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Effectiveness of Beer Keg Registration Law on Decreasing Underage Binge Drinking

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Introduction

Since the prohibition act of 1919, alcohol has always had high economic costs and benefits. While it increases revenues for the Federal Government through taxation and company profits, there are, unfortunately, several costs that impact society. These costs, also known as negative externalities, include a variety of actions like alcohol related traffic accidents, increased crime, and excessive binge drinking. A negative externality is described as "a cost that is suffered by a third party as a result of an economic transaction," in which the third party is indirectly affected (MaClean, 2013). In the case of alcohol, society is the third party being inadvertently affected by the transactions of producers and consumers. In order to reign in on some of the economic costs related to alcohol, Federal and State Governments have enacted various laws to try and limit or prohibit activities that cause these negative externalities. And even though there have been numerous studies done in economics to evaluate the effectiveness of said laws, conclusions still remain convoluted. In this study, I hope to unravel some of the complexity surrounding the effectiveness of one relatively understudied topic in economics: beer keg registration laws. This specific law requires that there be a tag/sticker with a unique identification number attached to each keg sold. This law only includes kegs exceeding a certain limit, usually a two to eight gallon minimum depending on the state (Figure 1). When the purchaser receives an identifying number with their keg, they must also leave information with the retailer, such as name, address, and telephone number ("APIS," n.d.). During my study I would like to look at adolescent use of alcohol and assess the effectiveness of this law on limiting their binge drinking.

Unfortunately, "all of the leading causes of morbidity and mortality among teenagers are one-third to one-half attributable to alcohol" (Harwood, Silianoff, Toomey & Wagenaar, 2005,

p.360). It is this reason that I find laws attributed to hindering alcohol consumption of adolescents to be imperative for further study. It is beer keg registration law that is of special importance because alcohol of this type is often times most readily available to teens. Kegs offer adolescents large quantities of alcohol at low prices and ultimately lead to a considerable number of cases of underage binge drinking (appendix-figure 2). Since registrations force individuals to take responsibility for purchasing a keg, there is hope that it would be less likely for those that are of legal age to supply minors. If one policy was found that helped to significantly limit underage drinking, like these keg registrations, a Federal law could be enacted that would meaningfully reduce this negative externality.

For my study I have hypothesized that a beer keg registration law would have a negative association with young adult binge drinking. The meaning of that being that for each registration law we would see some kind of meaningful decline in the binge drinking per month. In my literature review I found several studies that have looked at similar variables regarding keg registrations. My analysis builds off some of these exploratory studies by isolating particular variables, accounting for more control variables in my equation, and using number of binge drinking days as my dependent variable rather than an independent. Three particular studies that aided in my research were: an exploratory study by Ringwalt and Paschall on the utility of keg registrations, an article by the National Institute on Alcohol Abuse and Alcoholism (NIH), and "Measuring public policy: The case of beer keg registration laws."

Literature Review

According to the NIH 1.4 million American teens were binge drinking on five or more days a month. This is just one of the startling statistics they put forth in their September 2015 article, "Underage Drinking" (2015). In their article the authors studied multiple factors as to

why teens participate in binge drinking, the reasons it is potentially so dangerous, and approximately how many teens join in on drinking activities. They also state the definitive definition for binge drinking as: "For adults, it [binge drinking] means drinking so much within about 2 hours that blood alcohol concentration (BAC) levels reach 0.08g/dL, the legal limit of intoxication" ("Underage," p. 3). Notice this definition is for adults and the number of drinks it takes for children to reach this limit of intoxication can be as little as three drinks for girls aged 9-17. And while often people believe there are other vices our youth choose to use, figure 2 shows that when compared to things such as cigarettes and marijuana, alcohol consumption is continually higher ("Underage," p. 1-2).

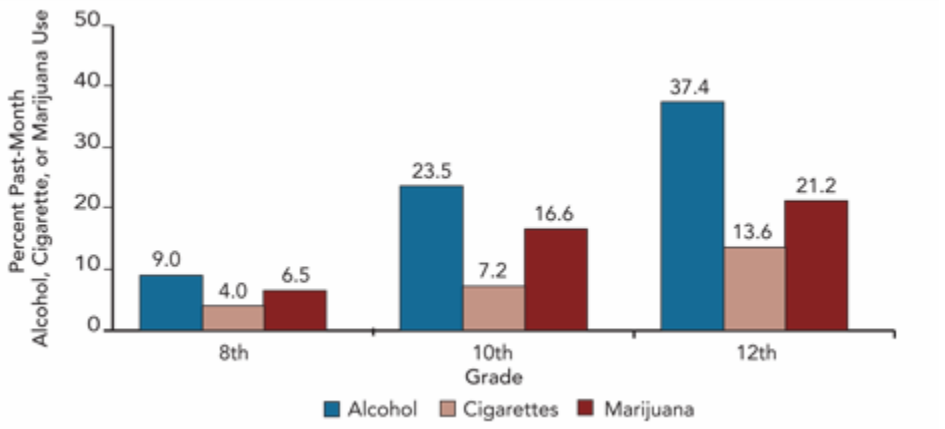

Figure 2 – Sourced from NIH "Underage Drinking"

For these reasons the NIH agrees that further environmental interventions, like policy enactments, are necessary to limit and prevent underage drinking.

Unfortunately, in the case of alcohol limiting policies it becomes increasing difficult to measure their effectiveness across state borders due to jurisdictional variabilities. After prohibition was repealed with the 21st Amendment, states were granted the right to control and create policies regarding alcohol within their own borders. So today while some states may each have a keg registration law they could vary "considerably in statutory and regulatory provisions

and implementation procedures" (Harwood, et al., 2005, p. 359). In the article, "Measuring public policy: The case of beer keg registration laws," the authors conducted research to evaluate the similarities between the state's registration laws. Some of their conclusions were that all state laws clearly target the sellers with responsibility for information collection, and that most states also require the keg registration forms that are filled out at time of purchase to be held onto for some required amount of time. As well, they found that with this registration, law enforcement was given direct access to each of those provisions at any time if deemed necessary. Lastly, the authors found that 19 out of 21 states currently having enacted a registration law have listed the size requirement mentioned earlier (two-eight gallons). Knowing some background of this policy is extremely important when needing to analyze the effects it will have on young adult binge drinking (Harwood, et al., 2005, p. 359-361). Also noting that most of the provisions of the state laws are similar can make comparisons slightly more accurate.

A few years after the policy analysis of the keg registration law was concluded the original exploratory study of the association between keg registration laws and underage binge drinking was completed. In late 2009, an article titled, "The Utility of Keg Registration Laws: A Cross-Sectional Study," was the first to look at the strength of the registrations on variables such as: beer consumption on a whole throughout states, adolescent binge drinking, and drinking and driving (Paschall & Ringwalt, 2010, p. 106). Authors, Ringwalt and Paschall (2010), collected data concerning years until 2006 from the Alcohol Policy Information System and hypothesized negative associations of the keg registrations with each of their variables. After they completed their analysis they did indeed find a negative association with each. But, in the end they concluded that in their exploratory study "…states' keg registration laws *per se* were unrelated to a variety of outcomes related to *per capita* beer consumption, the prevalence of adolescent binge

drinking, and the prevalence of adolescents who drove after drinking or rode in cars whose drivers had done so" (p. 107). They listed a number of limitations that could have hindered their research, like acknowledging the need to account for state level differences in not only strictness of registration policy but also underage drinking habits. Although they stated that future studies could eliminate these limitations by using a number of different techniques, leaving future analysis open Paschall & Ringwalt, 2010).

Methodology

This study uses a multinomial logistic regression, or logit model because the dependent variable is a categorical variable. The dependent variable, NT5drink, is the number of days of binge drinking in the previous month and therefore may only take on a specified number of outcomes. Those outcomes being: 1-30/31, depending on the month ("Logistic," 2015). The model in this analysis looks at a regression equation between anykeg and NT5drink. With a null hypothesis (H_0) of, states having a beer keg registration law will have no effect on the number of binge drinking days last month. I am going to be testing this against my hypothesis, (H_a), which is that because there is a keg registration law in place this will lead to a decline in the overall number of binge drinking days in the last month. All results were received and analyzed through Stata, where a regression model was formulated based off an original model. This model is as follows:

$$\text{NT5drink} = \beta_0 + \beta_1 \text{anykeg} + \beta_2 \text{vertical} + \beta_3 \text{scanner} + \beta_4 \text{beertax07} + \beta_5 \text{host} + \beta_6 \text{latino} + \beta_7 \text{white} + \beta_8 \text{black} + \beta_9 \text{asian} + \beta_{10} \text{indian} + \beta_{11} \text{female} + \beta_{12} \text{employment} + \beta_{13} \text{income} + \delta_0 \text{educat} + \delta_1 \text{state} + \delta_2 \text{year} + \mu$$

Clarifying the figures used above, β is representative of a coefficient that will be produced after regression is ran and δ is used to show a dummy variable that will be used in Stata. Lastly, in the above equation, μ is a placeholder for the error term in my model. Table 1 in the appendix summarizes descriptions for each of the independent variables. The focus of this study was the explanatory variable anykeg. The importance of the other explanatory variables is to make sure to take into account a variety of other factors that could be affecting why someone may or may not be participating in binge drinking. Things like race, gender, and various other alcohol policies implemented in the state needed to be accounted for in the model. Also by using a multiple regression like this I am able to see if there is perhaps a variable that effects NT5drink more than anykeg, after my analysis is ran. Though, in economics, ceteris paribus, a keg registration law should cause a decrease in the number of days spent binge drinking and therefore we should expect a negative association with β_1 anykeg and NT5drink.

Results

This analysis uses data from the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System (BRFSS). The pooled cross sectional data comes from a telephone survey of households that "provide(s) state estimates for a variety of health related behaviors, including binge drinking." BRFSS collected the individual (voluntary) level survey for a period of twelve years from 1998-2010 (Gitelman, Paschall, & Ringwalt, 2010, p. 80). It was stated that the purpose of their study was, "to examine whether state level prevalence estimates of binge drinking that are based on survey data are associated with alcohol sales…" (Gitelman, et al., 2010, p. 180). In their survey they asked for information from adolescents/young adults ranging in age from 18-29 (Appendix: Figure 3). The questions

requested information like income and education level, if they were employed at the current time, how many underage people (under age 18) were living in their household, and if they had previous engaged in binge drinking over the past month. Over this twelve year period (1998-2010) these surveys were being conducted over the telephone monthly, nationwide.

The BRFSS data set used in this analysis was expansive, taking into account 52 variables. Of those, this study used the following independent variable: anykeg, vertical, scanner, beertax07, host, Latino, White, Black, Asian, Indian, female, employment, i.educat, income, i.state, and i.year (see Appendix: Table 1). Unfortunately since these surveys were voluntary there is risk that information provided is not completely truthful. These answers are taken on the good faith of each individual who participated. As well, this data is limited in that some states still have some differing policies regarding their registration laws, so therefore jurisdictional errors could present themselves in the results. And during the twelve year period some states did not have a registration law and did not initiate one until the later years of surveys. All of these limitations to the data should be noted when delving into the regression results. Advantageously though, this data set contained almost 450,000 observations for comparison, of which my regression used 212,118.

In my regression results the explanatory variable of anykeg was found to be not significant. While it did have a negative coefficient, like hypothesized, -0.0186 is not substantial enough to have any significance on the number of days engaged in binge drinking. This means that when increasing by one binge drinking day last month, having a beer keg registration law initiated only helped to discourage that by -0.0186 of a point. Unfortunately, in the long run this is not going to be very effective in preventing underage binge drinking on a large scale. Also, at a 5% significance level the p-value calculated for anykeg was 0.711, which is not smaller than

0.05 and therefore I could only fail to reject the null hypothesis. I would also have to fail to reject the null hypothesis at either a 1% or a 10% significance level (Wooldridge, 2013). This means that with the available data from this dataset there is not sufficient evidence against the hypothesis of: "states having a beer keg registration law will have no effect on the number of binge drinking days last month." Table 2 in the appendix describes in detail all results of this analysis, including coefficients and standard errors of all variables (rounded to the nearest ten thousandth of a point).

Looking further at my regression results, according to my R^2 value, only 5.5% of the total variation in the results can be attributed to the regression analysis. While this is not a very high R^2 value, it is important to note here that R^2 values do not indicate whether there is a causal interpretation; it does not suggest whether or not the correct model/regression was used, and it can also not offer any indication of whether all variables were accounted for ("Coefficient," 2015). So, after deeming my initial variable of interest, anykeg, not significant, I chose to look at a few other variables in my model. Those variables were a selection of the other alcohol policy variables I included in the regression equation: scanner, host, and vertical. For a brief background, scanner refers to the scanner law that requires the proper identification of anyone purchasing alcohol be scanned in order to verify age. A vertical law refers to the license of anyone who is under the legal age of 21 will retain a vertical identification as opposed to a horizontal one, and a host law is the social host law that imposes responsibility on the host in supplying/serving alcohol to minors. The reason I chose these was due to their similarity in type of variable to the original one I was observing. Of these three other policy variables I found only vertical to be significant at the 5% significant level, with a p-value of 0.016. For this case we could create two hypotheses as well. H_0 would be the same as before except with vertical laws

instead of keg registrations, so we would have: H_0 = states having a vertical law will have no effect on the number of binge drinking days last month. Then H_a = states having a vertical law would see a decline in the number of binge drinking days in the past month. In this case, we would have sufficient evidence to reject the null hypothesis. The other two, scanner and host, had p-values of 0.941 and 0.641 respectively and therefore were not significant at the 5% level (Wooldridge, 2015). So with these results although I found that anykeg was not economically significant to NT5drink, with my regression I was able to observe a possible variable of significance, vertical. In future studies perhaps this variable could be looked at further.

Conclusion

From the regression analysis performed, we can conclude that, for this particular dataset, the fact that a state has a keg registration law in place has no effect on the number of binge drinking days in a given month. My coefficient for the independent variable of interest, anykeg, was not statistically significant, with only a negative association of -.0186. It would be unable to make any impact across the population. I was also unable to reject my original null hypothesis at any significance level (1, 5, or 10%). However, there are several limitations to this dataset that may cause my conclusions to be misleading. In general due to the fact that this study included data collected across various states, there may be errors due to policy implications in one state not carrying forward into another. There was no way for this to be accounted for in the regression model, other than finding a data set separate for each state. In future research this could be pursued further in order to account for various jurisdictional errors to the fullest extent. Another limitation found was when using surveys there is always the possibility of falsified records due to human dishonesty. Unfortunately, as mentioned earlier, these surveys were given in hopes that

all respondents were voluntarily giving their most truthful and meaningful answers. This assumption was upheld through all of the analyses made previously

For future extensions of this research I believe it would be helpful to obtain more specified surveys of each state. Therefore after regressions are run comparisons can be made to see if one state's legislation is performing at standards higher than another. As well, all these policies could be looked at across gender, race, or income level groups to see effectiveness in subgroups of populations. Although there were limitations observed in this analysis, there are future options for study, and this provides a firm foundation for which those can be established.

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Appendix

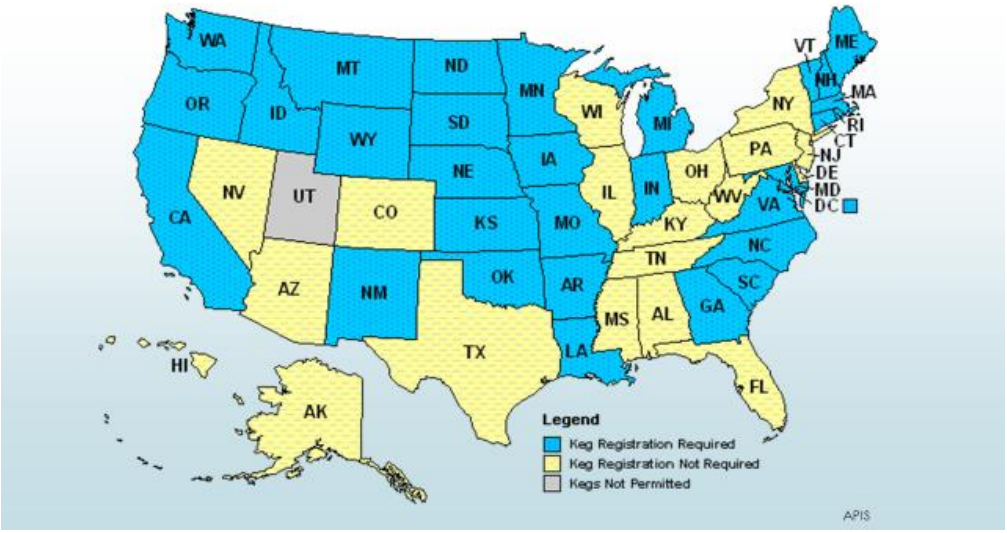

Figure 1: Representation of all current states with keg registration laws
Sourced from: alcoholpolicy.niaaa.nih.gov

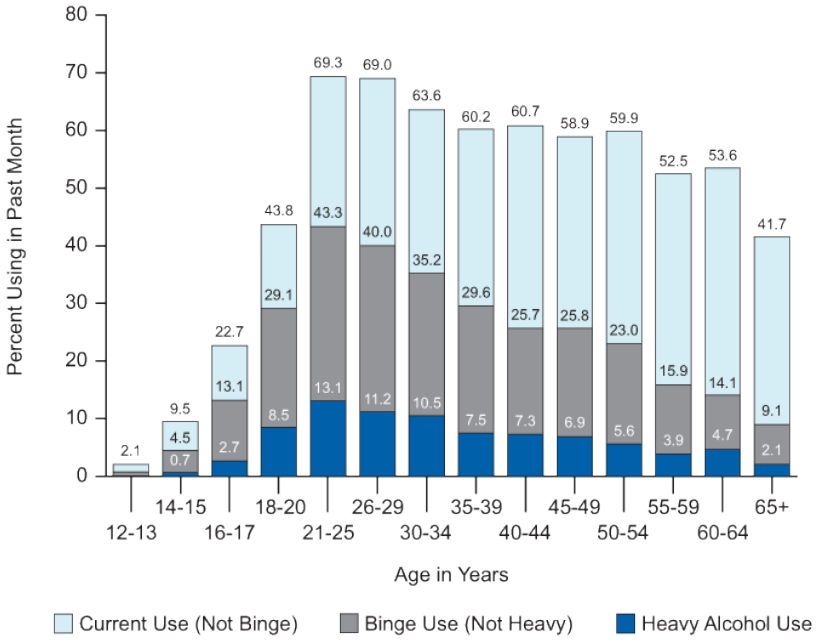

Figure 3: Highest percentage of binge users are in 18-29 age range
[*Age Range of BRFSS survey]
Sourced from: www.samhsa.gov

Table 1: Independent Variable Descriptions

Independent Variable	Description
anykeg	Keg Registration or Label Law Enacted
vertical	State Vertical ID Law Enacted
scanner	State Scanner ID Law Enacted
beertax07	2007 Constant Beer Tax
host	State Host Law Enacted
latino	Hispanic
white	Nonhispanic White
black	Nonhispanic Black
asian	Nonhispanic Asian
indian	Nonhispanic American Indian
female	Gender=Female
employment	Indicator for working
i.educat	Dummy Variable Education
income	% Income
i.state	Dummy Variable State
i.year	Dummy Variable Year

Table 2: Regression Results Summary

Dependent Variable:	**NT5drink**
Independent Variables	**(1)**
anykeg	**-.0186**
	(.0499)
vertical	**.0997**
	(.0402)
scanner	**.0050**
	(.0663)
beertax07	**.0011**
	(.0029)
host	**-.0200**
	(.0426)
latino	**-.5230**
	(.0643)
white	**-.1944**
	(.0652)
black	**-.7611**
	(.0703)
asian	**-.8010**
	(.0708)
indian	**.2079**
	(.1121)
female	**-1.5347**
	(.0327)

employment	**.0178**
	(.0047)
income	**-.0039**
	(.0004)
_Ieducat_2	**-0.4770**
	(0.5174)
_Ieducat_3	**-0.7033**
	(0.4936)
_Ieducat_4	**-1.0149**
	(0.4896)
_Ieducat_5	**-1.2070**
	(0.4841)
_Ieducat_6	**-1.6729**
	(0.4817)
_Istate_2	**-0.3257**
	(0.0802)
_Istate_4	**0.1525**
	(0.2805)
_Istate_5	**-0.0035**
	(0.2578)
_Istate_6	**0.0614**
	(0.2714)
_Istate_8	**-0.1060**
	(0.2996)
_Istate_9	**0.0059**
	(0.2715)
_Istate_10	**0.4013**
	(0.2757)
_Istate_11	**0.3167**
	(0.2965)
_Istate_12	**-0.0788**
	(0.1790)
_Istate_13	**-0.1792**
	(0.1671)
_Istate_15	**0.2091**
	(0.0541)
_Istate_16	**-0.1320**
	(0.2691)
_Istate_17	**0.3408**
	(0.2758)
_Istate_18	**0.0560**
	(0.2845)
_Istate_19	**0.1813**
	(0.2611)
_Istate_20	**-0.1159**
	(0.2656)
_Istate_21	**-0.0517**
	(0.3011)
_Istate_22	**0.0735**
	(0.2242)
_Istate_23	**-0.0110**

	(0.2257)
_Istate_24	0.0414
	(0.2985)
_Istate_25	0.1778
	(0.3021)
_Istate_26	0.0276
	(0.2631)
_Istate_27	0.1458
	(0.2803)
_Istate_28	-0.1346
	(0.1927)
_Istate_29	0.2510
	(0.3156)
_Istate_30	0.0655
	(0.2844)
_Istate_31	0.0484
	(0.2297)
_Istate_32	0.1461
	(0.2863)
_Istate_33	-0.0410
	(0.2414)
_Istate_34	0.0923
	(0.2901)
_Istate_35	-0.2387
	(0.1940)
_Istate_36	0.0902
	(0.2895)
_Istate_37	-0.2753
	(0.1652)
_Istate_38	-0.0362
	(0.2801)
_Istate_39	0.1422
	(0.2738)
_Istate_40	-0.2601
	(0.1963)
_Istate_41	0.0071
	(0.2992)
_Istate_42	0.1120
	(0.3014)
_Istate_44	0.2187
	(0.2899)
_Istate_45	0.1548
	(0.0902)
_Istate_46	-0.0595
	(0.2478)
_Istate_47	-0.4456
	(0.2864)
_Istate_48	0.1254
	(0.2625)
_Istate_49	-0.0885
	(0.2121)

_Istate_50	**0.1391**
	(0.2402)
_Istate_51	**-0.0012**
	(0.2439)
_Istate_53	**-0.2694**
	(0.2460)
_Istate_54	**0.3959**
	(0.2716)
_Istate_55	**0.3172**
	(0.3056)
_Istate_56	**- 0.0019**
	(0.3210)
_Iyear_1999	**-0.0842**
	(0.1079)
_Iyear_2000	**0.0800**
	(0.1108)
_Iyear_2001	**-0.0616**
	(0.1038)
_Iyear_2002	**0.0360**
	(0.1119)
_Iyear_2003	**0.0338**
	(0.1105)
_Iyear_2004	**-0.1189**
	(0.1111)
_Iyear_2005	**-0.2877**
	(0.1095)
_Iyear_2006	**-0.1355**
	(0.1148)
_Iyear_2007	**-0.1337**
	(0.1132)
_Iyear_2008	**-0.0849**
	(0.1174)
_Iyear_2009	**-0.1385**
	(0.1179)
_Iyear_2010	**-0.2387**
	(0.1166)
_Iyear_2011	**-0.5463**
	(0.1981)
Intercept	**4.0871**
	(.5183)
Number of Observations	**212,118**
R-squared	**0.0551**

[All Results Rounded to the Nearest Ten Thousandth of a Point]