

THE EFFECT OF MARIJUANA AVAILABILITY ON ALCOHOL USE:

EVIDENCE FROM MARIJUANA LEGALIZATION

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Abstract

This paper analyzes the impact of marijuana legalization in Colorado on alcohol consumption. The empirical analysis is based on a sample of adults ages 18-39 from Colorado, Utah, Arizona, New Mexico, Wyoming, Nebraska, and Kansas over the years 2008-2013. Using data from the Center for Disease Control's Behavior Risk Surveillance Survey, this research finds that there is no statistically significant effect of the legalization of marijuana on alcohol consumption. Therefore, this study can neither confirm nor refute the hypothesis that the two goods are substitutes or complements. Furthermore, this research finds that marijuana legalization has no significant effect on smoking or BMI.

1. Introduction

The legalization of marijuana has long been a topic of debate in the United States. The most obvious effects of legalization would be increased consumption and availability of marijuana along with higher state tax revenues, but there could be other unintended consequences. For example, legalization could potentially decrease or increase alcohol consumption, depending on whether marijuana and alcohol are substitutes or complements. The legalization of marijuana will greatly increase the supply of the good thereby reducing the price of consumption. If marijuana and alcohol are substitutes, there will be a shift in the demand curve for alcohol and a subsequent reduction in use. In a similar manner, if alcohol and marijuana are complements, we would expect demand for alcohol to increase after legalization.

Prior studies have focused on the relationship between alcohol and marijuana consumption using policies that affect the availability of alcohol, specifically the raising of the minimum drinking age. Most of these studies found that lowering the availability of alcohol led to a subsequent increase in marijuana consumed by adolescents, suggesting that the two goods are substitutes (DiNardo and Lemieux, 1992; Chaloupka and Laixuthai, 1994; Crost and Guerrero, 2012). Other studies show that while availability of alcohol may have been limited by this policy the early use of alcohol encourages adolescents to experiment with marijuana, implying that the

two goods are complements (Pacula, 1998). Neither of these relationships has been confirmed through the analysis of individual demand equations for alcohol and marijuana.

In this paper, I examine the joint consumption of marijuana and alcohol. I evaluate the effect of a particular government intervention – the legalization of marijuana in Colorado – on the consumption of both substances in a simple demand theoretic framework. I use the immediate surrounding states that did not legalize marijuana in the three years preceding and the year following legalization as a comparison sample. This legislation creates a “natural experiment” in which I can obtain estimates of the causal effect of the legalization of marijuana on alcohol consumption. Unlike previous studies that examine the effect of the minimum drinking age law on alcohol and marijuana consumption, the legalization of marijuana offers a unique opportunity to explore the same economic question from a different perspective. The data sample for this analysis also covers a wider age group than previous studies, which focus on young adolescents.

Using data from the Center for Disease Control’s Behavioral Risk Factor Surveillance System, this study shows that marijuana legalization has no statistically significant effect on alcohol consumption. Therefore, this analysis does not support previous findings that the two goods are either substitutes or complements. Furthermore, marijuana legalization has no statistically significant effect on smoking or BMI. However, due to the timing of this study and the lack of available data, this topic may require further investigation as the effects of the law continue to become clearer.

2. Background

2.1 History of Marijuana Legislation

Laws regarding the use of both medical and recreational marijuana were previously uniform throughout the United States. Congress effectively criminalized the drug in 1937 with the passage of the Marijuana Tax Act, which restricted possession of the drug to those who paid an excise tax for authorized medical and industrial uses. In 1956 the Narcotics Control Act set

mandatory sentences for marijuana-related offenses, but the minimum sentence was repealed in 1970 because it was deemed too harsh. The most recent federal marijuana law was passed in 1986 and resulted in raised federal penalties for possession and dealing. Since then, individual states have taken to passing their own legislation concerning medical marijuana. California was the first state to legalize medical marijuana in 1996, and 22 other states have followed suit since then.

In November 2012, Colorado and Washington became the first states to pass initiatives that effectively legalize marijuana. For the purposes of this study, the focus will be on Colorado and the immediate surrounding states because marijuana was available for sale earlier in Colorado. While marijuana remains illegal at the federal level, the U.S. Department of Justice announced in August 2013 that they “will defer the right to challenge their legalization laws at this time.” Under the new law, anyone over the age of 21 can legally purchase one ounce of recreational marijuana per transaction. The law does not place any limits on the amount an individual can possess. While the law went into effect in 2012, marijuana retail outlets were not opened in Colorado until January 1, 2014. Because survey data is only available through 2013, this analysis does not incorporate the delayed opening of marijuana retail outlets.

2.2 Prior Research

There is some research on the link between marijuana and alcohol. DiNardo and Lemieux (1992) were one of the first to examine this relationship. Their study focused on the impact of the increase in the minimum drinking age on the prevalence of alcohol and marijuana use among high school seniors. Using aggregated state data from the Monitoring the Future Survey, they estimated a model for alcohol and marijuana consumption using the minimum legal purchasing age, the average regional price of beer, state decriminalization status, and a price for marijuana when necessary. DiNardo and Lemieux found that the law change caused a slight decrease in the prevalence of alcohol use and a slight increase in marijuana use, effectively concluding that the two are substitutes in consumption.

Chaloupka and Laixuthai (1994) found similar results in their study on the success of the “War on Drugs.” They used data from the same survey as DiNardo and Lemieux to estimate a model of the different frequencies of alcohol use among adolescents. Teenage drinking and adolescent binge drinking were estimated as functions of the price of alcohol, legal drinking ages, and the price of marijuana. The price of marijuana was determined by the presence or absence of decriminalization and data from the DEA. Two different regressions were run using the wholesale price of marijuana and the retail price of marijuana, each returning different results. While Chaloupka and Laixuthai concede that there was clearly measurement error in the marijuana money price data, they found statistically significant results supporting a substitution effect between marijuana and alcohol when they used the wholesale price of marijuana.

Conversely, Pacula (1997) found in her study that alcohol and marijuana were economic complements. She used data from the National Longitudinal Survey of Youth to determine that the federal tax on beer has a negative and significant effect on the demand for both alcohol and marijuana. The major difference between this study and those above is that Pacula estimated an individual level demand equation and includes additional proxies for the price of marijuana and cigarettes. She cites Kandel and Maloff (1983) and Ellickson and Hays (1991) in arguing that early use of alcohol encourages adolescents to experiment with marijuana, further implying that the two are complements.

In a more recent study, Crost and Guerrero (2012) use the increase in the minimum drinking age to examine the impact of increased alcohol availability on marijuana use. They formulate a model using data from the National Survey of Drug Use and Health to determine the probability and use of both alcohol and marijuana and to compare people who have just turned 21 and people about to turn 21. In doing this, they assume that these people are similar in characteristics that determine substance abuse, apart from the ability to legally purchase alcohol. Crost and Guerrero concluded that the consumption of marijuana decreases sharply at age 21 while the consumption of alcohol increases, suggesting that the two are substitutes.

3. Data

The Behavior Risk Factor Surveillance System (BRFSS) is an annual survey conducted by the Center for Disease Control in all 50 states as well as the District of Columbia and three U.S. territories. BRFSS conducts over 400,000 adult telephone interviews each year, gathering data on health-related risk behaviors, chronic health conditions, and use of preventative services. Response rates vary by state but usually range from 30-70%. In recent years BRFSS has expanded the interviews to both landline and cellular phones, thereby increasing the response rate. In response to popular demand, the CDC has also expanded the number and depth of the interview questions.

Due to the extensive nature of the survey, detailed information about individual respondents is available. For the purposes of this study, personal characteristics such as age, sex, race, health status, income, and education are very helpful because they can have an impact on an individual's choice to consume alcohol or marijuana. There are also multiple measures of alcohol use as well as smoking habits, which are of particular importance to this study. Many of these variables are categorical, so dummy variables were created in order to accurately depict their effect. Dummy variables were also created for state and year variables. A treatment variable was also created to account for the effect of a response from Colorado in either 2012 or 2013 (i.e. after marijuana had been legalized in 2012).

Table 1 provides the descriptive statistics for the sample of observations used in this analysis. Approximately 18% of the original sample was lost due to missing data, refusals to answer survey questions, or lack of knowledge regarding the answer to a survey question. The sample was further restricted to individuals between the ages of 18 and 39 living in Colorado, Wyoming, Utah, Kansas, New Mexico, Arizona, Oklahoma, and Nebraska. These states were included because they share a border with Colorado, the treatment state. Of the states in the sample, only Colorado, Arizona, and New Mexico have legalized medical marijuana. Data was

Table 1
Variable definitions and descriptive statistics

Category	Variable	Description	Mean	Standard deviation
Alcohol	Alcohol last month	Number of days in last 30 days <i>R</i> had at least one drink of any alcoholic beverage	6.682	6.804
	Average drink	Average number of drinks consumed on days <i>R</i> drank	2.797	2.631
	Binge drink	Number of times in past 30 days <i>R</i> had 5 or more drinks for men or 4 or more drinks for women on an occasion	1.444	3.446
	Max drink	Largest number of drinks <i>R</i> consumed on any occasion	4.508	4.23
Smoke	Smoke	DV=1 if <i>R</i> ever smoked at least 100 cigarettes (5 packs), 0=otherwise	0.448	0.587
State	Colorado	DV = 1	0.163	0.37
	Wyoming	DV = 1	0.078	0.268
	Utah	DV = 1	0.091	0.287
	Kansas	DV = 1	0.167	0.373
	New Mexico	DV = 1	0.091	0.288
	Arizona	DV = 1	0.057	0.232
	Oklahoma Nebraska	DV = 1	0.091 0.262	0.287 0.44
Year	2008	DV = 1	0.176	0.381
	2009	DV = 1	0.185	0.388
	2010	DV = 1	0.139	0.346
	2011	DV = 1	0.269	0.443
	2012	DV = 1	0.226	0.418
	2013	DV = 1	0.004	0.07
	After	DV = 1 if response from 2012 or 2013	0.231	0.422
	LEGAL	DV = 1 if in CO and from 2012 or 2013	0.037	0.189
Personal characteristics	Male	DV = 1	0.481	0.5
	Age	Age of <i>R</i> at interview date	31.116	5.554
	Weight	Weight of <i>R</i> in pounds at interview date	176.839	43.962
	Height	Height of <i>R</i> in inches at interview date	68.215	4.4
	Height squared	Height squared	4672.489	603.457

Table 1 (continued)

Category	Variable	Description	Mean	Standard deviation
Health	BMI	Weight*703/height squared	26.606	5.705
	Health excellent	DV = 1	0.384	0.486
	Health very good	DV = 1	0.361	0.480
	Health good	DV = 1	0.207	0.405
	Health fair	DV = 1	0.042	0.201
	Health poor	DV = 1	0.007	0.081
Income	Income <\$10,000	DV = 1	0.033	0.180
	Income \$10,000-\$15,000	DV = 1	0.034	0.181
	Income \$15,000-\$20,000	DV = 1	0.059	0.235
	Income \$20,000-\$25,000	DV = 1	0.078	0.269
	Income \$25,000-\$35,000	DV = 1	0.106	0.308
	Income \$35,000-\$50,000	DV = 1	0.16	0.367
	Income \$50,000-\$75,000	DV = 1	0.198	0.399
	Income >\$75,000	DV = 1	0.331	0.471
Education	Education none	DV = 1	0.00	0.016
	Education elementary	DV = 1	0.006	0.079
	Education some HS	DV = 1	0.04	0.195
	Education HS grad	DV = 1	0.219	0.414
	Education some college	DV = 1	0.319	0.466
	Education college grad	DV = 1	0.415	0.493
Race	White	DV = 1	0.876	0.329
	Black	DV = 1	0.032	0.175
	Hispanic	DV = 1	0.132	0.474
	Other	DV = 1	0.092	0.3

Sources are the 2008-2013 Center for Disease Control Behavior Risk Surveillance surveys.

only taken from the 2008-2013 surveys. The final sample employed in all regressions consists of 36,976 observations.

The reliability and validity of self-reported data has been previously debated, and the prevalence of errors due to misreporting in the sample is possible. However, the data gathered by BRFSS has been widely used by federal agencies and other CDC divisions and has been deemed suitable for the purposes of this study.

4. Theoretical Model

This analysis uses a simple difference-in-difference model in order to determine the effect of marijuana legalization on alcohol consumption. For the purposes of this study, the “intervention” is the passing of the Colorado marijuana legalization initiative in 2012, and the “treatment” group is individuals living in Colorado at the time of the survey. Therefore, the control group is the individuals from all surrounding states included in the sample. By using a difference-in-difference model, this study attempts to determine what would have happened to alcohol consumption in the absence of marijuana legalization. The biggest assumption of the difference-in-difference model is that the time trends in the absence of the intervention are the same in both Colorado and the surrounding states.

The following sections examine the relationship between the legalization of marijuana in Colorado and alcohol consumption among individuals ages 18-39. The empirical analysis is based on the BRFSS survey and relies on four regression models to estimate the overall impact of legalization on alcohol consumption. This is followed by two regression models to estimate the impact of legalization on smoking and BMI respectively. The goal of performing these analyses is to provide evidence that the measured effects of marijuana legalization on alcohol use, smoking, and BMI do not only reflect the endogeneity of state laws regarding marijuana. This is achieved by controlling for year and state effects in each of the regression models.

4.1 Analysis of Effects on Alcohol Consumption

First I examine the impact of marijuana legalization on alcohol consumption by fitting linear regression models. The following model for individuals consuming alcohol in state s at time t is considered:

$$y_{ist} = x_{ist}\beta + LEGAL_{st}\alpha + \mu_s + \lambda_t + \varepsilon_{ist}$$

where y is one of four measures of alcohol consumption sampled in state s at time t per individual i . The measures of alcohol consumption are number of days alcohol was consumed in

the previous month, the average number of drinks in the last month, the number of times in the last month the individual consumed more than 5 drinks for men or 4 drinks for women, and the maximum number of drinks consumed in the last month. x_{ist} is a vector of individual characteristics and a set of dummies for those personal characteristic variables that were reported categorically. The personal characteristic variables consist of age, sex, and race and there are dummies for health status, income, and education. $LEGAL_{st}$ equals 1 after 2012 in Colorado and 0 otherwise, μ_s is the state effect, and λ_t is the year effect.

4.2 Analysis of Effects on Smoking and BMI

Lastly I examine the impact of the legalization of marijuana on smoking and alcohol consumption by fitting similar linear regression models. The models are the same as above, except that Y_{it} is either a measure of smoking or a measure of BMI. An individual is considered a smoker if they have ever smoked at least 100 cigarettes (5 packs). The same personal characteristic variables and the same dummy variables used in the previous four regressions on alcohol consumption are present in these two models as well. Cigarettes and marijuana may be substitutes in consumption and marijuana may affect BMI if legalization causes an increase in unhealthy diet habits. Therefore, both of these outcomes have the potential to be affected by the legalization of marijuana.

5. Results

5.1 Analysis of Effects on Alcohol Consumption

I first computed the annual means for each of measure of alcohol consumption in both the treatment and control groups. The trends across the time period covered in the sample can be seen in Figure 1. In all control states, all measures of alcohol consumption increase from 2008 to 2011 and then decrease in recent years. Colorado essentially follows the same trends with the exception of max drink, which shows an increase in recent years. In all years, individuals living in Colorado

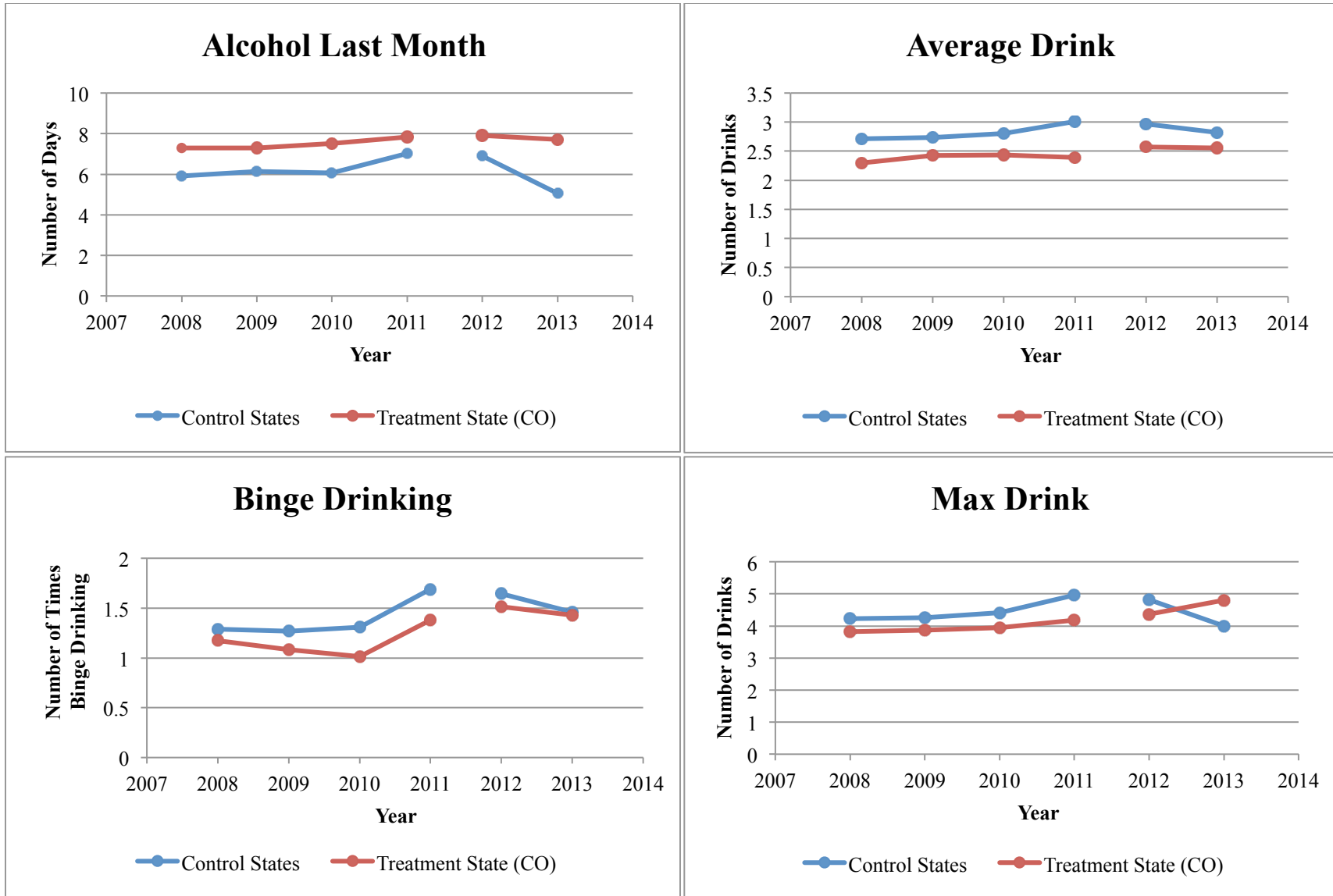


Figure 1
Means for Measures of Alcohol Consumption
Overlaid regressions use regression discontinuity at 2012. Data sourced from 2008-2013 BRFSS surveys.

are consuming smaller quantities of alcohol, but the data shows that they are drinking more frequently than those living in surrounding states. As the graphs show, the legalization of marijuana has almost no effect on alcohol consumption. Between 2011 and 2012 there is very little change, if any, across all variables. There are larger relative changes between 2012 and 2013 for each measure of consumption, indicating that the effects of legalization are starting to become more apparent.

The estimated effect of the Colorado marijuana legalization on the four measures of alcohol consumption is reported in Table 2. The treatment variable has a small positive effect on all the measures except for alcohol last month, indicating that the legalization of marijuana may cause an increase in the quantity of alcohol consumed, but may cause a decrease in the frequency of consumption. None of these effects are statistically significant at the 5% or even the 10% level, so the results of this study do not support or refute the hypothesis that alcohol and marijuana are substitutes or complements. However, marijuana was not available for sale in retail outlets until the beginning of 2014. Because it had not been released at the time of the study, the 2014 BRFSS survey was not included in the sample. In reality, this analysis only examines the effect of the legalization of possession of marijuana, and not necessarily the increased availability of marijuana. While making possession legal will increase consumption, this change likely will not have an immediate effect on the availability of marijuana. Wider access to marijuana is what will drive future consumption. Therefore further investigation would be necessary in order to determine the true effect of marijuana legalization on alcohol consumption.

Other variables had statistically significant effects on the measures of alcohol consumption. The two lowest levels of income significantly influenced all measures of alcohol consumption, but the effect varies across measures. Lower income levels have the largest positive effect on all measures except alcohol last month, where the lowest income levels have the largest negative effect of all measures of consumption. In other words, poorer people are drinking more

Table 2
Coefficient estimates from OLS regressions – Alcohol Consumption

Variable	Alcohol last month			Average drink			Binge drink			Max drink		
	Coefficient		Standard error	Coefficient		Standard error	Coefficient		Standard error	Coefficient		Standard error
Colorado	1.128	**	0.121	-0.480	**	0.046	-0.262	**	0.061	-0.820	**	0.072
Wyoming	0.451	**	0.141	-0.299	**	0.053	-0.174	**	0.072	-0.595	**	0.084
Utah	0.674	**	0.133	-0.190	**	0.050	-0.091		0.068	-0.378	**	0.079
Kansas	-0.198	*	0.108	-0.260	**	0.041	-0.254	**	0.055	-0.721	**	0.064
New Mexico	0.453	**	0.137	-0.295	**	0.052	-0.250	**	0.070	-0.826	**	0.081
Arizona	0.729	**	0.160	-0.135	**	0.060	-0.011		0.082	-0.464	**	0.095
Oklahoma	-0.522	**	0.135	-0.271	**	0.051	-0.298	**	0.069	-0.730	**	0.080
2008	0.015		0.508	-0.212		0.192	-0.334		0.259	-0.410		0.301
2009	0.206		0.507	-0.137		0.192	-0.327		0.258	-0.279		0.301
2010	0.128		0.509	-0.115		0.192	-0.348		0.259	-0.227		0.302
2011	1.014	**	0.506	-0.095		0.191	-0.092		0.257	-0.010		0.300
2012	0.732		0.500	-0.010		0.189	0.011		0.254	0.001		0.296
Age	0.012	*	0.007	-0.040	**	0.003	-0.035	**	0.003	-0.097	**	0.004
Sex	2.785	**	0.070	1.044	**	0.026	1.053	**	0.036	2.498	**	0.041
White	1.191	**	0.125	-0.316	**	0.047	0.236	**	0.064	0.039		0.074
Black	0.577	**	0.222	-0.628	**	0.084	-0.162		0.113	-0.880	**	0.132
Hispanic	-0.499	**	0.079	-0.014		0.030	-0.113	**	0.040	-0.115	**	0.047
Health excellent	0.092		0.433	-0.640	**	0.163	-1.082	**	0.221	-0.706	**	0.257
Health very good	-0.084		0.430	-0.538	**	0.162	-0.948	**	0.219	-0.565	**	0.255
Health good	-0.184		0.432	-0.387	**	0.163	-0.785	**	0.220	-0.367		0.256
Health fair	-0.167		0.455	-0.072		0.172	-0.420	*	0.232	0.080		0.270
Income <\$10,000	-0.469	**	0.207	0.495	**	0.078	0.430	**	0.106	0.456	**	0.123
Income \$10,000-\$15,000	-0.559	**	0.205	0.291	**	0.077	0.226	**	0.104	0.241	**	0.122
Income \$15,000-\$20,000	-0.388	**	0.164	0.169	**	0.062	0.145	*	0.084	0.105		0.098
Income \$20,000-\$25,000	-0.479	**	0.146	0.188	**	0.055	0.193	**	0.074	0.060		0.086
Income \$25,000-\$35,000	-0.246	*	0.128	0.188	**	0.048	0.167	**	0.065	0.041		0.076
Income \$35,000-\$50,000	-0.233	**	0.108	0.069	*	0.041	0.017		0.055	-0.048		0.064

Income \$50,000-\$75,000	-0.314	**	0.099	-0.007	0.037	0.015	0.050	-0.045	0.059			
Education none	4.421	**	2.202	-0.533	0.832	3.144	**	1.122	0.498	1.307		
Education elementary	-1.601	**	0.445	0.784	**	0.168	0.067	0.227	0.430	0.264		
Education some HS	-0.537	**	0.191	1.351	**	0.072	1.043	**	0.097	1.392	**	0.113
Education HS grad	-0.496	**	0.099	0.805	**	0.037	0.608	**	0.050	0.885	**	0.059
Education some college	-0.589	**	0.085	0.444	**	0.032	0.300	**	0.043	0.386	**	0.050
LEGAL	-0.048		0.223	0.021		0.084	0.060		0.113	0.075		0.132
Constant	3.767	**	0.722	4.242	**	0.273	2.777	**	0.368	7.139	**	0.428
R ²	0.060			0.104			0.050			0.144		

Sources are the 2008-2013 Center for Disease Control Behavior Risk Surveillance surveys. All regressions include 36,976 observations.

Omitted variables are: sex (female), race (other), income >\$75,000, and education college.

**Indicates statistical significance at 5% confidence level

*Indicates statistical significance at 10% confidence level

on each occasion and binge drinking more often, but they drink the fewest number of times per month. Because of their low income, these individuals may not have the opportunity to drink nearly as often, but when they do they appear to drink more than their richer counterparts. Education had much more scattered results, but generally people who dropped out of high school tended to drink the most. Health status also had some significant effects: across all alcohol measures, those who reported being healthier tended to drink less in both quantity and frequency. This could be due to reverse causation: healthier people may choose to drink less, but they may be healthier because they are drinking less.

Age had a similar effect on alcohol consumption compared to income. As people grew older, they tended to consume less alcohol but drank more frequently. Young people are therefore similar to poor people in that they may not be able to drink nearly as often, but they tend to consume larger quantities of alcohol on any given occasion. Race had various effects: Hispanics had negative effects for all measures and blacks showed negative effects for all but alcohol last month. On the other hand, whites showed positive effects for all but average drink. Being male had a positive and statistically significant effect on all measures of alcohol consumption.

While the year effects were rarely statistically significant, living in Colorado had statistically significant effects on all measures of consumption. On average, Coloradans drank more frequently than those in the surrounding states, but they drank less in quantity. Colorado is surrounded by some very religious states such as Utah, where frequent drinking is not as prevalent. Therefore, restricting the sample to bordering states could have caused an upward bias on this variable. Colorado is also known for its craft breweries and consistently ranks in the top 15 states in the nation for number of citizens who reported binge drinking in the past month, which could also explain the results.

5.2 Analysis of Effects on Smoking and BMI

The estimated effect of the Colorado marijuana legalization on smoking and BMI is reported in Table 3. Similar to the measures of alcohol consumption, the coefficients for the treatment variable were statistically insignificant for both smoking and BMI at both the 5% level and the 10% level. While insignificant, legalization had a slight negative effect on smoking and a slightly positive effect on BMI. This could indicate that increased consumption of marijuana caused a decrease in cigarette smoking, effectively making these two goods substitutes. Additionally, increased marijuana consumption could cause an increase in unhealthy eating which in turn could lead to higher BMIs. Because these results are statistically insignificant, additional research would be necessary to determine the effect of increased availability of marijuana on smoking and BMI.

The effects of other variables on smoking and BMI varied in statistical significance and magnitude. All levels of income had a statistically significant and positive effect on both smoking and BMI. The coefficients on smoking predictably declined as income rose, but BMI varied. All levels of education had statistically significant and positive effects on smoking, but these effects became smaller as education level rose. Individuals with less education may not be fully aware of the dangers of smoking and therefore may be more likely to smoke. Health status also had statistically significant and negative effects on smoking and BMI, which is not surprising.

Age had a very small but statistically significant positive effect on smoking and a slightly larger positive effect on BMI. As people age they tend to lose muscle mass and therefore BMI will rise, so these results make sense. Being male returned similar results as well, and predictably males tend to have higher BMIs. Race had mixed effects once again, but all were statistically significant. Being white increased the chances of smoking, but had a negative effect on BMI. The opposite was true for blacks and Hispanics; while being less likely to smoke, their BMIs were higher.

Table 3
Coefficient estimates from OLS regressions – Smoking and BMI

Variable	Smoked at least 100 cigarettes		BMI	
	Coefficient	Standard error	Coefficient	Standard error
Colorado	0.042 **	0.010	-1.319 **	0.099
Wyoming	0.022 *	0.012	-0.488 **	0.115
Utah	0.011	0.011	-1.040 **	0.109
Kansas	-0.002	0.009	0.081	0.089
New Mexico	-0.003	0.012	-0.415 **	0.112
Arizona	0.028 **	0.014	-0.391 **	0.131
Oklahoma	0.068 **	0.012	0.110	0.110
2008	-0.065	0.043	-1.962 **	0.415
2009	-0.074 *	0.043	-1.813 **	0.415
2010	-0.080 *	0.044	-1.819 **	0.416
2011	-0.052	0.043	-1.975 **	0.413
2012	-0.003	0.043	-0.544	0.409
Age	0.007 **	0.001	0.159 **	0.005
Sex	0.037 **	0.006	0.818 **	0.057
White	0.047 **	0.011	-0.749 **	0.102
Black	-0.069 **	0.019	0.916 **	0.182
Hispanic	-0.018 **	0.007	0.288 **	0.065
Health excellent	-0.262 **	0.037	-4.272 **	0.354
Health very good	-0.206 **	0.037	-3.039 **	0.352
Health good	-0.153 **	0.037	-1.065 **	0.353
Health fair	-0.094 **	0.039	0.356	0.372
Income <\$10,000	0.136 **	0.018	0.630 **	0.170
Income \$10,000-\$15,000	0.160 **	0.018	0.537 **	0.168
Income \$15,000-\$20,000	0.151 **	0.014	0.784 **	0.134
Income \$20,000-\$25,000	0.108 **	0.012	0.611 **	0.119
Income \$25,000-\$35,000	0.087 **	0.011	0.666 **	0.105
Income \$35,000-\$50,000	0.062 **	0.009	0.673 **	0.089
Income \$50,000-\$75,000	0.049 **	0.008	0.582 **	0.081
Education none	0.194	0.188	-1.312	1.801
Education elementary	0.307 **	0.038	-0.199	0.364
Education some HS	0.368 **	0.016	0.363 **	0.156
Education HS grad	0.272 **	0.008	0.733 **	0.081
Education some college	0.171 **	0.007	0.852 **	0.070
LEGAL	-0.021	0.019	0.048	0.182
Constant	0.226 **	0.062	25.895 **	0.590
R ²	0.076		0.106	

Sources are the 2008-2013 Center for Disease Control Behavior Risk Surveillance

surveys. All regressions include 36,976 observations. Omitted variables are: sex (female), race (other), income >\$75,000, and education college.

**Indicates statistical significance at 5% confidence level

*Indicates statistical significance at 10% confidence level

Once again the effects of the year were mostly insignificant for smoking, but were significant for BMI with the exception of 2012. The significant negative effects on BMI could be due to the stress from the financial crisis. People also had less disposable income to spend on excess food, which could account for the negative effect. Once again the coefficients on Colorado are statistically significant for both outcomes. Although the coefficient on smoking is somewhat small, the negative effect on BMI is the largest among the state effects. Colorado consistently ranks among the top healthiest states in America along with Utah, justifying the large negative coefficients on these variables.

5.3 Limitations

There are some limitations of my analysis. Most importantly, the fact that marijuana retail outlets were not opened until 2014 and that survey data is only available through 2013 could account for the lack of significant results. While people were still legally allowed to consume and possess marijuana in 2012 and 2013, it became much more widely available and accessible in 2014. The expansion of marijuana into retail outlets would likely cause a larger increase in consumption because people feel more comfortable walking into a store than buying from someone on a street corner. This could account for the small change in alcohol consumption during the period observed in this analysis.

There is also the possibility of omitted variable bias. Such variables could include the price of marijuana, for which data is not readily available, along with the employment status of the individual. Including the effect of being enrolled in college may have had an impact, but unfortunately this data was only available for 2012 and 2013. Lastly, eliminating any individual who did not respond to one of the questions included in the analysis could also have an adverse effect on the results. Given these limitations and the fact that the effects of legalization may take several years to materialize, I believe the relationship between the consumption of alcohol and marijuana requires further study.

6. Conclusion

Although the results were not statistically significant, the results of this study showed that the legalization of marijuana could possibly have unintended consequences relating to alcohol consumption. Previous studies have suggested that alcohol and marijuana are economically related, either as substitutes or as complements. This study takes a different approach to this issue by examining the effects of a marijuana policy on alcohol consumption. This study also examines the effect of marijuana legalization on smoking and BMI in an effort to capture all consequences of the policy, but these results are also statistically insignificant.

The main implication of this study is that further investigation is needed to capture the effect of increased availability of marijuana on alcohol consumption. Because marijuana was not accessible in retail outlets in the time period covered by this sample, these results do not capture the true effect of legalization. These effects will likely emerge in the next few years and could help other states make a decision on marijuana legalization.

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