.33)
Liquor outlets per capita	0.127 (1.73)	0.112 (1.63)	0.133 (1.77)	0.124 (1.69)	0.127 (1.72)	0.126 (1.71)	0.132 (2.03)	0.127 (1.74)
Percent dry	-0.015 (-1.21)	-0.014 (-1.05)	-0.015 (-1.25)	-0.016 (-1.13)	-0.016 (-1.27)	-0.016 (-1.23)	-0.013 (-1.23)	-0.015 (-1.20)
Alcohol laws arrest rate	-0.0002 (-1.44)	-0.0002 (-1.71)	-0.0002 (-1.64)	-0.0002 (-1.42)	-0.0002 (-1.54)	-0.0002 (-1.45)	-0.0002 (-1.58)	-0.0002 (-1.35)
Alcohol laws arrest rate missing	-0.017 (-0.21)	-0.031 (-0.36)	-0.023 (-0.28)	-0.017 (-0.20)	-0.020 (-0.25)	-0.018 (-0.22)	-0.013 (-0.17)	-0.017 (-0.20)
Keg info required		-0.073 (-1.67)						
Keg deposit			-0.203 (-2.15)					
BAC .08				0.006 (0.16)				
Drivers license loss age 18 or 19				-0.223 (-2.39)				
Drivers license loss age 21				-0.010 (-0.15)				
Age 21 to serve or sell					0.048 (0.61)			
Mandatory training						-0.042 (-0.56)		
Incentives for voluntary training						0.029 (0.66)		
Count of fake ID supports						-0.011 (-0.36)		
Sunday ban							-0.093 (-1.33)	
Sunday local							-0.014 (-0.16)	
Count of exceptions								-0.001 (-0.02)
Female	-0.724 (-39.06)	-0.723 (-39.08)	-0.724 (-38.94)	-0.723 (-39.08)	-0.724 (-39.08)	-0.724 (-39.02)	-0.724 (-39.06)	-0.724 (-39.04)
Age	-0.129 (-27.29)	-0.129 (-27.38)	-0.129 (-27.02)	-0.129 (-27.38)	-0.129 (-27.26)	-0.129 (-27.40)	-0.129 (-27.38)	-0.129 (-27.30)
Black	0.208 (7.32)	0.209 (7.30)	0.208 (7.32)	0.208 (7.32)	0.208 (7.32)	0.208 (7.28)	0.208 (7.33)	0.208 (7.33)

Hispanic	0.190 (6.08)	0.193 (6.28)	0.193 (6.20)	0.190 (6.07)	0.191 (6.09)	0.190 (6.07)	0.191 (6.06)	0.190 (6.14)
Other race	0.100 (2.10)	0.101 (2.11)	0.101 (2.13)	0.098 (2.06)	0.100 (2.11)	0.100 (2.11)	0.098 (2.06)	0.100 (2.10)
Age greater than grade	0.496 (18.92)	0.496 (19.02)	0.496 (18.96)	0.496 (18.95)	0.495 (18.93)	0.496 (18.86)	0.496 (18.93)	0.495 (18.99)
Age less than grade	0.317 (3.60)	0.317 (3.61)	0.316 (3.58)	0.317 (3.59)	0.317 (3.61)	0.318 (3.61)	0.315 (3.59)	0.317 (3.61)
Real state per capita income	-0.047 (-1.52)	-0.055 (-1.84)	-0.040 (-1.27)	-0.046 (-1.32)	-0.048 (-1.54)	-0.051 (-1.55)	-0.052 (-1.65)	-0.047 (-1.43)
State unemployment rate	0.020 (1.19)	0.018 (1.13)	0.019 (1.13)	0.022 (1.19)	0.020 (1.16)	0.019 (1.03)	0.018 (1.09)	0.020 (1.11)

Notes: N=120,021. T-statistics in parentheses, based on state-clustered standard errors. Intercept not shown. All models also include year and state fixed effects.

Table 5: Number of Fights
Negative Binomial Regression with TPCA

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Real beer price	-0.123 (-2.89)	-0.121 (-2.99)	-0.101 (-2.20)	-0.120 (-2.80)	-0.123 (-3.27)	-0.095 (-2.00)	-0.118 (-2.73)
Liquor outlets per capita	0.127 (1.72)	0.123 (1.67)	0.141 (1.83)	0.120 (1.70)	0.125 (1.75)	0.141 (1.82)	0.106 (1.60)
Percent dry	-0.013 (-1.06)	-0.016 (-1.18)	-0.015 (-1.27)	-0.016 (-1.22)	-0.014 (-1.13)	-0.012 (-1.10)	-0.015 (-1.06)
Alcohol laws arrest rate	-0.0002 (-1.35)	-0.0002 (-1.57)	-0.0002 (-1.56)	-0.0002 (-1.69)	-0.0002 (-1.14)	-0.0002 (-1.64)	-0.0002 (-1.45)
Alcohol laws arrest rate missing	-0.014 (-0.17)	-0.024 (-0.30)	-0.019 (-0.25)	-0.024 (-0.29)	-0.010 (-0.13)	-0.020 (-0.27)	-0.020 (-0.24)
Driving 1	-0.015 (-0.43)					-0.025 (-0.99)	
Driving 2	0.001 (0.03)					0.003 (0.13)	
Selling 1		-0.004 (-0.20)				-0.001 (-0.05)	
Selling 2		-0.002 (-0.09)				0.008 (0.44)	
Selling 3		-0.018 (-0.86)				-0.017 (-0.95)	
Keg 1			-0.027 (-2.07)			-0.026 (-1.89)	
Keg 2			-0.062 (-2.08)			-0.070 (-2.24)	
Restrictive 1				0.014 (0.57)			0.018 (0.72)
Restrictive 2				-0.006 (-0.18)			-0.0002 (-0.01)
Restrictive 3				-0.024 (-0.90)			-0.026 (-1.01)
Restrictive 4				0.007 (0.36)			0.018 (0.94)
Exception 1					-0.002 (-0.06)		-0.021 (-0.62)
Exception 2					0.012 (0.55)		0.015 (0.65)

Notes: N=120,021. T-statistics in parentheses, based on state-clustered standard errors. Intercept not shown. Models include state fixed effects and all additional variables shown in Table 4.

Table 6: Binge Drinking

	All respondents (N=119,644)			Drinkers (any amount) (N=54,320)		
	(1)	(2)	(3)	(4)	(5)	(6)
Real beer price	-0.067 (-0.98)	-0.078 (-1.09)	-0.100 (-1.52)	-0.072 (-1.72)	-0.088 (-1.91)	-0.095 (-2.37)
Liquor outlets per capita	0.059 (0.89)	0.050 (0.77)	0.039 (0.60)	0.086 (1.67)	0.078 (1.51)	0.080 (1.52)
Percent dry	-0.033 (-2.76)	-0.037 (-2.57)	-0.027 (-2.20)	-0.027 (-2.26)	-0.036 (-2.18)	-0.025 (-1.93)
Alcohol laws arrest rate	0.0003 (1.20)	0.0003 (1.10)	0.0004 (2.02)	0.0001 (0.94)	0.0001 (0.71)	0.0002 (1.24)
Alcohol laws arrest rate missing	0.322 (1.72)	0.316 (1.62)	0.343 (2.03)	0.168 (2.06)	0.155 (1.71)	0.179 (2.24)
Keg deposit	-0.126 (-1.38)			-0.147 (-2.01)		
BAC .08		0.037 (0.71)			0.044 (1.00)	
Drivers license loss age 18 or 19		-0.222 (-2.74)			-0.099 (-1.86)	
Drivers license loss age 21		-0.053 (-0.82)			-0.104 (-2.19)	
Mandatory training			-0.108 (-1.18)			-0.010 (-0.14)
Incentives for voluntary training			-0.130 (-1.77)			-0.069 (-1.22)
Count of fake ID supports			-0.030 (-0.61)			0.001 (0.04)
Female	-0.587 (-18.83)	-0.587 (-18.76)	-0.588 (-18.91)	-0.516 (-24.10)	-0.515 (-24.02)	-0.515 (-24.21)
Age	0.213 (20.03)	0.212 (20.00)	0.212 (19.92)	0.118 (17.61)	0.117 (17.66)	0.118 (17.50)
Black	-0.994 (-17.19)	-0.995 (-17.26)	-0.996 (-17.26)	-0.627 (-16.08)	-0.628 (-16.22)	-0.628 (-16.29)
Hispanic	-0.157 (-4.17)	-0.158 (-4.08)	-0.157 (-4.08)	-0.124 (-5.34)	-0.125 (-5.14)	-0.124 (-5.28)
Other race	-0.279 (-2.60)	-0.283 (-2.64)	-0.286 (-2.65)	-0.060 (-1.04)	-0.065 (-1.13)	-0.066 (-1.12)
Age greater than grade	0.150 (3.91)	0.150 (3.93)	0.150 (3.98)	0.159 (5.10)	0.159 (5.08)	0.159 (5.13)
Age less than grade	1.186 (7.88)	1.187 (7.89)	1.179 (7.82)	1.023 (9.25)	1.021 (9.27)	1.020 (9.15)

Real state per capita income	0.043 (1.11)	0.045 (1.06)	0.025 (0.52)	0.008 (0.27)	0.017 (0.52)	0.003 (0.08)
State unemployment rate	0.034 (1.42)	0.036 (1.46)	0.025 (0.98)	0.018 (0.89)	0.021 (1.03)	0.016 (0.81)

Notes: T-statistics in parentheses, based on state-clustered standard errors. Intercept not shown.
Models also include year and state fixed effects.