AMERICAN ASSOCIATION OF WINE ECONOMISTS

AAWE WORKING PAPER
No. 95

Economics

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December 2011

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Regulating the availability of beer, wine, and spirits in grocery stores: Beverage-specific effects on prices, consumption, and traffic fatalities

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Abstract

The availability of beer, wine, and spirits in grocery stores varies across the United States due to state-level regulations. Recently there have been a number of controversial legislative proposals to expand the distribution of certain alcoholic beverages, notably wine. Here we estimate how grocery store alcohol availability affects the prices and consumption of different types of alcohol. Then, changes in total alcohol consumption and the relative shares of beer, wine, and spirits are linked to traffic fatalities. While states with higher levels of total alcohol consumption have higher traffic fatality rates, econometric results show that the type of alcoholic beverage consumed is also relevant. Holding constant the total quantity of alcohol consumed, a higher share of wine correlates with lower traffic fatality rates, while the opposite is true for beer. Spirits are more strongly associated to traffic fatalities than wine, but less than beer. These findings suggest that the ethanol alcohol content in beverages is not a good indicator of its relative impact on traffic fatalities, and arguments against the wider distribution of wine as a way to reduce social problems may not be fully justified.

Keywords: Alcohol; Consumption shares; Deregulation; Social cost; Traffic fatalities; Wine in grocery stores.

JEL Classifications: I18, K23, L51, Q18

The authors would like to thank Doug Young and Agnieszka Bielińska-Kwapisz for generously sharing their data set. Second authorship is shared equally between Costanigro and Garg.

December 2011

1. Introduction

The production, distribution, and sales of alcohol have seen a long history of governmental regulation in the United States. In addition to federal laws, numerous state-specific regulations were enacted after the repeal of the Prohibition Act in 1933. Laws concerning the distribution and availability of alcohol were originally designed as a way to reduce the social problems associated with alcohol consumption. However, some of these regulations may continue to exist for historical reasons and because of rent-seeking behavior (Simon 1966; Smith 1982; Benson, Rasmussen, and Zimmerman 2003; Rickard 2012). Much research has been done to examine the economic effects of various alcohol policies in the United States, such as taxes and the minimum drinking age, yet little is known about the effects of wider distribution of alcoholic beverages.

Whatever the cause, the heterogeneity of alcohol distribution laws in the United States is striking. No alcohol is sold in grocery stores[1] in twelve states, beer is the only alcohol available in grocery stores in six states, beer and wine are sold in grocery stores in fifteen states, and beer, wine and spirits are sold in grocery stores in seventeen states (see Table 1). Despite these differences, the common sense assumption underlying these regulations is that beverages with higher alcohol content are socially more dangerous[2]. Here, this notion is challenged, and we argue that the occasion in which alcoholic beverages are typically consumed and the modality of consumption may be more relevant than the ethanol alcohol content.

Figure 1 shows the average number of traffic fatalities and wine consumption as a share of total alcohol consumption between 1982 and 2000 by state. This information suggests that states with high wine consumption as a share of total alcohol consumption have had relatively low traffic fatality rates, and that states with low wine consumption shares have had high traffic fatality rates. Although Figure 1 does not offer any conclusive evidence of this relationship, it does suggest that further investigation of the effects of grocery store sales of wine on traffic fatalities is warranted.

The primary objective of this paper is to study the links between the different policies mandating selective availability[3] of alcohol and the associated social consequences. To be precise, we contribute to the vast literature using traffic fatality rates as a measure of acute problems related to alcohol overconsumption. This objective is pursued via a structural model of how alcohol distribution laws affect alcohol prices and the total cost (including search costs) of purchasing different types of alcohol. These effects are then traced to their influence on the total alcohol consumption, the composition of the basket of alcoholic beverages, and to their ultimate effect on traffic fatalities.

The introduction of alcohol into grocery stores is a contentious policy issue. Numerous proposals seeking to introduce wine, and in some cases beer and wine, into grocery stores have met significant resistance from liquor store owners and the associated lobbying groups (e.g., Distilling the Truth, 2011; The Last Store on Main Street, 2011). Furthermore, these same lobby groups have partnered with social interest groups concerned that the introduction of wine into grocery stores would increase alcohol consumption and increase the various problems associated with alcohol. Food retailers are generally supportive of proposals that increase grocery store alcohol availability, as are state governments that are expected to benefit from additional tax revenues and various fees.

Much research has examined the impact of various policies that could be used to decrease alcohol consumption and the problems it creates (e.g., Cook and Moore, 2002; Campbell et al., 2009), and within this arena there are several studies that focus on effects of specific alcohol-related policies on traffic fatalities (e.g., Kenkel 1993; Ruhm 1996; Dee 1999). There is some evidence in the literature (e.g., McDonald 1986; Smart 1986; Wagenaar and Holder 1995; Her et al., 1999) suggesting that wider availability of alcohol may lead to an increase in per capita alcohol consumption. However, a clear link between selective availability of alcohol in grocery stores and traffic fatalities is yet to be established. Perhaps more importantly, the vast majority of the work examining the effects of policies on traffic fatalities fails to consider that different alcoholic beverages are often consumed in different occasions, and by different social groups. Our study begins to redress both of these issues.

We examine how grocery store availability of beer, beer and wine, and beer, wine and spirits influence beverage-specific prices and consumption. Wider availability of alcohol in grocery stores is expected to decrease prices due to greater competition among retailers and decrease search costs given less visits to various outlets. It is not clear that all alcoholic beverages contribute to traffic fatalities equally or contribute to traffic fatalities relative to their ethanol alcohol content. The impact of specific alcoholic beverages on traffic fatality rates is expected to be influenced by demographic details for consumers of the different alcoholic beverages, consumption locations for the different beverages, and whether consumption of specific beverages occurs with food, among other factors.

2. An Overview of Regulations Applied to Alcohol Markets

There is a large literature that examines impacts of alcohol regulations in the United States. This work comprises analyses of regulations that are designed to address acute social problems (e.g., traffic accidents, family violence) and chronic social problems (e.g., liver cirrhosis, pancreatitis, and specific types of cancer). Much of the research in this arena can be divided into studies that examine regulations designed to control alcohol consumption and those designed to curb the problems caused by excessive alcohol consumption. Among the policies designed to control alcohol consumption, economists have closely examined the effects of minimum drinking age legislation, limitations on keg purchases, Sunday sales restrictions, and various types of alcohol taxes.

Economic research suggests that changes in the minimum drinking age would have limited impacts on the number of traffic fatalities in the United States (e.g., Miron and Tetelbaum 2009; Lovenheim and Slemrod 2010) and in Canada (see Sen 2001); however, others caution against such changes given the range of potential external costs (Carpenter and Dobkin 2011) and once the long-run effects are considered (Kaestner and Yarnoff 2011). The effects from increasing alcohol taxes have also been widely studied, and many have argued that such taxes, notably for beer, would reduce the number of traffic fatalities (Saffer and Grossman 1987; Ruhm 1996; Ponicki, Gruenewald, and LaScala 2007; Sen and Campbell 2010). Others, however, have found much less response in traffic fatalities to higher beer taxes (Ornstein 1980; Young and Likens 2000) and Chaloupka and Wechsler (1996) find that the response is linked to gender and is relatively small among males. Overall, there continues to be a debate among economists on the relative efficiencies of various policy mechanisms in alcohol markets (see Coate and Grossman 1988; Chaloupka, Saffer, and Grossman 1993; Kenkel 1993; Cook and Moore 2002; Wagenaar, Tobler, and Komro, 2010).

There is also a branch of research that examines the role of policies that impact the availability of alcohol (including density of outlets, local access laws, licensing requirements, and hours of sales) on traffic fatalities. Using panel data, Gruenewald, Ponicki, and Holder (1993) find that per capita outlet densities were positively related to sales of wine and spirits, and these relationships were statistically significant in two of their four model specifications. Stehr (2010) and Lovenheim and Steefel (2011) find limited impact of Sunday sales restrictions on traffic fatalities. Baughman et al. (2001) show that more liberal alcohol access laws reduce the travel distance required to obtain alcohol; the reduced travel time to obtain alcohol is then linked to lower traffic fatality rates. Campbell et al. (2009) summarize a number of papers that examine the links between alcohol outlet density and alcohol-related harms, and highlight that 50 percent of the studies reviewed found a positive relationship between alcohol outlet density and motor-vehicle crashes. McCarthy (2003) found that an increase in the density of off-site licenses decreases traffic crashes, whereas an increase in the number of general alcohol on-site licenses increases traffic crashes.

Overall, most of the previous research examining how alcohol policies affect traffic accidents has focused on the role of taxes, drinking under the influence laws, local access regulations, and minimum drinking age restrictions. In addition, much of this work examines the direct link between policy instruments and traffic fatalities. We extend these analyses in two important ways. First, the different distribution arrangements are included as a policy variable in our model; that is, we differentiate between states that sell no alcohol, sell beer in grocery stores (BIGS), sell beer and wine in grocery stores (WIGS), and sell beer, wine and spirits in grocery stores (SIGS). Second, we model the effects of grocery store alcohol availability on alcohol prices and consumption, and then model the effects of total consumption and consumption shares of specific beverages on traffic fatalities.

3. Data

To understand the effects of alcohol policies on alcohol consumption and the social problems associated with alcohol, we would ideally use long-term longitudinal data. Because these data are not available, we follow what others have done in this arena and resort to state-level data across time. Our analysis uses panel data across the 48 contiguous states between 1982 and 2000[4]. Alcohol price data was collected from ACCRA (2000), which documents time-series city-level prices for standard beer, wine, and spirit products; city-level data was aggregated and deflated to create real state-level price data for the three types of alcohol. State-level per capita consumption data for beer, wine, and spirits is available from NIH-NIAAA (2010) starting in 1982; consumption data is expressed in ethanol units to account for the different amounts of alcohol found in beer, wine, and spirits. State-level traffic fatality information was collected from NHTSA (2010), and it was also available starting in 1982. Traffic fatalities are reported for six categories—total fatalities, total weekend fatalities, total youth fatalities, total youth weekend fatalities, non-weekend fatalities, and non-weekend youth fatalities—and we examine factors influencing fatalities in each category.

In addition to price and consumption data for beer, wine, and spirits, and traffic fatality data, we use information describing alcohol taxes and markups, several exogenous demographic, alcohol policy, and traffic-related variables in our model following Young and Bielińska-Kwapisz (2006). Demographic variables include income, population living in dry counties, population between 18 and 29 years of age, population over 65 years of age, shares of the population associated with different religious affiliations[5], and tourism income. Variables describing alcohol policies include a legal index (see Young and Bielińska-Kwapisz 2006 for additional details), maximum blood alcohol levels, keg registration restrictions, alcohol sale hours[6], and the minimum drinking age. Traffic-related variables include seat belt laws and vehicle miles traveled.

Our estimation of alcohol prices and alcohol consumption includes binary variables to describe the availability of beer, wine, and spirits in grocery stores. Wine availability in grocery stores was collected from the Wine Institute (2009); beer and spirit availability in grocery stores was compiled from information provided by the state departments of alcoholic beverage control

(U.S. Department of Treasury 2011). The data employed in our analysis contain a surprising amount of heterogeneity in the state laws that regulate alcohol availability in grocery stores.

4. Conceptual and Empirical Model

Figure 2 presents an illustration of how selective alcohol availability laws may influence traffic fatalities. At the top of Figure 2 we outline the availability possibilities; BIGS, WIGS and SIGS are expected to have a direct impact on the costs associated with alcohol consumption. The first mechanism is the increase in price competition in the retail sector; the second effect is a reduction in search costs for consumers, who can purchase alcohol in their regular trips to the grocery store. Because these laws are selective with respect to the types of beverages allowed for sale, we also expect that the policy variables will impact the relative costs of consuming beer, wine and spirits. Thus, induced price and search cost changes will not only affect the total consumption of alcohol, but also the composition of the basket of alcoholic beverages consumed. In turn, total quantity of alcohol and the relative shares of beer, wine and spirits are expected to influence traffic fatalities. It is also possible that allowing specific alcoholic beverages in grocery stores may coincide with increased temporal availability of alcohol, thereby encouraging riskier night trips to the store. Since policy makers can use specific, ad hoc legislation to regulate *where* and *when* alcohol is allowed for sale, it is important to keep the two effects separate. This last consideration advises against directly regressing fatality rates on BIGS, WIGS and SIGS, and instead to take a structural modeling approach that allows for a detailed consideration of the chain of events triggered by each policy.

Following the framework outlined in Figure 2, our empirical model includes three stages. In stage I, we regress alcohol prices on the policy variables and other controls. To avoid endogeneity issues, fitted prices (from stage I) are used in stage II, where we estimate how prices, availability policies, and other control variables influence consumption of alcoholic beverages. Finally, in stage III we measure how total alcohol consumption, consumption shares of selected alcoholic beverages, and store opening hours affect traffic fatalities.

Before we detail the empirical specification, a significant data issue needs to be addressed. Over the time period for which we could compile the full dataset, the availability of alcoholic beverages in grocery stores is time invariant with one exception: Iowa deregulated wine and spirits sales in 1985, and allowed them both to be sold in grocery stores (Holder and Wagenaar 1990; Wagenaar and Holder 1991). This data limitation, which is common to many other studies in the field, implies that identification of the price effects of the policy variables in stage I and stage II rests on the cross-sectional comparison of the states. While fixed effects or difference-in-difference approaches are ruled out by this data limitation, we take extra care in controlling for state-specific effects which may contaminate our results.

Equation (1) outlines the model used to estimate prices for the three alcoholic beverages. Using superscripts *b*, *w* and *s* to represent the types of alcoholic beverages in stage I, P_{rt}^{b}, P_{rt}^{w} and P_{rt}^{s} respectively represent the prices of beer, wine and spirits in state *r* in year *t*. For the regressors, $\mathbf{A}_{rt}$ is the (horizontal) vector of grocery store availability dummy variables (BIGS, WIGS and SIGS), $\mathbf{M_{rt}}$ is a vector of state-specific alcohol taxes and markups, $\mathbf{R}_{r}$ is a vector of regional dummy variables[7], $\mathbf{Z}_{rt}$ is a vector of nine exogenous demographic variables including income, and $\mathbf{T}_{rt}$ includes year-specific dummy variables and state-specific linear time trends. To keep the notation simple, for alcoholic beverage *i*, we use α^{i} to indicate the (column) vectors of parameters of principal policy interest, while β_{n}^{i} are parameters associated with the many other control variables, and ε_{rt}^{i} are the error terms.

$$\left.\begin{aligned}
\ln P^{b}{}_{rt} &= \beta_0^b + \mathbf{A}_{rt}{}^{b}\alpha^b + \mathbf{M}_{rt}{}^{b}\beta_1^b + \mathbf{R}_r\beta_2^b + \mathbf{Z}_{rt}\beta_3^b + \mathbf{T}_{rt}\beta_4^b + \varepsilon^{b}{}_{rt} \\
\ln P^{w}{}_{rt} &= \beta_0^w + \mathbf{A}_{rt}{}^{w}\alpha^w + \mathbf{M}_{rt}{}^{w}\beta_1^w + \mathbf{R}_r\beta_2^w + \mathbf{Z}_{rt}\beta_3^w + \mathbf{T}_{rt}\beta_4^w + \varepsilon^{w}{}_{rt} \\
\ln P^{s}{}_{rt} &= \beta_0^s + \mathbf{A}_{rt}{}^{s}\alpha^s + \mathbf{M}_{rt}{}^{s}\beta_1^s + \mathbf{R}_r\beta_2^s + \mathbf{Z}_{rt}\beta_3^s + \mathbf{T}_{rt}\beta_4^s + \varepsilon^{s}{}_{rt}
\end{aligned}\right\} \quad (1)$$

In stage II, we estimate a model of consumption of alcoholic beverages where regressors include predicted prices (from stage I), the availability policy variables, and the other controls introduced earlier. The notation used in equation (2) is similar to that used in equation (1), and here we denote consumption of alcoholic beverage *i*, in state *r* in year *t,* as C_{rt}^i. In addition to the full vector of own and cross prices predicted from stage I, denoted as $\hat{\mathbf{P}}_{rt}$, we also include grocery store alcohol availability, binary variables for regions, demographic variables, year-specific dummy variables, and state-specific time trends in the estimation. The parameter γ_1^i captures the substitution effects owed to changes in relative prices of the three alcoholic beverages and γ_2^i measures the effect of reducing search costs for selected alcoholic beverages; δ_2^i and δ_3^i measure the effects of the other control variables and ξ_{rt}^i are the error terms.

$$\left.\begin{aligned}
\ln C_{rt}^b &= \delta_0^b + \ln \hat{\mathbf{P}}_{rt}\gamma_1^b + \mathbf{A}_{rt}\gamma_2^b + \mathbf{R}_r\delta_1^b + \mathbf{Z}_{rt}\delta_2^b + \mathbf{T}_{rt}\delta_3^b + \xi^{b}{}_{rt} \\
\ln C_{rt}^w &= \delta_0^w + \ln \hat{\mathbf{P}}_{rt}\gamma_1^w + \mathbf{A}_{rt}\gamma_2^w + \mathbf{R}_r\delta_1^w + \mathbf{Z}_{rt}\delta_2^w + \mathbf{T}_{rt}\delta_3^w + \xi^{w}{}_{rt} \\
\ln C_{rt}^s &= \delta_0^s + \ln \hat{\mathbf{P}}_{rt}\gamma_1^s + \mathbf{A}_{rt}\gamma_2^s + \mathbf{R}_r\delta_1^s + \mathbf{Z}_{rt}\delta_2^s + \mathbf{T}_{rt}\delta_3^s + \xi^{s}{}_{rt}
\end{aligned}\right\} \quad (2)$$

The details of the empirical specification of stage III are outlined in equation (3). Here the dependent variable, traffic fatalities, is denoted as *F*, and the superscript *f* = (*1,2,…,6*) is used to classify fatalities into the six categories differentiated by age group and time of week for which data are available. Defining $\hat{C}_{rt}^{total}$ as the total quantity of alcohol consumed (in ethanol units), we regress fatality rates on total alcohol consumption and the consumption share of ethanol units attributable to alcoholic beverage *k* (where *k* includes two of the three alcoholic beverages), denoted as $\hat{B}_k$. A matrix of variables describing highway safety policies (e.g., minimum drinking age, seat belt laws, blood alcohol limits, and server training laws), total vehicle miles traveled, and a dummy variable indicating when alcohol is for sale after 10 p.m., denoted as $\mathbf{G}_{rt}$, is also included, as are the year-specific dummy variables and state-specific linear time trends. Because one of the three consumption shares needs to be dropped from the equation, the complete pattern of effects on fatality rates attributable to substitution across alcoholic beverages (holding total alcohol consumption constant) can be recovered by estimating three regressions for each fatality category. Thus, η^{ij} captures the effect of substituting beverage *i* for beverage *j*. The vector of policy variables $\mathbf{A}_{rt}$ is not included as a stage III regressor; total alcohol consumption, share of alcoholic beverages, and temporal availability measures are used to control links between alcohol availability in grocery stores and fatality rates.

$$F^{f}{}_{rt} = \eta_0 + \ln \hat{C}_{rt}^{total}\eta^{total} + \hat{B}^{b}\eta^{wb} + \hat{B}^{s}\eta^{ws} + \mathbf{G_{rt}}\chi_0 + \mathbf{T_{rt}}\chi_1 + \nu^{f}{}_{rt} \quad (3)$$

Stage I is estimated as a Seemingly Unrelated Regression (SUR) since we would expect the unobserved variation in prices to be correlated across beer, wine and spirits. In stage II, using an SUR allows us to impose the Slutsky symmetry constraints that provide three extra moment conditions and thereby improve the efficiency of our estimator. In the last stage, stage III, we estimate a least squares model that uses predicted estimates (bootstrapped standard errors) from stage II.

The empirical framework adopted here enables us to contribute to the literature that studies the links between alcohol policies and social issues; it allows us to assess the impact of policies on the prices and consumption of different alcoholic beverages, and then examines how consumption influences traffic fatality rates. Within this framework we consider the effects of total alcohol consumption, and beverage-specific consumption shares on traffic fatalities. We argue that many alcohol policies, including grocery store alcohol availability, influence traffic fatalities exclusively through the changes in patterns of alcohol consumption. This includes changes in the composition of the basket of alcoholic beverages as well as the size of that basket. This framework can easily be extended to examine other regulation issues in alcohol markets, including alcohol taxation policy and Sunday sale restrictions. It also could be extended to facilitate a comparison of the economic and social implications of various policy instruments used to control problems that stem from excessive alcohol consumption.

5. Results

Estimation results for the model presented in equation (1) are presented in Table 2. Here we see that six of the seven types of taxes and markups have positive and statistically significant effects on alcohol prices, and that the effect is always largest on the alcoholic beverage that is the target of the policy. The grocery store alcohol availability variables show that prices are approximately 7 percent higher for wine and spirits in states with BIGS. In states with WIGS, we see that prices of beer are 5.1 percent lower, prices of wine are 6.8 percent lower, and prices of spirits are 4.4 percent higher. This is intuitively appealing if we think that competition from wine in grocery stores reduces beer prices, wider distribution of wine reduces wine prices, and spirit prices are higher given that they have fewer sales outlets. With SIGS we again see lower beer and wine prices, but no statistically significant effect on spirit prices. Estimated coefficients for the demographic variables show that higher levels of unemployment are linked to lower prices for wine and spirits, and this suggests that prices of these beverages are more responsive to economic conditions. Prices are lower in states with larger populations between 18 and 29 years, and with populations over 65 years of age. The results also show that wine and spirit prices are higher and statistically significant in states with a larger proportion of dry areas.[8]

The estimated effects on the consumption of beer, wine, and spirits are listed in Table 3. Here we used fitted values for prices from stage I. All of the own- and cross-price elasticities are negative, and only the cross-price elasticities between beer and spirits are statistically significant.

We expected to find more statistical significance among the elasticity coefficients; however, our findings are similar to what others have estimated using similar data (e.g., Nelson 2003) and are in line with elasticities estimated for various alcoholic beverages in different countries in different time periods (for a nice summary, see Fogarty 2008). In addition, the estimation of price elasticities may be constrained by the number of dummy variables included in the model to control for state-level effects and time trends, and to any branding, reputation, and advertisement effects which we do not control for. The results show that states with WIGS have 12.9 percent higher beer consumption rates and 48.6 percent higher wine consumption rates. States with SIGS have higher consumption rates of beer and wine, but to a smaller degree than states with WIGS; these measures only capture the search cost effect of the different types of grocery store alcohol availability, as we are holding prices constant.

Table 3 also shows that states with WIGS have a 16.3 percent higher rate of spirit consumption, but that SIGS does not have a statistically significant effect on spirit consumption. At first this appears like a counter-intuitive finding, but it may be a result of product selection and substitution possibilities in the two cases. For example, consumers may purchase less spirits in a grocery store if beer and wine are also available, or if there is any stigma attached to purchasing spirits in a grocery store. In addition, if there is WIGS and spirits are only available in licensed liquor stores, then liquor stores may have a greater incentive to focus their marketing efforts on spirit sales. With WIGS we observe a large increase in wine consumption, and this result is very similar to findings shown in previous work (e.g., MacDonald 1986; Adrian, Ferguson, and Her 1996). We see a positive and statistically significant income effect for wine and spirit consumption, but no statistically significant income effect for beer. Table 3 also shows that tourism (measured as revenues from hotels and restaurants as a share of gross state product) has a positive and statistically significant effect on consumption of alcohol. Consumption of all three alcoholic beverages increases in states with higher Catholic populations, and decreases in states with higher Mormon populations and populations living in dry areas.

Table 4 provides regression results from the third stage in our framework that estimates total traffic fatalities. The estimated effects of total alcohol consumption, alcoholic beverage shares (for two of the three beverages), and various policy parameters on total traffic fatalities are shown. Results in the first column show that increases in total alcohol consumption increase traffic fatalities; as total consumption (of ethanol alcohol) increases by 1 percent traffic fatalities increase by 0.00156 percentage points. In addition, higher rates of beer and spirit consumption as a share of total alcohol consumption are linked to higher rates of traffic fatalities. Previous work has also found a positive relationship between beer consumption and traffic fatalities (Ruhm, 1996; Mann et al., 2006). Estimated coefficients in the second and third columns show that states with higher rates of wine consumption as a share of total alcohol consumption have lower rates of traffic fatalities. Overall, these results indicate that an increase in beer and spirit consumption, as a share of total alcohol consumption, increases traffic fatalities whereas an increase in wine consumption as a share of total alcohol consumption decreases traffic fatalities.

Table 4 also shows that states with alcohol available for sale after 10 p.m. have higher traffic fatality rates. The legal index variable is a composite of six policies that were implemented to discourage drunken driving (for additional details, see Young and Bielińska-Kwapisz 2006), and regression results show that this variable has a negative and statistically significant effect on total traffic fatalities. Furthermore, increases in the number of vehicle miles travelled increases traffic fatalities, and seat belt laws decrease traffic fatalities.

In addition to data that describe total traffic fatalities, we also have information about traffic fatality rates among youths, on weekends, among youths on weekends, an all other times total, and an all other times total for youths (NHTSA 2010). In Table 5 we follow the format used in Table 4, but provide regression results using these five subcategories of traffic fatalities as the dependent variables. In each case we see that traffic fatalities increase with total alcohol consumption, and increase as the consumption of beer and spirits, as shares of total alcohol consumption, increase. Furthermore, we continue to find that the estimate describing sales after 10 p.m. is positive and statistically significant, and this coefficient is largest when we examine total youth fatalities. This result suggests that any policy change that introduces alcohol into grocery stores should also consider restrictions on the hours for which alcohol is available.

Recently there has been a renewed interest to expand wine, and in some cases beer and wine, distribution beyond liquor stores and into grocery stores in several states. Proposals put forward have been viewed as a vehicle for state governments to raise additional revenue through sales taxes, excise taxes, annual license fees, and franchise fees (one-time entrance fees charged to grocery stores), yet there has been strong opposition towards these proposals from liquor store owners and social interest groups. The estimates from our framework can be used to better understand the likely impacts of introducing wine into grocery stores on traffic fatalities, and allow us to weigh in on an issue that has immediate policy relevance in the United States.

6. Simulating the Effects of Introducing Wine into Grocery Stores

The results from stage I and stage II in our analysis show that states with wine available in grocery stores have lower wine prices and higher rates of wine consumption. We also find a negative and statistically significant relationship between wine consumption as a share of total alcohol consumption and traffic fatalities. The introduction of alcoholic beverages into grocery stores, notably wine, has been a contentious policy issue in many states in recent years, and it is expected to generate subsequent policy proposals in the near future. To shed some new light on this policy debate we use the results from the three stages in our analysis to simulate the likely effects of introducing wine into grocery stores on prices and consumption of the three alcoholic beverages, and the effects on traffic fatalities.

We conduct two simulation experiments: i) introducing beer and wine into grocery stores, and ii) introducing wine into grocery stores that already sell beer. These two policy scenarios reflect recent legislative proposals in various states. Proposals that seek to introduce beer and wine into grocery stores have recently been initiated in Colorado, Delaware, and Oklahoma. Among the states that currently sell beer in grocery stores, there have been recent proposals to introduce wine into grocery stores in Kentucky, New York State, and Tennessee. Some states, and in particular New York State, have had similar proposals resurface regularly beginning in the 1960s (e.g., New York State Moreland Commission, 1964). However, none of the recent proposals have become legislation.

Each simulation exercise involves four steps. We use estimates from our model to simulate changes in prices, changes in consumption shares for alcoholic beverages, changes in total alcohol consumption, and changes in fatalities. Price changes for beverage *i* from introducing WIGS are calculated as $\Delta P_i^{0\rightarrow WIGS} = [\hat{P}_i \big| WIGS] - \hat{P}_i]$ and price changes from introducing only wine into grocery stores are calculated as $\Delta P^{i,BIGS\rightarrow WIGS} = [\hat{P}^i \big| WIGS] - [\hat{P}^i \big| BIGS]$. Second, we simulate the change in the consumption share of alcoholic beverage *k*, denoted B^k, for both of the policy change scenarios, while holding prices constant. The changes in consumption shares given WIGS are calculated as $\Delta B^{k,0\rightarrow WIGS} = [\hat{B}^k \big| WIGS]\Big|_{p*} + \sum_i \frac{dB^k}{dP^i} \cdot \Delta P^{i,0\rightarrow WIGS}$ and the changes in consumption shares with the introduction of wine only into grocery stores are calculated as

$\Delta B^{k,BIGS\to WIGS} = [\hat{B}^k \left| WIGS] - [\hat{B}^k \right| BIGS]\Big|_{p^*} + \sum_i \frac{dB^k}{dP^i} \cdot \Delta P^{i,BIGS\to WIGS}$. Changes in total alcohol consumption with WIGS are calculated as $\Delta C^{total,0\to WIGS} = [\hat{C}^{total} \left| WIGS]\right|_{p^*} + \sum_i \frac{dC^{total}}{dP^i} \cdot \Delta P^{i,0\to WIGS}$ and changes in total alcohol consumption with the introduction of wine only into grocery stores are calculated as $\Delta C^{total,BIGS\to WIGS} = [\hat{C}^{total} \left| WIGS] - [\hat{C}^{total} \right| BIGS]\Big|_{p^*} + \sum_i \frac{dC^{total}}{dP^i} \cdot \Delta P^{i,BIGS\to WIGS}$.

Finally, in the fourth step, we simulate changes in traffic fatality rates for the two policy scenarios; here we provide simulated results for each of the six traffic fatality categories. With WIGS, the change in the traffic fatality rate for category *f* is calculated as

$\Delta F^{f,0\to WIGS} = \sum_k \Delta B^{k,0\to WIGS} \cdot \frac{dF^f}{dB^k} + \Delta C^{total,0\to WIGS} \cdot \frac{dF^f}{dC^{total}}$, and with the introduction of wine only the change is calculated as

$\Delta F^{f,BIGS\to WIGS} = \sum_k \Delta B^{k,BIGS\to WIGS} \cdot \frac{dF^f}{dB^k} + \Delta C^{total,BIGS\to WIGS} \cdot \frac{dF^f}{dC^{total}}$.

Table 6 summarizes price, consumption, and traffic fatality effects from the two simulation experiments. The first column shows the simulated results for a policy change that would allow beer and wine to be available in grocery stores, holding alcohol sales hours constant. Here we see a negative and statistically significant effect on beer and wine prices, and a positive and statistically significant effect on spirit prices. We find that total alcohol consumption would increase, beer consumption as a share of total consumption would fall, and the spirit share of consumption would fall (but the effect is not statistically significant). As a result, this policy change would have a positive impact on wine's share of consumption. Our simulation results show that introducing WIGS would have a negative effect on traffic fatality rates for all six traffic fatality categories. Only two of the traffic fatality effects—youth weekend and youth other times—are statistically significant, and these results are only statistically significant at the 10 percent level.

Results in the second column of Table 6 show the simulated effects of introducing wine into grocery stores where beer was already available. Here we find that the price of beer, wine, and spirits would fall, and all three effects are statistically significant. In this case the price decrease for wine is nearly twice as high as it was in the first simulation experiment. Similar to the first column, total alcohol consumption would increase and this effect is statistically significant. Again, we find that beer's share of consumption and spirits' share of consumption would fall with the introduction of wine into grocery stores that currently sell beer, but neither effect is statistically significant. The results in the second column show that the introduction of wine into grocery stores would have no statistically significant effect on traffic fatalities in any of the six categories.

The simulation results indicate that the introduction of wine into grocery stores would have a strong impact of prices of all alcoholic beverages and would affect total alcohol consumption; in the case of a policy change to WIGS, it has a statistically significant effect on the shares of consumption of alcoholic beverages. Overall, the simulation results indicate that introducing wine, either in conjunction with beer or into outlets that already sell beer, would have very limited effects on traffic fatality rates.

7. Summary and Policy Implications

We use state-level data between 1982 and 2000 to examine the impact of grocery store alcohol availability on price and consumption of specific alcoholic beverages, and on traffic fatality rates. Our results shed some new, and perhaps surprising, light on some of the controversy that surrounds recent policy discussions that have proposed to introduce wine into grocery stores. In particular, we find that states with grocery store wine availability have lower wine prices and higher wine consumption rates. We also find that an increase in total alcohol consumption increases traffic fatalities, but that increases in specific beverages as shares of total alcohol consumption have different impacts of traffic fatality rates. Notably, states with higher consumption shares of beer and spirits have higher traffic fatality rates, and therefore states with a higher consumption share of wine have lower traffic fatality rates. Our results suggest that arguments against legislation that proposes to introduce wine into grocery stores for reasons related to traffic fatalities may be misguided. Specifically, the conventional wisdom that alcoholic beverages with higher ethanol content are more dangerous in terms of traffic fatalities is not obvious in our simulation results.

In addition, we find that sale hours of alcohol impacts traffic fatality rates, and policies surrounding hours of sale of alcohol at grocery stores should be considered in conjunction with legislative proposals that seek to change alcohol availability in grocery stores. Results that isolate youth traffic fatalities suggest two important findings. First, an increase in total alcohol consumption, beer consumption as a share of total alcohol consumption, and spirit consumption as a share of total alcohol consumption have relatively large effects on youth traffic fatalities. Second, the coefficient on the variable that describes sale hours of alcohol is largest for youth fatalities. Both of these findings suggest that youth fatalities are most closely tied to beer and spirit consumption, and are particularly sensitive to alcohol sale hours.

There has been a long history of government regulation related to wine markets in the United States, and many regulations have been state-specific. Prior to 1970, twenty-five states did not allow wine to be sold in grocery stores; between 1969 and 1985 eight of the twenty-five states that sold wine in government-owned outlets introduced reform that allowed wine to be sold in grocery stores. Recently there has been a renewed interest to expand wine distribution beyond liquor stores and into grocery stores in several states, yet there has been strong opposition towards these proposals from various constituents including social interest groups concerned about the effects of increased wine availability on traffic fatalities. Our simulation results suggest that introducing wine into grocery stores—either alone or coupled with the introduction of beer—would not lead to a positive and statistically significant impact on traffic fatalities. However, because we find a positive relationship between grocery store wine availability and consumption of all three alcoholic beverages, the aggregate effect on traffic fatalities from the introduction of wine into grocery stores may include competing effects from different beverages.

Overall, our research makes three important contributions to the literature examining the links between alcohol policy, alcohol consumption, and traffic fatalities in the United States. First, although policies concerning the availability of alcohol—in terms of outlet density, local access laws, licensing requirements, and hours of sales—have been studied, we examine availability as it relates to alcohol sold in grocery stores. Evaluating the economic and social impacts of wider distribution of alcohol is an important policy issue in the United States, and it is widely expected that additional proposals concerning grocery store alcohol availability will resurface in several states in the near future. Second, our framework allows us to comment on how total consumption and components of total consumption respond to policies and policy changes. We think this is especially important in alcohol markets because policies are often beverage-specific and policies have different impacts on different beverages. This research provides a novel approach to study the economic impacts of alcohol policies, and can be extended to examine a wide range of policy issues concerning alcohol access, alcohol prices, and alcohol distribution. Third, we bridge economic research in the areas of alcohol demand and alcohol regulation. There are separate, but related, literatures that examine the impact of public policies on alcohol demand and the impact of alcohol control policies on traffic fatalities. In this article we develop a framework to create linkages from beverage-specific policies to alcohol consumption to traffic fatalities.

Footnotes

[1] Grocery stores includes all outlets that sell food such as supermarkets, convenience stores, pharmacies, and gas stations.

[2] The columns in Table 1 show that wine is never sold in grocery stores without beer, and spirits are never sold in grocery stores without wine and beer. Therefore, there is an implicit assumption among policy makers that beverages with higher ethanol alcohol content are more dangerous and lead to greater social problems.

[3] We use the term "availability" to describe the retail location of alcohol sales rather than the time of alcohol sales.

[4] With the exception of information about grocery store alcohol availability and alcohol availability after 10 p.m., we use data from Young and Bielińska-Kwapisz (2006).

[5] Saffer and Grossman (1987), Coate and Grossman (1988), and Chaloupka, Saffer, and Grossman (1993) present the argument for including populations with various religious affiliations to measure aversion to alcohol across states.

[6] Here we used a binary variable that was set equal to 1 if alcohol was available after 10 p.m.; this included all states except Connecticut, Minnesota, New Jersey, Oklahoma, Pennsylvania, Rhode Island, Utah, and Mississippi.

[7] We classified states into four regional dummy variables following Nelson (2003); the classifications are shown below:

West: Washington, Oregon, California, Nevada, Idaho, Utah, Montana, Wyoming, Colorado
Midwest: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio, Michigan
Northeast: Maine, Vermont, New York, Pennsylvania, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Massachusetts, New Hampshire
South: Arizona, New Mexico, Oklahoma, Texas, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Virginia, West Virginia, Kentucky, Tennessee

[8] Estimated coefficients for the dummy variables that describe regions, years, and state-specific time trends are not reported in the tables of results, but are available from the authors upon request.

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Table 1. Selective Availability of Alcohol in Grocery Stores by State

No (or limited) Alcohol Sales	Only Beer Sales Allowed	Only Beer and Wine Sales Allowed	Beer, Wine, and Spirit Sales Allowed
Alaska	Connecticut	Alabama	Arizona
Colorado	Kentucky	Arkansas	California
Delaware	Mississippi	Florida	Hawaii
Kansas	New York	Georgia	Illinois
Massachusetts[a]	Tennessee	Idaho	Indiana
Minnesota	Wyoming	Maine	Iowa
New Jersey[a]		Montana	Louisiana
North Dakota		New Hampshire	Maryland
Oklahoma		North Carolina	Michigan
Pennsylvania		Oregon	Missouri
Rhode Island[b]		South Carolina	Nebraska
Utah		Texas	Nevada
		Vermont	New Mexico
		Virginia	Ohio
		Washington	South Dakota
			West Virginia
			Wisconsin

Source: Wine Institute 2009; United States Department of Treasury 2011.

[a] In Massachusetts and New Jersey each grocery store chain is limited to two licenses, so with few exceptions, most grocery stores do not sell alcoholic beverages.

[b] Rhode Island allows wine sales in grocery stores only in towns with 10,000 or fewer residents and in Newport.

Table 2. Regression results from stage I: Estimating a model of alcohol prices

	Dependent Variable: Log Prices		
	Beer	**Wine**	**Spirits**
Log of Beer Tax	0.0522***	-0.0322	0.00344
	(0.0170)	(0.0221)	(0.0169)
Log of Wine Tax	0.0345***	0.0894***	0.0234***
	(0.00690)	(0.00897)	(0.00687)
Log of Spirits Tax	0.0902***	0.136***	0.460***
	(0.0346)	(0.0451)	(0.0345)
Spirits Tax Percent	0.000851	0.00136*	0.00172***
	(0.000542)	(0.000706)	(0.000540)
State Spirits Markup	0.000458**	0.000558**	0.00153***
	(0.000184)	(0.000240)	(0.000184)
Wine Tax Percent	0.00484***	0.00816***	0.00353***
	(0.00105)	(0.00136)	(0.00104)
State Wine Markup	0.000328	0.000347	-0.000325
	(0.000234)	(0.000305)	(0.000233)
BIGS	-0.00984	0.0647***	0.0695***
	(0.0135)	(0.0175)	(0.0134)
WIGS	-0.0507***	-0.0683***	0.0441***
	(0.0119)	(0.0155)	(0.0119)
SIGS	-0.0191*	-0.0539***	0.0105
	(0.0105)	(0.0137)	(0.0105)
Log of real per capita income	-0.0678*	0.00918	-0.0508
	(0.0370)	(0.0481)	(0.0368)
Unemployment rate (percent)	-0.00169	-0.00382*	-0.00962***
	(0.00164)	(0.00214)	(0.00164)
Share of GSP from hotels/restaurants (percent)	-0.00406*	-0.0126***	-0.00514**
	(0.00208)	(0.00271)	(0.00208)
Population between 18 and 29 (percent)	-0.00353	-0.0141***	-0.0172***
	(0.00290)	(0.00377)	(0.00288)
Population above 65 (percent)	-0.00692***	-0.00862**	-0.0134***
	(0.00266)	(0.00347)	(0.00265)
Catholic Population (percent)	-0.00133***	-0.00314***	0.000137
	(0.000452)	(0.000588)	(0.000450)
Mormon Population (percent)	-0.00287***	5.39e-05	0.00120***
	(0.000457)	(0.000595)	(0.000455)
Southern Baptist Population (percent)	0.00312***	-0.00129	-0.00278***
	(0.000848)	(0.00110)	(0.000845)
Population living in dry areas (percent)	-4.18e-05	0.000997*	0.00281***
	(0.000445)	(0.000579)	(0.000444)
Constant	6.099***	5.162***	4.883***
	(0.359)	(0.467)	(0.358)
Observations	869	869	869
R-squared	0.715	0.856	0.829

Note: * $p<0.10$; ** $p<0.05$; *** $p<0.01$

Table 3. Regression results from stage II: Estimating a model of alcohol consumption

	Dependent Variable: Log Consumption		
	Beer	**Wine**	**Spirits**
Log of Beer Price	-0.263	-0.0719	-0.461***
	(0.339)	(0.175)	(0.120)
Log of Wine Price	-0.0719	-0.154	-0.176
	(0.175)	(0.263)	(0.176)
Log of Spirit Price	-0.461***	-0.176	-0.0306
	(0.120)	(0.176)	(0.126)
BIGS	0.0240	0.0696	0.0512
	(0.0286)	(0.0527)	(0.0347)
WIGS	0.129***	0.486***	0.163***
	(0.0189)	(0.0374)	(0.0297)
SIGS	0.0446**	0.324***	0.0364
	(0.0182)	(0.0382)	(0.0283)
Log of real per capita income	0.0336	1.224***	0.244**
	(0.0691)	(0.116)	(0.0971)
Unemployment rate (percent)	-0.0123***	0.00587	-0.0187***
	(0.00222)	(0.00543)	(0.00361)
Share of GSP from hotels/restaurants (percent)	0.0260***	0.0432***	0.0755***
	(0.00290)	(0.00461)	(0.00393)
Population between 18 and 29 (percent)	-0.00847*	0.0310***	0.0272***
	(0.00489)	(0.0104)	(0.00717)
Population above 65 (percent)	-0.0182***	0.00464	-0.0175*
	(0.00419)	(0.00812)	(0.00898)
Catholic Population (percent)	0.00474***	0.0184***	0.00555***
	(0.000899)	(0.00166)	(0.00127)
Mormon Population (percent)	-0.00566***	-0.00435***	-0.00750***
	(0.000936)	(0.00131)	(0.00108)
Southern Baptist Population (percent)	-0.00756***	0.000418	0.00731***
	(0.00213)	(0.00310)	(0.00204)
Population living in dry areas (percent)	-0.00111	-0.00823***	-0.00567***
	(0.000719)	(0.00119)	(0.000798)
Constant	4.752***	-12.57***	0.948
	(1.525)	(1.752)	(1.364)
Observations	869	869	869
R-squared	0.896	0.951	0.932

Note: * p<0.10; ** p<0.05; *** p<0.01

Table 4. Regression results from step three: Estimating total traffic fatalities

	Dependent Variable: Fatality Rates (per thousand)[a] Using Alcoholic Beverage Shares for:		
	Beer and Spirits	Beer and Wine	Wine and Spirits
Beer Share (percentage points)	0.0102***	0.00321***	
	(0.00157)	(0.00120)	
Wine Share (percentage points)		-0.00694***	-0.0102***
		(0.00115)	(0.00140)
Spirits Share (percentage points)	0.00695***		-0.00322***
	(0.00125)		(0.00121)
Log Total Alcohol Consumption	0.154***	0.154***	0.154***
	(0.0257)	(0.0222)	(0.0245)
Stores open late[b]	0.0211***	0.0210***	0.0210***
	(0.00721)	(0.00676)	(0.00628)
21 Drinking Age	0.00681*	0.00680	0.00680
	(0.00392)	(0.00419)	(0.00418)
Legal Index (0-6)	-0.00495***	-0.00496***	-0.00496***
	(0.00118)	(0.00115)	(0.00117)
Vehicle miles traveled (1000s/driver)	0.00374*	0.00372**	0.00372**
	(0.00193)	(0.00159)	(0.00170)
Seat belt law	-0.00853***	-0.00853***	-0.00853***
	(0.00289)	(0.00292)	(0.00293)
Illegal per se BAC of 0.08	-0.00709*	-0.00712**	-0.00713*
	(0.00378)	(0.00359)	(0.00395)
Keg registration	0.00472	0.00478	0.00480
	(0.00579)	(0.00522)	(0.00478)
Lower BAC for youth	0.0134***	0.0134***	0.0134***
	(0.00334)	(0.00317)	(0.00309)
Server training law	-0.00835**	-0.00835**	-0.00835**
	(0.00383)	(0.00368)	(0.00383)
Constant	-0.795***	-0.100	0.221***
	(0.131)	(0.0910)	(0.0351)
Observations	850	850	850
R-squared	0.860	0.860	0.860

[a] In the total traffic fatality category, the mean rate is 0.189 fatalities per thousand.

[b] Dummy variable equals one if any type of alcohol is available after 10 p.m.

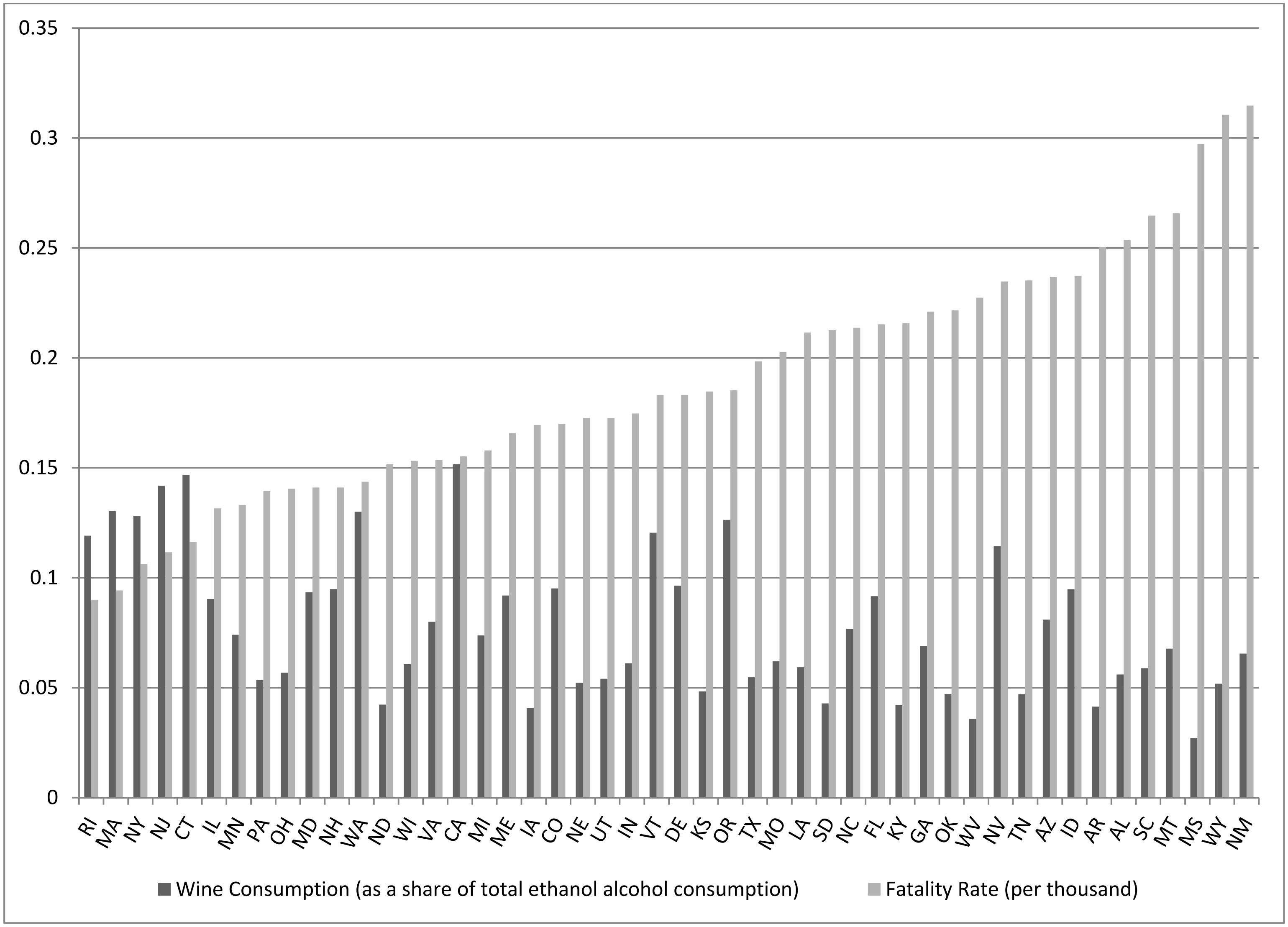
Table 5. Regression results from Step three: Estimating five specific types of fatalities

	Dependent Variable: Fatality Rates (per thousand)				
	Total Youth	Total Weekend	Youth Weekend	Other Total	Other Youth
Mean Fatality Rates (per thousand)	0.388	0.045	0.129	0.0978	0.158
Beer Share (percentage points)	0.0248***	0.00274***	0.00932***	0.00465***	0.0117***
	(0.00383)	(0.000487)	(0.00213)	(0.000872)	(0.00224)
Spirits Share (percentage points)	0.0122***	0.00163***	0.00643***	0.00372***	0.00580***
	(0.00334)	(0.000395)	(0.00205)	(0.000707)	(0.00181)
Log Total Alcohol Consumption	0.297***	0.0455***	0.104***	0.0565***	0.127***
	(0.0540)	(0.00965)	(0.0317)	(0.0113)	(0.0301)
Stores open late	0.0548***	0.00794***	0.0284***	0.0123***	0.0216**
	(0.0212)	(0.00254)	(0.00987)	(0.00350)	(0.00888)
21 Drinking Age	-0.00999	0.00137	-0.00653	0.00235	0.00221
	(0.00979)	(0.00142)	(0.00499)	(0.00167)	(0.00492)
Legal Index (0-6)	-0.0123***	-0.00133***	-0.00321	-0.00198***	-0.00489**
	(0.00393)	(0.000407)	(0.00203)	(0.000666)	(0.00194)
Vehicle miles traveled	0.0121***	0.000842	0.00174	0.00271***	0.00842***
	(0.00448)	(0.000546)	(0.00209)	(0.000848)	(0.00262)
Seat belt law	-0.0272***	-0.00104	-0.00842	-0.00679***	-0.0153***
	(0.00940)	(0.00115)	(0.00529)	(0.00163)	(0.00552)
Illegal per se BAC of 0.08	-0.0129	-0.00294*	-0.00604	-0.00217	-0.00326
	(0.0125)	(0.00159)	(0.00743)	(0.00224)	(0.00755)
Keg registration	0.0150	3.78e-06	0.00623	0.00594*	0.00920
	(0.0175)	(0.00208)	(0.00988)	(0.00324)	(0.00861)
Lower BAC for youth	0.0155	0.00177	0.000843	0.00941***	0.0103**
	(0.00988)	(0.00117)	(0.00473)	(0.00159)	(0.00497)
Server training law	0.00318	-0.00440***	-0.00483	0.00153	0.00883
	(0.0118)	(0.00125)	(0.00683)	(0.00234)	(0.00710)
Constant	-1.739***	-0.208***	-0.692***	-0.384***	-0.900***
	(0.347)	(0.0397)	(0.199)	(0.0752)	(0.193)
Observations	850	850	850	850	850
R-squared	0.731	0.769	0.628	0.840	0.659

Table 6. Simulating the effects of introducing wine into grocery stores

	Policy Change (Alcohol Types Available in Grocery Stores)	
	No Alcohol Available to Beer and Wine Available	Beer Available to Beer and Wine Available
Price Effects, n=869		
Beer	-5.068***	-4.084***
	(1.193)	(1.433)
Wine	-6.831***	-13.30***
	(1.552)	(1.864)
Spirits	4.409***	-2.539*
	(1.188)	(1.427)
Consumption Effects, n=850		
Beer Share	-3.642***	-2.132
	(1.137)	(1.507)
Spirit Share	-0.190	-1.095
	(1.052)	(1.275)
Total	21.25***	21.83***
	(1.942)	(2.608)
Fatality effects, n=850		
Total	-0.00559	0.00436
	(0.00761)	(0.00953)
Youth	-0.0295	-0.00135
	(0.0208)	(0.0277)
Weekend	-0.000636	0.00231
	(0.00237)	(0.00302)
Youth Weekend	-0.0130*	-0.00415
	(0.00781)	(0.0102)
Total All Other Times	-0.00563	-0.00164
	(0.00374)	(0.00426)
Youth All Other Times	-0.0168*	-0.00365
	(0.0101)	(0.0127)

Figure 1: Average number of traffic fatalities and wine as a share of total alcohol consumption, 1982 to 2000



Sources: NIH-NIAAA (2010); NHTSA (2010).

Figure 2. Potential Links between Selective Alcohol Availability and Traffic Fatalities