Binge Drinking in the United States: Do Religion and Region Matter?

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Binge drinking has been the target of economic studies due to the negative factors associated with such behavior. Although many factors have been considered to influence binge drinking, this paper examines the role of religion and region. While it is generally believed that prohibition encourages more than it deters binge drinking, our results indicate that restrictions such as bans on alcohol purchases result in less binge drinking, and that both culture and region measures should be considered predominant factors.

I. Introduction

Binge behavior has long been the focus of economic studies, and the debate continues as to what causes individuals to engage in such behavior. In particular, the study of binge drinking of alcohol provides a specific case study of binge behavior in general. Binge drinking has long drawn the attention of social scientists due to societal problems linked to heavy drinking such as problem behaviors and health risks. Drinking and driving, sexual assault, injuries, and long-term health risks are all common problems associated with excessive drinking (Abbey, 1991, 2002; Hingson *et al.*, 2002; Perkins, 2002; Wechsler *et al.*, 1994).

Binge drinking has been the subject of studies such as Knight *et al.* (2003), Austin and Ressler (2012), Miron (2004), and Thornton (1991). These studies suggest that policy along with multiple other factors influence binge drinking and that prohibition often can have unintended consequences like political corruption, loss of civil liberties, and more potent products (Miron, 2004).

This paper adds to the current literature by attempting to measure the causes of binge drinking using a unique dataset, namely, county-level data collected by the Robert Wood Johnson Foundation measuring binge drinking, while also considering the role that religion and region play on binge drinking in the United States. Section II reviews the relevant literature on both binge drinking and the economics of prohibition, and Section III presents an empirical model with the expected theoretical relationships of explanatory variables and our measure of binge drinking. Section IV provides the results, and Section V provides concluding comments.

II. Literature Review

The National Institute on Alcohol Abuse and Alcoholism describes binge drinking to occur when a female consumes four drinks or more or when a male consumes five drinks or more within a two hour time period (NIAAA, 2012). In the United States today, much of the concern about binge drinking focuses on alcohol consumption among college students, with alcohol abuse among college students in particular being an area of concern for many years (Wechsler *et al*., 1994). The high severity of the problems associated with binge drinking has led many colleges to establish programs or bans to reduce drinking (Walters *et al*., 2000a, 2000b and 2001). Although public colleges and universities account for only 27 percent of four-year schools in the U.S., they comprise 68 percent of undergraduates. This implies that changes within the state college system could have a large impact on overall binge drinking activities and general alcohol consumption among students. Knight *et al*. (2003) found that although males tended to drink more heavily than females, there were less significant differences in the rate of drinking among legal versus underage drinkers and students living on campus and those living off-campus. They also found that heavy high school drinkers were linked to higher levels of alcohol consumption in college. Knight *et al*. concluded that "…strict alcohol policy enforcement practices by campus security may influence heavy drinking among students" (p. 696). However, particular weaknesses of this study include its reliance on nonobjective measures and a limited sample of schools.

A recent paper by Austin and Ressler (2012) studies the relationship between the use of designated drivers and alcohol consumption while controlling for workplace policies. While the authors note there has been little research into the variables that impact binge drinking itself, they suggest there is also some evidence that suggests behavior can be altered by workplace policy. In particular, they find that, after controlling for workplace policy variables when a designated driver was present, individuals were around 15 percent more likely to binge drink. They conclude that designated driver policies increase alcohol consumption.

Miron (2004) argued that prohibition had little effect on drug use and carried with it adverse consequences. Due to the quality and lack of data available on drug prohibition it is difficult to evaluate its effects (National Research Council, 2001; Horowitz, 2001). The most beneficial analysis comes from studying the prohibition of alcohol in the United States from 1920 to 1933. Miron concluded that prohibition cannot be proven to be directly responsible for decreasing cirrhosis deaths because rates had dropped dramatically by 1917 and started decreasing in 1908 (Miron, 2004). According to Miron, some of the more likely explanations for the decline were an increase in alcohol tax from 1916-1917, reduced immigration, the worldwide flu epidemic of 1918, and World War I. Miron found that, in general, drug or alcohol prohibitions seldom reduce consumption while resulting in unintended costs, including reductions in health, increases in crime, the destruction of civil liberties, and even the funding of terrorism.

Much of Miron's conclusions were supported in Thornton (1991), which found that prohibition causes political corruption, the promotion of crime, and overall higher prices. Corruption escalates with prohibition because politicians will accept bribes to protect those operating outside of the law. Prohibition will also cause a rise in crime due to the fact that the parties engaging in the transaction lack traditional methods of resolution. As prices for the prohibited goods rise, consumers demand substitutes and often, stronger and more dangerous products will result in order to compensate for the increased price. Thornton concludes that complete prohibition is impossible and the unintended consequences that result come at a high cost to society.

These studies suggest that many different factors can influence binge drinking and that binge drinking itself may result from prohibitions that increase the costs of drinking. They also suggest the intended effects of prohibition are quite limited and are overshadowed by unintended adverse consequences that can result in both the overconsumption of the prohibited good as well as increased demand for substitutes.

III. Model

Simple estimation by ordinary least squares is performed using the following equation (with descriptions of variables to follow):

$$Logit(Binge) = \alpha + \beta_1 LIQUOR\ STORE\ RATE + \beta_2 DRY\ COUNTY + \beta_3 MEDIAN\ AGE + \beta_4 COLLEGE + \beta_5 PER\ CAPITA\ INCOME + \beta_6 POPULATION + \beta_7 BAPTIST + \beta_8 EPISCOPALIAN + \beta_9 CATHOLIC + \beta_{10} NORTH + \beta_{11} MIDWEST + \beta_{12} SOUTH + \beta_{13} WEST + \varepsilon \tag{1}$$

The dependent variable, BINGE, is the measure of binge drinking by county in the United States. The use of this variable in particular improves on previous studies due to its computation through a study conducted by the Robert Wood Johnson Foundation in conjunction with the University of Wisconsin's Population Health Institute that ranked counties on several key health factors including the prevalence of binge drinking. This study will henceforth be cited as RWJ (2010). To the best of our knowledge, this unique binge drinking measure has not been utilized in empirical studies in the academic literature. The resulting measure is between 0 and 1 and is positively related to binge drinking. As suggested by Baum (2008) and Greene (1993), logit transformation was conducted on the binge measure for the computation of BINGE to correct for possible nonsensical predictions for extreme values for the regressors that can result in ordinary least squares regressions that contain doubly truncated dependent variables. Therefore, the dependent BINGE variable is the logit transformation of the percentage of binge drinkers by county, collected by the RWJ Foundation in 2010.

The first six explanatory variables are socio-economic measures by county that are expected to explain binge drinking. LIQUOR STORE RATE is the ratio of liquor stores to the county population and was compiled by RWJ (2010). This variable's expected sign is ambiguous, as counties with few liquor stores may either encourage binge drinking if drinkers believe their access to alcohol is limited (promoting overconsumption when accessed) or discourage binge drinking if decisions to binge are based on access to alcohol itself. DRY COUNTY is a dummy variable indicating whether a county prohibits the sale of alcohol. Dry counties are assigned a 1, while others are assigned a zero. (Although dry counties predominant in the American South, we counted 33 states that contain at least one dry county.) We expect an inverse relationship with BINGE if prohibitions increase the cost of drinking, thus causing drinkers to abuse alcohol when they can access it. MEDIAN AGE is the median age of the population and was compiled by the U.S. Census Bureau (2010). We expect an inverse relationship between the age of the drinker and the likelihood to binge drink. COLLEGE represents the percentage of college graduates in the population as was compiled by the U.S. Census Bureau (2010), and PER CAPITA INCOME measures the per capita income of individuals in the population and was compiled by the U.S. Census Bureau (2010). We expect an inverse relationship between both variables and binge drinking if bingeing is a low socio-economic activity. POPULATION represents the population of the county collected by

RWJ (2010). This variable was converted into logs. We expect a negative relationship assuming that with higher populations come more recreational substitutes available to binge drinking. (Although we considered including unemployment by county in the model, we decided to omit this variable out of concerns its high level of correlation with PER CAPITA INCOME was skewing our results.)

The next seven explanatory variables are the variables for religion and region by county that are expected to explain binge drinking. The three religion variables were collected from a survey conducted by the Religious Congregations and Membership Study 2000, conducted by the Association of Statisticians of American Religious Bodies which compiled statistics by county for 149 religious congregations or bodies in the United States. We chose to focus on the effects of Baptist, Episcopalian, and Catholic influences on binge drinking because these comprise the three largest national religious bodies in the United States and that they, directly and indirectly, affect cultural constraints on human action. For each congregation, we include the number of members for every 1000 people in each county. The effect of region on BINGE is measured with four dummy variables: North, Midwest, South, and West. Table 1 lists the region assigned to each state.

Table 1: States by Region

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

IV. Results

The results of ordinary least squares regressions are found in Table 2. Model 1 is a basic model showing the first six variables. In Model 1, LIQUOR STORE RATE is significant and positively correlated with BINGE, suggesting that access to alcohol affects binge decisions. The next variable, DRY COUNTY, is negatively correlated and significant, contrary to expectations. This result suggests that while prohibitions may or may not reduce general alcohol consumption, they do affect excessive drinking as measured by BINGE. Overall, the average percent of binge drinking was 11.5 percent with a confidence interval of 11.1 to 11.9 in dry counties and 14.1 percent with a confidence interval of 13.9 to 14.4 for non-dry counties. (Both intervals are calculated at the 95 percent confidence interval.) Due to the results of the Brown-Forsythe test of constant variance

(F = 15.9194, p = 0.0001), an unequal variance assumption is warranted. A two sample t-test showed a significant difference in the percent of binge drinking (t = -9.66, df = 717.23, $p < 0.0001$).

Both MEDIAN AGE and COLLEGE had the expected negative relationships with BINGE (although COLLEGE is not significant). Surprisingly, PER CAPITA INCOME has a positive relationship with BINGE which was unexpected as binge drinking is typically viewed as a low-income activity. POPULATION in Model 1 has a negative relationship with BINGE as was predicted, but is not significant.

Models 2-4 show the first six explanatory variables and add the individual religion variables to examine their impact and, with few exceptions, the signs and significances observed in Model 1 are consistent. The coefficient estimate for BAPTIST is negative and highly significant, the estimate for CATHOLIC is positive and highly significant, and the estimate for EPISCOPALIAN is positive but less significant than BAPTIST and CATHOLIC. These results suggest lower incidences of binge drinking in counties influenced by Baptist beliefs and higher incidences in counties influenced by Catholic beliefs. Interestingly, the inclusion of CATHOLIC in Model 4 causes COLLEGE to become positive (but insignificant).

Models 5-8 add the individual region variables to examine their relationship with BINGE. While all were significant, only SOUTH has an inverse relationship with BINGE, suggesting that relative to other parts of the country, binge drinking is less of a social problem in the South. Adding SOUTH to the model, however, causes POPULATION to become positive. Adding MIDWEST also causes POPULATION and COLLEGE to change signs (and become positive). With interesting exceptions, the results are consistent with expectations while expanding the model to consider the effect of religion and region suggests its robustness.

Table 2: Ordinary Least Squares Regression Results

Variable	Model 1 Coefficient	Model 2 Coefficient	Model 3 Coefficient	Model 4 Coefficient	Model 5 Coefficient	Model 6 Coefficient	Model 7 Coefficient	Model 8 Coefficient
LIQUOR STORE RATE	.0385** (4.03)	0.0190* (2.19)	0.0369** (3.87)	.0068 (0.77)	0.0330** (3.42)	0.0316** (3.55)	0.0081 (0.94)	0.0373** (3.93)
DRY COUNTY	-0.1247** (-4.20)	-0.0841** (-3.16)	-1234** (-4.17)	-0.1648** (-6.06)	-0.1318** (-4.45)	-0.0684* (-2.46)	-0.0930** (-3.53)	-0.1286** (4.35)
MEDIAN AGE	-0.0105** (-4.88)	- 0.01119** (-6.20)	-0.0101** (-4.73)	-0.0113** (-5.74)	-0.0119** (-5.49)	-0.0092** (-4.61)	-0.0113** (-5.92)	-0.0097** (-4.55)
COLLEGE	-0.0023 (-1.42)	-0.0031* (-2.14)	-0.0034* (-2.08)	0.0011 (0.77)	-0.0020 (-1.26)	0.0056** (3.64)	-0005 (0.35)	-0.0048** (-2.89)
PER CAPITA INCOME	0.000036** (14.34)	0.00002** (9.29)	0.00006** (14.19)	0.00002** (10.08)	0.00004** (14.11)	0.00002** (10.02)	0.00002** (9.72)	0.00004* (14.67)
POPULATION	-0.0130 (1.33)	-0.0035 (-0.41)	-0.0112 (-1.15)	-0366** (-4.08)	-0.0240* (-2.37)	0.0214* (2.33)	0.0119 (1.37)	-0.0071 (-0.72)
BAPTIST		-0.0015** (-25.58)	-	-	-	-	-	-
EPISCOPALIAN	-	-	0.0028** (3.37)	-	-	-	-	-
CATHOLIC	-	-	-	0.0034** (22.45)	-	-	-	-

Table 2: Ordinary Least Squares Regression Results: Continues

Variable	Model 1 Coefficient	Model 2 Coefficient	Model 3 Coefficient	Model 4 Coefficient	Model 5 Coefficient	Model 6 Coefficient	Model 7 Coefficient	Model 8 Coefficient
NORTH	-	-	-	-	0.1412* (3.97)	-	-	-
MIDWEST	-	-	-	-	-	0.3856** (20.09)	-	-
SOUTH	-	-	-	-	-	-	-0.4608** (-26.54)	-
WEST	-	-	-	-	-	-	-	0.1382** (5.09)
Constant	-2.1755** (-14.85)	-1.6547** (-12.48)	-2.1985** (-15.02)	-1.8153** (-13.44)	-1.9962** (-13.05)	-2.5679** (-18.65)	-1.8901** (-14.50)	-2.2631** (-15.41)
N	2593	2593	2593	2593	2593	2593	2593	2593
R^2	0.1763	0.3407	0.1799	0.3089	0.1813	0.2875	0.3527	0.1848

Dependent variable: BINGE (*t*-statistics in parenthesis)
** significant at 1% level or lower, * significant at 5%

It is unlikely that this data contains multicollinearity among the variables. For this to exist, the computed coefficients would possess large standard errors relative to the coefficients themselves. Our results show that the standard errors are generally close in size to the corresponding coefficients. Specification error exists in the presence of any misspecification of the explanatory variables. To ensure that no further misspecification bias occurred in the model, Ramsey's RESET test was utilized. To carry out this test, a second regression was run including the values for estimated values of BINGE raised to the second, third, and fourth powers for a total of three new regessors. This yielded a new R^2, referred to below as "R^2 (new)". Ramsey's RESET test is an *F*-test computed in the following manner:

$$F^* = [R^2(\text{new}) - R^2(\text{old})] / 3 \text{ (new regressors)}$$

Therefore, in Model 1, the *F*-statistic is computed as $F^* = (22.85-17.63)/3 = 1.74$. Since 1.74 is less than the critical value of $F(3, 2584) = 3.78$, the null hypothesis that this model is correctly specified as linear cannot be rejected. (The Ramsey RESET test was computed in the remaining models. The results are available from the authors upon request.)

The results of a White's test for heteroskedasticity suggest the presence of heteroskedasticity in the data with a χ^2-test statistic of 180.68, which exceeds the corresponding critical value when df = 25. This result can affect the standard errors and, by extension, lead to distorted *p*-values. However, the results of a White's correction test resulted in *p*-values and significance levels similar to the results derived in the original regressions, an outcome that is congruent with the assumption that heteroskedasticity problems are unlikely in large sample sizes such as our own. Similarly, although diagnostic plots resulting from our regressions indicate a slight deviation from normality, we are confident our regression is robust to slight violations of the normality assumption due to the large sample size.

Interaction Terms

In order to examine the relative strengths of religion and region, we reran Model 1 with interaction terms combining the individual religion measures with the regions. The results are shown in Table 3 and suggest the predominance of region over religion. While the results for Baptists, Episcopalians, and Catholics are all positively related to BINGE when they interact with NORTH, MIDWEST, and WEST, they are all inversely related to BINGE when they interact with

SOUTH. This means that Catholics in the South are less likely to binge drink and that Baptists in the other three regions are more likely to binge drink. To further test how the region affects the percent of binge drinking, we performed a one-way analysis of variance (ANOVA). Due to the heterogeneity of the variance detected by Levene's test, a Welch ANOVA was implemented. At the 0.05 level of significance, a significant difference in binge drinking by region was detected ($F = 390.53$ ndf = 3, ddf = 807, $p < 0.0001$). A Tukey post hoc comparison indicates that binge drinking rates in the North and Midwest are significantly higher than the other two regions, while the binge drinking rate in the South is significantly lower than the other three regions.

Table 3: Interaction Variable Results

Variable	NORTH	MIDWEST	SOUTH	WEST
BAPTIST	0.0056***	-		
	(3.54)			
EPISCOPALIAN	0.0041*	-		
	(1.75)			
CATHOLIC	0.0003***	-		
	(2.60)			
BAPTIST		0.0003*		
		(1.86)		
EPISCOPALIAN		0.0098***		
		(8.57)		
CATHOLIC		0.0017***		
		(22.24)		
BAPTIST	-		-0.0014***	
			(-25.25)	
EPISCOPALIAN	-	-	-0.0127***	
			(-9.09)	
CATHOLIC	-	-	-0.0002	
			(-1.57)	
BAPTIST	-	-	-	0.0015***
				(3.47)
EPISCOPALIAN	-	-	-	0.0050***
				(3.45)
CATHOLIC	-	-	-	0.0007***
				(5.93)
N	2593	2593	2593	2593
R^2 BAPTIST	0.1799	0.1771	0.3390	0.1798
R^2 EPISCOPALIAN	0.1773	0.1991	0.2018	0.1801
R^2 CATHOLIC	0.1785	0.3086	0.1771	0.1874

Dependent variable: BINGE (t-statistics in parenthesis)
*** significant at 1% level or lower, ** significant at 5% or lower, * significant at 10% or lower

While religious beliefs help shape regional cultures (and constraints), the results for the interaction terms suggest that individuals belonging to minority religions (such as Catholics in the South or Baptists in the North, Midwest, and West) conform to region in which they reside. Region appears to play a more important role than religion does on binge drinking.

V. Conclusion

This paper adds to the literature on factors that influence binge drinking by considering the role that religion and region play and finds that regional constraints influenced in part by the dominant religion also affect the likelihood to binge drink by adherents to minority religions. It also finds that blanket prohibitions on drinking, whether explicit (in the case of dry counties) or implicit (by low access to liquor stores or via religious teaching in the case of counties influenced by Baptist beliefs regarding alcohol consumption), may cause individuals to binge drink less regardless of their effect on drinking in general. The relationship measured herein regarding per capita incomes and binge drinking is probably even more surprising because binge drinking is often viewed as a low income activity and these models show otherwise.

The interaction variable results also depict some interesting results. They show the region seems to play a more important role than religion in binge drinking. They suggest that prohibitive policies that discourage drinking in general do not necessarily promote binge drinking, and that in fact explicit or implicit prohibitions of alcohol consumption in general, while penalizing the majority of drinkers who do not binge or otherwise drink irresponsibly, may have the effect of reducing instances of binge drinking and the problems that result from it.

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