Alcamentos

Departamento de Estadística, Estructura y O.E.I.

0803

ALCOHOLIC BEVERAGES AS DETERMINANTS OF TRAFFIC FATALITIES

José Mª Arranz[1] y Ana I. Gil[2]

[1]Universidad de Alcalá y Alcamétrica
[2]Universidad Autónoma de Madrid

DEPARTAMENTO DE
ESTADÍSTICA, ESTRUCTURA ECONÓMICA Y O.E.I.
Plaza de la Victoria, 2
28802 Alcalá de Henares (Madrid)
Teléfono: 91 885 42 01
http://www.uah.es/centros_departamentos/departamentos

Universidad de Alcalá

Alcamentos

Nº: 0803

ALCOHOLIC BEVERAGES AS DETERMINANTS OF TRAFFIC FATALITIES

José Mª Arranz[1] y Ana I. Gil[2]

[1]Universidad de Alcalá y Alcamétrica

[2]Universidad Autónoma de Madrid

DEPARTAMENTO DE
ESTADÍSTICA, ESTRUCTURA ECONÓMICA Y O.E.I.
Plaza de la Victoria, 2
28802 Alcalá de Henares (Madrid)
Teléfonos: 91 885 42 01
http://www.uah.es/centros_departamentos/departamentos

ALCOHOLIC BEVERAGES AS DETERMINANTS OF TRAFFIC FATALITIES

José Mª Arranz [1,*]
Ana I. Gil[2]

[1]Universidad de Alcalá and Alcamétrica
[2]Universidad Autónoma de Madrid

September 2008

Abstract

The most important contribution of this research lies in considering the impact of wine, beer and liquors on the ratio of traffic fatalities because each kind of alcoholic beverage is characterized by different ethanol content. The data, drawn for case of Spain, validate our theoretical hypothesis. Our findings support the strategy of incrementing alcohol taxes in order to reduce the negative externalities of alcohol abuse. However, it is necessary to implement non-economic policies because of the existence of collateral effects (positive crossed price elasticities).

Keywords: Fatalities, Alcoholic beverages, Sanctions.
JEL classification: I1, H2.

*Corresponding author.
Facultad de Ciencias Económicas y Empresariales
Universidad de Alcalá
Plaza de la Victoria, 2
28802 Alcalá de Henares, Madrid (SPAIN)
e-mail: josem.arranz@uah.es

ALCOHOLIC BEVERAGES AS DETERMINANTS OF TRAFFIC FATALITIES

José Mª Arranz and Ana I. Gil

1. Introduction

Traffic accidents represent one of the main causes of death in Spain (Arranz and Gil 2008), and in most developed countries in general. The most dramatic realization behind the number of fatalities is that most of them could have been avoided; in fact, the most detected driving infractions are drunk-driving and excessive speed. Both are the most frequent reasons for traffic accidents (Spanish General Directorate of Traffic 2004). The most important contribution of this research lies in presenting evidence of the impact of different kinds of alcoholic beverages on the ratio of traffic fatalities in Spain[1] because each kind of alcoholic beverage is characterized by different ethanol content. In particular, the effectiveness of diverse economic policies and traffic policies applied with the end of reducing the number of traffic fatalities[2].

2. Theoretical and empirical framework

There is strong empirical evidence pointing to the positive link between alcohol consumption and the number of traffic accidents. Most governments frequently implement increasing alcohol taxes, which raises the final price of alcoholic beverages, and

[1] The Spanish General Directorate of Traffic (2005) estimates that there are around 3,000 mortal traffic accidents per year which cause the death of 5,000 people.

[2] Arranz and Gil (2008) analyse the existing relationship among alcohol consumption and traffic accidents in Spain without distinguishing by type of alcoholic beverages.

consequently, reduces alcohol demand as the acquisition capacity is restrained (Young and Bielinska-Kwapisz 2006). Nevertheless, the effectiveness of policies centred on tax increases is under debate being an efficient policy for some authors (Benson et al. 2000), while for others, tax effects are limited due to the existence of fixed spatial effects (Mast et al. 1999) or due to the occurrence of measurement errors at the time of calculating alcohol prices (Young and Bielinska-Kwapisz 2003), or even due to the presence of alcohol consumption in early stages of life (Sloan et al. 1994). To reduce drunk driving, there have been implemented also non-monetary policies such as restraining the access of stores to alcohol licenses (McCarthy 2003) and raising the minimum legal age at which people can buy alcoholic beverages (Cook and Tauchen 1984). The proportion of young males and the levels of alcohol consumption per capita are key factors of fatal crashes (Scuffham 2003). The effectiveness of this minimum legal age is questioned by Asch and Levy (1987), who concede greater importance to the experiences of driving and drinking than to the minimum legal age for buying alcoholic beverages. Nevertheless, young males are usually the ones who are more likely to be novel drivers and to underestimate the consequences of alcohol abuse.

For the empirical application of the Spanish case (1998-2002), there had not been substantial legislative changes until July 2006 when the driver's license started to be regulated under a point system. Concerning alcohol issues, the minimum legal age to buy alcoholic beverages has been increased from 16 to 18 years in most of the Autonomous Communities (at different times). Concerning traffic measures, one of the main legal changes (in Spain) has been to reduce the allowed BAC from 0.8 grams per litre in 1992 to 0.5 in 2003. So the effectiveness of this policy will be only analyzed when we have available data for traffic accidents for the year 2003 and later. Regards sanctions the monetary penalty has scarcely raised to 2 Euros from the 1990 to 2001 (we will consider this variable as a constant).

Table 1 contains the means and standard deviations of the variables classified by different sources from 1998 to 2002. Our empirical model is structured by two equations. First the individual demand for wine, beer and liquor as functions of price of alcoholic beverages, individual incomes and dummy variables that summarize fixed temporal and regional effects. Second equation estimates the rate of traffic fatalities as a function of alcohol consumption, traffic sanctions (proxy variable of traffic measures) and the expedited new driver's license. Several dummy variables introduce fixed effects related to the different Autonomous Communities and time periods in both stages. These equations are:

$$C_{ijt} = Z_{it}\phi + w_{it} \qquad \text{i=1,2,…18; t=1998,…2002; j=1(wine), 2(beer), 3(liquor)} \qquad (1)$$

$$R_{it} = C_{ijt}\alpha + X_{it}\beta + v_{it} \qquad \text{i=1,2,…18; t=1998,…2002; j=1(wine), 2(beer), 3(liquor)} \qquad (2)$$

where C_{ijt} represents the consumption per capita of the alcoholic beverages j for the Autonomous Community *i* for the year *t*; R_{it} is the rate of traffic fatalities; X_{it} and Z_{it} are matrices of explicative variables; β,α and ϕ are vectors of parameters; w_{it}, and v_{it} are residuals which summarize the unobserved aspects that influence both alcohol consumption and traffic fatalities.

[Insert Table 1]

Concerning the estimation method, OLS can be also implemented if only if alcohol consumption is an exogenous variable in equation of traffic accidents (the test of Hausman and the Augmented Test Regression fail to reject the null hypothesis of exogeneity). Lastly, due to the small number of observations (90 observations) we also test if the estimated parameters might be biased by a problem of heteroskedasticity. Once we checked and rejected the possibility of heteroskedasticity to use OLS.

3. Results

For each alcoholic beverages, the direct price elasticities are negative except for wine. According to the cross-price elasticities of demand, an increasing in the price of wine reduces the regional demand per capita for beer and liquors, and in the same way, an increasing in the price of liquor reduces the regional demand per capita for beer. There is also empirical evidence that an increasing in the price of beer enhances the regional demand per capita for wine and liquors, and lastly, an increasing in the price of liquor enhances the regional demand per capita for wine. In regard to the income effect, our results bring to light that an increase of 1% in the regional labour costs increases the regional demand for wine by 0.71%.

[Insert Table 2]

Our empirical results validate our theoretical hypothesis, thus higher levels of alcohol consumption increase the tendency of traffic fatalities, and what is more, this effect will be higher with the ethanol content of the alcoholic beverage. So increases of wine, beer and liquor demand by 1% provoke increases of 0.063%, 0.089% and 0.281% in the number of traffic fatalities, respectively. This result, next to the fact that an increase in the current price of alcoholic beverages reduces the present demand of alcohol, allows us to affirm that an increase in the price of alcoholic beverages reduces the rate of traffic fatalities. By definition, the elasticity fatalities with respect to the price of alcohol, *Efp*, is equal to the product of the price-consumption elasticity, *Ecp*, and the consumption-fatality elasticity, *Efc*. Increases of beer and liquor prices in 1% reduce the number of traffic fatalities by 0.043% and 0.0026% respectively, although the magnitude of these last two results is not statistically significance. Regarding the implementation of traffic sanctions, we prove that this measure is effective in the way that it is negatively correlated with the rate of traffic fatalities, so for example a 10% increase of sanctions[3] of citizens reduces the rate of traffic fatalities by a 0.34%. Contrary to what we would have expected, the number of new drivers does not increase the tendency to suffer a traffic accident, which our analysis shows to be derived from two facts. Novice drivers have lower speed limits during the first year, and lower legal BAC for the first two years.

[Insert Table 3]

4. Conclusion

We find empirical evidence that the content of ethanol that characterises the different kinds of alcoholic beverages is positively correlated with the rate of traffic fatalities. It is exactly the differences in the hardness of the negative externalities which justifies the different rate of taxation for each kind of alcoholic beverages. Although taxes are the most applied public policy instrument for reducing alcohol abuse, we have to be cautious analyzing the efficiency of these policies, because in reducing the consumption of a specific alcoholic beverage, we could be promoting the consumption of others, with an even higher ethanol content. We also find that the implementation of traffic sanctions is effective in a way that is negatively

[3] This result brings to light the effectiveness of implementing harder traffic sanctions to reduce traffic fatalities in Spain as in the USA according to the empirical study of Young and Likens (2000). Kenkel and Koch (2001) suggest that it is necessary to increase the penalties until they reach their real social costs.

correlated with the rate of traffic fatalities. In fact, the policy makers have a wide range of possibilities, such as a driver's license that operates under a point system. Although in Spain this system has been recently implemented, the experiences of other countries show positive results (for example France).

5. References

Arranz JM, Gil, A (2008) Traffic accidents, deaths and alcohol consumption. Applied Economics (in press).

Asch P, Levy D (1987) Does the minimum drinking age affect traffic fatalities? Journal of Policy Analysis and Management 6: 180-192.

Benson B, Mast B, Rasmussen D (2000) Can police deter drunk driving? Applied Economics 32: 357-366.

Cook P, Tauchen, G (1984) The effect of minimum drinking age legislation on youthful auto fatalities, 1970-1977. Journal of Legal Studies 13: 169-190.

Kenkel D, Koch S (2001) Deterrence and knowledge of the law: The case of drunk driving. Applied Economics 33: 845-854.

Mast B, Benson B, Rasmussen, D (1999) Beer taxation and alcohol-related traffic fatalities. Southern Economic Journal 66: 214-249.

McCarthy P (2003) Alcohol-related crashes and alcohol availability in grass-roots communities. Applied Economics 35: 1331-1338.

Scuffham A (2003) Economic factors and traffic crashes in New Zealand. Applied Economics 35: 179-188.

Sloan F, Reilly B, Schenzler C (1994) Tort liability versus other approaches for deterring careless driving. International Review of Law and Economics 14: 53-71.

Spanish General Directorate of Traffic (2004) Las principales cifras de siniestralidad vial. España 2004. Observatorio Nacional de Seguridad Vial, Madrid.

Spanish General Directorate of Traffic (2005) Informe 2003-04. Observatorio Nacional de Seguridad Vial, Madrid.

Young D, Bielinska-Kwapisz A (2003) Alcohol consumption, beverage prices, and measurement error. Journal of Studies on Alcohol 64: 235-238.

Young D, Bielinska-Kwapisz,A (2006) Alcohol prices, consumption, and traffic fatalities. Southern Economic Journal 72: 690-703.

Young D, Likens T (2000) Alcohol regulation and auto fatalities. International Review of Law and Economics 20: 107-126.

Table 1. Variables and descriptive statistics (1998-2002).

Variables	Description	Mean (S. Deviation)
Survey of Deaths by Cause, Spanish National Institute of Statistics		
Y_{it}=*RFT*	Rate of traffic fatalities (logistic transformation) by Autonomous Communities.	0.016 (0.03)
Statistic Yearbook about Labour Issues, Spanish Labour Ministry		
INCOMEDF	Labour cost per worker by Autonomous Communities. (in Euros deflated to 2001)	1313.932 (157.777)
Consumption Household Survey, Spanish Ministry of Food, Agriculture and Fishing		
CWINE	Annual consumption of wine per capita (Kg.) by Autonomous Communities.	12.301 (4.898)
CBEER	Annual consumption of beer per capita (Kg.) by Autonomous Communities.	8.848 (5.969)
CLIQUOR	Annual consumption of liquors per capita (Kg.) by Autonomous Communities.	2.971 (2.978)
PWINE	Price of wine by Autonomous Communities (Euros/Kg.)	2.839 (0.331)
PBEER	Price of beer by Autonomous Communities (Euros/Kg.)	1.154 (0.097)
PLIQUOR	Price of liquors by Autonomous Communities (Euros/Kg.)	7.729 (0.652)
Statistic Yearbook, General Directorate of Traffic		
SANCTION(t-1)	Number of sanctions (every 1000 citizens) by Autonomous Communities for the period t-1.	133.650 (179.099)
NDA	Number of novice drivers type A and A1 (every 1000 citizens) by Autonomous Communities for the period t.	0.927 (1.656)

We have also included dummies for year and region variables

Table 2. Estimation of the demand for alcoholic beverages.

	Wine Consumption			Beer Consumption			Liquor Consumption		
	Coef.	**S. Dev.**	**Elasticity**	**Coef.**	**S. Dev.**	**Elasticity**	**Coef.**	**S. Dev.**	**Elasticity**
PWINE	0.0024*	0.0014	0.4590	0.0005	0.0012	0.1230	0.0005***	0.0002	0.4205
PBEER	-0.0087**	0.0039	-0.6882	-0.0044	0.0034	-0.4884	-0.0013**	0.0005	-0.4358
PLIQUOR	-0.0002	0.0007	-0.1001	0.0003	0.0006	0.1959	-0.0001	0.0001	-0.0942
INCOMEDF	0.0007*	0.0004	0.7069	0.0001	0.0003	0.2139	0.0001	0.0000	0.0355
INTERCEPT	0.3799	0.6324	-	1.3538**	0.5598	-	0.1506*	0.0846	
F-Snedecor (Prob)	9.42 (0.00)			22.74 (0.00)			302.10 (0.00)		
R^2 *(Adjusted)*	0.5658			0.7709			0.9790		
R^2	0.6330			0.8063			0.9822		

Note: *** indicates individual significance at the 1% level; ** 5% level; * 10% level ;
Alcohol Consumption has been divided by 10;
The elasticity terms have been evaluated at the mean of the independent variables.

Table 3. Estimation of the rate of traffic fatalities.

	Model 2		
	Coefficient	**S. Deviation**	**Elasticity**
WINECONSUMPTION	0.0009	0.0010	0.0630
BEERCONSUMPTION	0.0019*	0.0012	0.0886
LIQUORCONSUMPTION	0.0135*	0.0078	0.2808
SANCTION(t-1)	-0.0004*	0.0002	-0.0344
NDA	-0.0004*	0.0002	-0.0218
INTERCEPT	0.0079***	0.0026	-

Note: *** indicates individual significance at the 1% level; ** 5% level; * 10% level ;
The SANCTION (t-1) variable has been divided by 100;
The elasticity terms have been evaluated at the mean of the independent variables.

Relación de títulos publicados en la colección ALCAMENTOS.

Nº	Autor/es	Título
0801	Juan Muro Cristina Suárez Maria del Mar Zamora	The impact of e-commerce on the tourist purchase decision: An empirical micro analysis
0802	Jhon James Mora Juan Muro	Diploma earning differences by gender in Colombia
0803	José Mª Arranz Ana I. Gil	Alcoholic beverages as determinants of traffic fatalities