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A

**RACIAL DIFFERENCES IN THE EFFECTS OF  
REGULATORY VARIABLES ON ALCOHOL-RELATED MORTALITY**

**By**

**Chong-Hwan Son**

**A dissertation submitted to the Graduate Faculty in Economics in partial  
fulfillment of the requirement for the degree of Doctor of Philosophy,  
The City University of New York**

**2002**

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This manuscript has been read and accepted for the Graduate Faculty in Economics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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## **Abstract**

### **RACIAL DIFFERENCES IN THE EFFECTS OF REGULATORY VARIABLES ON ALCOHOL-RELATED MORTALITY**

**By**

**Chong-Hwan Son**

**Advisor: Professor Michael Grossman**

**We examine racial differences in the effects of regulatory variables on alcohol-related mortality in a time series of states of the United States for the period from 1980 through 1991. Six causes of death are studied: (1) diseases in which alcohol use is the primary cause including alcoholic cirrhosis of the liver and alcohol dependence syndrome; (2) motor vehicle traffic accidents; (3) suicides; (4) homicides; (5) falls, fires, and other accidents; and (6) cancers of the alimentary tract. Our main result is that the price of liquor is a more important regulatory variable for whites, while the per capita number of outlets that are licensed to sell alcohol is a more important regulatory variable for blacks. For whites, we find that price has a negative and significant effect on primary cause alcohol mortality, with an elasticity of -0.19. This finding is important because many more deaths in this category are due to alcohol than those in the other categories, and because deaths in which alcohol is the primary cause account for almost one-quarter of those studied. Our results imply that a 10 percent rise in price would lower the number of whites who die from causes directly related to alcohol by 2 percent. For blacks, outlet density elasticities, based on significant regression coefficients, are 0.34 for primary cause mortality and 0.16 for homicide. These results are important because these two causes of death account for almost three-fifths of all black deaths studied and because the**

black homicide rate of 47 deaths per 100,000 population is larger than any other race-specific death rate in this study, and is almost seven times larger than the white rate. Our results imply that the black homicide rate would fall by approximately 2 percent and the primary cause mortality rate would fall by approximately 3 percent if the number of alcohol outlets were reduced by 10 percent.

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## **CHAPTER 1 INTRODUCTION**

This study examines racial differences in the effects of regulatory variables on alcohol-related mortality in a time series of states in the United States for the period from 1980 through 1991. Six causes of death are studied: (1) diseases in which alcohol use is the primary cause, including alcoholic cirrhosis of the liver and alcohol dependence syndrome; (2) homicides; (3) suicides; (4) cancers of the alimentary tract; (5) falls, fires, and other accidents; (6) motor vehicle traffic accidents. The six causes of deaths have different characteristics in terms of drinking patterns for current drinkers. Alcohol primary cause and cancers of the alimentary tract emerge from chronic heavy drinking, by which the alcohol damage accumulates for a period of time. 80% of the deaths in the alcohol primary cause category are due to liver cirrhosis disease, a well-known proxy of chronic heavy drinking (Cook and Tauchen, 1982; Grossman et al., 1992; Ponicki and Gruenewald, 1995; Shim, 1999; Kerr et al., 2000; Xie et al., 2000). In contrast, the others are related to excessive drinking at one time.

The selection of deaths that are primarily caused by alcohol and deaths to which alcohol is a contributory cause is guided by classifications introduced by Ravenholt (1984) and modified and used by Sloan, Reilly, and Schenzler (1994) in their study of the effects of regulatory variables on alcohol-related mortality. The main difference between the one by Sloan and his colleagues and this study is that the former does not estimate separate regression models for whites and blacks. While they consider other regulatory variables, this study emphasizes results for the money price of alcohol. This is because

the money price is the main measure examined in the studies cited above. This present study chooses to measure the price of alcohol by the price of distilled spirits since Cook and Tauchen (1982); and Chaloupka et al. (1993); and Grossman (1993) find that cirrhosis mortality--an important component of deaths for which alcohol is a primary cause--is quite responsive to the cost of distilled spirits; a study by Kerr et al. (2000) finds that the price of distilled spirits, but not the price of beer, has negative and significant effect on liver cirrhosis mortality. These studies, like the one by Sloan, Reilly, and Schenzler (1994), do not conduct separate analyses for whites and blacks. Moreover, Saffer (1991) summarizes evidence suggesting that beer and wine consumption are associated with meals, family settings, and other occasions of traditional life. On the other hand, spirits consumption is associated with occasions where intoxication is an important outcome.

However, the impact of beer drinking on alcohol-related problems should not be ignored because beer is the leading alcoholic beverage in terms of consumption of pure ethanol among distilled spirits, wine, and beer (Caces and Harford, 1998); and Schweitzer et al. (1983) and Nelson (1997, 1999) find that distilled spirits and beer are substitute. That is alcohol drinkers will substitute freely between the two types of alcoholic beverages within their budget constraint when the price of one or the other rises. Thus this study additionally tests the hypothesis that beer drinking has a significant role with alcohol-related mortality rates: here, real beer tax is treated as the price of alcohol in empirical models (see chapter 6).

Due to the well-known excess mortality of blacks, this study focuses on white and black differences and excludes persons of other races. This study does not consider

Hispanics as a separate group because they do not constitute a large enough portion of the population in enough states. The underlying hypothesis is that whites and blacks may respond differently to variables that alter the “full price” of consuming alcohol. Main elements of the full price are money price and alcohol availability, treated mainly as regulatory variables. Since alcohol is either the primary factor or an important secondary factor in the six causes of death that we consider, these differences can be traced in turn to racial differences in key parameters in the demand function for alcohol. Saffer and Chaloupka (1999), Tung (1999), and Nair et al. (forthcoming) report that alcohol consumption by whites and blacks does not respond in the same manner to changes in the money prices of alcoholic beverages. These prices vary among states of the United States primarily because different states tax alcoholic beverages at very different rates.

## **CHAPTER 2**

### **LITERATURE REVIEW**

Applications of addiction models to alcohol consumption are different from those of cigarette smoking since many individuals consume a relatively small amount of alcohol, and thus the distribution of alcohol consumption is spread more broadly. Since the behavior of only chronic heavy drinkers could be taken into account concerning the rational addiction to alcohol consumption (Grossman, 1991), and since a certain amount of alcohol drinking is beneficial, for example, it can reduce coronary heart disease (Gordon and Doyle, 1987; Klatsky et al., 1981), the drinking pattern leads the effects of alcohol drinking on the alcohol-related problems for current drinkers. Using a standard model of consumer behavior with ignoring the rational addiction for alcohol demand specification, Manning et al. (1995) find that heavy drinkers have a lower price elasticity of demand for alcohol compared to light or moderate drinkers. The chronic heavy drinkers in addictive behavior have a high probability of deaths due to alcohol because they keep piling up the toxic stocks of alcohol. When one considers the effects of alcohol-drinking patterns on the six causes of deaths, chronic heavy alcohol drinking is directly related to more deaths due to the cancers of alimentary and alcohol primary causes (in which 80% of deaths are due to liver cirrhosis disease). In short, the degree of alcohol-related problems depends on the alcohol drinking patterns. This fact deeply connects this alcohol-related mortality study with the addiction study, although this study disregards rational and myopic addiction behavior. Hence, reviewing the main stream of

alcohol-related studies (alcohol demand, alcohol addiction, and alcohol-related mortality) is certainly necessary to this study.

### **2.1. Alcohol demand study**

Coate and Grossman (1988) examine the price sensitivity of beer, the most-consumed alcoholic beverage among youths, and the effectiveness of legal drinking age laws for the youths between the ages of 16 and 21 for the years from 1976 through 1980. The second National Health and Nutrition Examination Survey (NHANES II) is used in the alcohol consumption data. The price sensitivity for youths could impact their future alcohol consumption: if youths drink alcoholic beverages frequently, they will often abuse alcohol in adulthood. In the alcohol demand equation, a percentage distribution of drinking frequencies is the dependent variable with the limited sample of 1,761 youths. The frequencies pertain to four drinking categories: 4-7 times a week, 1-3 times a week, less than once a week, and never. The four outcome categories bring the multinomial logit equations to use by the method of maximum likelihood. The independent variables are real price of liquor, real price of beer, beer legal drinking age, legal drinking age, border age<sup>1</sup>, and four religious variables.

Coefficients of the price of beer and legal drinking age for all models are negative and significant except in the infrequent drinking category. Price elasticities of probabilities for the first category (as drinking 4-7 times) and the second (as drinking 1-3 times a week) are -1.18 and -0.59 respectively, while for the infrequent drinking category it is 0.05. This fact means that the high frequent drinking group has more price sensitivity to the alcohol demand than that of the infrequent drinking. All of the coefficients for

liquor are smaller in absolute value than those for beer because beer is the most popular alcoholic beverage among youths. For youths, real beer prices and minimum legal age have a negative relationship to alcohol consumption.

The price sensitivity to alcohol demand for youths is also studied by Nair et al. (1999). They adapt the data 1982 and 1989 Monitoring the Future Survey of high school seniors managed by the Institute for Social Research (ISR) at the University of Michigan. Their study classifies drinking events into three types - in the past year, in the past month, and in the past two weeks. In the past two weeks category, they use a dichotomous indicator as 1 if at least one drinking occasion occurred where five or more drinks were consumed and 0 otherwise. In the other two cases, drinking frequencies are divided into four categorical measures, as in Coate and Grossman (1988). The probit and ordered probit specification are conducted for estimating the probability of alcohol consumption for all eight gender/race specific specifications: males, females, blacks, whites, black males, black females, white males, white females.

The real beer tax on drinking probabilities has negative effects for measures of alcohol drinking frequencies for all gender/race specific subgroups except black males. Coefficients of income are positive and significant for all, whereas minimum legal drinking age has a significantly negative effect on the frequency of drinking among females alone, and black and white males for 2 of the 3 measures. The price effect of beer on alcohol demand is bigger for females than for males, but the male binge effect exceeds that of female. For a male if beer tax increases by one dollar, the probability of heavy

---

<sup>1</sup> Dichotomous variable that equals 1 if youth lives within 20 miles of a state with a lower legal drinking age than his or her state of residence, computed separately for beer and liquor but assumed the same value for each beverage.

drinking falls by 2.35%; others held constant. This study results in an increase in the probabilities of the infrequency category and a decrease in the probabilities of the high frequency categories when the beer tax rises - the same result as in the study by Coate and Grossman (1988). In other words, more youths move from higher drinking categories into lower drinking categories when the beer tax rises. In addition, white youths are more responsive to the beer tax and minimum legal drinking age than the black youths.

A large proportion of adult population does not drink currently, and frequency of drinking and quantity of alcohol consumption among current alcohol drinkers are different. The different drinking patterns may not have the same response to changes in the price of alcohol. Manning et al. (1995) explore how the price responsiveness of demand for alcohol affects light, moderate, and heavy drinkers. The study splits alcohol consumption into two categories: frequency of alcohol drinking and quantity consumption of aggregated alcohol beverages. The two categories require two empirical models. One is a two equation multiple regression model for the conditional drinking quantity, and the other is an alternative two-part model as quantile regression using a linear programming approach for all drinkers. Price of alcohol, family income, and other socio-demographic measures are in the explanatory variables.

In the model of the alcohol consumption as volume of pure ethanol, total price elasticities for all drinkers are -0.80 and -0.74 for the two-part model and quantile regression respectively. The magnitude of the price elasticities of alcohol demand is quite sensitive to the price. In the elasticity estimates across quantiles as unconditional (all adults) price elasticity estimates, light drinkers have price elasticity; and moving toward moderate drinking, the demand becomes more price elastic. More toward the highest

level of drinking, price elasticity diminishes. In the model for days of heavy drinking (number of days of heavy drinking), elasticity of heavy drinking as the days with five or more drinks during last two weeks is -0.58. Price sensitivity of alcohol consumption for moderate drinkers is larger than that for heavy drinkers. Also, it is considerable that the price elasticity of upper 5% drinkers, who consume 36% of all alcohol, is two fifth of the price elasticity for all others and the upper 10% drinkers consuming 51% of all alcohol. Income effects on alcohol consumption are positive for all groups. And an increase in education level raises volume of drinking, but it reduces the number of days with five or more drinks.

A structural demand function confronts problems of the endogeneity: endogenous variables treated as exogenous variables. In the market, prices are determined by the interaction of quantities of demand and supply. Thus price should be an endogenous variable in any demand equation. To solve this problem, Cook and Tauchen (1982) employ liquor tax, set by local or state governments, as the price of liquor. They test responsiveness to changes in liquor taxes on liquor consumption and cirrhosis mortality using 30 states where are all licenses for the 16 years between 1962 and 1977. In both the demand and mortality equations, lagged effects of the liquor price for alcohol consumption did not appear in the estimates, but income effects are spread over two years. They treat cirrhosis-related deaths<sup>2</sup> as a proxy of heavy drinkers; about 80 percent of all cirrhosis fatalities in 1974 were the results of excessive drinking.

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<sup>2</sup> Each drinker is characterized by a toxic threshold for lifetime alcohol consumption with the cirrhosis-related death occurring if and when total consumption exceeds this threshold. All drinkers are moving towards their threshold levels at their rates of alcohol consumption. The proportion of the population that reaches this threshold each year is the cirrhosis mortality rate.

In the liquor consumption equation, estimated coefficients of the taxes are -0.063, -0.009, and -0.072 for the current tax, one year lagged tax, and sum of tax respectively. This figure implies, based on a 1976 price level, an increase in one-dollar tax per proof gallon reduces liquor consumption by 7.2% with a price elasticity of -1.8, and the magnitude of the elasticity of lagged tax with respect to liquor consumption is relatively small. In income effects on liquor consumption, a thousand dollar increase in per capita

income raises liquor consumption by 13.8% with 0.43 of income elasticity. In the cirrhosis mortality equation, estimated tax coefficients are -0.060, -0.006, and -0.054 for the current tax, one year lagged tax, and sum of tax respectively. The effect of a tax change on cirrhosis mortality is -5.4% per dollar. The two different demand equations (liquor consumption and cirrhosis mortality as heavy drinking) for alcohol are quite responsive to the price of liquor.

Tung (1999) explores the price sensitivity of alcohol consumption by age, gender, race, and ethnicity using the second National Health and Nutrition Survey (NHANES II) with the percentage distribution of beverage-specific drinking frequencies - drinking occasions per week in the past three months. He divides drinking frequencies into four categorical outcomes with adult/youth, gender, race specifications: frequent drinking as more than three drinking occasions per week; fairly frequent drinking as 1-3 drinking occasions; infrequent drinking as less than one drinking occasion; and never drinking occasions. The ordered logit equations are applied in the estimates because of the ordered categorical variables for measures of drinking frequencies. For whites, beer price elasticities in the full samples are -0.476, -0.367, and -0.203 for frequent, fairly frequent, infrequent drinking occasions respectively; for blacks, 0.315, 0.233, and 0.125. On the

other hand, liquor price elasticities are 0.628, 0.528, and 0.313 for whites, and -1.609, -1.394, and -0.646 for blacks. In other words, whites and blacks respond oppositely to price changes in both liquor and beer in drinking frequent analysis. Real household income positively influences alcohol consumption in most of the sub-categories.

## **2.2. Alcohol addiction study**

Alcohol is one of the harmful addictive goods. The first category of the six causes of deaths in this study is mainly allocated to liver cirrhosis disease, which results from the accumulation of alcohol damage over years for heavy drinkers who are more likely to be addicted to alcoholic beverages. Becker and Murphy (1988) develop a theory of rational addiction as individuals maximize their utility over time. This rational behavior seems to be the counterpart of a typical addiction model such as myopic behavior for harmful goods, as the rational behavior accounts not only for past prices but also for future prices into the current demand equations. They define rationality and addiction with stable and unstable steady state levels of stocks of addictive goods, and explain the impact of changes in permanent or temporary prices on rational addiction, and mention income effects on consumer behavior for addictive goods. The importance of myopic behavior - having a large time discount factor - is interpreted by using different degrees of time preferences among different age groups in the addiction models.

Becker et al. (1991) review the theory of the rational addiction model by Becker-Murphy (1988), and support the model by quoting other empirical studies. Reinforcement ( $dC/dS > 0$ ,  $U_{CS} > 0$ ; where C represents an addictive good and S represents stock of addictive capital) and tolerance ( $dU/dS = U_S < 0$ ) for the addictive behavior are stated. They assert the relation of stocks of addictive capital with consumption of addictive

goods for changes in the long- and short-run prices at a steady state ( $C=dS$ ) and unstable steady state. In summarizing the empirical evidence, the long-run price elasticities of addictive goods range from -0.7 to -0.8, and from -0.3 to -0.4 in the short run. Consumption of addictive goods (cigarettes, alcohol, and gambling) is clearly responsive to price, and increases in the prices of addictive goods have a larger response in the long-run than in the short-run.

Grossman (1991) reviews addictive behavior using some empirical evidence of cigarettes, gambling at horse-racing tracks, leisure time, and excessive alcohol consumption, and examines the Becker-Murphy (B-M) model for an assumption of addictive goods not sensitive to price. And he adapts model 1 and model 2<sup>3</sup> to investigate rational addiction and the demand for excessive alcohol consumption. The first model results in price elasticities for excessive alcohol consumption that are -1.28 and -1.07 in the long- and short-run respectively, and -0.83 and -0.72 in the second model. This result indicates that excessive alcohol consumption responds somewhat to price in both the long- and short-run, and also that excessive alcohol consumption corresponds to addictive behavior, and that consumers are farsighted rather than myopic.

Another alcohol addiction study by Chaloupka et al. (1992) explains whether past consumption determines current consumption by ignoring the addictive phases of alcohol. As does other addiction literature, they examine price sensitivity of aggregate alcohol consumption using the total sales of distilled spirits per capita for all persons, and age adjusted cirrhosis mortality rates for ages thirty years and older, using a data set of a

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<sup>3</sup> In the equation 12, the model 1 includes real per capita income, the percentage of the population age 25 and older with at least a high school education, the percentage of the female population ages 25-34 that are divorced, the unemployment rate, and the percentages of population of four religions. The Model 2 replaces all the demographic variables except income with dichotomous variables for each state except one.

time-series of an annual state cross-section for the 50 states and District of Columbia for the years from 1962 through 1983. In the first aggregate alcohol demand equation from the Ordinary Least Squares estimation, price elasticities of distilled spirits range from -0.33 to -0.42 with state dummies, and from -1.26 to -1.55 replacing demographic variables for the state dummies, whereas alcohol consumption does not respond to changes in the prices of distilled spirits in every model from the two-stage least square estimation. The aggregate alcohol demand function employs all persons. In fact, individuals who consume some quantity of alcohol may not appear as evidencing addictive behavior in aggregate alcohol consumption models. In excessive alcohol demand equations, the short-run price elasticity ranges from -0.53 to -0.78 with state dummies and from -0.68 to -1.16 replacing the demographic variables for the state dummies. The long-run price elasticity bounds from -0.53 to -1.20 with the state dummies and from -0.78 to -1.50 replacing the demographic variables for the state dummies. In short, excessive alcohol consumption responds to changes in price in both the short- and long-run.

Since the B-M model introduced, other studies have tested the rational addiction model. Grossman et al. (1998) conduct an empirical test to prove that rational behavior exists for an addictive good such as alcohol for young adults with two different specifications: the standard alcohol demand function; and the rational addiction model in which past and future consumption play an important role in current consumption. They illustrate the rational addiction model with empirical analyses using a general structural demand function for current consumption. Drinking occasions and number of drinks on a typical drinking occasion are treated as alcohol consumption from the follow-up survey

data conducted by the University of Michigan's Institute for Social Research. The price of beer is used as a measure of the price of alcohol because beer is the alcoholic beverage of choice for young adults. Price coefficients in all models are consistent. In non-addictive models, the price elasticity of alcohol demand is an average of -0.29 from the Ordinary Least Square estimation. In rational addictive models, the estimated outcomes of past and future consumption are positive and significant in all regression models from the two-stage Least Square and Ordinary Least Square estimates. The positive and significant estimated coefficients of past and future consumption mean that alcohol consumption is consistent with rational addiction behavior, and inconsistent with the assumption of myopic addiction. In the measure of degrees of addiction, the ratio of the long-run elasticity to the corresponding short-run elasticity is an average of 1.60: price elasticities of alcohol demand averages -0.65 and -0.41, in the long- and short-run respectively.

### **2.3. Alcohol-related mortality study**

Cook and Tauchen (1982) find that the lagged effects of alcoholic beverage consumption on liver cirrhosis mortality rates are not significant, and they explain that the long-term use of alcoholic beverages may fill the reservoirs of death stocks for heavy drinkers, whereas the short-term effects of alcohol consumption may determine the limited level of an individual's death threshold. Similarly, Ponicki and Gruenewald (1995) investigate the relationship of alcohol sales to cirrhosis mortality, and test the lagged effects of alcohol consumption using a cross-sectional time series data with ages of 15 and above for the period from 1975 to 1986. They use state-level retail sales data of alcoholic beverages as a proxy of the measure of alcohol consumption, and convert each beverage's sales to

liters of annual pure ethanol sold per population of age 15 and above. They present a least squares dummy variable (LSDV) specification to curtail biased coefficient estimates of the ordinary least squares regression method with time series cross sectional data. They find that distilled spirits consumption has positive and significant effects on liver cirrhosis mortality with an elasticity of 0.28. This figure implies that a one percent increase in spirits sales reflects over an one-fourth percent increase in cirrhosis mortality rates. For beer and wine, the lagged effects of beverage sales on cirrhosis mortality rates are insignificant. The insignificant lagged effects of alcohol sales on cirrhosis mortality rates may mean that the long-term drinking of heavy drinkers impacts the short-term drinking pattern with changing the drinkers' probabilities of death due to liver cirrhosis.

Xie et al. (2000) investigate direct and indirect influences of prevention measures on alcoholic cirrhosis mortality rates in Canadian provinces from 1968 to 1986. They develop two equation models. The first model expresses alcohol consumption as a function of economic, demographic, and prevention variables. The second represents alcohol-related harm as a function of both alcohol consumption and prevention variables. The two models are recursive since the dependent variable in the first equation (alcohol consumption) appears on the right hand side of the second equation, but not vice versa. The alcohol liver cirrhosis mortality rate, only caused by alcohol drinking, represents the drinking-related harm. Annual per capita consumption of alcoholic beverage is estimated from province-level retail sales data of liters of pure ethanol among distilled spirits, beer, and wine, using time-series cross-sectional data. Because of the problems of bias from ordinary least squares for the time series cross-sectional data, they also use a least squares dummy variable (LSDV) specification. The minimum legal drinking age and physical

availability of alcohol are positive and statistically significant in alcohol consumption equations, but not in alcohol-related harm equations. This fact implies that these variables influence alcoholic liver cirrhosis mortality indirectly. On the other hand, alcohol consumption and rates of the Alcoholics Anonymous (AA) members and groups per 10,000 population are positively and significantly associated with alcohol liver cirrhosis mortality. And legal drinking age and rate of retail outlets have no direct influence on cirrhosis mortality rates, while they are directly related to alcohol consumption - a major factor in cirrhosis mortality.

An objective of the study by Kerr et al. (2000) is to investigate interactions between beverage-specific alcohol consumption and cirrhosis mortality among English-speaking and beer drinking countries such as Australia, Canada, New Zealand, the United Kingdom, and the United States for the years from 1953 to 1993. Measures of alcohol consumption are converted into liters of the pure ethanol per capita for population 15 and older in each empirical model: total alcohol model (aggregated ethanol consumption of distilled spirits, wine, and beer); beverage-specific model (including the three alcoholic beverages in the right hand sides in models); and spirits model (only including spirits consumption in models). In the total alcohol model, coefficients of present and 1-year lagged total alcohol consumption have significant and positive, and an one-liter increase in ethanol consumption produces a 16.0% increase in cirrhosis mortality. In the beverage specific model, only estimates of distilled spirits, attributed to the mortality by 41%, are significantly related to cirrhosis mortality. For spirit models, consumption of present and 1-year lagged spirits is significantly associated with the mortality. An increase in one-liter ethanol from spirits consumption is allied with a 35.2% increase in the mortality, and

the attribution of spirits consumption is 45% to mortality. Thus spirit consumption is a significant factor on cirrhosis mortality, whereas influences of beer and wine consumption on mortality are inconsistent.

I put the study by Sloan et al. (1994) last in this section because the idea of selecting six causes of alcohol-related deaths is guided by their study. They investigate the effects of various regulatory variables on the six causes of alcohol-related mortality (alcohol primary cause; traffic accidents; homicides; suicides; falls, fires, and other accidents; and contributory causes) by state from 1982 through 1988. They assume that the consumption of alcoholic beverages contributes to the six causes in three different ways. In the first, damage to self may be involved in the primary and contributory causes of deaths and suicide categories. In the second, damage to self and others includes the traffic accidents and falls, fires, and other accidents categories. In the third, damage to others is related to the homicide category. Death rates, weighted by population, per 1,000 population aged 25 to 64 for each category, declined over the years except for rates for traffic accident mortality. Alcohol prices are the consolidated price of alcohol per gallon from distilled spirits, wine, and beer.

Including the state and year dummies, estimated coefficients of alcohol prices are negative but not significant in primary cause regression models, whereas they are negative and significant in the traffic accident category. The effects of Mandatory minimum jail terms and the dram shop law on primary causes have no evidence in this study, but the dram shop law negatively and significantly affects traffic accidents. Income has significant and positive effects, and percentage of blacks has significant and negative impacts on both categories mentioned above. In both homicide and suicide categories,

alcohol price has negative effects, and the dram shop law has negative and significant effects on homicides, but not on suicides. Mandatory jail terms have no relationship to either homicides or suicides. Income negatively affects them. The death penalty has a negative influence on homicides. In falls, fires, and other accidents and contributory categories, alcohol prices have positive and significant effects on contributory causes. They found no evidence of the effects of mandatory jail terms, and the percentage of the black population has a positive impact on both categories. In general, coefficients of alcohol prices are negative, and those of income are positive in empirical models of the six causes of alcohol-related deaths.

## **CHAPTER 3**

### **DATA AND EMPIRICAL IMPLEMENTATION**

#### **3.1. Mortality Rates**

With one exception, the mortality rates employed in this study pertain to the forty-eight contiguous states of the United States for the years 1980 through 1991.<sup>4</sup> The exception pertains to motor vehicle traffic accident mortality. Here the absence of data related to penalties for apprehensions and convictions of drunken driving for 1980, 1981, and 1991 limits the period to 1982 through 1990. Deaths pertain to whites or blacks; persons of other races are excluded. Hispanics can be whites or blacks and are included in the appropriate racial category. The following states have extremely small black populations and are excluded from the black regressions: Idaho, Maine, Montana, New Hampshire, North Dakota, South Dakota, Vermont, and Wyoming. Cause-specific deaths were obtained from public use tapes of all deaths occurring within the United States as released by the National Center for Health Statistics (various years). Cause of death was categorized according to the International Classification of Diseases, ninth revisions (ICD-9). Population figures employed to calculate deaths per 100,000 persons were taken from the web site maintained by the Bureau of the Census.

Definitions, means, and standard deviations of the six race-specific death rates employed as outcomes are contained in Table 1. These death rates were selected from a classification scheme developed by Ravenholt (1984) and modified by Sloan, Reilly, and

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<sup>4</sup> We omitted Alaska and Hawaii from the data set because several important variables were missing. We also excluded the District of Columbia because its size and nature make it likely that residents obtain alcohol from neighboring states.

**Table 1**  
**Table 1 Definitions, Means, and Standard Deviations of Mortality Rates<sup>a</sup>**

Variable	Definition	Mean	
		Whites	Blacks
Alcohol primary cause	Deaths due to alcohol psychoses, alcohol dependence syndrome, alcohol abuse, alcoholic polyneuropathy, alcoholic cardiomyopathy, alcohol gastritis, or chronic liver disease and cirrhosis	16.349 (4.902)	35.826 (13.859)
Homicides	Deaths due to homicide	7.274 (3.589)	46.626 (13.677)
Suicides	Deaths due to suicide	16.632 (3.659)	9.510 (3.230)
Cancers of Alimentary Tract	Deaths due to malignant neoplasm of lip, oral cavity, pharynx, liver, intrahepatic bile duct, or larynx	5.513 (1.090)	12.106 (2.964)
Falls, fires, and other accidents	Deaths due to these causes	9.642 (2.442)	18.663 (6.342)
Motor vehicle traffic Accidents	Deaths due to motor vehicle traffic accidents	18.280 (4.683)	21.237 (8.117)
		46.275 <sup>b</sup> (11.822)	23.407 <sup>b</sup> (11.278)

<sup>a</sup>Deaths per thousand population. Standard deviations in parentheses. White means and standard deviations weighted by state- and year-specific white population ages 25 through 64 (except <sup>b</sup> ages of 18 through 20). Black means and standard deviations weighted by state- and year-specific black population ages 25 through 64. White data exclude Alaska, Hawaii, and the District of Columbia. Black data exclude these three states and Idaho, Maine, Montana, New Hampshire, North Dakota, South Dakota, Vermont, and Wyoming. All mortality data except for motor vehicle traffic accidents pertain to the years 1980 through 1991. Motor vehicle traffic accidents pertain to the years 1982 through 1990.

Schenzler (1994). Ravenholt presents estimates of the percentages of deaths from a variety of causes that are attributable to alcohol. He then identifies the deaths in which alcohol is the primary cause as those in which this percentage is equal to 100. Sloan, Reilly, and Schenzler modify this definition to include deaths due to chronic liver disease and cirrhosis not specified as attributable to alcohol. They do so because of evidence that Ravenholt's estimate that only 25 percent of these deaths are due to alcohol is too low.

Because of the stigma associated with excessive alcohol use, physicians are often reluctant to attribute the cause of death to alcohol. This study adopts Sloan, Reilly, and Schenzler's procedure and includes all deaths due to chronic liver disease and cirrhosis in its measure of primary cause alcohol mortality. The five other death rates in Table 2 are those in which Ravenholt estimates that at least 25 percent of all deaths are attributable to alcohol.

This study limits its analysis to death rates of persons between the ages of 25 and 64. Among the causes of death included in this study, there are a significant number of deaths for persons below the age of 25 only for motor vehicle accident mortality (ages 18 through 21 tested). Deaths (of persons over the age of 65) are much more likely to involve factors unrelated to alcohol use.

If the six race-specific death rates in Table 1 are aggregated, the overall alcohol mortality rate is 74 per 100,000 population for whites and 144 per 100,000 population for blacks. Deaths in which alcohol is the primary cause account for 22 percent of all white deaths in the six categories and for 25 percent of all black deaths. The black alcohol primary cause, alimentary tract cancer, and overall death rates are twice as large as the corresponding white death rates. The black-white mortality ratio varies considerably for the three other causes. This ratio equals 6.4 in the case of homicide, 1.2 in the case of motor vehicle accident mortality, and 0.6 in the case of suicide - the only category in which the death rate for whites is higher than for blacks (see Table 1 and Figure 1: Appendix A-1). Both race mortality rates per 100,000 population declined in the years between 1980 and 1991 with one exception: the rate of deaths due to the motor vehicle traffic accidents rose gradually after 1983 up to 1989.

### **3.2. Measurement of Independent Variables**

Definitions, means, and standard deviations of the independent variables in the multiple regressions estimated are contained in Table 2. The price of alcohol is given by the real price of liquor (distilled spirits) in 1982-84 dollars. The use of the price of liquor has already been justified. The money price was taken from the Inter-City Cost of Living Index, published quarterly by the American Chamber of Commerce Researchers Association (ACCRA, various years) for 250 - 300 cities. The specific liquor price collected by the ACCRA is the price of a 750 milliliter bottle of Seagram 7-Crown (see Appendix A: real liquor price). Quarterly state prices were computed as population weighted averages of city prices, and annual prices were obtained by averaging over the four relevant quarters. The money price was then divided by the annual Bureau of Labor Statistics Consumer Price Index (CPI) for the United States as a whole (1982-84 = 1).

The per capita number of outlets that are licensed to sell alcoholic beverages for consumption on the premises, off the premises, or on and off the premises is a negative correlate of the amount of travel time required to purchase alcohol and should have positive effects on consumption and mortality. The total number of licenses was taken from the Distilled Spirits Council of the United States (various years) and from the Jobson Publishing Corporation (various years). The percentage of the state population residing in dry counties that prohibit the sale of alcohol is a positive correlate of travel time. As such, it should have effects that are opposite to those of the number of licenses. This variable was taken from the same sources as the license variable.

Real per capita income and the unemployment rate have been shown to be important determinants of alcohol consumption and certain fatality rates by a variety of

**Table 2**  
**Definitions, Means, and Standard Deviations of Independent Variables<sup>a</sup>**

Variable	Definition	Mean	
		Whites	Blacks
Real liquor price	Price of a 750-ml bottle of Seagram 7-Crown divided by Consumer Price Index (1982-84 = 1)	6.842 (0.621)	6.802 (0.607)
Real beer tax	Average state excise tax, in dollars, on a package of 24 12-ounce cans of beer, divided by Consumer Price Index (1982-84 = 1)	1.061 (0.478)	1.229 (0.625)
Real income	Money per capita personal income divided by Consumer Price Index (1982-84 = 1)	12806.9 (2124.2)	12733.4 (2282.7)
Unemployment	Annual average state unemployment rate	7.063 (2.142)	7.137 (2.175)
Licenses	Number of establishments per capita licensed to sell alcohol for consumption on the premises, off the premises, or on and off the premises	1.168 (0.567)	1.115 (0.590)
Dry	Percentage of population residing in dry counties (counties that prohibit the sale of alcohol)	4.482 (8.568)	5.538 (9.083)
Catholic	Percentage of the population who are Catholics	20.880 (12.752)	18.896 (13.133)
Protestant	Percentage of the population who are Protestants (excludes Mormons and Southern Baptists)	20.932 (8.183)	20.771 (6.852)
Southern Baptist	Percentage of the population who are Southern Baptists	6.716 (8.928)	9.951 (10.303)
Mormon	Percentage of the population who are Mormons	1.244 (5.402)	0.523 (1.314)
High school education	Percentage of the population aged twenty-five and over with at least a high school education	74.271 (6.120)	72.056 (6.087)
Mandatory administrative per se <sup>b</sup>	Dichotomous indicator equal to one if state has a law calling for mandatory administrative driver-license suspension or revocation after first DUI arrest	0.172 (0.377)	0.145 (0.353)

Table 2 (continued)

Mandatory minimum administrative <sup>b</sup>	Mandatory minimum administrative driver-license suspension or revocation in days after first DUI arrest	13.975 (47.116)	7.761 (31.666)
Mandatory fine <sup>b</sup>	Dichotomous indicator equal to one if state has a law requiring a minimum fine for first conviction for driving under the influence of alcohol (DUI)	0.345 (0.475)	0.332 (0.471)
Real fine <sup>b</sup>	Mandatory minimum fine in dollars for first DUI conviction divided by the Consumer Price Index (1982-84 = 1)	91.687 (135.99)	85.255 (129.11)
Legal drinking age <sup>c</sup>	Minimum legal age to purchase or consume alcoholic beverages	20.381 (0.948)	20.216 (1.060)

<sup>a</sup> Standard deviations in parentheses. White means and standard deviations weighted by state- and year-specific white population ages 25 through 64. Black means and standard deviations weighted by state- and year-specific black population ages 25 through 64. None of the state-specific data is race-specific. White data exclude Alaska, Hawaii, and the District of Columbia. Black data exclude these three states and Idaho, Maine, Montana, New Hampshire, North Dakota, South Dakota, Vermont, and Wyoming. All variables except for mandatory fine, real fine, mandatory administrative per se, and mandatory minimum administrative pertain to the years 1980 through 1991. The four variable just mentioned pertain to the years 1982 through 1990.

<sup>b</sup>Employed as an independent variable only when motor vehicle accident mortality is the dependent variable.

<sup>c</sup>Employed as an independent variable only when motor vehicle accident mortality (ages 18 to 21) is the dependent variable.

researchers (for example, Sloan, Reilly, and Schenzler 1994; Saffer and Chaloupka 1999; Ruhm 2000). Higher-income people consume more alcohol, which should raise mortality. A factor that goes in the opposite direction is that higher income people may allocate more resources to goods that improve health, such as medical care. Unemployment may create stress and cause alcohol consumption to rise. This factor may be mitigated by reductions in purchasing power not reflected by current per capita income, or by reductions in the value of time that lower the relative price of health. Money per capita income was taken from the Bureau of Economic Analysis (various

years) and was deflated by the CPI to obtain real per capita income. The unemployment rate was taken from the Bureau of the Census (various years).

Grossman and Kaestner (1997) review a large body of literature suggesting that the number of years of formal schooling completed has a positive causal effect on good health and therefore a negative effect on mortality. We employ the percentage of the state population aged 25 and over with at least a high school education to capture this effect. This variable was available for the Census of Population Years of 1980 and 1990 (Bureau of the Census 1983, 1993). Values for other years were computed using state-specific exponential growth trends. These values were adjusted so that a population-weighted national average of state estimates for an intercensal year was equal to the observed national rate as reported by the Bureau of the Census (various years). This variable is too collinear to be included in regression models with dichotomous indicators for each state except one (see below).

When the motor vehicle accident mortality rate is the dependent variable, this study employs four measures related to the expected penalty for apprehension and conviction of driving under the influence of alcohol. The first is a dichotomous indicator for the presence of a mandatory administrative per se law. This law requires the state licensing agency to suspend or revoke a driver's license after a driving under the influence of alcohol (DUI) arrest. The second variable is the mandatory minimum license action in days associated with this law (zero for states with no mandatory administrative sanctions). The third and fourth variables pertain to fines for the conviction of DUI. We include a dichotomous indicator for the presence of a law requiring a mandatory minimum fine for the first conviction of DUI and the real

mandatory minimum fine (equal to zero in states with no mandatory minimum). These variables were taken from Chaloupka, Saffer, and Grossman (1993) and were not available for 1980, 1981, and 1991. Hence, the motor vehicle mortality regressions are limited to the years 1982 through 1990.<sup>5</sup>

“Drinking sentiment” may play a potential role in the endogenous determination of alcoholic beverage prices, alcohol consumption, and mortality. This factor refers to cultural and taste factors that may either encourage or discourage alcohol consumption. For example, antidrinking sentiment should be relatively widespread in states in which those religious groups that oppose the use of alcohol, such as the Mormons and Southern Baptists, are prevalent. These states may enact high excise tax rates on alcohol as part of the political process. In this situation, the price coefficients that emerge from regressions that omit drinking sentiment overstate in absolute value the true parameters. To account for drinking sentiment, the percentages of the state population that are Mormons, Southern Baptists, Catholics, and Protestants (excluding Mormons and Southern Baptists) are included in one specification of the model. The omitted category pertains to the percentage of the population that is Jewish or has no religion. The religion variables for 1980 and 1990 were taken from surveys conducted by the Glenmary Research Center (Quinn et al. 1982; Bradley et al. 1992). For other years, they were obtained from interpolations and extrapolations of state-specific logarithmic time trends between 1980 and 1990.

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<sup>5</sup> The regression coefficient of the real fine or the minimum number of days that the driver’s license is suspended should be negative. Chaloupka, Saffer, and Grossman (1993) show that the sign of the coefficient of the dichotomous indicator for the presence of a law is ambiguous because the average penalty in states without mandatory penalties is not known.

An alternative estimation strategy to control hard-to-measure variables, such as drinking sentiment, is to employ dichotomous indicators for 11 of the 12 years in the sample period and for 47 of the 48 states. The time indicators capture the impact of unobserved factors that have the same impact on mortality in each state. The state indicators capture unobserved factors that vary among states but do not vary over time. If these unobserved factors are correlated with the regulatory variables, alcohol consumption, and mortality and are excluded from the model, the estimated regulatory effects are biased.

Based on the above, this study includes time dummies in all regression models and state dummies in one model. Since the religion and education variables must be interpolated or extrapolated for all years except 1980 and 1990, they are highly collinear with the set of state and time dummies. Hence these variables are excluded when the state dummies are included. A drawback to both the model with the state dummies and the model with religion and education is that the general degree of collinearity among regressors increases. Thus, this research also fits a model in which religion, education, and the state dummies are omitted. One justification for this procedure is that the percentage of the population residing in dry counties controls for anti-drinking sentiment. A second justification is that the price coefficient is not necessarily overestimated in absolute value if drinking sentiment is omitted. The bias could go in the other direction if states in which prodrinking sentiment is widespread (antidrinker sentiment is weak) and alcohol consumption is large enact higher alcohol taxes because the taxation of alcohol is an attractive source of revenue.

## CHAPTER 4 ANALYTICAL FRAMEWORK

The theoretical model which provides the basis for the empirical analysis of the mortality rates considered in this paper consists of three equations. The first is a technical relationship in which the probability of death ( $\pi$ ) from a certain cause is positively related to an individual's alcohol consumption ( $a$ ) and depends on a vector of additional variables ( $x$ ):

$$\pi = \pi(a, x). \tag{1}$$

Examples of variables in the  $x$  vector include the individual's level of formal schooling, genetic endowment, and other demographic, socioeconomic, and personal characteristics. This equation can be thought of as a fatality production function since it relates a negative outcome (the probability of death) to a key input (alcohol consumption). The second equation is a demand function for alcohol:

$$a = a(p, y), \tag{2}$$

where  $p$  is the "full price" of alcohol and  $y$  is a vector of other determinants of alcohol consumption, one of whose members is income. The full price is defined broadly to include not only the money price but such indirect cost elements such as the monetary value of the travel and waiting time to obtain alcohol, and the monetary value of the expected penalties for consuming alcohol in certain settings (for example, shortly before driving). The demand function results from the maximization of the individual's expected utility function subject to the endogenous probability of death and to an appropriate income constraint.

Substitution of the alcohol demand equation into the probability of death equation yields a reduced form probability equation:

$$\pi = \pi(p, y, x). \quad (3)$$

This equation can be aggregated across all individuals in a given state and year to yield an empirically estimable mortality equation. Economic theory predicts that increases in the full price of alcohol will reduce alcohol consumption and, as a result, reduce deaths from causes associated with this consumption. The increase in full price can result from an increase in alcohol excise taxes, which increase the money price and which vary considerably across states. It also can result from increases in the monetary value of the travel and waiting time to obtain alcohol. For example, suppose that the number of outlets that are licensed to sell alcohol falls. Then travel time rises and consumption and fatalities decline. Finally, an increase in the expected penalty for driving while under the influence of alcohol raises full price and lowers consumption and deaths from motor vehicle crashes. These propositions are examined in the empirical analyses to follow using multiple regression techniques.

The following presents the empirical models with the least squares dummy variable (LSDV) specification (Greene, 1993). The nature of pooled cross-sectional and time series data, the observed explanatory variables as individual (state) and time varying variables (Hsiao, 1986), could violate the Classical Assumptions, such as the heteroskedasticity, serial correlation, and multicollinearity. The LSDV specification with the fixed effect model could be a remedy for serial correlation and multicollinearity. Including state dummy variables could remove the consequences of time-invariant differences among states on the dependent variables associated with the other

independent variables; including year dummies could control the effects of time-series differences to each state over time. In addition, the weighted least squares are used in the empirical model to reduce the problem of heteroskedasticity. The empirical model is assumed to be:

$$\pi_{it} = \beta_0 + X_{it}\beta_1 + T_{it}\beta_2 + S_{it}\beta_3 + \varepsilon_{it} \quad (4)$$

where subscript  $i$  denotes state and subscript  $t$  year.  $\pi_{it}$  presents the mortality rates varying across states and over years, a  $i^*t \times 1$  matrix.  $\beta_0$  is the constant intercept, and  $\beta_1$  ( $k \times 1$  matrix, where  $k$  is the number of explanatory variables, excepting state and year dummy variables) is a vector of coefficients of all explanatory variables.  $\beta_2$  ( $t \times 1$  matrix) and  $\beta_3$  ( $i \times 1$  matrix) are vectors of coefficients of year and state dummy variables respectively. All  $\beta$ s are column vectors and state-year invariant.  $X_{it}$  is a  $i^*t \times k$  matrix of explanatory variables.  $T_{it}$  and  $S_{it}$  are year and state dummy variables containing  $i^*t \times t$  and  $i^*t \times i$  matrix respectively. The equation (4) can be modified into three simple basic empirical models for whites and blacks in the six causes of alcohol-related mortality rates:

$$\pi = \beta_0 + X\beta_1 + T\beta_2 + \varepsilon \quad (\text{state dummy variables excluded}) \quad (4a)$$

$$\pi = \beta_0 + X\beta_1 + T\beta_2 + S\beta_3 + \varepsilon \quad (\text{year and state dummy variables included}) \quad (4b)$$

$$\pi = \beta_0 + X\beta_1 + T\beta_2 + R\beta_4 + \varepsilon \quad (\text{state dummy variables excluded and adding religious and education variables}) \quad (4c)$$

where  $R$ , a vector, includes the four religious and education variables and  $\beta_4$  is the coefficient.

The empirical models are expected to avoid the violation of the Classical Assumptions since this study uses the LSDV model and the weighted least squares

regression. Also, the empirical regression models tested show clear evidence of the absence of multicollinearity and autocorrelation, but are unclear about the absence of heteroscedasticity. First of all, the variance inflation factors (VIF)<sup>6</sup> (Studenmund, A. H., 1992) for independent variables in white and black models are calculated to reveal the existence of multicollinearity among the explanatory variables. The highest value of VIFs in this test is only 2.153 for the real income variable for the black empirical model - which theoretically implies the absence of multicollinearity. Also, the Durbin-Watson d test is used to detect serial correlation (only first order serial correlation) in the twelve empirical models (each race having three specifications for liquor and beer models) only for alcohol primary cause mortality. The tested d value varies from 1.658 to 1.971 with an average of 1.818. The d values are high enough to accept the null hypothesis of no positive serial correlation<sup>7</sup>. Finally, the Spec option<sup>8</sup> in the Statistical Analysis System (SAS) program makes it easier to detect the heteroscedasticity because too many explanatory variables (with dummy variables) are in an empirical model to specify for the other tests. The weighted regressions in the empirical models are actually conducted by regression procedures rather than by transformed variables (all weighted variables by a

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<sup>6</sup> For variable  $X_i$ , calculate  $R_i^2$  by regressing  $X_i$  on the other independent variables, the VIF for  $X_i$  is given by  $VIF(X_i) = 1 / (1 - R_i^2)$ . And then analyze the degree of multicollinearity by evaluating the size of the VIF ( $X_i$ ). There is no table of formal critical VIF value, but if  $VIF(X_i) > 5$ , the multicollinearity is severe. The religion, education, and dummy variables are excluded.

<sup>7</sup> Based on the Durbin-Watson statistic,  $d = 2(1 - \rho)$ , where  $\rho$  is the coefficient of a regression of the residuals as a function of their values lagged one time period. At the one-sided 99 percent confidence test, the critical d value is  $d_u = 1.65$  with the largest number of explanatory variables at the D-W statistical table. The decision rule is, if  $d > d_u$ , do not reject the null hypothesis of no positive serial correlation.

<sup>8</sup> A test of the first and second moment specification provides consistent covariance matrix, White's chi-square value, and associated probability for the null hypothesis of homoscedasticity. The decision rule is accept the null hypothesis of  $\sigma_i = \sigma$  homoscedasticity if  $Spec <$  the critical value of the chi-square. For larger values of degrees of freedom (df) the expression  $z = (2\chi^2)^{1/2} - (2(df)-1)^{1/2}$  may be used and the resulting upper tail area can be obtained from the standardized normal distribution.

parameter before the regression procedure). According to the SAS procedure, the chi-square values for Spec are robust with an increasing degree of freedom, with comparing the F-statistics from the OLS regression results. The smallest value of chi-square is 123 with degrees of freedom of 91, and the largest value equals 575 with degrees of freedom of 602. These figures imply that the z-scores vary from -0.78 to 2.23. Thus, based on the evidence, it is ambiguous whether or not one should reject the null hypothesis of existence of the homoscedasticity ( $\sigma_i = \sigma$ ) at the 5 percent level of significance on a one-tail test.

## **CHAPTER 5 EMPIRICAL RESULTS**

Tables 3, 4, 5, 6, 7, 8, and 9 contain ordinary least squares multiple regression estimates of alcohol primary cause mortality; homicides; suicides; cancers of the alimentary tract mortality; fires, falls, and other accidents; motor vehicle accident mortality; and motor vehicle accident mortality (age: 18-20), respectively. In each table three regressions are presented for whites and three are presented for blacks. The first omits religion and education variables and the set of state dummies. The second includes the state dummies. The third deletes the state dummies and adds the religion and education variables. Each race-specific regression is weighted by the square root of the race-specific population between the ages of 25 and 64, in Table 9, only 18 and 20.

### **5.1. Alcohol Primary Cause Mortality**

Liver cirrhosis mortality, a well-known proxy for chronic heavy drinkers (Cook and Tauchen, 1982; Grossman et al., 1992; Ponicki and Gruenewald, 1995; Shim, 1999; Kerr et al., 2000; Xie et al., 2000), constitutes 80 percent of the deaths in the alcohol primary cause category in this study. An overview of the results suggests that empirical outcomes are sensitive to alternative specifications. This means that few definitive conclusions can be reached. One important exception is that the significance of the negative liquor price coefficient in the white primary cause regressions is very robust. (See the first three models in Table 3.) While the magnitude of the coefficient varies, the t-ratio is at least equal to 2.37 in absolute value. Hence, the estimate is significant at the 1 percent level on a one-tailed test in all three models. In other words, real liquor price has a significant

**Table 3**  
**Alcohol Primary Cause Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.465 (-4.594)	-0.445 (-2.368)	-1.042 (-4.065)	0.952 (0.869)	-1.088 (-1.025)	1.342 (1.168)
Real income	0.00113 (10.478)	-0.00052 (-6.052)	0.00014 (1.118)	0.00184 (5.050)	-0.00278 (-5.679)	0.00111 (1.849)
Unemployment	0.345 (3.233)	-0.237 (-4.454)	-0.161 (-1.789)	-0.555 (-1.466)	-1.290 (-4.330)	-0.900 (-2.448)
Licenses	-1.714 (-5.483)	0.781 (1.664)	-1.052 (-3.060)	4.002 (3.569)	11.013 (4.187)	2.089 (1.209)
Dry	-0.072 (-3.401)	-0.100 (-3.058)	-0.008 (-0.391)	0.019 (0.261)	-0.311 (-1.959)	-0.019 (-0.228)
Catholic			-0.079 (-4.118)			-0.246 (-2.359)
Protestant			-0.393 (-19.366)			0.066 (0.590)
Southern Baptist			-0.180 (-5.678)			-1.126 (-7.528)
Mormon			-0.206 (-7.083)			-0.433 (-0.992)
High school education			-0.156 (-3.534)			-1.399 (-5.848)
R-squared	0.373	0.945	0.631	0.265	0.817	0.356
F-statistic	20.761	138.751	45.021	10.408	34.363	12.064

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

role in alcohol primary cause mortality of whites, whereas the price has a weak effect on the mortality of blacks. Since the model with the state dummies is the most completely

specified, this study highlights the coefficients that emerge from it. The price of alcohol is the most important determinant among the regulatory variables to alcohol consumption. Consider the alcohol primary cause regressions in Table 2. At the point of sample means, the elasticity of the white death rate with respect to the price of liquor equals -0.19. The black elasticity of -0.21 is very similar, although it is based on a coefficient that is not significant.

When the demand side in the market equilibrium mechanism is considered, individuals' income level is one of the most important determinants of the demand for normal goods, for which demand goes up when income is higher and goes down when income is lower. Under the assumption of alcohol as a normal good, Cook and Tauchen (1982); Nair et al. (1999); and Tung (1999) find that an increase in real income raises alcohol consumption. Hence, the effects of an increase in real income are expected to be a positive relationship with alcohol primary cause mortality: others held constant <sup>9</sup>. Put differently, the effect of income on primary alcohol cause mortality should be positively associated, but estimated income coefficients for both races with the state dummies are negative and statistically significant with income elasticities of -0.41 and -0.99 for whites and blacks respectively. These figures indicate that the higher income group consumes more alcohol but may allocate more resources to goods that improve health such as medical care.

Unemployment is one of the stressful factors and self-depression variables. Thus we expect the unemployment rate to have a positive effect on alcohol consumption and

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<sup>9</sup> From the probability of death ( $\pi$ ):

$$\pi = \pi\{a(p,y), x\}$$

where  $a$  is alcohol consumption;  $p$  represents price of alcohol;  $y$  denotes income;  $x$  corresponds to a vector of additional variables. Since  $\partial\pi / \partial a > 0$  and  $\partial a / \partial y > 0$ ,  $d\pi / dy = (\partial\pi / \partial a) * (\partial a / \partial y) > 0$ .

the mortality rate of alcohol primary causes, but the estimated white and black coefficients are negative and significant. An increase in the numbers of licenses raises the mortality rates for both races. The black elasticity of 0.34 is much larger than the white elasticity of 0.05. These results are somewhat surprising because whites have higher wage rates and hence higher values of time than blacks. Given this fact and the equal elasticities of the time required to obtain alcohol with respect to outlet density, one would expect a larger elasticity for whites. This is because a one percent reduction in time represents a larger percentage reduction in full price the larger is the value of time.<sup>10</sup> Hence one interpretation of the results is that travel time is much more sensitive to outlet density for blacks than for whites. Another interpretation is that other factors associated with a relatively large number of outlets stimulate alcohol consumption by blacks more than by whites. In conclusion for the discussion of the results in Table 2 by noting that the coefficient of the percentage of the population residing in counties that prohibit the sale of alcohol is negative and significant in model 2 for whites and in the corresponding model 5 for blacks. This is consistent with the positive outlet density effect. It also is consistent with an anti-drinking sentiment interpretation. All of the religious variables are statistically significant for both races.

## 5.2. Homicides, Suicides, and Cancers of Alimentary Tract Mortality<sup>11</sup>

<sup>10</sup> Suppose that the demand function for alcohol is

$$\ln a = k + \epsilon \ln f,$$

where  $f$  is the full price,  $k$  is a constant, and  $\epsilon$  is the price elasticity. Note  $f = p + wt$ , where  $w$  is the wage rate and  $t$  is the amount of time required one unit of  $a$ . Hence

$$(\partial \ln a / \partial \ln t) = s\epsilon,$$

where  $s = wt/p$ . Let  $d$  be outlet density, let  $\eta$  be the elasticity of  $t$  with respect to  $d$ , and note that  $\eta$  is negative. Then

$$(\partial \ln a / \partial \ln d) = s\eta\epsilon.$$

<sup>11</sup> From now on, all results discussed in the text pertain to model with state dummies.

Homicides relate to damage to others by alcohol drinking. In Table 4, for estimates of homicides for blacks, a negative and significant price effect is found with price elasticity of  $-0.30$ , and the license effect is positive and of a significant level, with an elasticity of  $0.16$ . The homicide elasticity is notable because the black homicide rate of 47 deaths per 100,000 population is larger than any of the other death rates considered, and almost seven times greater than the white homicide rate. Homicides also are highly related to alcohol drinking (alcohol is attributed to homicides by 55%, Welte and Abel, 1989; with 50%, Ravenholt, 1984). The empirical results suggest that the black homicide rate would fall by approximately 2 percent if the number of alcohol outlets fell by 10 percent. Unemployment, a stressful variable, has negative and significant effects for whites and blacks, whereas the effect of dry on homicides is positive and significant.

In contrast to homicides, suicides and cancers of the alimentary tract mortality correlate to alcohol drinking damage to self. In Tables 5 and 6, for whites, negative price effects for both suicides and alimentary tract cancer mortality are found with price elasticities of  $-0.06$  and  $-0.14$  respectively. The license coefficient of alimentary tract cancer is positive and significant with an elasticity of  $0.15$ . For blacks, the estimated coefficients of licenses are positive for both suicides and alimentary cancer with license elasticities of  $0.12$  and  $0.04$  respectively. A higher unemployment rate is associated with a higher suicide rate because being unemployed could motivate self-depression as stress (Caces and Harford, 1998). As expected, in suicides the estimated coefficients of the unemployment rate for whites and blacks are positive and significant with relatively high t-statistics comparing with other explanatory variables.

### **5.3. Falls, Fires, and Other Accidents and Motor Vehicle Traffic Accidents**

**Table 4**  
**Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-0.287 (-1.088)	0.498 (3.562)	0.424 (2.092)	-1.708 (-1.593)	-0.321 (-0.367)	0.686 (0.603)
Real income	0.00014 (1.536)	0.00015 (2.340)	0.00008 (0.796)	-0.00053 (-1.473)	0.00052 (1.279)	-0.00151 (-2.543)
Unemployment	0.100 (1.130)	-0.202 (-5.105)	-0.096 (-1.345)	2.444 (6.590)	-0.751 (-3.064)	2.254 (6.196)
Licenses	-2.731 (-10.566)	-0.061 (-0.175)	-0.633 (-2.327)	0.655 (0.596)	6.817 (3.148)	4.230 (2.474)
Dry	-0.005 (-0.275)	0.091 (3.741)	-0.020 (-1.302)	-0.286 (-4.090)	0.296 (2.265)	0.017 (0.214)
Catholic			-0.070 (-4.617)			-0.326 (-3.165)
Protestant			-0.257 (-15.983)			-0.453 (-4.129)
Southern Baptist			0.119 (4.742)			0.078 (0.528)
Mormon			-0.132 (-5.741)			-1.030 (-2.385)
High school education			-0.094 (-2.686)			1.165 (4.923)
R-squared	0.199	0.943	0.568	0.276	0.873	0.353
F-statistic	8.727	134.112	34.720	10.986	52.766	11.899

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table 5**  
**Suicide Regressions\***

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.472 (-5.908)	-0.158 (-0.841)	-0.652 (-3.524)	-1.146 (-4.044)	0.528 (1.427)	-0.525 (-1.908)
Real income	-0.00095 (-11.247)	-0.00012 (-1.389)	-0.00093 (-9.954)	-0.00006 (-0.669)	0.00012 (0.692)	-0.00055 (-3.806)
Unemployment	-0.041 (-0.495)	0.112 (2.110)	-0.152 (-2.349)	0.352 (3.592)	0.346 (3.330)	0.324 (3.686)
Licenses	-1.808 (-7.401)	-0.486 (-1.035)	0.811 (3.268)	-0.440 (-1.515)	1.035 (1.128)	-0.012 (-0.029)
Dry	-0.099 (-5.969)	0.084 (2.557)	0.021 (1.510)	-0.050 (-2.719)	-0.024 (-0.434)	0.002 (0.098)
Catholic			-0.186 (-13.461)			-0.078 (-3.140)
Protestant			-0.229 (-15.619)			0.039 (1.465)
Southern Baptist			0.046 (1.996)			-0.091 (-2.546)
Mormon			-0.121 (-5.761)			0.212 (2.027)
High school education			0.276 (8.649)			0.319 (5.567)
R-squared	0.312	0.901	0.655	0.092	0.590	0.321
F-statistic	15.857	73.693	50.004	2.945	11.087	10.319

\*t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table 6**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.045 (0.568)	-0.109 (-1.323)	0.003 (0.042)	0.208 (0.854)	0.027 (0.081)	0.117 (0.471)
Real income	0.00017 (6.409)	-0.00018 (-4.774)	-0.00005 (-1.506)	0.00018 (2.234)	-0.00009 (-0.574)	-0.00005 (-0.375)
Unemployment	0.095 (3.610)	0.024 (1.044)	-0.008 (-0.357)	-0.035 (-0.413)	-0.091 (-0.971)	-0.127 (-1.592)
Licenses	0.284 (3.684)	0.722 (3.513)	-0.095 (-1.095)	1.593 (6.382)	0.448 (0.542)	0.714 (1.907)
Dry	0.017 (3.183)	-0.018 (-1.233)	-0.007 (-1.341)	0.014 (0.881)	-0.053 (-1.065)	-0.006 (-0.348)
Catholic			0.024 (4.900)			-0.029 (-1.305)
Protestant			-0.041 (-8.066)			0.016 (0.657)
Southern Baptist			-0.045 (-5.605)			-0.270 (-8.337)
Mormon			-0.045 (-6.147)			-0.189 (-2.003)
High school education			-0.124 (-11.117)			-0.375 (-7.232)
R-squared	0.227	0.786	0.524	0.204	0.604	0.340
F-statistic	10.261	29.756	29.002	7.399	11.753	11.183

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table 7**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-0.010 (-0.079)	-0.332 (-2.350)	0.269 (2.296)	-0.335 (-0.867)	-0.380 (-0.782)	-0.465 (-1.273)
Real income	-0.00063 (-14.443)	0.00006 (0.913)	-0.00027 (-4.653)	-0.00157 (-12.204)	-0.00037 (-1.666)	0.00001 (0.036)
Unemployment	-0.088 (-2.034)	-0.271 (-6.764)	-0.029 (-0.704)	-0.341 (-2.549)	-0.656 (-4.804)	-0.181 (-1.549)
Licenses	-0.729 (-5.735)	-1.403 (-3.975)	0.353 (2.248)	-0.938 (-2.371)	-5.815 (-4.826)	1.063 (1.936)
Dry	0.033 (3.787)	0.026 (1.043)	0.002 (0.245)	0.094 (3.742)	0.058 (0.801)	0.024 (0.943)
Catholic			-0.022 (-2.531)			-0.049 (-1.484)
Protestant			-0.008 (-0.874)			0.017 (0.487)
Southern Baptist			0.123 (8.508)			0.134 (2.827)
Mormon			0.012 (0.880)			0.101 (0.725)
High school education			-0.017 (-0.842)			-0.533 (-7.021)
R-squared	0.582	0.874	0.690	0.563	0.816	0.690
F-statistic	48.626	56.338	58.573	37.202	34.265	48.472

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table 8**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real liquor price</b>	-0.413 (-1.205)	0.229 (0.780)	0.508 (1.862)	-0.600 (-1.005)	0.234 (0.342)	0.416 (0.757)
<b>Real income</b>	-0.00139 (-11.679)	0.00020 (1.452)	-0.00077 (-5.539)	-0.00211 (-9.996)	0.00017 (0.526)	-0.00033 (-1.122)
<b>Unemployment</b>	0.093 (0.834)	-0.674 (-8.029)	-0.002 (-0.025)	-0.513 (-2.590)	-0.735 (-3.862)	-0.499 (-2.852)
<b>Licenses</b>	-3.018 (-9.300)	-0.333 (-0.389)	0.713 (1.949)	-5.368 (-9.022)	3.150 (1.542)	0.284 (0.336)
<b>Dry</b>	-0.050 (-2.177)	0.059 (0.632)	-0.022 (-1.094)	-0.093 (-2.429)	-0.578 (-3.207)	0.007 (0.161)
<b>Catholic</b>			-0.165 (-8.172)			-0.247 (-5.120)
<b>Protestant</b>			-0.173 (-8.130)			-0.244 (-4.538)
<b>Southern Baptist</b>			0.234 (6.463)			0.331 (4.323)
<b>Mormon</b>			-0.115 (-3.768)			-0.059 (-0.289)
<b>High school education</b>			0.109 (2.160)			-0.007 (-0.052)
<b>Mandatory administrative per se</b>	0.588 (0.924)	0.108 (0.260)	1.054 (2.093)	4.148 (3.601)	0.665 (0.590)	3.993 (3.919)
<b>Mandatory minimum administrative</b>	-0.001 (-0.133)	-0.004 (-1.193)	-0.002 (-0.653)	-0.032 (-2.785)	-0.010 (-0.824)	-0.021 (-2.133)
<b>Mandatory fine</b>	-2.554 (-2.343)	-0.326 (-0.453)	-0.497 (-0.564)	4.786 (2.358)	2.156 (1.276)	6.651 (3.742)
<b>Real fine</b>	0.008 (2.117)	0.004 (1.417)	0.005 (1.525)	-0.026 (-3.452)	-0.007 (-1.046)	-0.028 (-4.390)

Table 8 (continued)

R-squared	0.465	0.910	0.687	0.589	0.872	0.711
F-statistic	21.234	58.297	40.756	28.765	36.922	37.628

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

The damage of alcohol drinking to both self and others includes the categories of falls, fires, and other accidents, and motor vehicle traffic accidents. Table 7 shows regression results of falls, fires, and other accident mortality. Negative price effects for whites and blacks are found with price elasticities of -0.24 for whites and -0.14 for blacks. Coefficients of the unemployment rate and licenses for both races are negative and significant. The estimated license coefficient for blacks is negative only in this mortality category among the six causes of alcohol-related mortality regressions.

Motor vehicle traffic accident mortality rate for whites is highest among the six causes of deaths (see Table 1). In the study by Sloan et al., (1994), an increase in the price of distilled spirits reduces motor vehicle traffic accident mortality rate, but in the present study, there is no evidence that the price of distilled spirits negatively affects motor vehicle traffic accident mortality. In Table 8, estimated alcohol price coefficients for both races are positive but not significant. For blacks, a positive effect of licenses is found, and negative and significant effect of dry is found. The implication of these results is that the conventional wisdom, the full price of an alcoholic beverage falls when more retail outlets are permitted and then to consume more alcohol beverages; and the full price of an alcohol beverage rises when the dry increases because of increasing travel time, is

**Table 9**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real liquor price</b>	0.400 (0.440)	1.167 (1.119)	2.293 (2.809)	-0.313 (-0.291)	2.937 (1.804)	1.667 (1.583)
<b>Real income</b>	-0.00274 (-8.475)	-0.00042 (-0.848)	-0.00111 (-2.662)	-0.00103 (-2.648)	0.00009 (0.111)	0.00095 (1.637)
<b>Unemployment</b>	0.269 (0.932)	-1.273 (-4.242)	0.340 (1.242)	0.258 (0.737)	-0.893 (-1.931)	0.167 (0.494)
<b>Licenses</b>	-7.512 (-8.844)	4.420 (1.468)	0.320 (0.297)	-5.763 (-5.408)	-5.052 (-1.025)	2.941 (1.798)
<b>Dry</b>	-0.052 (-0.882)	-0.074 (-0.229)	0.032 (0.533)	0.065 (0.966)	0.457 (1.090)	0.282 (3.682)
<b>Catholic</b>			-0.324 (-5.474)			-0.430 (-4.577)
<b>Protestant</b>			-0.210 (-3.364)			-0.404 (-3.845)
<b>Southern Baptist</b>			0.684 (6.420)			0.456 (3.122)
<b>Mormon</b>			-0.319 (-3.733)			0.127 (0.352)
<b>High school education</b>			0.688 (4.511)			0.449 (1.790)
<b>Legal drinking age</b>	-1.358 (-2.311)	0.094 (0.183)	-1.093 (-2.037)	-1.752 (-2.554)	-0.784 (-1.030)	-1.239 (-1.790)
<b>Mandatory administrative per se</b>	1.057 (0.615)	-1.919 (-1.259)	3.184 (2.088)	2.437 (1.133)	0.452 (0.162)	3.187 (1.576)
<b>Mandatory minimum administrative</b>	-0.007 (-0.522)	0.004 (0.355)	-0.014 (-1.233)	-0.022 (-1.014)	-0.037 (-1.218)	-0.021 (-1.052)
<b>Mandatory fine</b>	-5.265 (-1.854)	-0.600 (-0.236)	1.502 (0.581)	4.621 (1.274)	-6.319 (-1.563)	8.162 (2.385)

Table 9 (continued)

Real fine	0.016 (1.587)	0.006 (0.693)	0.003 (0.381)	-0.017 (-1.273)	0.026 (1.532)	-0.022 (-1.749)
R-squared	0.424	0.819	0.575	0.310	0.595	0.428
F-statistic	16.901	25.398	23.956	8.508	7.794	10.935

<sup>t</sup>-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 18 through 20.

proved. In the four measured variables of penalty for apprehension and conviction of driving under the influence of alcohol, the signs of the estimated black coefficients of mandatory fine and real fine for mortality due to motor vehicle traffic accidents are the reverse of those of whites. The negative effects of mandatory fine and real fine are found for whites and for blacks respectively. Table 9 presents the empirical results of motor vehicle traffic accidents for those aged of 18 and 20 for testing the effects of minimum legal drinking age on motor vehicle traffic accident mortality. The mortality rate of motor vehicle traffic accidents for young white adults exceeds the rate for young black adults (see Table 2 and Figure 2). No strong evidence of the negative effects of legal drinking age on motor vehicle traffic accidents is found, but five out of the six estimated coefficients are negative. In other words, the drinking age may have a negative effect on motor vehicle traffic accident mortality for young adults. The coefficients of alcohol prices become robust compared to the coefficients for adults, but are still positive and insignificant.

## **CHAPTER 6**

### **AN EXPANDED LOOK AT OTHER SPECIFICATIONS**

The following presents empirical regression models added to the liquor specifications in the previous chapter. The changes in the empirical results from the previous results, mainly with the price of alcohol, are briefly illustrated. There are eight additional results shown as Appendix Tables B through I: real beer tax (substitute real beer tax for the price of liquor); real liquor price and real beer tax; no dry and licenses; real beer tax with no dry and licenses; real liquor price and real beer tax with no dry and licenses; no licenses; real beer tax with no licenses; real liquor price and real beer tax with no licenses. In each table three regressions are presented for whites and three are presented for blacks. The first omits the religion and education variables and the set of state dummies. The second includes the state dummies. The third deletes the state dummies and adds the religion and education variables. Each race-specific regression is weighted by the square root of the race-specific population between the ages of 25 and 64; but in Table 9s, the ages of 18 and 20. As mentioned in the previous chapter, all results will be discussed with model (2) for whites and model (5) for blacks as including state dummies.

#### **6.1. Real Beer Tax**

In this section, real beer tax is treated as a measure of the price of alcohol. In monopoly states, the states design the collection of their revenue from liquor by price markups from liquor sales rather than by imposing excise taxes. Thus instead of excise taxes, for all states the price of liquor is a good proxy for a measure of the price of alcohol when the price of liquor is in the model. On the other hand, since privates can sell beer in the

monopoly states, beer taxes are appropriate substitute for the price of beer (Grossman, 1991). Real beer tax is quite independent from the prices of liquor during the sample years. The simple correlation coefficients are positive, but not substantial: 0.197 and 0.256 for the white sample and black sample respectively. And beer still remains one of the important determinants of alcohol-related problems: beer is the leading alcoholic beverage in terms of the pure ethanol consumption among distilled spirits, wine, and beer (Caces and Harford, 1998). The alcohol demand study by Tung (1999) finds that all real beer price coefficients are negative for whites in the drinking occasion models. And there is another reason why this study accounts real beer tax into empirical specifications: when the money price of alcohol becomes an independent variable in an alcohol demand equation, the endogeneity problem may occur because the price could be determined by market mechanism, implying a structural demand equation. But excise taxes on alcoholic beverages are set by state and federal governments, so the tax on alcohol is an suitable substitute for the price of alcohol to avoid the endogeneity problem.

In the results of the primary alcohol cause category as shown in Table 3B, the estimated white coefficient of real beer tax is negative but not significant, while the black coefficient is negative and significant with 3.93 of the t-statistics in absolute value. Elasticity of the white death rate with respect to real beer taxes is -0.08. The black elasticity of -0.36 is extremely different from the white elasticity. This fact means that beer is associated with chronic heavy drinking for blacks. This significant result tells us that beer drinking is an important determinant to deaths due to alcohol primary causes for blacks. It is against the conventional wisdom that heavy drinkers prefer to consume distilled spirits, becoming addicted, and having a higher probability of deaths caused by

liver cirrhosis. The estimated coefficients and t-statistics for other explanatory variables are virtually unchanged from coefficients in the specifications of real prices of liquor in the previous chapter, not only in the alcohol primary cause mortality rate category, but also in the other categories.

The following explains the Tables of B-1 through B-7. There is evidence of a negative effect of real beer tax on homicides; in fact a negative effect is strongly expected for blacks because blacks have more alcohol-related problems with beer drinking. And in suicides, the signs of real beer tax coefficients are the opposite of those of liquor prices for both races: from negative to positive for whites, and positive to negative for blacks. A negative effect of the real beer tax on alimentary tract cancer mortality is found for blacks with increasing the t-statistics. In the liquor study, the price of real liquor has a positive relationship with white and black motor vehicle traffic accident mortality rates. However, real beer taxes have negative effects on the white and black motor vehicle traffic accident mortality rates for adult and young adult drivers, but insignificant. It is expected for young adults because the most often consumed beverage for the young adults is beer rather than distilled spirits. The results imply that beer drinking is more involved in motor vehicle traffic accident mortality for both races than is distilled spirit drinking. In addition, it is strongly expected that the legal minimum drinking age negatively influences motor vehicle traffic accident mortality for those aged 18 and 20 because beer is consumed by young adults more than any other alcoholic beverage, but the empirical result appears only negative, and not in a significant relation with motor vehicle traffic accident mortality rates for both white and black young adults.

## **6.2. Other Specifications**

In Appendix Tables C through I show results of the rest of the other specifications. First of all, by putting the real price of liquor and real beer tax together in the right hand side of empirical models, the signs of their estimated coefficients remain the same, and the magnitude of coefficients and t-statistics are quite similar to those when fitting real liquor price and real beer tax alone in empirical models for all of the six categories.

Second, fitting no dry and licenses, real beer tax with no dry and licenses, and real liquor price and real beer tax with no dry and licenses, this study tests whether changes in the percentage of dry and numbers of licenses contribute to the full price of alcohol because of traveling time. This specification implies that only the money price of alcohol fits in empirical models. If dry and licenses have a significant effect on alcohol-related mortality rates, omitting two variables weighs alcohol prices heavier in models. In the results, coefficients of liquor models with or without dry and licenses are practically unchanged, while in the beer model, estimated coefficients and t-statistics rise for all categories except motor vehicle traffic accident mortality. Especially, the white coefficients of real beer taxes in the alcohol primary cause category become significant at the 2.5 percent level on a one-tailed test.

Finally, with specifying no licenses, real beer tax with no licenses, and real liquor price and real beer tax with no licenses, empirical models take only dry to capture antidrinking sentiment. The simple correlation coefficients for white and black samples between licenses and prices of alcohol are found to be negative, and all regression coefficients are negative and significant (the lowest t-statistic equals 3.3 in absolute value among all regression models; dependent variables are real liquor price and real beer tax for white and black samples). Thus it is expected that the price effect could become more

negative and bigger in absolute value when omitting the license in models. However, coefficients of alcohol prices are virtually unchanged. Put differently, licenses and dry are trivial explanatory variables compared to the magnitude of the prices of distilled spirits and beer in empirical models.

## **CHAPTER 7 SUMMARY AND CONCLUSION**

This paper has examined racial differences in the effects of regulatory variables on alcohol-related mortality in a time series of states of the United States for the period from 1980 through 1991. Six causes of death have been studied: (1) diseases in which alcohol use is the primary cause including alcoholic cirrhosis of the liver and alcohol dependence syndrome; (2) homicides; (3) suicides; (4) cancers of the alimentary tract; (5) falls, fires, and other accidents; (6) motor vehicle traffic accidents. Due to the well-known excess mortality of blacks, this paper has focused on white/black differences.

Our main results pertain to the price of liquor and to the per capita number of outlets that are licensed to sell alcohol. Both are subject to government regulation. Price is influenced by excise taxation at the Federal and state levels, and outlet density is controlled directly by states. For whites, this study finds that price has a negative and significant effect on primary cause alcohol mortality and on mortality from falls, fires, and other accidents. For blacks, no negative and significant price effects are found. The white elasticity of primary cause mortality with respect to price of -0.19 is important because many more deaths in this category are due to alcohol than those in the other categories, and because deaths in which alcohol is the primary cause account for almost one-quarter of those studied. These results imply that a 10 percent rise in price would lower the number of whites who die from causes directly related to alcohol by 2 percent.

For whites, positive and significant outlet density effects are found for primary cause mortality and for alimentary tract cancers. For blacks, positive and significant

effects emerge for primary cause mortality, homicides, and motor vehicle accident mortality. The average of the three positive and significant black outlet density elasticities equals 0.22. The corresponding average for whites is 0.10. The black elasticities of 0.34 for primary cause mortality and 0.16 for homicide are important because these two causes of death account for almost three-fifths of all black deaths studied, and because the black homicide rate of 47 deaths per 100,000 population is larger than any other race-specific death rate in this study, and is almost seven times larger than the white rate. The results imply that the black homicide rate would fall by approximately 2 percent and the black primary cause mortality rate would fall by approximately 3 percent if the number of alcohol outlets were reduced by 10 percent.

Taken together, the findings indicate that alcohol excise tax hikes are more effective tools in reducing white alcohol-related mortality, while curbs in the number of alcohol outlets are more effective tools in reducing black alcohol-related mortality. These results do not necessarily imply that excise taxes should be raised, that the number of alcohol outlets should be reduced, or that their rate of growth should be curtailed. To reach these conclusions, a full cost-benefit analysis of these policies and other policies to regulated alcohol is required. The findings do imply that the benefits of reductions in several different mortality rates should be included in this analysis.

In the additional beer empirical specifications, real beer tax is found to have a negative effect on alcohol primary cause, cancers of alimentary tract, and motor vehicle traffic accidents for whites, and alcohol primary cause, suicides, cancers of alimentary tract, and motor vehicle traffic accidents for blacks. Specifically, the t-statistic of the estimated black coefficient for alcohol primary cause becomes robust (from -1.03 to -

3.93). The elasticity of the white death rate with respect to real beer tax equals -0.08 and the elasticity for blacks is -0.36. The elasticity for blacks is remarkable because the black death rate due to alcohol primary cause is 36 per 100,000 population: the rate accounts for nearly 25 percent of all black deaths in the six categories. The elasticity is also quite larger than the liquor price elasticities of -0.19 for whites and -0.21 for blacks. Although in the liquor study, no evidence is found of the negative effects of alcohol price on motor vehicle traffic accidents (and for ages of 18 and 20) for both races, all of the estimated coefficients of real beer tax for motor vehicle traffic accident mortality regressions are negative. This fact implies that beer drinking is more involved in motor vehicle traffic accident mortality for both races than distilled spirit drinking. Unfortunately, the additional dry- and licenses-related specifications do not result in any clear changes in the effects of explanatory variables on the six death categories from the basic models.

Although this study does not bring sufficient evidence of the negative effects of real liquor price and real beer tax on the six alcohol-related mortality rates, it finds that negative effects of real liquor prices are found for whites and blacks on alcohol primary cause (liver cirrhosis disease or excessive alcohol drinking) mortality rates. We should also consider the tax strategy on beer rather than on distilled spirits for a reduction in the black alcohol-related mortality, as beer is clearly involved in motor vehicle traffic accidents more than distilled spirits.

As shown in Figures 1 and 2, most of the alcohol-related mortality rates and the real prices of alcoholic beverages substantially declined during the sample years. This fact is against the conventional wisdom of the relationship between the demand (an increase in alcohol consumption raises alcohol-related mortality rates) for and the price of

a normal good. However it could be happen. Nelson investigates trends of alcohol consumption of beer, wine, and distilled spirits for the years of 1974 and 1990 (1997) and 1977 and 1994 (1999). He finds a decline in per capita alcohol consumption and total alcohol consumption during the sample years because of the decline in the college-aged population and the increase in the elderly (age 65+) population. Substantially the alcohol gallons per capita consumption for beer remained the same level (in 1980: 1.44; in 1985: 1.40; in 1990: 1.40), while the alcohol gallons per capita consumption for liquor fell (in 1980: 1.10; in 1985: 0.90; in 1990: 0.81). The increase in the alcohol consumption share of beer (50% in 1980 to 55% in 1990) and the decrease in the alcohol consumption share of distilled spirits (38% in 1980 to 32% in 1990) are associated with the reduction of alcohol consumption (Nelson, 1999) because beer contains an average of 4.5 percent of the alcohol (ethanol) and distilled spirits are 45 percent alcohol (Schweitzer et al., 1983). The above statements should be the answer for the same direction of the downward trends of the price of alcohol and mortality rates, but it becomes ambiguous in causes of alcohol primary causes and cancers of alimentary tract in which death rates could be more influenced by medical care.

Nelson's studies (1997, 1999) find that beer and distilled spirits were substitute using the cross-price effect on the demand equations in conditional demand elasticities for years of 1974 through 1990 in 1997, and 1977 through 1994 in 1999. In other words, alcohol drinkers will substitute freely between the two types of alcoholic beverages within their budget constraint when the price of one or the other rises. He finds significant results that the own-price elasticities ranges from -0.16 to -0.20 and from -0.16 to -0.39 for beer and spirits respectively, and that cross-price elasticities for beer and

the demand for spirits vary from 0.12 to 0.22 and from 0.08 to 0.16 for spirits and demand for beer. Spirits are bigger in the own-price elasticity, and smaller in the cross-price elasticity. Stated differently, an increase in the price of spirits is more effective than an increase in the price of beer to reduce the alcohol consumption that is directly related to alcohol-related problems. Furthermore, raising the price of liquor reduces alcoholism, but raising the price of beer clearly increases alcoholism (Schweitzer et al., 1983). Kerr et al. (2000) find that only the estimate of distilled spirits is significantly related to cirrhosis mortality among spirits, beer, and wine. Thus, regardless of racial differences, controlling the price of liquor is a more effective instrument to lower alcohol-related problems than controlling the price of beer, although higher prices of both liquor and beer have negative influences on alcohol-related mortality rates in this study.

This study reaches some empirical outcomes, but it still misses some important factors for alcohol-related mortality. The results may not apply to prevention policy. O'Donnell (1985) reviews literature about drinking locations, and finds that 40-60% of drinkers consume alcoholic beverages outside of their home. This finding suggests that the responses of selling prices between retailed outlets (off the premises) and bars (or restaurants: on the premises) to an increase in wholesale price by raising alcohol excise tax could be different because of the dissimilar nature of margin rates for both places. Hence, the selling price sensitivity to changes in the wholesale price of bars or restaurants could be lower. If governments raise a small amount of excise taxes on alcoholic beverages only for wholesalers, alcohol drinkers who consume at bars or restaurants may be unaware of the increased price of alcoholic beverages because of a low selling price sensitivity to the increase in the costs.

Also, a large proportion of the adult population does not drink currently, and frequencies of drinking and quantities of alcohol consumption are different among current drinkers - for example, the upper 10 percent of drinkers consume 51 percent of the alcohol (Manning et al., 1995). This study does not consider drinking frequency, nor does it consider some other crucial explanatory variables such as tourism or interstate travel; weather (warm as distilled spirits and cold as beer). Moreover, there are other regulatory variables as well - retail availability (Sunday sales for beer; drug or grocery sales), price controls (resale price maintenance), and advertising controls (billboard advertising, retailer novelties, print price advertising) (Ornstein and Hanssens, 1985). This paper also does not consider medical care factors. Holder and Parker (1992) find that an increase in treatment of alcoholics reduces the liver cirrhosis mortality rates and raises the hospital discharge rate of cirrhosis patients from 13.4% in 1970 to 16.5% (22%) in 1985. Put differently, health care clearly affects the reduction of liver cirrhosis mortality. This fact means that alcohol primary cause mortality also depends on medical care. Since this study finds the relationship between alcohol primary cause mortality rates and real incomes is negative and significant, we put off to another study the effect of income on the mortality rates and medical care factors.

## Appendix A: Real Liquor Price

The ACCRA collected this price through the third quarter of 1988. From the fourth quarter of 1988 through the third quarter of 1989, the price of a one-liter bottle of J&B Scotch was collected. From the fourth quarter of 1989 through the fourth quarter of 1991, the price of a 750-milliliter bottle of J&B was reported. We converted this series into one giving the price of a 750-milliliter bottle of Seagram 7-Crown as follows. This price was given for 1980Q1-1988Q3. For 1988Q4-1989Q3, we had the price of a one-liter bottle of J&B Scotch. The mean price in 1988Q3 was \$7.74. The mean price in 1988Q4 was \$17.72. The inflation factor in the distilled spirits component of the CPI for the United States as a whole was 1.0034. The 1988Q3 price times the inflation factor is 7.77. Based on the change to a 750-milliliter bottle of J&B Scotch in 1989Q4, the ratio of the price of a 750-milliliter bottle to a one-liter bottle is 0.79 (see below). Since  $17.72 * 0.79 = 14.00$ , and  $7.77 / 14.00 = 0.56$ , prices from 1988Q4-1989Q3 were multiplied by  $0.79 * 0.56 = 0.44$ . For 1989Q2-1991Q4, we had the price of a 750-milliliter bottle of J&B. The mean price in 1989Q3 was 18.56. The mean price in 1989Q4 was \$14.73. The inflation factor from the distilled spirits component of the CPI was 1.0099. The mean price times inflation was \$18.74 and  $14.73 / 18.74 = 0.79$ . This adjustment factor was used above. Therefore, prices from 1989Q4-1991Q4 were multiplied by 0.56

## Appendix A-1: Trends

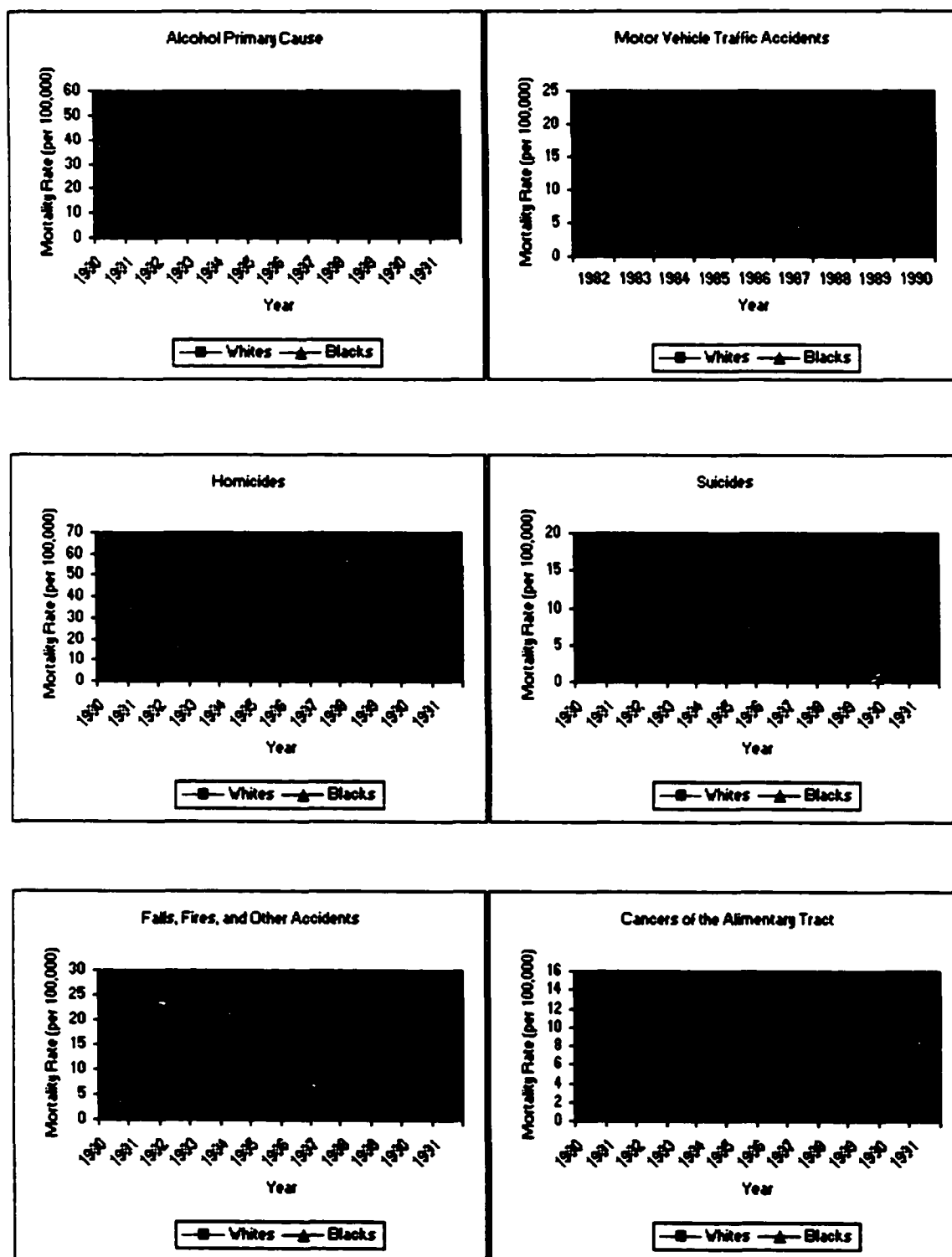


Figure 1. Trends in Mortality Rates from Six Causes

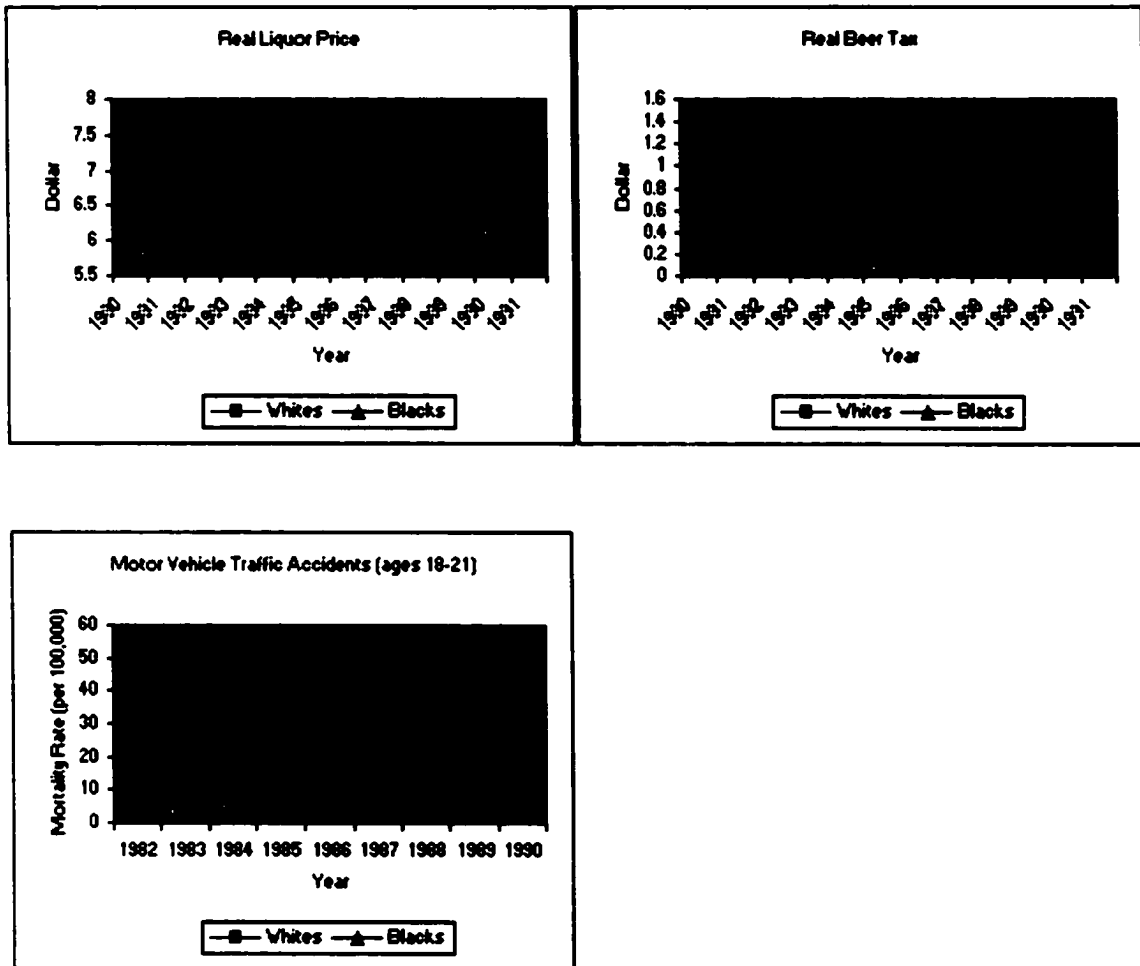


Figure 2. Trends in Real Liquor Price, Real Beer Tax, Mortality Rates of Motor Vehicle Traffic Accidents Ages 18-20

## Appendix B: Real Beer Tax

**Table B-1**  
**Alcohol Primary Cause Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.969 (2.258)	-1.165 (-1.840)	0.523 (1.398)	4.041 (3.425)	-10.360 (-3.928)	7.280 (5.839)
Real income	0.00124 (10.514)	-0.00051 (-5.905)	0.00022 (1.724)	0.00259 (6.191)	-0.00281 (-5.852)	0.00115 (1.996)
Unemployment	0.399 (3.667)	-0.209 (-3.974)	-0.139 (-1.515)	-0.398 (-1.056)	-1.213 (-4.199)	-0.738 (-2.070)
Licenses	-1.205 (-3.650)	0.605 (1.264)	-0.592 (-1.782)	5.1089 (4.466)	8.776 (3.313)	1.397 (0.926)
Dry	-0.072 (-3.313)	-0.101 (-3.097)	-0.001 (-0.024)	0.063 (0.887)	-0.339 (-2.168)	0.056 (0.708)
Catholic			-0.095 (-5.035)			-0.114 (-1.232)
Protestant			-0.398 (-19.432)			0.130 (1.226)
Southern Baptist			-0.189 (-5.737)			-1.280 (-8.739)
Mormon			-0.217 (-7.373)			-0.293 (-0.694)
High school education			-0.149 (-3.281)			-1.213 (-5.197)
R-squared	0.355	0.944	0.621	0.282	0.823	0.399
F-statistic	19.224	138.121	43.198	11.340	35.786	14.478

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-2**  
**Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.896 (2.573)	1.682 (3.581)	-1.213 (-4.197)	-0.827 (-0.706)	1.784 (0.809)	0.163 (0.128)
Real income	0.00023 (2.416)	0.00014 (2.113)	0.00002 (0.172)	-0.00071 (-1.702)	0.00051 (1.258)	-0.00154 (-2.612)
Unemployment	0.1334 (1.510)	-0.235 (-6.012)	-0.1349 (-1.903)	2.419 (6.457)	-0.740 (-3.065)	2.256 (6.180)
Licenses	-2.452 (-9.151)	0.189 (0.533)	-0.882 (-3.438)	0.809 (0.712)	7.201 (3.250)	3.789 (2.454)
Dry	-0.002 (-0.138)	0.092 (3.800)	-0.035 (-2.272)	-0.298 (-4.200)	0.299 (2.290)	0.012 (0.144)
Catholic			-0.068 (-4.642)			-0.298 (-3.156)
Protestant			-0.256 (-16.148)			-0.442 (-4.063)
Southern Baptist			0.141 (5.565)			0.086 (0.570)
Mormon			-0.127 (-5.593)			-1.018 (-2.356)
High school education			-0.118 (-3.348)			1.168 (4.887)
R-squared	0.208	0.943	0.578	0.272	0.873	0.353
F-statistic	9.151	134.150	36.169	10.811	52.840	11.874

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-3**  
**Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.910 (2.685)	1.140 (1.810)	0.832 (3.112)	-1.437 (-4.679)	-1.097 (-1.172)	-0.281 (-0.906)
Real income	-0.00084 (-9.068)	-0.00012 (-1.424)	-0.00086 (-9.255)	-0.00035 (-3.160)	0.00013 (0.786)	-0.00052 (-3.647)
Unemployment	0.012 (0.134)	0.113 (2.162)	-0.124 (-1.884)	0.300 (3.054)	0.324 (3.156)	0.319 (3.606)
Licenses	-1.313 (-5.037)	-0.332 (-0.696)	1.130 (4.759)	-0.631 (-2.116)	0.800 (0.851)	0.321 (0.857)
Dry	-0.099 (-5.785)	0.082 (2.517)	0.032 (2.212)	-0.068 (-3.650)	-0.025 (-0.454)	0.004 (0.213)
Catholic			-0.194 (-14.369)			-0.102 (-4.436)
Protestant			-0.232 (-15.812)			0.030 (1.118)
Southern Baptist			0.031 (1.312)			-0.093 (-2.558)
Mormon			-0.128 (-6.106)			0.200 (1.909)
High school education			0.291 (8.963)			0.312 (5.388)
R-squared	0.279	0.901	0.653	0.103	0.589	0.317
F-statistic	13.489	74.103	49.636	3.313	11.058	10.123

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.786 (7.933)	-0.301 (-1.087)	0.671 (7.554)	0.353 (1.331)	-1.379 (-1.641)	0.857 (3.095)
Real income	0.00025 (9.228)	-0.00018 (-4.695)	-0.00003 (-0.913)	0.00025 (2.646)	-0.00009 (-0.571)	-0.00004 (-0.325)
Unemployment	0.120 (4.777)	0.031 (1.353)	0.012 (0.559)	-0.022 (-0.256)	-0.089 (-0.966)	-0.108 (-1.360)
Licenses	0.476 (6.245)	0.677 (3.235)	-0.055 (-0.692)	1.658 (6.444)	0.151 (0.178)	0.659 (1.970)
Dry	0.019 (3.875)	-0.018 (-1.257)	0.002 (0.392)	0.018 (1.131)	-0.056 (-1.132)	0.003 (0.176)
Catholic			0.027 (5.958)			-0.015 (-0.756)
Protestant			-0.040 (-8.320)			0.023 (0.968)
Southern Baptist			-0.058 (-7.366)			-0.289 (-8.887)
Mormon			-0.046 (-6.577)			-0.173 (-1.852)
High school education			-0.110 (-10.228)			-0.353 (-6.811)
R-squared	0.305	0.785	0.568	0.205	0.606	0.352
F-statistic	15.320	29.714	34.706	7.480	11.876	11.857

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	0.230 (1.336)	0.370 (0.776)	-0.872 (-5.267)	4.168 (11.130)	3.599 (2.958)	2.517 (6.396)
<b>Real income</b>	-0.00061 (-12.913)	0.00006 (0.958)	-0.00032 (-5.522)	-0.00082 (-6.197)	-0.00039 (-1.738)	0.00007 (0.390)
<b>Unemployment</b>	-0.080 (-1.846)	-0.257 (-6.468)	-0.057 (-1.400)	-0.173 (-1.445)	-0.646 (-4.850)	-0.122 (-1.088)
<b>Licenses</b>	-0.669 (-5.059)	-1.362 (-3.774)	0.189 (1.285)	0.535 (1.472)	-5.040 (-4.124)	1.425 (2.997)
<b>Dry</b>	0.034 (3.870)	0.024 (0.962)	-0.009 (-1.000)	0.137 (6.052)	0.066 (0.912)	0.060 (2.414)
<b>Catholic</b>			-0.021 (-2.537)			-0.039 (-1.346)
<b>Protestant</b>			-0.008 (-0.838)			0.026 (0.776)
<b>Southern Baptist</b>			0.139 (9.582)			0.066 (1.419)
<b>Mormon</b>			0.015 (1.170)			0.137 (1.027)
<b>High school education</b>			-0.034 (-1.693)			-0.467 (-6.347)
<b>R-squared</b>	0.583	0.873	0.702	0.654	0.820	0.714
<b>F-statistic</b>	48.892	55.725	61.986	54.760	35.070	54.480

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	2.547 (5.853)	-1.030 (-0.758)	0.799 (2.057)	4.755 (8.255)	-2.820 (-1.175)	2.642 (4.473)
Real income	-0.00115 (-9.437)	0.00020 (1.469)	-0.00078 (-5.618)	-0.00131 (-6.073)	0.00019 (0.608)	-0.00031 (-1.111)
Unemployment	0.184 (1.705)	-0.686 (-8.358)	0.018 (0.191)	-0.345 (-1.903)	-0.756 (-4.085)	-0.448 (-2.636)
Licenses	-2.272 (-6.908)	-0.477 (-0.545)	0.583 (1.653)	-3.599 (-6.290)	2.616 (1.252)	0.194 (0.253)
Dry	-0.039 (-1.775)	0.057 (0.612)	-0.013 (-0.600)	-0.043 (-1.214)	-0.605 (-3.336)	0.037 (0.933)
Catholic			-0.152 (-7.647)			-0.206 (-4.709)
Protestant			-0.170 (-7.972)			-0.224 (-4.281)
Southern Baptist			0.223 (6.110)			0.285 (3.788)
Mormon			-0.114 (-3.726)			-0.037 (-0.186)
High school education			0.133 (2.594)			0.080 (0.629)
Mandatory administrative per se	0.586 (0.963)	0.059 (0.143)	0.908 (1.817)	4.169 (4.063)	0.498 (0.445)	3.814 (3.944)
Mandatory minimum administrative	0.003 (0.546)	-0.004 (-1.129)	-0.001 (-0.365)	-0.021 (-2.054)	-0.009 (-0.713)	-0.018 (-1.863)
Mandatory fine	-2.834 (-2.801)	-0.365 (-0.506)	-0.137 (-0.160)	4.913 (2.668)	1.913 (1.127)	6.979 (4.059)
Real fine	0.011 (3.033)	0.004 (1.440)	0.004 (1.304)	-0.022 (-3.298)	-0.007 (-0.994)	-0.027 (-4.403)

Table B-6 (continued)

<b>R-squared</b>	<b>0.505</b>	<b>0.910</b>	<b>0.687</b>	<b>0.656</b>	<b>0.873</b>	<b>0.726</b>
<b>F-statistic</b>	<b>24.834</b>	<b>58.291</b>	<b>40.866</b>	<b>38.353</b>	<b>37.098</b>	<b>40.660</b>

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table B-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	<b>4.300</b> (3.577)	<b>-3.812</b> (-0.771)	<b>1.224</b> (1.044)	<b>3.083</b> (2.753)	<b>-4.077</b> (-0.683)	<b>0.490</b> (0.420)
<b>Real income</b>	<b>-0.00237</b> (-7.082)	<b>-0.00039</b> (-0.794)	<b>-0.00119</b> (-2.839)	<b>-0.00055</b> (-1.294)	<b>0.00021</b> (0.266)	<b>0.00086</b> (1.487)
<b>Unemployment</b>	<b>0.345</b> (1.213)	<b>-1.325</b> (-4.497)	<b>0.363</b> (1.309)	<b>0.340</b> (0.982)	<b>-1.082</b> (-2.391)	<b>0.143</b> (0.423)
<b>Licenses</b>	<b>-6.423</b> (-7.257)	<b>3.805</b> (1.226)	<b>-0.427</b> (-0.407)	<b>-4.593</b> (-4.126)	<b>-5.793</b> (-1.147)	<b>2.094</b> (1.354)
<b>Dry</b>	<b>-0.034</b> (-0.583)	<b>-0.080</b> (-0.247)	<b>0.053</b> (0.850)	<b>0.096</b> (1.433)	<b>0.438</b> (1.032)	<b>0.281</b> (3.592)
<b>Catholic</b>			<b>-0.283</b> (-4.806)			<b>-0.373</b> (-4.167)
<b>Protestant</b>			<b>-0.199</b> (-3.164)			<b>-0.383</b> (-3.650)
<b>Southern Baptist</b>			<b>0.668</b> (6.139)			<b>0.469</b> (3.168)
<b>Mormon</b>			<b>-0.307</b> (-3.567)			<b>0.155</b> (0.429)
<b>High school education</b>			<b>0.750</b> (4.848)			<b>0.468</b> (1.843)
<b>Legal drinking age</b>	<b>-0.946</b> (-1.622)	<b>-0.032</b> (-0.061)	<b>-1.344</b> (-2.521)	<b>-1.345</b> (-1.975)	<b>-0.937</b> (-1.176)	<b>-1.363</b> (-1.974)
<b>Mandatory administrative per se</b>	<b>0.912</b> (0.544)	<b>-2.152</b> (-1.417)	<b>2.554</b> (1.676)	<b>2.737</b> (1.333)	<b>-0.374</b> (-0.134)	<b>2.441</b> (1.238)
<b>Mandatory minimum administrative</b>	<b>-0.002</b> (-0.155)	<b>0.005</b> (0.398)	<b>-0.011</b> (-0.935)	<b>-0.017</b> (-0.798)	<b>-0.036</b> (-1.162)	<b>-0.017</b> (-0.838)
<b>Mandatory fine</b>	<b>-4.711</b> (-1.734)	<b>-0.833</b> (-0.328)	<b>2.992</b> (1.174)	<b>5.041</b> (1.408)	<b>-6.901</b> (-1.673)	<b>8.598</b> (2.507)

Table B-7 (continued)

<b>Real fine</b>	<b>0.017</b> (1.748)	<b>0.007</b> (0.746)	<b>-0.001</b> (-0.101)	<b>-0.016</b> (-1.202)	<b>0.026</b> (1.582)	<b>-0.023</b> (-1.810)
<b>R-squared</b>	<b>0.441</b>	<b>0.818</b>	<b>0.568</b>	<b>0.325</b>	<b>0.592</b>	<b>0.424</b>
<b>F-statistic</b>	<b>18.116</b>	<b>25.343</b>	<b>23.274</b>	<b>9.111</b>	<b>7.675</b>	<b>10.759</b>

\*t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 18 through 20.

## Appendix C: Real Liquor Price and Real Beer Tax

Table C-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.025 (2.431)	-1.042 (-1.646)	0.717 (1.930)	3.974 (3.337)	-10.176 (-3.814)	7.284 (5.706)
Real liquor price	-1.487 (-4.682)	-0.418 (-2.219)	-1.103 (-4.279)	0.484 (0.443)	-0.505 (-0.479)	-0.016 (-0.014)
Real income	0.00124 (10.669)	-0.00052 (-6.001)	0.00016 (1.263)	0.00257 (6.095)	-0.00279 (-5.803)	0.00115 (1.983)
Unemployment	0.378 (3.532)	-0.230 (-4.313)	-0.140 (-1.544)	-0.399 (-1.057)	-1.237 (-4.214)	-0.738 (-2.068)
Licenses	-1.458 (-4.435)	0.635 (1.331)	-1.033 (-3.009)	5.208 (4.464)	8.817 (3.324)	1.387 (0.827)
Dry	-0.069 (-3.250)	-0.099 (-3.047)	0.001 (0.071)	0.062 (0.860)	-0.337 (-2.154)	0.056 (0.701)
Catholic			-0.074 (-3.878)			-0.113 (-1.092)
Protestant			-0.392 (-19.343)			0.131 (1.209)
Southern Baptist			-0.194 (-5.975)			-1.280 (-8.697)
Mormon			-0.206 (-7.107)			-0.292 (-0.692)
High school education			-0.141 (-3.155)			-1.212 (-5.189)
R-squared	0.379	0.945	0.633	0.282	0.823	0.399
F-statistic	20.059	137.081	43.355	10.666	35.088	13.789

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-2**  
**Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	0.908 (2.606)	1.547 (3.313)	-1.307 (-4.512)	-0.598 (-0.507)	1.941 (0.870)	0.002 (0.001)
<b>Real liquor price</b>	-0.306 (-1.167)	0.458 (3.292)	0.535 (2.662)	-1.638 (-1.513)	-0.432 (-0.489)	0.686 (0.589)
<b>Real income</b>	0.00023 (2.407)	0.00014 (2.246)	0.00005 (0.468)	-0.00064 (-1.522)	0.00052 (1.286)	-0.00151 (-2.540)
<b>Unemployment</b>	0.129 (1.459)	-0.213 (-5.406)	-0.135 (-1.910)	2.421 (6.471)	-0.761 (-3.101)	2.254 (6.170)
<b>Licenses</b>	-2.504 (-9.222)	0.156 (0.443)	-0.669 (-2.500)	0.473 (0.409)	7.236 (3.261)	4.229 (2.464)
<b>Dry</b>	-0.002 (-0.107)	0.090 (3.744)	-0.036 (-2.344)	-0.292 (-4.112)	0.301 (2.300)	0.017 (0.211)
<b>Catholic</b>			-0.078 (-5.185)			-0.326 (-3.080)
<b>Protestant</b>			-0.259 (-16.394)			-0.453 (-4.101)
<b>Southern Baptist</b>			0.144 (5.686)			0.078 (0.518)
<b>Mormon</b>			-0.132 (-5.825)			-1.030 (-2.379)
<b>High school education</b>			-0.121 (-3.472)			1.165 (4.870)
<b>R-squared</b>	0.210	0.944	0.584	0.276	0.873	0.353
<b>F-statistic</b>	8.698	134.760	35.226	10.338	51.807	11.334

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-3  
Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.966 (2.938)	1.196 (1.892)	0.961 (3.614)	-1.298 (-4.243)	-1.317 (-1.395)	-0.164 (-0.520)
Real liquor price	-1.493 (-6.029)	-0.189 (-1.005)	-0.733 (-3.976)	-0.993 (-3.539)	0.604 (1.616)	-0.494 (-1.755)
Real income	-0.00085 (-9.401)	-0.00013 (-1.458)	-0.00090 (-9.762)	-0.00030 (-2.777)	0.00012 (0.681)	-0.00055 (-3.809)
Unemployment	-0.010 (-0.119)	0.104 (1.955)	-0.124 (-1.915)	0.301 (3.103)	0.353 (3.396)	0.321 (3.630)
Licenses	-1.567 (-6.113)	-0.318 (-0.667)	0.837 (3.409)	-0.834 (-2.781)	0.751 (0.800)	0.004 (0.009)
Dry	-0.096 (-5.806)	0.083 (2.544)	0.033 (2.330)	-0.064 (-3.486)	-0.027 (-0.495)	0.001 (0.011)
Catholic			-0.180 (-13.099)			-0.081 (-3.174)
Protestant			-0.227 (-15.666)			0.037 (1.401)
Southern Baptist			0.028 (1.187)			-0.088 (-2.405)
Mormon			-0.121 (-5.836)			0.208 (1.992)
High school education			0.296 (9.236)			0.314 (5.435)
R-squared	0.323	0.901	0.663	0.126	0.592	0.322
F-statistic	15.636	72.963	49.364	3.932	10.948	9.947

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-4  
Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.785 (7.913)	-0.271 (-0.976)	0.681 (7.603)	0.330 (1.231)	-1.418 (-1.668)	0.867 (3.060)
Real liquor price	0.028 (0.375)	-0.102 (-1.232)	-0.055 (-0.882)	0.169 (0.689)	0.108 (0.321)	-0.044 (-0.176)
Real income	0.00025 (9.224)	-0.00018 (-4.737)	-0.00003 (-1.005)	0.00024 (2.550)	-0.00009 (-0.590)	-0.00004 (-0.340)
Unemployment	0.120 (4.785)	0.026 (1.119)	0.012 (0.558)	-0.022 (-0.258)	-0.084 (-0.893)	-0.108 (-1.357)
Licenses	0.481 (6.217)	0.684 (3.270)	-0.076 (-0.925)	1.693 (6.453)	0.142 (0.168)	0.631 (1.695)
Dry	0.019 (3.861)	-0.018 (-1.223)	0.002 (0.412)	0.018 (1.089)	-0.057 (-1.138)	0.003 (0.154)
Catholic			0.028 (5.987)			-0.014 (-0.594)
Protestant			-0.040 (-8.225)			0.024 (0.982)
Southern Baptist			-0.058 (-7.392)			-0.288 (-8.831)
Mormon			-0.045 (-6.480)			-0.173 (-1.840)
High school education			-0.110 (-10.181)			-0.353 (-6.799)
R-squared	0.305	0.786	0.569	0.206	0.607	0.352
F-statistic	14.405	29.303	33.151	7.060	11.641	11.295

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.230 (1.338)	0.472 (0.989)	-0.933 (-5.635)	4.285 (11.409)	3.818 (3.107)	2.746 (6.873)
Real liquor price	-0.015 (-0.117)	-0.345 (-2.428)	0.348 (3.027)	-0.840 (-2.438)	-0.599 (-1.231)	-0.977 (-2.746)
Real income	-0.00061 (-12.902)	0.00006 (0.878)	-0.00030 (-5.191)	-0.00079 (-5.913)	-0.00037 (-1.656)	0.00002 (0.123)
Unemployment	-0.081 (-1.847)	-0.274 (-6.821)	-0.057 (-1.406)	-0.172 (-1.445)	-0.675 (-4.994)	-0.120 (-1.071)
Licenses	-0.672 (-5.005)	-1.337 (-3.721)	0.328 (2.142)	0.363 (0.985)	-4.991 (-4.084)	0.798 (1.521)
Dry	0.034 (3.869)	0.025 (1.033)	-0.009 (-1.075)	0.141 (6.214)	0.068 (0.943)	0.052 (2.101)
Catholic			-0.028 (-3.232)			0.001 (0.030)
Protestant			-0.010 (-1.075)			0.042 (1.234)
Southern Baptist			0.141 (9.754)			0.076 (1.657)
Mormon			0.012 (0.924)			0.153 (1.160)
High school education			-0.037 (-1.828)			-0.463 (-6.334)
R-squared	0.583	0.874	0.706	0.659	0.820	0.719
F-statistic	45.935	55.471	60.457	52.439	34.512	53.089

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	<b>2.587</b> (5.946)	<b>-1.053</b> (-0.774)	<b>0.703</b> (1.790)	<b>5.069</b> (8.717)	<b>-2.874</b> (-1.194)	<b>2.713</b> (4.421)
<b>Real liquor price</b>	<b>-0.526</b> (-1.592)	<b>0.234</b> (0.796)	<b>0.430</b> (1.563)	<b>-1.532</b> (-2.780)	<b>0.280</b> (0.408)	<b>-0.242</b> (-0.435)
<b>Real income</b>	<b>-0.00115</b> (-9.445)	<b>0.00020</b> (1.489)	<b>-0.00075</b> (-5.432)	<b>-0.00127</b> (-5.921)	<b>0.00018</b> (0.584)	<b>-0.00033</b> (-1.156)
<b>Unemployment</b>	<b>0.170</b> (1.580)	<b>-0.672</b> (-7.991)	<b>0.022</b> (0.235)	<b>-0.377</b> (-2.093)	<b>-0.738</b> (-3.881)	<b>-0.453</b> (-2.654)
<b>Licenses</b>	<b>-2.347</b> (-7.076)	<b>-0.476</b> (-0.544)	<b>0.734</b> (2.010)	<b>-3.760</b> (-6.600)	<b>2.608</b> (1.247)	<b>0.061</b> (0.075)
<b>Dry</b>	<b>-0.038</b> (-1.739)	<b>0.055</b> (0.588)	<b>-0.014</b> (-0.672)	<b>-0.031</b> (-0.867)	<b>-0.607</b> (-3.338)	<b>0.037</b> (0.920)
<b>Catholic</b>			<b>-0.159</b> (-7.816)			<b>-0.197</b> (-4.080)
<b>Protestant</b>			<b>-0.171</b> (-8.051)			<b>-0.221</b> (-4.203)
<b>Southern Baptist</b>			<b>0.225</b> (6.162)			<b>0.286</b> (3.800)
<b>Mormon</b>			<b>-0.116</b> (-3.799)			<b>-0.034</b> (-0.168)
<b>High school education</b>			<b>0.127</b> (2.472)			<b>0.080</b> (0.635)
<b>Mandatory administrative per se</b>	<b>0.476</b> (0.778)	<b>0.092</b> (0.221)	<b>1.004</b> (1.997)	<b>3.480</b> (3.327)	<b>0.553</b> (0.489)	<b>3.717</b> (3.740)
<b>Mandatory minimum administrative</b>	<b>0.003</b> (0.599)	<b>-0.004</b> (-1.140)	<b>-0.002</b> (-0.460)	<b>-0.019</b> (-1.820)	<b>-0.009</b> (-0.713)	<b>-0.018</b> (-1.783)
<b>Mandatory fine</b>	<b>-2.391</b> (2.281)	<b>-0.345</b> (-0.478)	<b>-0.454</b> (-0.515)	<b>5.612</b> (3.049)	<b>1.916</b> (1.127)	<b>7.066</b> (4.077)

Table C-6 (continued)

<b>Real fine</b>	<b>0.009</b> <b>(2.553)</b>	<b>0.004</b> <b>(1.411)</b>	<b>0.005</b> <b>(1.616)</b>	<b>-0.024</b> <b>(-3.547)</b>	<b>-0.007</b> <b>(-0.989)</b>	<b>-0.027</b> <b>(-4.419)</b>
<b>R-squared</b>	<b>0.508</b>	<b>0.911</b>	<b>0.689</b>	<b>0.664</b>	<b>0.873</b>	<b>0.727</b>
<b>F-statistic</b>	<b>23.682</b>	<b>57.346</b>	<b>39.333</b>	<b>37.364</b>	<b>36.350</b>	<b>38.807</b>

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table C-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	4.294 (3.569)	-3.812 (-0.771)	0.847 (0.723)	3.226 (2.839)	-4.410 (-0.742)	0.016 (0.013)
<b>Real liquor price</b>	0.365 (0.407)	1.167 (1.118)	2.222 (2.701)	-0.820 (-0.760)	2.974 (1.825)	1.663 (1.524)
<b>Real income</b>	-0.00237 (-7.079)	-0.00038 (-0.779)	-0.00110 (-2.625)	-0.00052 (-1.223)	0.00013 (0.167)	0.00095 (1.634)
<b>Unemployment</b>	0.352 (1.235)	-1.256 (-4.173)	0.361 (1.312)	0.325 (0.935)	-0.892 (-1.929)	0.167 (0.493)
<b>Licenses</b>	-6.365 (-7.095)	3.843 (1.238)	0.349 (0.324)	-4.688 (-4.183)	-5.792 (-1.151)	2.939 (1.791)
<b>Dry</b>	-0.035 (-0.593)	-0.092 (-0.283)	0.042 (0.672)	0.103 (1.516)	0.417 (0.986)	0.282 (3.619)
<b>Catholic</b>			-0.317 (-5.304)			-0.430 (-4.441)
<b>Protestant</b>			-0.209 (-3.339)			-0.404 (-3.826)
<b>Southern Baptist</b>			0.671 (6.220)			0.456 (3.083)
<b>Mormon</b>			-0.321 (-3.749)			0.127 (0.352)
<b>High school education</b>			0.705 (4.566)			0.450 (1.772)
<b>Legal drinking age</b>	-0.903 (-1.522)	-0.001 (-0.003)	-1.048 (-1.940)	-1.423 (-2.065)	-0.951 (-1.198)	-1.238 (-1.784)
<b>Mandatory administrative per se</b>	1.004 (0.592)	-1.973 (-1.292)	3.134 (2.052)	2.309 (1.084)	0.235 (0.084)	3.186 (1.572)
<b>Mandatory minimum administrative</b>	-0.002 (-0.178)	0.005 (0.384)	-0.013 (-1.156)	-0.015 (-0.709)	-0.036 (-1.163)	-0.021 (-1.046)

Table C-7 (continued)

<b>Mandatory fine</b>	<b>-4.986</b> (-1.780)	<b>-0.707</b> (-0.278)	<b>1.536</b> (0.594)	<b>5.287</b> (1.470)	<b>-6.851</b> (-1.667)	<b>8.165</b> (2.377)
<b>Real fine</b>	<b>0.018</b> (1.793)	<b>0.006</b> (0.696)	<b>0.004</b> (0.417)	<b>-0.016</b> (-1.230)	<b>0.026</b> (1.590)	<b>-0.022</b> (-1.746)
<b>R-squared</b>	<b>0.441</b>	<b>0.819</b>	<b>0.575</b>	<b>0.326</b>	<b>0.596</b>	<b>0.428</b>
<b>F-statistic</b>	<b>17.136</b>	<b>24.995</b>	<b>22.952</b>	<b>8.651</b>	<b>7.768</b>	<b>10.448</b>

\*t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 18 through 20.

## Appendix D: No Dry and Licenses

Table D-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.190 (-3.692)	-0.458 (-2.413)	-0.802 (-3.266)	-0.070 (-0.066)	-1.121 (-1.033)	0.768 (0.741)
Real income	0.00111 (10.941)	-0.00053 (-6.061)	0.00027 (2.178)	0.00230 (7.231)	-0.00326 (-6.723)	0.00079 (1.442)
Unemployment	0.247 (2.277)	-0.218 (-4.083)	-0.182 (-2.025)	-0.058 (-0.163)	-1.367 (-4.521)	-0.871 (-2.410)
Catholic			-0.111 (-7.031)			-0.169 (-2.227)
Protestant			-0.397 (-19.976)			0.037 (0.384)
Southern Baptist			-0.165 (-5.300)			-1.152 (-7.805)
Mormon			-0.198 (-6.865)			-0.465 (-1.079)
High school education			-0.162 (-3.751)			-1.383 (-5.871)
R-squared	0.332	0.943	0.624	0.244	0.808	0.354
F-statistic	19.915	140.426	48.623	10.704	33.751	13.245

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-2**  
**Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.246 (0.866)	0.513 (3.628)	0.561 (2.898)	-2.314 (-2.196)	-0.280 (-0.316)	-0.506 (-0.491)
Real income	-0.00010 (-1.073)	0.00014 (2.189)	0.00016 (1.611)	0.00019 (0.589)	0.00019 (0.490)	-0.00213 (-3.925)
Unemployment	-0.022 (-0.229)	-0.220 (-5.529)	-0.116 (-1.632)	2.498 (7.121)	-0.866 (-3.501)	2.346 (6.527)
Catholic			-0.091 (-7.317)			-0.162 (-2.139)
Protestant			-0.263 (-16.746)			-0.473 (-4.890)
Southern Baptist			0.124 (5.058)			0.039 (0.268)
Mormon			-0.131 (-5.737)			-1.050 (-2.448)
High school education			-0.088 (-2.595)			1.169 (4.990)
R-squared	0.037	0.941	0.563	0.245	0.868	0.344
F-statistic	1.522	135.125	37.741	10.774	52.819	12.696

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-3  
Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.202 (-4.614)	-0.147 (-0.776)	-0.830 (-4.673)	-1.107 (-4.022)	0.526 (1.422)	-0.522 (-2.111)
Real income	-0.00093 (-11.286)	-0.00012 (-1.395)	-0.00102 (-11.478)	-0.00001 (-0.095)	0.00007 (0.438)	-0.00054 (-4.168)
Unemployment	-0.151 (-1.723)	0.096 (1.810)	-0.129 (-1.987)	0.295 (3.196)	0.338 (3.279)	0.325 (3.767)
Catholic			-0.159 (-13.888)			-0.078 (-4.327)
Protestant			-0.222 (-15.446)			0.040 (1.735)
Southern Baptist			0.038 (1.693)			-0.090 (-2.566)
Mormon			-0.124 (-5.924)			0.213 (2.071)
High school education			0.271 (8.709)			0.318 (5.646)
R-squared	0.217	0.899	0.647	0.076	0.589	0.321
F-statistic	11.090	75.190	53.698	2.743	11.493	11.454

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-4  
Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.003 (0.041)	-0.108 (-1.297)	0.022 (0.349)	-0.189 (-0.771)	0.020 (0.061)	-0.079 (-0.352)
Real income	0.00017 (6.680)	-0.00019 (-5.032)	-0.00004 (-1.215)	0.00035 (4.803)	-0.00011 (-0.712)	-0.00016 (-1.339)
Unemployment	0.113 (4.261)	0.028 (1.178)	-0.013 (-0.567)	0.164 (2.009)	-0.089 (-0.953)	-0.117 (-1.487)
Catholic			0.020 (5.035)			-0.003 (-0.193)
Protestant			-0.043 (-8.633)			0.006 (0.299)
Southern Baptist			-0.045 (-5.789)			-0.279 (-8.701)
Mormon			-0.046 (-6.307)			-0.200 (-2.137)
High school education			-0.121 (-11.216)			-0.370 (-7.219)
R-squared	0.199	0.780	0.521	0.133	0.603	0.333
F-statistic	9.953	29.835	31.880	5.088	12.187	12.059

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.161 (1.209)	-0.336 (-2.341)	0.188 (1.684)	0.054 (0.141)	-0.376 (-0.755)	-0.775 (-2.348)
Real income	-0.00076 (-18.055)	0.00008 (1.241)	-0.00032 (-5.632)	-0.0019 (-16.659)	-0.00011 (-0.510)	-0.00014 (-0.789)
Unemployment	-0.110 (-2.454)	-0.275 (-6.832)	-0.022 (-0.540)	-0.448 (-3.522)	-0.600 (-4.322)	-0.146 (-1.265)
Catholic			-0.011 (-1.565)			-0.004 (-0.175)
Protestant			-0.007 (-0.754)			0.026 (0.837)
Southern Baptist			0.118 (8.347)			0.130 (2.764)
Mormon			0.009 (0.684)			0.112 (0.816)
High school education			-0.015 (-0.769)			-0.543 (-7.241)
R-squared	0.540	0.870	0.687	0.539	0.806	0.687
F-statistic	47.000	56.309	64.120	38.776	33.400	53.147

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.127 (0.344)	0.235 (0.802)	0.340 (1.293)	0.361 (0.560)	0.205 (0.295)	0.350 (0.686)
Real income	-0.00158 (-12.973)	0.00021 (1.602)	-0.00086 (-6.531)	-0.00266 (-12.490)	-0.00021 (-0.715)	-0.00036 (-1.364)
Unemployment	-0.057 (-0.469)	-0.677 (-8.123)	-0.006 (-0.065)	-1.249 (-6.252)	-0.743 (-3.887)	-0.488 (-2.896)
Catholic			-0.147 (-8.652)			-0.236 (-6.607)
Protestant			-0.179 (-8.600)			-0.242 (-5.293)
Southern Baptist			0.214 (6.046)			0.327 (4.370)
Mormon			-0.128 (-4.236)			-0.054 (-0.269)
High school education			0.126 (2.588)			-0.014 (-0.115)
Mandatory administrative per se	0.688 (0.986)	0.130 (0.313)	1.004 (1.986)	2.947 (2.362)	0.517 (0.452)	3.997 (4.010)
Mandatory minimum administrative	-0.001 (-0.230)	-0.004 (-1.198)	-0.002 (-0.429)	-0.028 (-2.216)	-0.010 (-0.831)	-0.021 (-2.158)
Mandatory fine	-2.731 (-2.284)	-0.259 (-0.366)	-0.506 (-0.573)	5.039 (2.241)	1.016 (0.613)	6.613 (3.740)
Real fine	0.010 (2.332)	0.004 (1.418)	0.004 (1.438)	-0.026 (-3.157)	-0.005 (-0.797)	-0.028 (-4.410)
R-squared	0.354	0.910	0.682	0.491	0.867	0.711
F-statistic	15.193	60.412	44.125	22.094	36.913	41.599

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table D-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real liquor price</b>	1.837 (1.889)	1.146 (1.099)	2.262 (2.899)	1.184 (1.080)	2.984 (1.834)	1.204 (1.194)
<b>Real income</b>	-0.00339 (-10.393)	-0.00049 (-1.007)	-0.00115 (-2.915)	-0.00199 (-5.386)	0.00053 (0.730)	0.00084 (1.567)
<b>Unemployment</b>	-0.113 (-0.366)	-1.280 (-4.281)	0.358 (1.321)	-0.494 (-1.487)	-0.850 (-1.858)	0.484 (1.458)
<b>Catholic</b>			-0.311 (-6.306)			-0.287 (-4.049)
<b>Protestant</b>			-0.203 (-3.331)			-0.236 (-2.515)
<b>Southern Baptist</b>			0.682 (6.589)			0.459 (3.151)
<b>Mormon</b>			-0.314 (-3.753)			0.330 (0.910)
<b>High school education</b>			0.664 (4.591)			0.211 (0.854)
<b>Legal drinking age</b>	-0.792 (-1.247)	0.003 (0.007)	-1.061 (-2.026)	-1.210 (-1.703)	-0.839 (-1.105)	-0.962 (-1.375)
<b>Mandatory administrative per se</b>	1.273 (0.680)	-2.033 (-1.337)	3.184 (2.095)	2.346 (1.069)	0.486 (0.175)	4.512 (2.239)
<b>Mandatory minimum administrative</b>	-0.011 (-0.747)	0.005 (0.368)	-0.014 (-1.255)	-0.031 (-1.384)	-0.037 (-1.200)	-0.030 (-1.494)
<b>Mandatory fine</b>	-5.382 (-1.741)	-1.256 (-0.502)	1.356 (0.529)	6.227 (1.643)	-5.073 (-1.287)	7.527 (2.166)
<b>Real fine</b>	0.018 (1.689)	0.0071 (0.736)	0.004 (0.406)	-0.023 (-1.622)	0.023 (1.415)	-0.022 (-1.766)
<b>R-squared</b>	0.314	0.818	0.574	0.236	0.593	0.404
<b>F-statistic</b>	11.878	26.158	26.328	6.627	8.042	10.926

Table D-7 (continued)

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<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 18 through 20.

## Appendix E: Real Beer Tax with No Dry and Licenses

Table E-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.489 (3.615)	-1.325 (-2.111)	0.548 (1.505)	2.271 (2.018)	-11.998 (-4.590)	7.136 (5.840)
Real income	0.00132 (11.727)	-0.00051 (-5.864)	0.00029 (2.354)	0.00276 (7.099)	-0.00317 (-6.702)	0.00096 (1.816)
Unemployment	0.344 (3.129)	-0.188 (-3.571)	-0.150 (-1.642)	0.137 (0.377)	-1.251 (-4.295)	-0.670 (-1.915)
Catholic			-0.112 (-6.938)			-0.059 (-0.793)
Protestant			-0.399 (-19.911)			0.150 (1.589)
Southern Baptist			-0.179 (-5.610)			-1.287 (-9.014)
Mormon			-0.209 (-7.249)			-0.266 (-0.637)
High school education			-0.154 (-3.524)			-1.242 (-5.430)
R-squared	0.331	0.943	0.619	0.250	0.816	0.398
F-statistic	19.856	140.035	47.468	11.088	35.707	15.974

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-2  
Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.949 (5.525)	1.647 (3.525)	-1.030 (-3.623)	-0.700 (-0.625)	0.028 (0.013)	0.213 (0.169)
Real income	0.00013 (1.376)	0.00012 (1.890)	0.00012 (1.282)	0.00009 (0.231)	0.00019 (0.469)	-0.00215 (-3.970)
Unemployment	0.062 (0.659)	-0.254 (-6.462)	-0.162 (-2.272)	2.527 (6.965)	-0.852 (-3.496)	2.366 (6.561)
Catholic			-0.096 (-7.633)			-0.166 (-2.181)
Protestant			-0.264 (-16.889)			-0.478 (-4.911)
Southern Baptist			0.144 (5.812)			0.022 (0.150)
Mormon			-0.124 (-5.488)			-1.050 (-2.441)
High school education			-0.103 (-3.007)			1.171 (4.975)
R-squared	0.085	0.941	0.567	0.238	0.868	0.344
F-statistic	3.727	134.923	38.303	10.359	52.805	12.679

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-3**  
**Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	1.477 (4.433)	1.231 (1.980)	0.654 (2.467)	-1.140 (-3.911)	-1.250 (-1.371)	-0.286 (-0.944)
<b>Real income</b>	-0.00072 (-7.845)	-0.00013 (-1.469)	-0.00099 (-10.996)	-0.00022 (-2.137)	0.00010 (0.607)	-0.00057 (-4.386)
<b>Unemployment</b>	-0.054 (-0.612)	0.096 (1.845)	-0.093 (-1.397)	0.238 (2.524)	0.319 (3.139)	0.330 (3.799)
<b>Catholic</b>			-0.159 (-13.540)			-0.090 (-4.910)
<b>Protestant</b>			-0.224 (-15.337)			0.029 (1.219)
<b>Southern Baptist</b>			0.022 (0.961)			-0.097 (-2.748)
<b>Mormon</b>			-0.135 (-6.429)			0.200 (1.926)
<b>High school education</b>			0.280 (8.817)			0.311 (5.473)
<b>R-squared</b>	0.215	0.900	0.637	0.075	0.588	0.316
<b>F-statistic</b>	10.945	75.729	51.437	2.677	11.487	11.180

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.581 (5.981)	-0.468 (-1.705)	0.665 (7.714)	-0.218 (-0.842)	-1.371 (-1.673)	0.862 (3.168)
Real income	0.00024 (8.840)	-0.00019 (-4.907)	0.00002 (-0.753)	0.00031 (3.468)	0.00009 (-0.619)	-0.00015 (-1.251)
Unemployment	0.139 (5.369)	0.035 (1.533)	0.012 (0.543)	0.152 (1.817)	-0.082 (-0.903)	-0.088 (-1.128)
Catholic			0.025 (6.639)			0.008 (0.466)
Protestant			-0.040 (-8.455)			0.017 (0.828)
Southern Baptist			-0.056 (-7.416)			-0.300 (-9.427)
Mormon			-0.045 (-6.546)			-0.178 (-1.917)
High school education			-0.112 (-10.83)			-0.353 (-6.930)
R-squared	0.247	0.780	0.568	0.133	0.605	0.347
F-statistic	13.143	29.926	38.408	5.097	12.320	12.841

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.516 (3.050)	0.705 (1.484)	-0.841 (-5.225)	3.810 (10.485)	4.632 (3.831)	2.359 (6.048)
Real income	-0.00070 (-15.127)	0.00008 (1.243)	-0.00034 (-6.152)	-0.00113 (-9.017)	-0.00017 (-0.779)	-0.00013 (-0.764)
Unemployment	-0.090 (-1.999)	-0.263 (-6.589)	-0.056 (-1.389)	-0.127 (-1.075)	-0.606 (-4.497)	-0.052 (-0.464)
Catholic			-0.017 (-2.345)			0.017 (0.737)
Protestant			-0.009 (-1.060)			0.048 (1.595)
Southern Baptist			0.133 (9.447)			0.060 (1.309)
Mormon			0.011 (0.854)			0.166 (1.247)
High school education			-0.027 (-1.383)			-0.499 (-6.832)
R-squared	0.546	0.869	0.700	0.627	0.812	0.707
F-statistic	48.214	55.900	68.208	55.793	34.770	58.309

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	3.609 (8.412)	-0.927 (-0.701)	0.824 (2.170)	5.993 (10.567)	-2.296 (-0.976)	2.539 (4.383)
Real income	-0.00118 (-9.645)	0.00022 (1.628)	-0.00085 (-6.456)	-0.0015 (-6.964)	-0.00018 (-0.615)	-0.00030 (-1.155)
Unemployment	0.105 (0.934)	-0.689 (-8.452)	0.022 (0.239)	-0.764 (-4.300)	-0.754 (-4.058)	-0.412 (-2.514)
Catholic			-0.137 (-7.958)			-0.196 (-5.626)
Protestant			-0.173 (-8.333)			-0.200 (-4.447)
Southern Baptist			0.206 (5.814)			0.289 (3.987)
Mormon			-0.124 (-4.136)			-0.008 (-0.039)
High school education			0.142 (2.910)			0.052 (0.422)
Mandatory administrative per se	0.542 (0.845)	0.084 (0.204)	0.894 (1.784)	3.259 (3.088)	0.367 (0.322)	3.990 (4.213)
Mandatory minimum administrative	0.004 (0.760)	-0.004 (-1.143)	-0.001 (-0.199)	-0.017 (-1.602)	-0.009 (-0.736)	-0.019 (-2.033)
Mandatory fine	-2.617 (-2.456)	-0.277 (-0.392)	-0.275 (-0.323)	5.548 (2.867)	0.876 (0.527)	6.868 (4.026)
Real fine	0.012 (3.088)	0.004 (1.433)	0.004 (1.375)	-0.023 (-3.237)	-0.005 (-0.779)	-0.027 (-4.398)
R-squared	0.448	0.910	0.685	0.615	0.868	0.726
F-statistic	22.480	60.384	44.601	36.654	37.034	44.831

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table E-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	7.475 (6.297)	-5.197 (-1.088)	1.047 (0.913)	4.577 (4.244)	-3.529 (-0.610)	-0.298 (-0.256)
<b>Real income</b>	-0.00263 (-7.806)	-0.00044 (-0.911)	-0.00115 (-2.879)	-0.00115 (-2.780)	0.00067 (0.919)	0.00086 (1.602)
<b>Unemployment</b>	0.100 (0.337)	-1.322 (-4.505)	0.367 (1.331)	-0.190 (-0.574)	-1.033 (-2.305)	0.430 (1.293)
<b>Catholic</b>			-0.291 (-5.723)			-0.276 (-3.838)
<b>Protestant</b>			-0.188 (-3.054)			-0.221 (-2.358)
<b>Southern Baptist</b>			0.690 (6.542)			0.495 (3.405)
<b>Mormon</b>			-0.289 (-3.435)			0.347 (0.956)
<b>High school education</b>			0.706 (4.834)			0.221 (0.892)
<b>Legal drinking age</b>	-0.295 (-0.483)	-0.137 (-0.264)	-1.263 (-2.398)	-0.804 (-1.155)	-0.979 (-1.228)	-1.102 (-1.580)
<b>Mandatory administrative per se</b>	0.762 (0.428)	-2.268 (-1.498)	2.582 (1.697)	2.540 (1.224)	-0.343 (-0.123)	3.892 (1.986)
<b>Mandatory minimum administrative</b>	-0.001 (-0.094)	0.005 (0.420)	-0.012 (-1.038)	-0.024 (-1.107)	-0.035 (-1.146)	-0.028 (-1.375)
<b>Mandatory fine</b>	-3.794 (-1.318)	-1.410 (-0.565)	3.008 (1.194)	7.141 (1.939)	-5.513 (-1.376)	7.884 (2.272)
<b>Real fine</b>	0.017 (1.706)	0.007 (0.781)	-0.001 (-0.117)	-0.022 (-1.594)	0.024 (1.451)	-0.023 (-1.824)
<b>R-squared</b>	0.369	0.817	0.566	0.272	0.589	0.402
<b>F-statistic</b>	15.138	26.156	25.499	8.000	7.910	10.817

Table E-7 (continued)

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<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 18 through 64.

## Appendix F: Real Liquor Price and Real Beer Tax with No Dry and Licenses

Table F-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.633 (4.004)	-1.206 (-1.923)	0.706 (1.943)	2.373 (2.067)	-11.843 (-4.482)	7.240 (5.799)
Real liquor price	-1.301 (-4.073)	-0.427 (-2.249)	-0.861 (-3.491)	-0.500 (-0.461)	-0.448 (-0.418)	-0.425 (-0.416)
Real income	0.00131 (11.723)	-0.00052 (-5.969)	0.00028 (2.307)	0.00277 (7.107)	-0.00316 (-6.660)	0.00098 (1.846)
Unemployment	0.320 (2.943)	-0.210 (-3.928)	-0.156 (-1.727)	0.127 (0.347)	-1.274 (-4.296)	-0.678 (-1.933)
Catholic			-0.105 (-6.553)			-0.051 (-0.669)
Protestant			-0.394 (-19.786)			0.158 (1.638)
Southern Baptist			-0.176 (-5.579)			-1.278 (-8.859)
Mormon			-0.197 (-6.825)			-0.258 (-0.618)
High school education			-0.152 (-3.508)			-1.238 (-5.409)
R-squared	0.351	0.944	0.627	0.251	0.816	0.398
F-statistic	20.154	138.946	46.611	10.346	34.982	15.157

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-2**  
**Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.936 (5.465)	1.516 (3.264)	-1.150 (-4.055)	-0.240 (-0.211)	0.127 (0.057)	0.351 (0.273)
Real liquor price	0.114 (0.413)	0.475 (3.375)	0.659 (3.420)	-2.270 (-2.113)	-0.287 (-0.320)	-0.564 (-0.535)
Real income	0.00013 (1.390)	0.00013 (2.037)	0.00013 (1.362)	0.00014 (0.356)	0.00019 (0.486)	-0.00212 (-3.897)
Unemployment	0.064 (0.680)	-0.230 (-5.823)	-0.157 (-2.226)	2.479 (6.846)	-0.867 (-3.493)	2.356 (6.517)
Catholic			-0.101 (-8.052)			-0.156 (-1.986)
Protestant			-0.268 (-17.262)			-0.467 (-4.712)
Southern Baptist			0.142 (5.782)			0.033 (0.223)
Mormon			-0.133 (-5.927)			-1.040 (-2.413)
High school education			-0.104 (-3.085)			1.176 (4.985)
R-squared	0.085	0.943	0.576	0.245	0.868	0.344
F-statistic	3.485	135.615	37.673	10.038	51.720	12.041

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-3  
Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.622 (4.957)	1.281 (2.052)	0.819 (3.132)	-0.950 (-3.236)	-1.460 (-1.589)	-0.165 (-0.534)
Real liquor price	-1.312 (-5.121)	-0.179 (-0.948)	-0.899 (-5.063)	-0.935 (-3.368)	0.609 (1.633)	-0.495 (-1.959)
Real income	-0.00073 (-8.211)	-0.00013 (-1.504)	-0.00100 (-11.336)	-0.00020 (-1.958)	0.00008 (0.512)	-0.00055 (-4.190)
Unemployment	-0.079 (-0.907)	0.087 (1.646)	-0.099 (-1.527)	0.219 (2.339)	0.349 (3.389)	0.321 (3.697)
Catholic			-0.152 (-13.152)			-0.081 (-4.309)
Protestant			-0.218 (-15.241)			0.038 (1.578)
Southern Baptist			0.025 (1.106)			-0.088 (-2.455)
Mormon			-0.122 (-5.882)			0.209 (2.016)
High school education			0.283 (9.083)			0.314 (5.550)
R-squared	0.250	0.900	0.653	0.097	0.591	0.322
F-statistic	12.424	74.508	52.312	3.311	11.367	10.879

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.585 (5.996)	-0.441 (-1.602)	0.672 (7.724)	-0.187 (-0.707)	-1.406 (-1.697)	0.919 (3.308)
Real liquor price	-0.036 (-0.476)	-0.097 (-1.160)	-0.035 (-0.598)	-0.155 (-0.621)	0.100 (0.298)	-0.231 (-1.014)
Real income	0.000235 (8.809)	-0.00019 (-4.949)	-0.00002 (-0.765)	0.00031 (3.497)	-0.00009 (-0.635)	-0.00014 (-1.147)
Unemployment	0.139 (5.331)	0.031 (1.303)	0.012 (0.531)	0.149 (1.774)	-0.077 (-0.833)	-0.092 (-1.182)
Catholic			0.026 (6.660)			0.012 (0.697)
Protestant			-0.040 (-8.380)			0.022 (1.008)
Southern Baptist			-0.056 (-7.395)			-0.295 (-9.192)
Mormon			-0.044 (-6.415)			-0.174 (-1.870)
High school education			-0.112 (-10.814)			-0.351 (-6.894)
R-squared	0.247	0.781	0.568	0.134	0.605	0.348
F-statistic	12.265	29.485	36.463	4.777	12.067	12.251

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.502 (2.956)	0.804 (1.695)	-0.890 (-5.505)	3.944 (10.682)	4.857 (3.981)	2.657 (6.768)
Real liquor price	0.127 (0.958)	-0.356 (-2.480)	0.263 (2.400)	-0.660 (-1.891)	-0.652 (-1.317)	-1.212 (-3.771)
Real income	-0.00070 (-15.077)	0.00008 (1.153)	-0.00034 (-6.129)	-0.00112 (-8.914)	-0.00015 (-0.701)	-0.00007 (-0.408)
Unemployment	-0.088 (-1.943)	-0.281 (-6.957)	-0.054 (-1.347)	-0.140 (-1.193)	-0.639 (-4.665)	-0.075 (-0.678)
Catholic			-0.019 (-2.619)			0.039 (1.634)
Protestant			-0.011 (-1.244)			0.070 (2.315)
Southern Baptist			0.132 (9.425)			0.084 (1.843)
Mormon			0.007 (0.549)			0.188 (1.429)
High school education			-0.027 (-1.424)			-0.490 (-6.804)
R-squared	0.547	0.871	0.703	0.630	0.813	0.715
F-statistic	45.054	55.649	65.640	52.600	34.217	57.697

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	3.637 (8.417)	-0.948 (-0.716)	0.766 (1.993)	6.232 (10.736)	-2.338 (-0.991)	2.602 (4.340)
Real liquor price	-0.199 (-0.579)	0.239 (0.815)	0.258 (0.973)	-1.039 (-1.811)	0.241 (0.346)	-0.212 (-0.413)
Real income	-0.00118 (-9.646)	0.00022 (1.645)	-0.00085 (-6.435)	-0.00150 (-6.970)	-0.00019 (-0.635)	-0.00030 (-1.140)
Unemployment	0.099 (0.879)	-0.674 (-8.069)	0.026 (0.276)	-0.797 (-4.478)	-0.738 (-3.861)	-0.419 (-2.541)
Catholic			-0.139 (-8.015)			-0.192 (-5.311)
Protestant			-0.174 (-8.378)			-0.197 (-4.299)
Southern Baptist			0.205 (5.768)			0.294 (4.001)
Mormon			-0.127 (-4.205)			-0.004 (-0.022)
High school education			0.139 (2.841)			0.054 (0.442)
Mandatory administrative per se	0.499 (0.772)	0.118 (0.283)	0.949 (1.882)	2.809 (2.598)	0.414 (0.361)	3.902 (4.015)
Mandatory minimum administrative	0.004 (0.776)	-0.004 (-1.155)	-0.001 (-0.233)	-0.016 (-1.488)	-0.009 (-0.735)	-0.019 (-1.973)
Mandatory fine	-2.447 (-2.210)	-0.257 (-0.363)	-0.489 (-0.555)	6.078 (3.115)	0.879 (0.528)	6.968 (4.039)
Real fine	0.011 (2.855)	0.004 (1.403)	0.005 (1.557)	-0.024 (-3.406)	-0.005 (-0.776)	-0.027 (-4.412)
R-squared	0.448	0.910	0.685	0.619	0.868	0.726
F-statistic	21.063	59.382	42.517	34.796	36.258	42.600

Table F-6 (continued)

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<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table F-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	7.343 (6.179)	-5.196 (-1.088)	0.682 (0.596)	4.523 (4.099)	-3.821 (-0.663)	-0.666 (-0.556)
<b>Real liquor price</b>	1.417 (1.517)	1.146 (1.099)	2.209 (2.810)	0.265 (0.242)	3.014 (1.850)	1.342 (1.291)
<b>Real income</b>	-0.00262 (-7.787)	-0.00044 (-0.903)	-0.00115 (-2.893)	-0.00115 (-2.781)	0.00058 (0.795)	0.00083 (1.537)
<b>Unemployment</b>	0.136 (0.455)	-1.253 (-4.178)	0.379 (1.384)	-0.182 (-0.545)	-0.840 (-1.832)	0.468 (1.404)
<b>Catholic</b>			-0.304 (-6.016)			-0.298 (-4.038)
<b>Protestant</b>			-0.200 (-3.274)			-0.246 (-2.573)
<b>Southern Baptist</b>			0.673 (6.424)			0.468 (3.190)
<b>Mormon</b>			-0.314 (-3.749)			0.320 (0.880)
<b>High school education</b>			0.672 (4.623)			0.196 (0.791)
<b>Legal drinking age</b>	-0.153 (-0.247)	-0.106 (-0.205)	-1.014 (-1.913)	-0.784 (-1.117)	-0.992 (-1.249)	-0.990 (-1.410)
<b>Mandatory administrative per se</b>	1.123 (0.626)	-2.095 (-1.377)	3.147 (2.067)	2.672 (1.244)	0.270 (0.096)	4.518 (2.240)
<b>Mandatory minimum administrative</b>	-0.002 (-0.173)	0.005 (0.405)	-0.014 (-1.200)	-0.024 (-1.122)	-0.035 (-1.147)	-0.031 (-1.518)
<b>Mandatory fine</b>	-4.890 (-1.651)	-1.296 (-0.519)	1.357 (0.529)	7.040 (1.897)	-5.482 (-1.373)	7.410 (2.126)
<b>Real fine</b>	0.021 (1.997)	0.007 (0.731)	0.004 (0.440)	-0.022 (-1.575)	0.024 (1.460)	-0.023 (-1.772)

Table F-7 (continued)

R-squared	0.372	0.818	0.575	0.272	0.593	0.405
F-statistic	14.427	25.780	25.108	7.512	7.892	10.422

<sup>t</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

## Appendix G: No Licenses

Table G-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.145 (-3.562)	-0.441 (-2.343)	-0.802 (-3.262)	-0.007 (-0.007)	-1.083 (-1.001)	0.744 (0.717)
Real income	0.00102 (9.354)	-0.00054 (-6.227)	0.00027 (2.176)	0.00221 (6.244)	-0.00327 (-6.769)	0.00081 (1.485)
Unemployment	0.263 (2.432)	-0.237 (-4.444)	-0.182 (-2.017)	-0.054 (-0.151)	-1.408 (-4.657)	-0.844 (-2.311)
Dry	-0.052 (-2.437)	-0.098 (-3.002)	0.001 (0.037)	-0.042 (-0.594)	-0.299 (-1.848)	-0.046 (-0.590)
Catholic			-0.111 (-6.948)			-0.161 (-2.088)
Protestant			-0.397 (-19.474)			0.069 (0.620)
Southern Baptist			-0.165 (-5.223)			-1.140 (-7.641)
Mormon			-0.199 (-6.794)			-0.427 (-0.978)
High school education			-0.161 (-3.617)			-1.407 (-5.881)
R-squared	0.339	0.944	0.624	0.244	0.809	0.354
F-statistic	19.147	140.460	46.109	10.000	33.377	12.582

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-2  
Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.222 (0.784)	0.498 (3.563)	0.569 (2.933)	-1.865 (-1.795)	-0.318 (-0.361)	-0.525 (-0.509)
Real income	-0.00005 (-0.485)	0.00015 (2.369)	0.00016 (1.604)	-0.00047 (-1.361)	0.00021 (0.526)	-0.00211 (-3.866)
Unemployment	-0.030 (-0.316)	-0.202 (-5.110)	-0.109 (-1.524)	2.526 (7.339)	-0.824 (-3.342)	2.370 (6.531)
Dry	0.027 (1.421)	0.091 (3.741)	-0.015 (-0.982)	-0.296 (-4.358)	0.303 (2.297)	-0.039 (-0.497)
Catholic			-0.089 (-7.082)			-0.1548 (-2.018)
Protestant			-0.259 (-16.115)			-0.447 (-4.047)
Southern Baptist			0.128 (5.152)			0.050 (0.334)
Mormon			-0.128 (-5.538)			-1.018 (-2.345)
High school education			-0.097 (-2.759)			1.148 (4.828)
R-squared	0.040	0.943	0.564	0.275	0.870	0.344
F-statistic	1.558	136.533	35.900	11.711	52.459	12.054

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-3**  
**Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-1.135 (-4.425)	-0.161 (-0.854)	-0.837 (-4.710)	-1.041 (-3.783)	0.529 (1.428)	-0.521 (-2.103)
Real income	-0.00107 (-12.355)	-0.00011 (-1.297)	-0.00102 (-11.471)	-0.00010 (-1.144)	0.00007 (0.432)	-0.00055 (-4.158)
Unemployment	-0.127 (-1.472)	0.112 (2.108)	-0.136 (-2.084)	0.297 (3.258)	0.335 (3.237)	0.324 (3.717)
Dry	-0.078 (-4.559)	0.082 (2.525)	0.015 (1.055)	-0.044 (-2.426)	-0.023 (-0.414)	0.002 (0.111)
Catholic			-0.161 (-13.888)			-0.079 (-4.275)
Protestant			-0.225 (-15.299)			0.039 (1.467)
Southern Baptist			0.034 (1.488)			-0.091 (-2.554)
Mormon			-0.127 (-6.014)			0.212 (2.029)
High school education			0.280 (8.695)			0.319 (5.576)
R-squared	0.245	0.901	0.648	0.088	0.589	0.321
F-statistic	12.101	74.854	51.079	2.980	11.262	10.859

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	-0.008 (-0.106)	-0.105 (-1.265)	0.024 (0.395)	-0.174 (-0.706)	0.027 (0.081)	-0.087 (-0.387)
Real income	0.00019 (7.185)	-0.00019 (-5.074)	-0.00004 (-1.223)	0.00033 (4.048)	-0.00011 (-0.728)	-0.00015 (-1.257)
Unemployment	0.108 (4.118)	0.024 (1.037)	-0.010 (-0.443)	0.165 (2.019)	-0.096 (-1.027)	-0.107 (-1.355)
Dry	0.013 (2.563)	-0.016 (-1.110)	-0.006 (-1.199)	-0.010 (-0.622)	-0.053 (-1.056)	-0.016 (-0.916)
Catholic			0.021 (5.161)			-0.001 (-0.030)
Protestant			-0.042 (-8.158)			0.017 (0.702)
Southern Baptist			-0.044 (-5.500)			-0.275 (-8.486)
Mormon			-0.044 (-6.074)			-0.187 (-1.976)
High school education			-0.125 (-11.161)			-0.378 (-7.268)
R-squared	0.208	0.780	0.523	0.134	0.604	0.334
F-statistic	9.819	29.387	30.381	4.768	11.985	11.494

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-5  
Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	0.126 (0.959)	-0.339 (-2.366)	0.188 (1.683)	-0.110 (-0.293)	-0.383 (-0.767)	-0.769 (-2.328)
Real income	-0.00068 (-15.429)	0.00008 (1.277)	-0.00032 (-5.627)	-0.00166 (-13.362)	-0.00011 (-0.499)	-0.00014 (-0.821)
Unemployment	-0.123 (-2.782)	-0.271 (-6.673)	-0.022 (-0.529)	-0.458 (-3.674)	-0.593 (-4.257)	-0.152 (-1.307)
Dry	0.041 (4.707)	0.023 (0.905)	-0.001 (-0.069)	0.108 (4.407)	0.052 (0.696)	0.010 (0.416)
Catholic			-0.011 (-1.535)			-0.006 (-0.245)
Protestant			-0.007 (-0.720)			0.019 (0.534)
Southern Baptist			0.118 (8.228)			0.127 (2.677)
Mormon			0.009 (0.686)			0.104 (0.745)
High school education			-0.015 (-0.761)			-0.538 (-7.057)
R-squared	0.557	0.870	0.687	0.557	0.806	0.687
F-statistic	46.999	55.395	60.805	38.919	32.751	50.407

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-6  
Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real liquor price</b>	0.135 (0.365)	0.230 (0.784)	0.362 (1.377)	0.352 (0.539)	0.231 (0.337)	0.348 (0.682)
<b>Real income</b>	-0.00160 (-12.432)	0.00020 (1.512)	-0.00086 (-6.526)	-0.00266 (-11.871)	0.00002 (0.069)	-0.00036 (-1.352)
<b>Unemployment</b>	-0.052 (-0.428)	-0.672 (-8.029)	0.010 (0.110)	-1.250 (-6.237)	-0.775 (-4.102)	-0.490 (-2.837)
<b>Dry</b>	-0.010 (-0.412)	0.056 (0.606)	-0.029 (-1.429)	0.004 (0.096)	-0.543 (-3.030)	0.002 (0.059)
<b>Catholic</b>			-0.144 (-8.433)			-0.236 (-6.553)
<b>Protestant</b>			-0.172 (-8.043)			-0.244 (-4.539)
<b>Southern Baptist</b>			0.219 (6.170)			0.327 (4.335)
<b>Mormon</b>			-0.121 (-3.942)			-0.056 (-0.275)
<b>High school education</b>			0.106 (2.086)			-0.013 (-0.102)
<b>Mandatory administrative per se</b>	0.683 (0.978)	0.116 (0.280)	1.007 (1.996)	2.925 (2.302)	0.687 (0.608)	3.986 (3.918)
<b>Mandatory minimum administrative</b>	-0.001 (-0.281)	-0.004 (-1.204)	-0.002 (-0.492)	-0.027 (-2.145)	-0.010 (-0.858)	-0.021 (-2.119)
<b>Mandatory fine</b>	-2.740 (-2.290)	-0.275 (-0.388)	-0.595 (-0.673)	5.028 (2.230)	1.5441 (0.938)	6.617 (3.734)
<b>Real fine</b>	0.010 (2.325)	0.004 (1.401)	0.005 (1.505)	-0.026 (-3.138)	-0.006 (-0.861)	-0.028 (-4.404)
<b>R-squared</b>	0.354	0.910	0.684	0.491	0.871	0.711
<b>F-statistic</b>	14.226	59.357	42.227	20.654	37.381	39.502

Table G-6 (continued)

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<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table G-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real liquor price	1.791 (1.837)	1.150 (1.101)	2.227 (2.839)	0.732 (0.665)	2.948 (1.811)	1.034 (1.039)
Real income	-0.00331 (-9.568)	-0.00048 (-0.978)	-0.00115 (-2.902)	-0.00167 (-4.301)	0.00034 (0.452)	0.00055 (1.026)
Unemployment	-0.133 (-0.429)	-1.283 (-4.271)	0.347 (1.276)	-0.546 (-1.655)	-0.829 (-1.810)	0.260 (0.777)
Dry	0.049 (0.779)	-0.041 (-0.126)	0.029 (0.493)	0.172 (2.581)	0.400 (0.962)	0.237 (3.263)
Catholic			-0.314 (-6.311)			-0.318 (-4.512)
Protestant			-0.209 (-3.357)			-0.402 (-3.809)
Southern Baptist			0.677 (6.503)			0.411 (2.843)
Mormon			-0.321 (-3.780)			0.149 (0.411)
High school education			0.687 (4.512)			0.385 (1.546)
Legal drinking age	-0.821 (-1.290)	-0.001 (-0.002)	-1.109 (-2.080)	-1.469 (-2.063)	-0.842 (-1.109)	-1.218 (-1.754)
Mandatory administrative per se	1.283 (0.685)	-2.023 (-1.327)	3.166 (2.080)	1.164 (0.523)	0.347 (0.124)	3.184 (1.570)
Mandatory minimum administrative	-0.009 (-0.628)	0.005 (0.368)	-0.014 (-1.216)	-0.017 (-0.777)	-0.037 (-1.194)	-0.020 (-0.972)
Mandatory fine	-5.334 (-1.725)	-1.244 (-0.497)	1.450 (0.563)	5.492 (1.457)	-5.531 (-1.393)	7.789 (2.272)
Real fine	0.018 (1.696)	0.007 (0.738)	0.003 (0.384)	-0.019 (-1.385)	0.024 (1.449)	-0.022 (-1.776)

Table G-7 (continued)

R-squared	0.315	0.818	0.575	0.251	0.594	0.423
F-statistic	11.204	25.680	25.096	6.732	7.913	11.211

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

## Appendix H: Real Beer Tax with No Licenses

**Table H-1**  
**Alcohol Primary Cause Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.487 (3.630)	-1.312 (-2.108)	0.570 (1.523)	2.231 (1.974)	-12.237 (-4.696)	7.257 (5.822)
Real income	0.00122 (10.223)	-0.00052 (-6.036)	0.00029 (2.357)	0.00269 (6.295)	-0.00319 (-6.753)	0.00094 (1.773)
Unemployment	0.360 (3.289)	-0.209 (-3.957)	-0.152 (-1.654)	0.135 (0.370)	-1.298 (-4.460)	-0.691 (-1.958)
Dry	-0.057 (-2.641)	-0.100 (-3.055)	0.005 (0.257)	-0.030 (-0.437)	-0.334 (-2.115)	0.039 (0.501)
Catholic			-0.112 (-6.914)			-0.063 (-0.849)
Protestant			-0.400 (-19.497)			0.126 (1.184)
Southern Baptist			-0.180 (-5.528)			-1.299 (-8.961)
Mormon			-0.211 (-7.200)			-0.295 (-0.699)
High school education			-0.151 (-3.308)			-1.219 (-5.227)
R-squared	0.340	0.944	0.619	0.251	0.818	0.398
F-statistic	19.195	140.160	45.022	10.344	35.415	15.163

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-2  
Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.949 (5.535)	1.636 (3.546)	-1.144 (-3.929)	-1.114 (-1.012)	0.244 (0.112)	0.100 (0.078)
Real income	0.00019 (1.806)	0.00013 (2.076)	0.00012 (1.241)	-0.00069 (-1.670)	0.00020 (0.497)	-0.00213 (-3.922)
Unemployment	0.054 (0.574)	-0.235 (-6.010)	-0.154 (-2.154)	2.504 (7.049)	-0.810 (-3.331)	2.385 (6.565)
Dry	0.028 (1.518)	0.093 (3.823)	-0.027 (-1.739)	-0.313 (-4.615)	0.303 (2.293)	-0.036 (-0.453)
Catholic			-0.093 (-7.387)			-0.162 (-2.105)
Protestant			-0.258 (-16.168)			-0.455 (-4.159)
Southern Baptist			0.154 (6.061)			0.034 (0.225)
Mormon			-0.118 (-5.177)			-1.023 (-2.355)
High school education			-0.120 (-3.379)			1.151 (4.790)
R-squared	0.089	0.943	0.569	0.271	0.870	0.344
F-statistic	3.640	136.499	36.672	11.511	52.443	12.035

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-3  
Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.474 (4.511)	1.221 (1.974)	0.743 (2.734)	-1.214 (-4.192)	-1.268 (-1.388)	-0.286 (-0.924)
Real income	-0.00087 (-9.151)	-0.00012 (-1.369)	-0.00099 (-10.969)	-0.00036 (-3.259)	0.00010 (0.602)	-0.00057 (-4.370)
Unemployment	-0.031 (-0.355)	0.113 (2.155)	-0.099 (-1.493)	0.234 (2.504)	0.316 (3.093)	0.330 (3.769)
Dry	-0.083 (-4.816)	0.081 (2.496)	0.021 (1.457)	-0.056 (-3.156)	-0.025 (-0.447)	0.001 (0.008)
Catholic			-0.161 (-13.631)			-0.090 (-4.867)
Protestant			-0.228 (-15.312)			0.028 (1.080)
Southern Baptist			0.015 (0.626)			-0.097 (-2.707)
Mormon			-0.140 (-6.581)			0.200 (1.905)
High school education			0.294 (8.880)			0.311 (5.366)
R-squared	0.246	0.901	0.639	0.094	0.589	0.316
F-statistic	12.166	75.366	49.070	3.211	11.256	10.598

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	<b>0.582</b> (6.018)	<b>-0.466</b> (-1.698)	<b>0.675</b> (7.624)	<b>-0.234</b> (-0.902)	<b>-1.411</b> (-1.721)	<b>0.846</b> (3.046)
<b>Real income</b>	<b>0.00026</b> (9.262)	<b>-0.00019</b> (-4.952)	<b>-0.00002</b> (-0.740)	<b>0.00028</b> (2.852)	<b>-0.00009</b> (-0.632)	<b>-0.00014</b> (-1.223)
<b>Unemployment</b>	<b>0.135</b> (5.241)	<b>0.032</b> (1.377)	<b>0.011</b> (0.507)	<b>0.151</b> (1.805)	<b>-0.090</b> (-0.986)	<b>-0.085</b> (-1.085)
<b>Dry</b>	<b>0.013</b> (2.653)	<b>-0.016</b> (-1.138)	<b>0.002</b> (0.507)	<b>-0.012</b> (-0.767)	<b>-0.056</b> (-1.132)	<b>-0.005</b> (-0.303)
<b>Catholic</b>			<b>0.025</b> (6.528)			<b>0.008</b> (0.500)
<b>Protestant</b>			<b>-0.041</b> (-8.365)			<b>0.021</b> (0.874)
<b>Southern Baptist</b>			<b>-0.057</b> (-7.346)			<b>-0.298</b> (-9.229)
<b>Mormon</b>			<b>-0.045</b> (-6.544)			<b>-0.174</b> (-1.856)
<b>High school education</b>			<b>-0.111</b> (-10.247)			<b>-0.356</b> (-6.851)
<b>R-squared</b>	<b>0.256</b>	<b>0.781</b>	<b>0.568</b>	<b>0.134</b>	<b>0.606</b>	<b>0.347</b>
<b>F-statistic</b>	<b>12.868</b>	<b>29.481</b>	<b>36.452</b>	<b>4.792</b>	<b>12.123</b>	<b>12.179</b>

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-5**  
**Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.517 (3.119)	0.702 (1.479)	-0.887 (-5.367)	3.978 (11.298)	4.677 (3.863)	2.493 (6.282)
Real income	-0.00062 (-12.918)	0.00008 (1.277)	-0.00034 (-6.182)	-0.00081 (-6.124)	-0.00017 (-0.769)	-0.00015 (-0.892)
Unemployment	-0.102 (-2.304)	-0.259 (-6.429)	-0.053 (-1.304)	-0.117 (-1.031)	-0.597 (-4.418)	-0.074 (-0.659)
Dry	0.042 (4.813)	0.021 (0.824)	-0.011 (-1.215)	0.128 (5.871)	0.063 (0.860)	0.042 (1.733)
Catholic			-0.016 (-2.186)			0.012 (0.516)
Protestant			-0.007 (-0.778)			0.021 (0.631)
Southern Baptist			0.137 (9.490)			0.046 (0.997)
Mormon			0.013 (1.026)			0.135 (1.003)
High school education			-0.034 (-1.669)			-0.474 (-6.384)
R-squared	0.564	0.869	0.701	0.653	0.813	0.709
F-statistic	48.323	54.975	64.927	58.120	34.119	55.785

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-6**  
**Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	3.607 (8.398)	-0.873 (-0.659)	0.750 (1.931)	6.031 (10.606)	-3.472 (-1.480)	2.635 (4.472)
<b>Real income</b>	-0.00119 (-9.288)	0.00021 (1.538)	-0.00085 (-6.459)	-0.00143 (-6.340)	0.00008 (0.268)	-0.00034 (-1.290)
<b>Unemployment</b>	0.108 (0.956)	-0.684 (-8.351)	0.029 (0.313)	-0.767 (-4.315)	-0.789 (-4.304)	-0.441 (-2.638)
<b>Dry</b>	-0.007 (-0.316)	0.054 (0.581)	-0.019 (-0.922)	0.033 (0.949)	-0.584 (-3.229)	0.034 (0.900)
<b>Catholic</b>			-0.136 (-7.859)			-0.199 (-5.685)
<b>Protestant</b>			-0.169 (-7.925)			-0.224 (-4.292)
<b>Southern Baptist</b>			0.211 (5.885)			0.280 (3.827)
<b>Mormon</b>			-0.119 (-3.910)			-0.035 (-0.179)
<b>High school education</b>			0.128 (2.490)			0.075 (0.599)
<b>Mandatory administrative per se</b>	0.537 (0.837)	0.073 (0.175)	0.897 (1.789)	3.108 (2.912)	0.488 (0.435)	3.830 (3.973)
<b>Mandatory minimum administrative</b>	0.004 (0.712)	-0.004 (-1.151)	-0.001 (-0.257)	-0.015 (-1.374)	-0.009 (-0.716)	-0.018 (-1.862)
<b>Mandatory fine</b>	-2.619 (-2.455)	-0.292 (-0.412)	-0.316 (-0.371)	5.419 (2.793)	1.374 (0.836)	6.934 (4.060)
<b>Real fine</b>	0.012 (3.076)	0.004 (1.418)	0.004 (1.388)	-0.022 (-3.140)	-0.006 (-0.838)	-0.027 (-4.407)
<b>R-squared</b>	0.448	0.910	0.685	0.616	0.872	0.726
<b>F-statistic</b>	21.036	59.325	42.502	34.410	37.674	42.711

Table H-6 (continued)

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<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table H-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	<b>7.480</b> (6.300)	<b>-5.274</b> (-1.098)	<b>1.259</b> (1.078)	<b>4.764</b> (4.462)	<b>-2.718</b> (-0.465)	<b>0.443</b> (0.379)
<b>Real income</b>	<b>-0.00253</b> (-7.130)	<b>-0.00043</b> (-0.873)	<b>-0.00114</b> (-2.852)	<b>-0.00073</b> (-1.693)	<b>0.00047</b> (0.625)	<b>0.00057</b> (1.059)
<b>Unemployment</b>	<b>0.079</b> (0.263)	<b>-1.327</b> (-4.498)	<b>0.353</b> (1.279)	<b>-0.211</b> (-0.643)	<b>-1.012</b> (-2.256)	<b>0.227</b> (0.681)
<b>Dry</b>	<b>0.058</b> (0.959)	<b>-0.060</b> (-0.186)	<b>0.058</b> (0.944)	<b>0.195</b> (3.048)	<b>0.388</b> (0.918)	<b>0.246</b> (3.329)
<b>Catholic</b>			<b>-0.295</b> (-5.785)			<b>-0.300</b> (-4.211)
<b>Protestant</b>			<b>-0.200</b> (-3.184)			<b>-0.387</b> (-3.685)
<b>Southern Baptist</b>			<b>0.677</b> (6.354)			<b>0.426</b> (2.944)
<b>Mormon</b>			<b>-0.303</b> (-3.547)			<b>0.164</b> (0.454)
<b>High school education</b>			<b>0.753</b> (4.879)			<b>0.414</b> (1.648)
<b>Legal drinking age</b>	<b>-0.323</b> (-0.527)	<b>-0.145</b> (-0.279)	<b>-1.333</b> (-2.505)	<b>-1.026</b> (-1.483)	<b>-0.949</b> (-1.190)	<b>-1.304</b> (-1.889)
<b>Mandatory administrative per se</b>	<b>0.787</b> (0.442)	<b>-2.255</b> (-1.486)	<b>2.556</b> (1.679)	<b>1.504</b> (0.724)	<b>-0.423</b> (-0.151)	<b>2.668</b> (1.357)
<b>Mandatory minimum administrative</b>	<b>0.001</b> (0.040)	<b>0.005</b> (0.420)	<b>-0.011</b> (-0.956)	<b>-0.009</b> (-0.436)	<b>-0.036</b> (-1.150)	<b>-0.017</b> (-0.836)
<b>Mandatory fine</b>	<b>-3.780</b> (-1.313)	<b>-1.395</b> (-0.557)	<b>3.127</b> (1.240)	<b>6.141</b> (1.681)	<b>-5.869</b> (-1.457)	<b>8.180</b> (2.392)
<b>Real fine</b>	<b>0.018</b> (1.729)	<b>0.007</b> (0.783)	<b>-0.001</b> (-0.125)	<b>-0.017</b> (-1.283)	<b>0.024</b> (1.473)	<b>-0.023</b> (-1.812)

Table H-7 (continued)

R-squared	0.370	0.818	0.567	0.291	0.590	0.421
F-statistic	14.299	25.680	24.374	8.258	7.780	11.137

<sup>t</sup>-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

## Appendix I: Real Liquor Price and Real Beer Tax with No Licenses

Table I-1  
Alcohol Primary Cause Regressions<sup>a</sup>

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.626 (4.005)	-1.198 (-1.926)	0.750 (2.005)	2.327 (2.015)	-12.100 (-4.592)	7.361 (5.784)
Real liquor price	-1.256 (-3.943)	-0.411 (-2.180)	-0.870 (-3.515)	-0.451 (-0.412)	-0.392 (-0.367)	-0.425 (-0.416)
Real income	0.00121 (10.287)	-0.00053 (-6.134)	0.00029 (2.316)	0.00270 (6.299)	-0.00317 (-6.712)	0.00096 (1.803)
Unemployment	0.335 (3.095)	-0.229 (-4.289)	-0.159 (-1.756)	0.126 (0.344)	-1.317 (-4.449)	-0.699 (-1.976)
Dry	-0.052 (-2.442)	-0.098 (-3.002)	0.010 (0.502)	-0.027 (-0.385)	-0.333 (-2.102)	0.039 (0.501)
Catholic			-0.106 (-6.564)			-0.056 (-0.724)
Protestant			-0.396 (-19.448)			0.133 (1.237)
Southern Baptist			-0.179 (-5.553)			-1.291 (-8.809)
Mormon			-0.199 (-6.824)			-0.287 (-0.679)
High school education			-0.145 (-3.222)			-1.216 (-5.207)
R-squared	0.357	0.945	0.627	0.251	0.818	0.398
F-statistic	19.435	139.019	44.344	9.690	34.702	14.423

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-2  
Homicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.939 (5.481)	1.509 (3.290)	-1.286 (-4.420)	-0.748 (-0.667)	0.362 (0.164)	0.238 (0.182)
Real liquor price	0.090 (0.326)	0.460 (3.309)	0.685 (3.559)	-1.723 (-1.623)	-0.339 (-0.380)	-0.563 (-0.535)
Real income	0.00019 (1.810)	0.00014 (2.217)	0.00013 (1.320)	-0.00062 (-1.498)	0.00021 (0.518)	-0.00210 (-3.849)
Unemployment	0.056 (0.591)	-0.212 (-5.404)	-0.148 (-2.089)	2.469 (6.950)	-0.827 (-3.341)	2.374 (6.520)
Dry	0.028 (1.495)	0.090 (3.763)	-0.031 (-1.999)	-0.300 (-4.401)	0.304 (2.300)	-0.036 (-0.452)
Catholic			-0.098 (-7.805)			-0.151 (-1.915)
Protestant			-0.262 (-16.521)			-0.445 (-4.002)
Southern Baptist			0.153 (6.092)			0.045 (0.296)
Mormon			-0.127 (-5.604)			-1.013 (-2.328)
High school education			-0.124 (-3.531)			1.155 (4.800)
R-squared	0.089	0.944	0.579	0.275	0.870	0.344
F-statistic	3.414	137.111	36.262	10.994	51.388	11.457

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-3  
Suicide Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	1.612 (5.015)	1.275 (2.053)	0.934 (3.482)	-1.035 (-3.531)	-1.481 (-1.608)	-0.164 (-0.521)
Real liquor price	-1.245 (-4.937)	-0.193 (-1.025)	-0.921 (-5.189)	-0.844 (-3.041)	0.613 (1.643)	-0.495 (-1.957)
Real income	-0.00088 (-9.422)	-0.00012 (-1.406)	-0.00100 (-11.316)	-0.00032 (-2.960)	0.00008 (0.505)	-0.00055 (-4.175)
Unemployment	-0.056 (-0.649)	0.104 (1.945)	-0.108 (-1.654)	0.217 (2.337)	0.346 (3.343)	0.321 (3.668)
Dry	-0.078 (-4.622)	0.082 (2.525)	0.026 (1.846)	-0.050 (-2.806)	-0.027 (-0.489)	0.001 (0.009)
Catholic			-0.154 (-13.304)			-0.081 (-4.273)
Protestant			-0.224 (-15.326)			0.037 (1.404)
Southern Baptist			0.016 (0.687)			-0.088 (-2.418)
Mormon			-0.127 (-6.095)			0.208 (1.994)
High school education			0.300 (9.253)			0.314 (5.442)
R-squared	0.277	0.901	0.656	0.112	0.591	0.322
F-statistic	13.406	74.194	50.199	3.642	11.145	10.338

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-4**  
**Cancers of Alimentary Tract Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.587 (6.047)	-0.440 (-1.597)	0.683 (7.635)	-0.206 (-0.775)	-1.449 (-1.748)	0.902 (3.187)
Real liquor price	-0.048 (-0.633)	-0.094 (-1.128)	-0.038 (-0.634)	-0.134 (-0.535)	0.110 (0.327)	-0.231 (-1.013)
Real income	0.00026 (9.245)	-0.00019 (-4.992)	-0.00002 (-0.751)	0.00029 (2.889)	-0.00010 (-0.650)	-0.00013 (-1.121)
Unemployment	0.135 (5.193)	0.027 (1.162)	0.011 (0.491)	0.149 (1.768)	-0.085 (-0.911)	-0.090 (-1.139)
Dry	0.014 (2.684)	-0.016 (-1.106)	0.003 (0.550)	-0.011 (-0.698)	-0.057 (-1.138)	-0.005 (-0.302)
Catholic			0.025 (6.555)			0.012 (0.728)
Protestant			-0.040 (-8.307)			0.025 (1.035)
Southern Baptist			-0.057 (-7.336)			-0.293 (-9.001)
Mormon			-0.045 (-6.425)			-0.170 (-1.810)
High school education			-0.110 (-10.214)			-0.354 (-6.816)
R-squared	0.257	0.781	0.568	0.135	0.607	0.348
F-statistic	12.076	29.049	34.698	4.504	11.880	11.649

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-5  
Falls, Fires, and Other Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
Real beer tax	0.507 (3.045)	0.802 (1.691)	-0.943 (-5.682)	4.171 (11.679)	4.908 (4.017)	2.791 (6.994)
Real liquor price	0.091 (0.699)	-0.360 (-2.504)	0.274 (2.492)	-0.905 (-2.677)	-0.663 (-1.339)	-1.213 (-3.781)
Real income	-0.00062 (-12.899)	0.000078 (1.189)	-0.00034 (-6.164)	-0.00078 (-5.859)	-0.00015 (-0.689)	-0.00009 (-0.538)
Unemployment	-0.100 (-2.258)	-0.276 (-6.798)	-0.050 (-1.249)	-0.136 (-1.198)	-0.630 (-4.591)	-0.097 (-0.875)
Dry	0.042 (4.763)	0.022 (0.900)	-0.012 (-1.390)	0.134 (6.183)	0.066 (0.894)	0.042 (1.760)
Catholic			-0.018 (-2.452)			0.034 (1.412)
Protestant			-0.008 (-0.930)			0.043 (1.282)
Southern Baptist			0.136 (9.512)			0.070 (1.525)
Mormon			0.010 (0.739)			0.157 (1.181)
High school education			-0.035 (-1.759)			-0.465 (-6.353)
R-squared	0.565	0.871	0.704	0.658	0.813	0.717
F-statistic	45.292	54.758	62.711	55.659	33.594	55.348

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 576 observations in the white regressions and 480 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-6  
Motor Vehicle Traffic Accidents Regressions<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	3.635 (8.401)	-0.896 (-0.675)	0.678 (1.720)	6.312 (10.821)	-3.525 (-1.499)	2.716 (4.440)
<b>Real liquor price</b>	-0.194 (-0.561)	0.234 (0.797)	0.284 (1.066)	-1.164 (-2.002)	0.288 (0.419)	-0.257 (-0.499)
<b>Real income</b>	-0.00119 (-9.281)	0.00021 (1.557)	-0.00085 (-6.438)	-0.00141 (-6.234)	0.00007 (0.244)	-0.00034 (-1.281)
<b>Unemployment</b>	0.102 (0.900)	-0.670 (-7.983)	0.034 (0.362)	-0.805 (-4.524)	-0.771 (-4.086)	-0.451 (-2.677)
<b>Dry</b>	-0.006 (-0.284)	0.052 (0.557)	-0.021 (-1.019)	0.045 (1.278)	-0.586 (-3.233)	0.036 (0.942)
<b>Catholic</b>			-0.138 (-7.927)			-0.195 (-5.361)
<b>Protestant</b>			-0.170 (-7.963)			-0.221 (-4.209)
<b>Southern Baptist</b>			0.210 (5.853)			0.285 (3.855)
<b>Mormon</b>			-0.121 (-3.976)			-0.033 (-0.165)
<b>High school education</b>			0.123 (2.384)			0.079 (0.631)
<b>Mandatory administrative per se</b>	0.496 (0.767)	0.106 (0.254)	0.958 (1.899)	2.549 (2.319)	0.544 (0.481)	3.715 (3.745)
<b>Mandatory minimum administrative</b>	0.004 (0.731)	-0.004 (-1.162)	-0.001 (-0.301)	-0.013 (-1.176)	-0.009 (-0.715)	-0.017 (-1.784)
<b>Mandatory fine</b>	-2.453 (-2.213)	-0.272 (-0.383)	-0.556 (-0.630)	5.966 (3.058)	1.379 (0.837)	7.059 (4.085)
<b>Real fine</b>	0.011 (2.849)	0.004 (1.389)	0.005 (1.592)	-0.024 (-3.306)	-0.006 (-0.834)	-0.027 (-4.428)

Table I-6 (continued)

R-squared	0.448	0.911	0.686	0.621	0.872	0.727
F-statistic	19.784	58.350	40.635	32.905	36.904	40.690

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

**Table I-7**  
**Motor Vehicle Traffic Accidents Regressions (age:18-20)<sup>a</sup>**

	(1)	<u>Whites</u> (2)	(3)	(4)	<u>Blacks</u> (5)	(6)
<b>Real beer tax</b>	7.353 (6.185)	-5.287 (-1.102)	0.833 (0.712)	4.833 (4.413)	-3.051 (-0.523)	0.146 (0.120)
<b>Real liquor price</b>	1.367 (1.460)	1.153 (1.104)	2.151 (2.716)	-0.320 (-0.291)	2.975 (1.824)	1.003 (0.973)
<b>Real income</b>	-0.00253 (-7.140)	-0.00042 (-0.859)	-0.00114 (-2.873)	-0.00072 (-1.665)	0.00039 (0.522)	0.00055 (1.026)
<b>Unemployment</b>	0.115 (0.383)	-1.258 (-4.177)	0.369 (1.346)	-0.221 (-0.670)	-0.823 (-1.793)	0.261 (0.780)
<b>Dry</b>	0.053 (0.870)	-0.072 (-0.221)	0.038 (0.629)	0.199 (3.048)	0.366 (0.870)	0.239 (3.211)
<b>Catholic</b>			-0.307 (-6.043)			-0.316 (-4.321)
<b>Protestant</b>			-0.208 (-3.331)			-0.401 (-3.782)
<b>Southern Baptist</b>			0.665 (6.284)			0.408 (2.796)
<b>Mormon</b>			-0.323 (-3.798)			0.149 (0.413)
<b>High school education</b>			0.704 (4.565)			0.390 (1.544)
<b>Legal drinking age</b>	-0.183 (-0.296)	-0.116 (-0.223)	-1.066 (-1.986)	-1.054 (-1.507)	-0.963 (-1.212)	-1.214 (-1.744)
<b>Mandatory administrative per se</b>	1.133 (0.632)	-2.079 (-1.363)	3.115 (2.043)	1.328 (0.613)	0.186 (0.066)	3.172 (1.560)
<b>Mandatory minimum administrative</b>	-0.001 (-0.047)	0.005 (0.406)	-0.013 (-1.138)	-0.009 (-0.397)	-0.036 (-1.151)	-0.019 (-0.958)
<b>Mandatory fine</b>	-4.839 (-1.633)	-1.276 (-0.510)	1.479 (0.574)	6.245 (1.699)	-5.819 (-1.450)	7.817 (2.272)

Table I-7 (continued)

<b>Real fine</b>	0.021 (2.006)	0.007 (0.734)	0.004 (0.419)	-0.018 (-1.292)	0.024 (1.481)	-0.022 (-1.771)
<b>R-squared</b>	0.373	0.818	0.575	0.291	0.594	0.423
<b>F-statistic</b>	13.660	25.319	23.998	7.783	7.761	10.692

<sup>a</sup>t-statistics in parentheses. Intercepts not shown. All regressions include dichotomous variables for each year except one. Regressions (2) and (5) include dichotomous variables for each state except one. There are 432 observations in the white regressions and 360 observations in the black regressions. Regressions weighted by square root of race-state- and year-specific population aged 25 through 64.

## REFERENCES

- American Chamber of Commerce Researchers Association. Inter-City Cost of Living Index. Alexandria, Virginia: ACCRA, various years.
- Becker, Gary S.; Grossman, Michael; and Murphy, Kevin M., "Rational Addiction and the Effect of Price on Consumption" American Economic Review, 81, No. 2 (May 1991), pp. 237-241. Also published in Searching for Alternatives: Drug-Control Policy in the United States, edited by Melvyn B. Krauss and Edward P. Lazear. Stanford, California: Hoover Institution Press, 1991, pp. 77-86.
- Becker, Gary S. and Murphy, Kevin M., "A Theory of Rational Addiction", Journal of Political Economy, Vol. 96, No. 4 (1988), pp. 675-701.
- Bradley, Martin R.; Green, Norman M., Jr.; Jones, Dale E.; Lynn, Mac; and McNeil, Lou. Churches and Church Membership in the United States 1990. Atlanta, Georgia: Glenmary Research Center, 1992.
- Bureau of Economic Analysis, U.S. Department of Commerce. Survey of Current Business, various years.
- Bureau of the Census, U. S. Department of Commerce. 1980 Census of Population. Volume I: Characteristics of the Population. Chapter B: General Population Characteristics. Part 1: United States Summary. Washington, D. C.: U. S. Government Printing Office, 1983.
- Bureau of the Census, U. S. Department of Commerce. 1990 Census of Population. Volume I: Characteristics of the Population. Chapter B: General Population Characteristics. Part 1: United States Summary. Washington, D. C.: U. S. Government Printing Office, 1993.
- Bureau of the Census, U. S. Department of Commerce. "State Population Estimates." [www.census.gov/population/www/estimates/statepop.html](http://www.census.gov/population/www/estimates/statepop.html).
- Bureau of the Census, U.S. Department of Commerce. Statistical Abstract of the United States. Washington, D. C.: U. S. Government Printing Office, various years.
- Caces, FE and Harford, Thomas, "Time Series Analysis of Alcohol Consumption and Suicide Mortality in the United States, 1934-1987", Journal of studies on Alcohol, July 1998, pp. 455-460.
- Chaloupka, Frank J.; Grossman, Michael; Becker, Gary S.; and Murphy, Kevin M., "Alcohol Addiction: An Econometric Analysis", Presented at the annual meeting of the American Economic Association, Anaheim, California, January 1993.
- Chaloupka, Frank J.; Saffer, Henry; and Grossman, Michael, "Alcohol-Control Policies and Motor-Vehicle Fatalities" Journal of Legal Studies, 22, No. 1 (January 1993), pp. 161-186.
- Distilled Spirits Company of the United States. Annual Statistical Review. Washington, D. C.: Distilled Spirits Company of the United States, various years.
- Coate, Douglas and Grossman, Michael, "Effects of Alcoholic Beverage Prices and Legal Drinking

- Ages on Youth Alcohol Use”, Journal of Law and Economics, 31, No. 1 (April 1988), pp. 145-171.
- Cook, Philip J, “The Impact of Distilled-Spirits Taxes on Consumption, Auto Fatalities, and Cirrhosis Mortality”, Advances in Substance Abuse: Behavioral and Biological Research, edited by Harold D. Holder, Greenwich, Connecticut: JAI Press, Inc., 1987, pp. 159-167
- Cook, Philip J. and Tauchen, George, “The Effect of Liquor Taxes on Heavy Drinking”, Bell Journal of Economics, 13, No. 2 (Autumn 1982), pp. 379-390.
- Greene, William H., “Econometric Analysis”, Second Edition, Macmillan Publishing Company, New York, 1993.
- Gordon, Tavia and Doyle, Joseph T., “Drinking and Mortality”, American Journal of Epidemiology, Vol.125, No. 2 (1987), pp. 263-270.
- Grossman, Michael, “The Economic Analysis of Addictive Behavior.” Economics and the Prevention of Alcohol-Related Problems, edited by Michael E. Hilton and Gregory Bloss. National Institute of Alcohol Abuse and Alcoholism Research Monograph 25. NIH Publication No. 93-3513., Washington, D.C.: U.S. Government Printing Office, 1991, pp. 91-124.
- Grossman, Michael; Chaloupka, Frank J.; and Sirtalan, Ismail, “An Empirical Analysis of Alcohol Addiction: Results from the Monitoring the Future Panels”, Economic Inquiry, 36, No. 1 (January 1998), pp. 39-48 .
- Grossman, Michael and Kaestner, Robert. “Effects of Education on Health.” In The Social Benefits of Education, edited by Jere R. Behrman and Nevzer Stacey. Ann Arbor, Michigan: University of Michigan Press, 1997, 69-123.
- Gruenewald, Paul J. and Ponicki, William R., “The Relationship of Alcohol Sales to Cirrhosis Mortality”, Journal of Studies on Alcohol, November 1995, pp. 635-640.
- Holder, Harold D. and Parker, Robert Nash, “Effect of Alcoholism Treatment on Cirrhosis Mortality: a 20-year Multivariate Time Series Analysis”, British Journal of Addiction, Vol. 87 (1992), pp. 1263-1274.
- Hsiao, Cheng, “Analysis of Panel Data”, Cambridge University Press, New York, 1986.
- Jobson, Publishing Corporation. Licensed Beverage Marketing & Merchandising Fact Book . New York: Jobson Publishing Corporation, various years.
- Kerr, William C.; Fillmore, Kaye Middleton; and Marvy, Paul, “Beverage-specific Alcohol Consumption and Cirrhosis Mortality in a Group of English-speaking Beer-drinking Countries”, Addiction, 95, No 3 (2000), pp. 339-346.
- Klatsky, Arthur L.; Friedman, Gary D.; and Siegelau, Abraham B., “Alcohol and Mortality”, Annals of Internal Medicine, Vol. 95, No. 2 (August 1981), pp. 139-145.
- Manning, Willard G., Blumberg, Linda, and Moulton, Lawrence H., “The Demand for Alcohol: The Different Response to Price”, Journal of Health Economics, Vol. 14 (1995), pp.123-148.

- Nair, Rima; Chaloupka, Frank J.; Grossman, Michael; and Saffer, Henry, "Gender and Race Differences in Youth Alcohol Demand" Presented at the Taipei International Conference on Health Economics organized by the Institute of Economics, Academia Sinica in Taipei, Taiwan, March 1999.
- National Center for Health Statistics, U. S. Department of Health and Human Services. Vital Statistics Mortality Data. Public Use Data Tapes. Hyattsville, Maryland: National Center for Health Statistics, various years.
- Nelson, Jon P., "Broadcast Advertising and U.S. Demand for Alcoholic Beverages", Southern Economic Journal, Vol. 65, No. 4 (1999), pp. 774-790.
- Nelson, Jon P., "Economic and Demographic Factors in U.S. Alcohol Demand: A Growth-Accounting Analysis", Empirical Economics, Vol. 22, No. 1 (1997), pp. 83-102.
- O'Donnell, Mary A., "Research on Drinking Location of Alcohol-impaired Drivers: Implications for Prevention Policies", Journal of Public Health Policy, Vol. 6 (1985), pp. 510-521.
- Ornstein, Stanley I. and Hanssens, Dominique M., "Alcohol Control Laws and the Consumption of Distilled Spirits and Beer", Journal of Consumer Research, Vol. (September 1985), pp.200-213.
- Quinn, Bernard; Anderson, Herman; Bradley, Martin; Goetting, Paul; and Shriver, Peggy. Churches and Church Membership in the United States 1980. Atlanta, Georgia: Glenmary Research Center, 1982.
- Ravenholt, R.T., "Addiction Mortality in the United States, 1980: Tobacco, Alcohol, and Other Substances", Population and Development Review, 10, No.4 (December 1984), pp. 697-724.
- Ruhm, Christopher J. "Are Recessions Good for Your Health?" Quarterly Journal of Economics, Vol. 115, No. 2 (May 2000), 617-650.
- Shim, Kyumin, "Alcohol Addiction: An Econometric Analysis", Ph.D. Dissertation, City University of New York Graduate Center, 1999.
- Saffer, Henry. "Alcohol Advertising Bans and Alcohol Abuse: An International Perspective". Journal of Health Economics Vol. 10, No. 1 (August 1991), 65-79.
- Saffer, Henry, and Chaloupka, Frank J. "Demographic Differentials in the Demand for Alcohol and Illicit Drugs." In The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research, edited by Frank J. Chaloupka, Michael Grossman, Warren K. Bickel, and Henry Saffer. Chicago: University of Chicago Press: 1999, 187-211.
- Sloan, Frank A., Reilly, Bridget A., and Schenzler, Christoph, "Effects of Prices, Civil and Criminal Sanctions, and Law Enforcement on Alcohol-Related Mortality", Journal of Studies on Alcohol, July 1994, pp. 454-465.
- Studenmund, A. H., "Using Econometrics", Second Edition, edited by Greenman, John, Harper Collins Publishers, Washington, D.C., 1985.

**Tung, Shin Ta, "Price Sensitivity of Alcohol Beverages: The Differential Response to Price among Different Racial/Ethnic Population", Ph.D. Dissertation, City University of New York Graduate Center, 1999.**

**Welte, John W. and Abel, Ernest L., "Homicide: Drinking by the Victim", Journal of Studies on Alcohol, Vol. 50, No.3 (1989), pp.197-201.**

**Xie, X.; Mann, R. E.; and Smart, R.G., "The Direct Relationships between Alcohol Prevention Measures and Alcoholic Liver Cirrhosis Mortality", Journal of Studies on Alcohol, July 2000, pp. 499-506.**