Does Alcohol Advertising Induce Underage Drinking?

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Abstract

Underage drinking and alcohol abuse at all ages are causes for significant and widespread public health concern. We study whether alcohol advertisements influence underage drinking decisions. We use nationally representative and individual-level consumer data to generate measures of drinking behavior for both underage and overage survey respondents. These data include highly detailed measures of individual television viewing and magazine reading behavior. We combine these individual measures of media viewing with a comprehensive database of the placement of alcohol advertisements in magazines and market level summaries of alcohol advertising on television to generate individual estimates of alcohol advertising exposure. Our detailed data allow us to observe the same characteristics marketers use to determine where to place advertisements, which we exploit to control for the targeting of alcohol advertisements to drinkers. We find a positive and significant relationship between alcohol consumption and advertising exposure in both underage and overage samples.

1 Introduction

Some of the most significant and pervasive public health problems in the US are linked to underage alcohol consumption. Alcohol is the drug of choice for American youth, although it is illegal for those under the age of 21 to purchase. In 2004, roughly 28.7 percent or 10.8 million youth age 12 to 20 reported having had a drink in the past month (SAMSHA 2007). Although youth of these ages drink less often than the 6 days per month that the average adult drinks, when they do drink youth drink more (a per-occasion average of 5 versus 2.5 drinks for adults 26 and older). Nearly 19.7 percent or 7.4 million youth report that they consumed 5 or more drinks per occasion in the past month - an amount that is often labeled "heavy episodic" drinking. Because alcohol is implicated in all kinds of behaviors that affect health, these statistics represent a serious public health dilemma. For example, in 2006 alcohol was involved in traffic accidents that killed 13,740 people, almost one-third of all US traffic fatalities (National Highway Traffic Safety Administration, 2008). About 1,900 of those who die annually in alcohol-related accidents were under the age of 21 (Centers for Disease Control and Prevention, 2004). About 1,600 additional youth die in alcohol-related homicide and roughly 300 die from alcohol-related suicide (Hingson and Kenkel, 2004). Another 1,200 youth die in alcohol-related accidents of other types. In total, alcohol is involved in roughly 5,000 alcohol-related youth deaths. The CDC (2004) estimated that there were 75,766 alcohol-attributable deaths in 2001, leading to 2.3 million years of potential life lost, or approximately 30 years per alcohol-attributed death. Behind smoking and obesity, alcohol abuse is the third leading cause of US preventable deaths.

Alcohol use is also associated with many other negative but non fatal consequences. It is associated with risky behaviors such as sex with multiple partners, and unplanned, unprotected, and unwanted sex. These behaviors significantly increase drinkers' risks of contracting a sexually transmitted disease and unintended pregnancy. Ziegler et al. (2005) find underage alcohol use is associated with brain damage and neurodegeneration, potentially impairing learning and intellectual develop-

ment. The consequences of dangerous alcohol use are particularly severe on college campuses, where alcohol is implicated in half a million injuries and 70,000 sexual assaults annually (Hingson et al., 2005). Researchers estimate costs associated with US underage drinking that total $61.9 billion each year, equivalent to roughly $3 per illegal drink (Miller et al., 2006).

In this paper we investigate whether and how alcohol consumption varies with exposure to alcohol advertising. It is important to better understand whether and how advertising affects alcohol consumption because the US alcohol industry spends over a billion dollars annually on advertising and promotion.

Alcohol trade groups claim that they regulate how much and where their members advertise, in part to limit how much advertising youth see. Trade associations representing beer, liquor, and wine producers have officially agreed to only advertise on television programs or in magazines where underage youth comprise less than 30 percent of the target audience (a proportion roughly equal to the share of the US population that is younger than 21 years of age).

Despite these claims, youth saw much of the advertising. In 2007 alcohol producers spent $929 million to air 340,337 television advertisements (CAMY 2008). However, 40 percent of the alcohol advertisements youth saw on television in 2007 aired during programs for which underage youth comprised more than 30 percent of the audience. Another disturbing trend is that, over time, youth are seeing more alcohol advertising. In 2001 the average youth saw 217 alcohol advertisements on television. In 2007 the average youth saw 301 alcohol advertisements on television - an increase of 39 percent. This new trend has partly arisen because, in 1996, the Distilled Spirits Council of the United States, the main liquor trade group, decided to end an almost 40 year long self-imposed ban on television and radio advertising of spirits. Then, in 2001, the NBC network decided to accept and air liquor advertisements on their network programming. Not surprisingly, alcohol firms rapidly increased the amount they spent to advertise liquor on television. Between 1998 to 2007, television expenditures

on distilled spirits advertising increased by 1,891 percent. To finance this increase in television advertising, distilled spirits firms spent more but they also shifted advertising from print media - primarily from magazines to television. In 2001 alcohol firms spent $320 million on 3,616 magazine advertisements. By 2006 their expenditures had increased to $331 million, but they purchased fewer (2,831) magazine advertisements (CAMY 2007). Between 2001 and 2006 estimated youth exposure to alcohol advertising in magazines declined 48 percent from an average of 171 in 2001 to an average of 90 advertisements in 2006. This decline occurred partly because manufacturers reduced advertising in magazines with substantial youth readership more than they reduced advertising in magazine with a greater proportion of older readers. However, the sharp increase in television advertising likely led to greater overall exposure of youth to alcohol advertising. Whether greater exposure affected youths' propensity to drink remains an open question that we investigate.

This study explores the relationship between alcohol advertising in magazines and alcohol consumption in underage (aged 18-20) and overage (aged 21-25) youth. In Section 2 we briefly review the three main theoretical views on the role advertising play in consumer behavior. We then review the literature studying the relationship between advertising and health behaviors, notably alcohol and cigarette consumption. We outline our consumption and advertising data in Section 3. We also detail how we estimate magazine alcohol advertising exposure measures with individual-level variation and generate market-level television advertising exposure controls. In Section 4 we discuss our econometric model and identification strategy. Identifying a causal effect of advertising on alcohol consumption is difficult due to the potential endogeneity of exposure to advertising. We take several approaches to control for the likelihood that firms target alcohol advertisements at likely alcohol consumers. We present our results in Section 5. We find that when youth see more magazine alcohol advertising they are more likely to drink and they drink more. These results are mostly robust to the addition of stringent controls for advertisement targeting. We conclude in Section 6 with a discussion of the

limitations of the study and potential topics for future research.

2 Background

There are three main views of the role advertising plays in consumer behavior: persuasive, informative, and complementary (Bagwell 2007). The persuasive view posits that advertising directly affects a consumer's consumption because it changes his perception of the utility he will get when he consumes alcohol. This view supposes that advertising persuades because it creates contrived differences in alcohol products and generates and maintains product loyalty. The informative view conjectures that advertising provides information that it is costly for consumers to get; information about an alcohol product's existence, price, and quality. The complementary view posits that alcohol products and their advertisements are complements in consumption. This line of reasoning argues that consumers care not only about the utility they get from consuming the alcohol but also about "prestige" that consumption confers on them when their friends see them consuming a particular brand of alcohol. The argument is that advertising creates this prestige. In so doing, advertising creates a good that complements the consumption of a specific alcohol product. While each of these theories outline a different mechanism for how alcohol advertising may affect youth drinking, they are not mutually exclusive. Additionally, these theories do not unambiguously predict whether exposure to alcohol advertising increases whether and how much youth drink or if it simply influences the product choices of youth that have already chosen to drink.

In the empirical advertising/health behaviors literature, researchers have found mixed evidence that advertising affects individual decisions to smoke and drink alcohol. Chaloupka and Warner (2000) review the empirical literature on how cigarette advertising affects smoking. They conclude that no consensus has yet been reached that advertising substantially raises cigarette sales. In a more recent

review, Gallett and List (2003) buttress this conclusion. They find a median advertising elasticity of 0.07 in the short run and 0.09 in the long run. These estimates imply that a 10% increase in advertising expenditures results in less than a 1% increase in cigarette consumption. Some researchers argue that advertising may still affect sales but not on the margin (see Saffer 1995, 1998). A more recent meta-analysis of the effect of regulations on cigarette advertising and cigarette consumption supports this conclusion. Nelson (2005) finds that, while cigarette consumption does appear to increase when there is more advertising, the responsiveness was limited to years before 1964, the year the US Surgeon General issued the first official US government statement that smoking causes cancer. The studies Nelson reviews that look at the relationship between advertising and cigarette consumption after the 1964 Surgeon General`s report finds that cigarette sales varied much less with advertising and associations were generally statistically insignificant.

While findings in the empirical literature on alcohol advertising are similarly inconclusive, both literatures suffer from challenges that make it difficult to identify causal relationships. These challenges are related to small samples typically used in focus groups, study design, and recall biases inherent in how researchers measure the advertising people see. A focus-group study found the humor, lifestyles, and images portrayed in beer commercials to be highly appealing to 9-15 year old students (Waiters et al 2002). Similarly, Grube and Wallack (1994) established a relationship between awareness of television beer commercials and more positive beliefs about drinking and intentions to drink as an adult. While these patterns inform how we think about the relationship between advertising and attitudes, both studies uses small unrepresentative samples. Consequently, the associations they identify are difficult to generalize to broader populations.

In much of the empirical literature, researchers measure exposure to advertising in one of two ways - self-reported recall and average exposure of a given group. In studies that use the first method, researchers ask youth to report how many alcohol advertisements they recall having seen during a

given time period. Often researchers ask youth to recall whether they saw advertising for specific products and sometimes they even ask youth to recall where they saw the advertisements. Ellickson et al. (2005) use this method to conclude that South Dakota school children who see more advertising in magazines and at the point-of-sale drink more but the amount they drink is uncorrelated with the amount of television advertising they recall having seen. However, because individuals probably recall advertising better if they already drink (or want to drink), researchers question whether the measured associations reflect a cause-effect relationship. In the second method, researchers use data on television ratings of programs on which advertisements aired to estimate the amount of advertising that youth saw on average. Using this method one study found that youth age 15 to 25 drank significantly more alcohol in markets where the average level of alcohol advertising was higher (CAMY 2005). Using a similar method, Saffer (1997) finds that the motor vehicle fatality rate is higher in markets where more alcohol advertising aired. While this method does not suffer recall bias, it is also less than ideal because it assumes all youth in a given market were exposed to the same amount of advertising. More importantly, the method does not account for targeting of advertising to given markets. If firms advertise more in markets where people consume more alcohol then causality might run from consumption to advertising. To date no study has exploited individual variation in media viewing while confronting recall bias and controlling for targeting.

In this paper we investigate whether and how alcohol consumption varies with exposure to alcohol advertising. We use data uniquely suited to this task. We also use a new method to measure the amount of advertising to which individuals are exposed. This measure, described in more detail below, has several advantages over the existing literature. First, it is not based on what advertising the person remembers seeing. Instead, the measure is based on information each person provides about magazines he reads. Because individuals tend to read magazines regularly, our measure is less contaminated by recall bias. Second, our measure captures more variation in the advertising individuals saw. The

advertising exposure measure means we can overcome the shortcomings of the main two methods that have been used in most empirical literature to date. Our measure of magazine advertising is less prone to recall bias and our magazine measure does not assign an average exposure to all individuals in a given market or demographic group. Further, as we discuss below the variation in the advertising exposure that we will exploit will be variation that is plausibly unrelated to other determinants of the decision to drink.

3 Data

We use data from the 2000-2007 waves of the Simmons National Consumer Surveys. Administered biannually, the NCS uses a multi-stage stratified probability sample that is drawn from random digit dial sampling frames that exclude Hawaii and Alaska. NCS collects detailed information on consumption of all types, including detailed information on the type and amount of alcohol a person consumed in the prior 30 days. In addition to a rich set of demographic characteristics on the individual (age, race, sex, education, employment status, occupation, schooling status) Simmons also collects corresponding demographic information on the "head" of the household. Because the NCS is primarily used by firms trying to develop marketing plans, the NCS collects data on media consumption that is impressive in range, detail, and depth. For example, over these years the NCS asked whether respondents read each of 163 popular consumer magazines. For each magazine the NCS asks respondents to indicate how many of the last four issues they have read. Respondents also indicate how often they watch television and what times of day they typically watch TV. Finally, all respondents (including 18-20 year olds) answer a section on alcohol consumption, listing the number of drinks consumed in the last month for each of several categories and brands (e.g. light domestic beer, rum, Miller Lite, Bac-

ardi). The NCS yields a sample of all adults (age 18 and older) that, with sample weights, represents the US population living in households in the contiguous US. The pooled sample from the 2000-2007 waves consists of 190,419 adults. Of these, 8,224 are aged 18-20 and 9,783 are aged 21-25.

We use data on advertising of alcohol that appeared in consumer magazines from 2001-2008. These data are compiled by TNS Media Intelligence.[1] The data track alcohol advertisements, by product and brand name. Alcohol advertisements appeared in 142 the 163 magazines included in the NCS during our sample period. We sum counts of brand specific advertisements to create a count for each year of all advertisements for four separate types of alcohol. We separately track advertising in each year for beer, wine, liquor, and alcopops. We also sum across all types to create a count of the total number of alcohol advertisements that appeared in each magazine.

We do not have a comparable count of advertising individuals saw on television but we do include controls for exposure to television alcohol advertising. In particular, we include a control for the advertising seen by the average television viewer who all lived in the same Designated Marketing Area (DMA).[2] These data cover the period from 2002-2006. They are created by AC Nielsen (downloaded from http://camy.org/tvtrends/). To construct this measure, Nielsen tracks the audience of each and every television program every time it airs. Using these data, Nielsen constructs, for each advertisement, a "gross ratings points" (GRP) that measures the number of advertisements seen by the average person in an audience. A single GRP implies that the average person saw a particular advertisement once. Nielsen calculates GRP separately in 210 DMAs, which cover all areas of the US. We focus our models with television controls on the 48 DMAs that we can identify in the NCS. Our data contain the GRPs in each DMA for three age groups (12-17, 18-20, and 21-14) by gender. While we use the

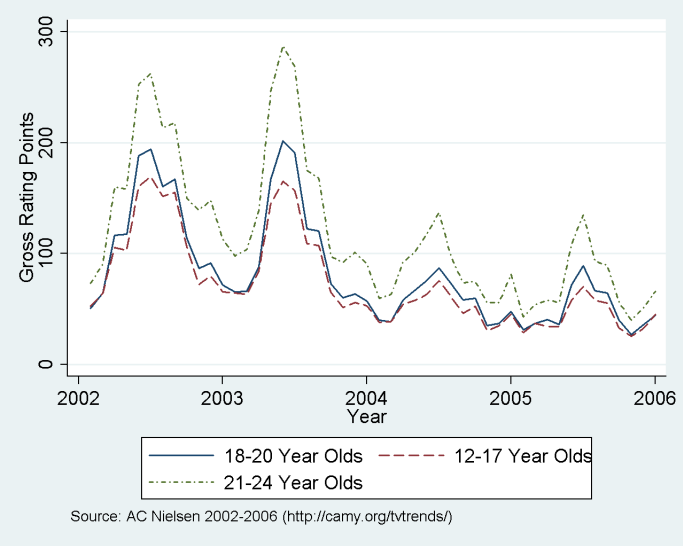
[1] We downloaded data for the 2001-2005 from http://camy.org/magtool/. Data for 2006-2008 are transcribed from TNS (various years).

[2] Nielsen defines 210 DMAs that span the US. DMAs are television broadcast regions defined as the group of counties whose population is served by the same television stations.

12-17 year old exposure trends for description, we concentrate our main analysis on the 18-20 and 21-24 year old trends. Figure 1 shows the national average trends in alcohol advertisement GRPs for these three age groups.

We generate estimates of alcohol television advertising exposure by matching the total GRPs in

Figure 1: Market Level Youth Exposure to TV Alcohol Advertisements



the six months prior to the survey to each individual by DMA, age, and gender. We identify a DMA for 77% of NCS respondents. Though we do not have program-level television advertising data, we include these market-level controls to account for potential omitted variable bias that could results from a correlation between magazine and television advertising exposure.

For the magazine advertising exposure measure we follow Avery et al (2007) and use data on each individual's magazine reading practices. Each NCS respondent indicates how many of the last four issues he read of each of 163 magazines. We convert these data into a fraction and assume that this fraction proxies for the fraction of issues of each magazine the respondent has read over the past half-year. We multiply the fraction of issues of each magazine the respondent read times the number of alcohol advertisements that appeared in each magazine in the six months prior to the survey. We

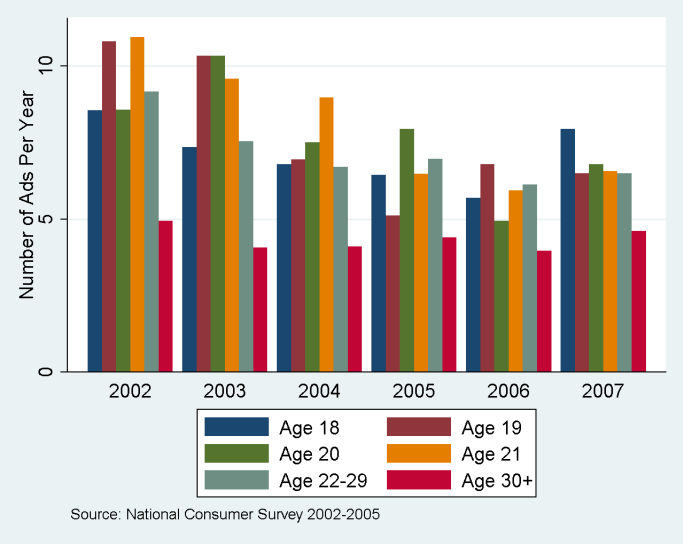
then sum across all magazines. Formally, potential exposure to alcohol advertisements of respondent i in year t is given by:

$$\text{EstMagExp}_i = \sum_m \text{read}_{im} \times \text{ads}_{mt}$$

where $read_{imt}$ denotes the reading intensity variable, and the subscripts denote respondent i, magazine m, and year t. It is worth observing that although one might suppose that it matters what one assumes about how advertising exposure "decays" over time, Avery et al. (2007) found that alternative formulations of the advertising measure did not materially change the results. To demonstrate the substantial variation in exposure to magazine alcohol advertising, Figure 2 displays age-specific averages of our estimated magazine exposure measure.

Table 1 presents summary statistics for the main variables included in our model. We find that

Figure 2: Estimated Magazine Alcohol Advertisement Exposure



37% of underage respondents (aged 18-20) and 65% of overage respondents (aged 21-25) had at least one drink in the past 30 days. The mean number of drinks in the past 30 days is 9.2 for underage respondents and 16.4 for overage respondents. The average underage respondent saw 7.0 alcohol

advertisments in magazines and 18.1 advertisments on television in the past 6 months. The average overage respondents saw 6.9 alcohol advertisements in magazines and 24.26 advertisements on television.

Table 1: Summary Statistics NCS 2002-2007

	Age 18-20		Age 21-25	
	Mean	Std. Dev.	Mean	Std. Dev.
Number of Drinks in the Past 30 Days	9.17	(23.85)	16.43	(27.73)
Any Alcohol in the Past 30 Days	0.37		0.65	
Alcohol Ad Gross Rating Points	18.08	(11.11)	24.26	(14.45)
Alcohol Gross Rating Points*TV Hours Per Week	248.73	(311.93)	343.10	(404.05)
Hours Spent Viewing Netwk TV Per Week	14.46	(14.72)	14.87	(14.54)
Total Magazine Alcohol Ad Exposure	6.99	(8.58)	6.87	(9.23)
Total Yearly Issues of Magazines Read	19.55	(5.78)	19.32	(5.88)
Female	0.54		0.56	
Number of Adults in the Household	3.49	(1.16)	3.32	(1.33)
Household Income * 10^-3	87.76	(66.60)	79.71	(63.85)
Education - Less Than High School	0.23		0.18	
Education - High School	0.44		0.28	
Education - Some College (< 4 years, > 1 year)	0.32		0.33	
Education - 4 Year College Degree	0.02		0.21	
Age	18.87	(0.84)	22.51	(0.86)
White	0.43		0.40	
Hispanic	0.43		0.49	
Black	0.08		0.06	
Other Race	0.18		0.17	
Observations	3628		4563	

Source: NCS 2002-2005

Note: When no standard deviation is reported the variable is an indicator. The mean then represents the proportion of the sample.

4 Model Specification and Identification

We estimate models of two basic types of drinking behavior. These are (1) the probability a person drinks at all in the past 30 days and (2) the quantity he drinks (measured in number of drinks in the past 30 days). We estimate separate models for underage and overage youth. For both outcomes the covariate of interest is exposure to alcohol advertising. The general structure of the our models is given by:

$$\text{Drink}_i = \text{AdExp}_i\beta + Demo_i\gamma + \text{MediaCtrl}_i\delta + \epsilon_i$$

where the data vary across individuals (i), markets (m) and time (t). The dependent variable ($Drink_i$) in our prevalence models is an indicator variable that equals "1" if a person reports having had one or more drinks in the past 30 days and "0" otherwise. In our models of drinking volume the dependent variable is the number of reported drinks in the past 30 days. $AdExp_{imt}$ is a vector of measures of exposure to alcohol advertisements in print and on television. We include an interaction between the average market television advertisement exposure and the number of hours per week an individual reports watching television, since we expect individuals that watch more television to see more alcohol advertisements on average. $Demo_{imt}$ is a vector of standard demographic characteristics such as age, race, sex, income,and education. $MediaCtrl_i$ is a vector of individual media viewing controls and includes the number of magazine issues read in the past six months and the number of hours of television watched in the past week.

The models exploit variation in exposure to alcohol advertisements as a natural experiment to determine their causal impact on drinking behavior. Variation in exposure comes from three sources: individual magazine reading habits, geographic variation in advertisement placement (for television), and temporal variation in advertisement placement. To draw causal inferences from non-experimental

data, we must rule out any other possible explanation for the correlation between advertisement exposure and alcohol consumption. Our identification strategy would be suspect if firms place alcohol advertisements on specific programs and in magazines read that people predisposed to drink are more likely to watch or read.[3]

To mitigate this challenge, we partly rely on the fact that the NCS is one of the primary sources of data that firms use to plan marketing campaigns. This fact means we observe and control for the same information firms use to target advertising. In addition to demographic controls, we specify additional models that include magazine fixed effects - i.e. a separate intercept for all 163 NCS magazines. When we estimate these models, we rely on variation in advertising in the same magazine over time and variation in the percentage of issues an individual reads conditional on reading a magazine. The magazine fixed effects specification assumes that any relationship between drinking behavior and magazine choices are strictly due to common tastes that determine drinking. To attach a causal interpretation to the advertising coefficient in these models we invoke two main assumptions. First, the drinking readership and alcohol advertisements of a given magazine do not significantly shift together over our five year window. Second, the individual choice of how many issues of a magazine to read conditional on reading at least one is unrelated to alcohol consumption.

As an additional robustness check, we follow Avery et al. (2007) and run falsification tests that use future advertising exposure to predict current alcohol consumption. To assign each person his future exposure to advertising, we assume he will read magazines in the future exactly as he reads them in the current period. Under this assumption, we construct a measure of the advertising that is going to appear in the magazine he reads during the six months after he responded to the NCS survey. If firms use the NCS data (or similar data) to target advertising at drinkers, future advertising should reflect targeting. However, if advertising actually causes consumption to vary, then there should be no rela-

[3]The analagous challenge for the measure of TV alcohol advertising is that firms advertise more in DMA where youth are more inclined to drink.

tionship between variation in future advertising and current consumption because the NCS respondent has not yet seen these advertisements the future exposure. We estimate models of drinking behavior that include both current and future levels of advertising exposure to control for any potential targeting.

5 Results

Table 2: OLS Estimates of Alcohol ConsumptionMagazine and Television Advertising

	Prevalence		Volume	
Age Group	18-20	21-25	18-20	21-25
Alcohol Ad Gross Rating Points	0.001	0.000	0.052	0.010
	(0.001)	(0.001)	(0.055)	(0.045)
Alcohol Gross Rating Points*TV Hours per Week	-0.000	0.000	-0.004	0.003
	(0.000)	(0.000)	(0.003)	(0.002)
Hours Spent Viewing Netwk TV Per Week	0.002**	0.000	0.216***	0.099*
	(0.001)	(0.001)	(0.049)	(0.052)
Total Magazine Alcohol Ad Exposure - Read. Wgt.	0.007***	0.006***	0.367***	0.400***
	(0.001)	(0.001)	(0.048)	(0.046)
Total Yearly Issues of Magazines Read	-0.001	0.004***	-0.076	0.089
	(0.001)	(0.001)	(0.070)	(0.072)
R^2	0.047	0.067	0.038	0.078
N	3628	4563	3628	4563

All models include demographic controls and survey wave dummies

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2 reports the main coefficients of interest for our baseline models of drinking prevalence and volume. For both measures of drinking in both samples we find that youth who see more magazine alcohol advertising drink more. The relationship is statistically significant with very small standard errors. As noted before, we include measures of television advertising specific to each age group and that varies over time, across DMAs and by sex. Although it is not our focus, we find no significant relationship between this measure of exposure to television advertising and drinking behavior of either age group. We find evidence that youth who watch more television drink more. Using these estimates

as our baseline, we now estimate models that explore whether these associations are causal or not.

In Table 3 we report estimates from models that include magazine fixed effects. As noted above,

Table 3: OLS Estimates of Alcohol ConsumptionMagazine Fixed Effects

	Prevalence		Volume	
Age Group	18-20	21-25	18-20	21-25
Alcohol Ad Gross Rating Points	-0.000	0.000	0.026	-0.003
	(0.001)	(0.001)	(0.053)	(0.044)
Alcohol Gross Rating Points*TV Hours per Week	-0.000	0.000	-0.003	0.003
	(0.000)	(0.000)	(0.002)	(0.002)
Hours Spent Viewing Netwk TV Per Week	0.002**	0.000	0.141***	0.056
	(0.001)	(0.001)	(0.047)	(0.050)
Total Magazine Alcohol Ad Exposure - Read. Wgt.	0.003**	0.001	0.115**	0.112**
	(0.001)	(0.001)	(0.058)	(0.055)
Total Yearly Issues of Magazines Read	0.000	0.001	-0.059	-0.169
	(0.002)	(0.002)	(0.107)	(0.108)
R^2	0.129	0.139	0.186	0.202
N	3628	4563	3628	4563

All models include demographic controls and survey wave dummies

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

adding these controls throws out all between magazine variation in advertising. While the coefficient estimates are more than 50 percent smaller in the prevalence models and more about 1/3 the magnitude of the baseline drinking volume models, three of the four coefficients are still positive and statistically significant. The decline in the absolute magnitude of the coefficient on magazine advertising is consistent with hypothesis that readers of some magazines are simply more likely to drink (more). The pattern we observe in the coefficients on the magazine fixed effects supports some commonly held perceptions about the type of consumers who read different magazines. For example, we find that underage Playboy readers are more likely to drink than non-readers and underage Good Housekeeping readers are less likely to drink than non-readers.

Under the assumptions discussed above, the coefficient estimates in Table 3 identify the causal effect of advertising on alcohol consumption. The coefficients suggest that advertising does induce

underage youth to drink but that advertising does not affect the participation decision of youth ages 21-25. The results also suggest that seeing more alcohol advertisements causes an increase in consumption of both 18-20 and 21-25 year olds (in about the same way).

In Table 4 we present coefficient estimates from drinking participation models that include the measure of exposure to future advertising we discussed above. To preserve space we pooled the sample of 18-20 and 21-25 year olds. Column (1) reproduces the basic model of Table 2 for the pooled sample. Column (2) replaces the current advertising measure with the future advertising measure. Column (3) adds back in the current advertising exposure measures. Column (4) reports coefficient estimates for a different sample and for a model that drops the controls for television alcohol advertising. We drop those variables because it allows us to estimate the model on a sample that is more than twice as large. The sample is bigger because we add respondents from the 2001, 2006, and 2007 NCS waves. We lacked the Nielsen GRP measures for these years. The sample is also bigger because we add NCS respondents living outside of the 48 DMAs we could match to Nielsen GRP measures.

Results in Table 4 show a similar effect of advertising exposure that we reported in Table 2. When we add both the current and future advertising measures in column (3) the coefficient on current advertising is positive and exactly the same as the coefficient reported in Table 3 with magazine fixed effects. However, neither of the coefficients on current and future advertising are statistically different from zero. In the model with the expanded sample, we find a positive and statistically significant coefficient on current advertising exposure and a statistically insignificant coefficient on future magazine alcohol advertising. This finding raises confidence that the current advertising is causing youth to be more likely to drink.

In Table 5 we report results from similar specifications that are estimated on the same samples. The dependent variables in these models is the amount consumed. Here we again find evidence that current exposure to magazine alcohol advertising increases the amount that youth drink. When

Table 4: OLS Estimates of Alcohol Consumption Volume
Anti-Test: Does future ad exposure predict drinking?

	(1)	(2)	(3)	(4)
Alcohol Ad Gross Rating Points	0.000		0.000	
	(0.001)		(0.001)	
Alcohol Gross Rating Points*TV Hours per Week	-0.000		0.000	
	(0.000)		(0.000)	
Hours Spent Viewing Netwk TV Per Week	0.002**	0.002**	0.002**	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)
Total Magazine Alcohol Ad Exposure - Read. Wgt.	0.007***		0.003	0.007***
	(0.001)		(0.003)	(0.002)
Total Yearly Issues of Magazines Read	0.003***	0.003***	0.003***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Future Pred. Alcohol Gross Rating Points		0.000	0.000	
		(0.001)	(0.001)	
Future Pred. Exp. to Alcohol Ads - Read. Wgt.		0.007***	0.004	-0.001
		(0.001)	(0.003)	(0.002)
R^2	0.109	0.109	0.110	0.110
N	6309	6309	6309	13263

All models include demographic controls and survey wave dummies
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

we include both current and future magazine alcohol advertising, we find a positive and statistically significant coefficient on current advertising and a small, positive, and statistically insignificant coefficient on future advertising exposure. Further, the coefficient estimate in the expanded sample in column (4) is almost exactly the same as the coefficient in the sample that includes controls for advertising of alcohol on television reported in column (3).

Table 5: OLS Estimates of Alcohol Prevalence
Anti-Test: Does future ad exposure predict drinking?

	(1)	(2)	(3)	(4)
Alcohol Ad Gross Rating Points	0.042		0.013	
	(0.037)		(0.044)	
Alcohol Gross Rating Points*TV Hours per Week	-0.001		0.001	
	(0.002)		(0.002)	
Hours Spent Viewing Netwk TV Per Week	0.202***	0.233***	0.228***	0.131***
	(0.043)	(0.041)	(0.046)	(0.016)
Total Magazine Alcohol Ad Exposure - Read. Wgt.	0.403***		0.340**	0.307***
	(0.036)		(0.159)	(0.110)
Total Yearly Issues of Magazines Read	0.045	0.042	0.041	-0.028
	(0.058)	(0.058)	(0.058)	(0.040)
Future Pred. Alcohol Gross Rating Points		0.060	0.054	
		(0.038)	(0.045)	
Future Pred. Exp. to Alcohol Ads - Read. Wgt.		0.438***	0.072	0.106
		(0.040)	(0.176)	(0.118)
R^2	0.067	0.067	0.067	0.058
N	6309	6309	6309	13263

All models include demographic controls and survey wave dummies
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Discussion

The results in Tables 3, 4, and 5 suggest that exposure to more alcohol advertising causes youth to consume alcohol and to consume more of it. Identifying a casual effect of advertising is greatly complicated by firms targeting advertisements at media popular with consumers of their products. However, our ability to control for magazine choices and the targeting of future advertisements allow us to confront this problem of potential reverse causality. Even when we rely on within magazine variation, we find evidence that suggests that advertising causes drinking. Using the models in Table 3, our results imply that if underage youth were to see an additional 8.6 alcohol advertisements (one standard deviation), their prevalence of underage drinking would increase by 3 percentage points and they would consume 1.0 more drinks per month. These implied effects represent a 7.5% increase in

the prevalance rate and a 10% increase in average consumption for this age group.

Despite the large number of alcohol advertisements that air on television, we find no relationship between our television advertising measures and alcohol consumption. However, unlike our magazine measures that exploit individually reported magazine readership to generate a reasonably accurate measure of advertising exposure, our television advertising measures are a very rough approximation of an individual's exposure to advertising. Therefore, it is not surprising that we find no significant relationship between television advertising and drinking. While television and magazines are different media, our magazine results imply that a similar effect of television advertising on consumption may exist. We hope to revisit this question in the future with more precise estimates of television advertising exposure.

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