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# Habit and Heterogeneity in College Students' Demand for Alcohol

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January 2002

# Research Paper Series, No. 17

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by

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**Acknowledgements**

**Abstract:**
This research investigates whether the positive association between college students' current and high-school drinking is due to habit formation or the influence of unobserved components of individual taste. Determining the mechanism underlying the persistence in alcohol use has significant policy implications. If habit formation exists, then policies that reduce alcohol use in one period should also reduce alcohol use in future periods. If however, persistence reflects unmeasured personal characteristics, then policies targeting youth will have no impact on their long term drinking behavior. The empirical investigation is based on individual level data from the 1997 and 1999 waves of the Harvard School of Public Health College Alcohol Study (CAS). CAS provides information on students' current drinking behavior as well as retrospective information on drinking during the final year of high-school. An instrumental variables framework is used to address the heterogeneity issue in examining the relationship between past and current drinking. The results show that after controlling for individual specific unobserved characteristics, high-school drinking has a significant and positive impact on college drinking, indicating the existence of habit formation. However, the effect of habituation is found to be moderated by unobserved heterogeneity.

## 1. INTRODUCTION

Empirical research has established that excessive drinking is associated with an increased likelihood of drinking and driving, violence, crime, and poor labor market and educational outcomes.[1] The costs associated with drinking related behaviors are not borne exclusively by those who engage in excessive drinking. Other drivers, passengers and pedestrians are put at risk when intoxicated individuals choose to drive. Family members are at risk of violence, and children face an increased likelihood of suffering the problems associated with economic disadvantage when one or both parents drink excessively.

The high social cost associated with excessive drinking makes it interesting from an economic perspective as well as a policy perspective. The fact that college students disproportionately engage in excessive drinking makes them a particularly interesting group. Statistics from the Monitoring the Future Survey show that 70% of college students 1-4 years beyond high-school report using alcohol in the last month, and 40% report heavy episodic drinking in the 2 weeks prior to survey, compared to 60% and 35% respectively for their non-college peers (Johnson, O'Malley and Bachman, 2000). In order to understand how excessive alcohol use on college campuses can be curbed, a growing empirical literature has examined the contemporaneous relationship between price and policy variables and drinking in the student population.[2] This paper differentiates itself by taking an intertemporal perspective to examining college students' drinking behavior.

There are two reasons why an intertemporal approach may provide additional insights for the development of policies to reduce problem drinking on college campuses. First, individuals' drinking patterns exhibit persistence over time. Second, initiation into alcohol use generally occurs

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[1] See Cook and Moore (2000) for a good review of this literature.
[2] See for example Chaloupka and Wechsler (1996); Czart (2001); Williams, Pacula, Chaloupka and Wechsler (2001); and Wechsler, Lee, Gledhill-Hoyt, Nelson (2001).

during high-school.  While the fact that drinking behavior is persistent may be obvious, what is less obvious - and crucial for policy development - is the mechanism by which it occurs.  If the experience of past drinking alters preferences, prices, or constraints relevant to future choices, then true state dependence - or habit formation - is said to exist.  Alternatively, individuals may differ in unobserved factors that influence drinking behavior.  If this unobserved heterogeneity is correlated over time and not properly controlled for, then previous drinking will act as its proxy resulting in spurious state dependence (Heckman, 1981).

Whether habit or heterogeneity cause the observed persistence in students' drinking has different policy implications.  If habit formation exists, then policies that reduce alcohol use in one period should also reduce alcohol use in future periods.  For example, under habit formation policies that reduce drinking during high-school, such as minimum drinking age laws and setting very low allowable blood alcohol concentration limits for youth driving, will impact drinking in college, even if the policies are no longer binding.  If, however, persistence in drinking reflects solely unmeasured personal characteristics, such as individuals' rate of time preference or degree of risk aversion, then policies that only impact on youth will have no impact on their long term drinking behavior.  Moreover, if unobserved attitudes to risk are important in the drinking decision then policies that increase the cost of alcohol use for youth may lead them to substitute other risky behavior for drinking.

To disentangle the roles of habit and heterogeneity in explaining the persistence of college students' drinking, this paper uses data from the College Alcohol Survey (CAS) conducted by the Harvard School of Public Health (Wechsler et al., 1994, 1998, 2000).  CAS is a nationally representative study of alcohol use among full-time students at four-year colleges.  In addition to enquiring about current drinking behavior, students surveyed in the CAS are also asked about drinking during their last year in high-school.  This retrospective information is used to establish

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whether there is evidence of true habit formation in the relationship between high-school and college drinking.

The remainder of this paper is set out as follows. In the following section, this research is placed in context of the existing literature. Section 3 outlines the conceptual framework and estimation strategy. Section 4 describes the data used in the analysis. The results from estimation are presented in section 5, and section 6 discusses the implications of the findings.

## 2. BACKGROUND

Beginning with Grossman, et al. (1987), a series of studies have documented the responsiveness of youthful drinking to several measures of the contemporaneous full price of alcohol consumption including the price of alcohol, the tax on beer, minimum purchase age laws and other state and local restrictions on access to alcohol. Good reviews of this literature are provided by Grossman, Chaloupka, Saffer and Laixuthai (1994), and Cook and Moore (2000). The focus of this section is on those studies that have examined the intertemporal dimension of alcohol consumption.

There are very few published papers that investigate the relationship between past and current drinking. These studies can be separated into those that take a reduced form or correlation approach, and those that engage in structural modeling. Beginning with the former, Mullahy and Sindelar (1989) use data on males aged 25-59 from the Epidemiological Catchment Area survey to investigate the relationship between early onset of alcoholism and current alcoholism, treating early onset as exogenous. They find that early onset (measured by indicators for earliest symptoms of alcoholism at 18 years or younger, and earliest symptoms of alcoholism between 19 and 22) is a key determinant of displaying symptoms of alcoholism in the current period.

Of direct relevance to this study is the research by Wechsler et al. (1995, 2000). Wechsler et al. (1995) use the first wave of the CAS to examine the relationship between college students' current binge drinking and binge drinking during high-school. Treating high-school drinking as

exogenous, they find that binging during a typical drinking episode in the last year of high-school is a strong predictor of college binging. This finding is confirmed by Wechsler et al. (2000) using the 1999 wave of the CAS.

While these studies provide evidence of the persistence of alcohol use controlling for a range of factors, they shed no light on the respective roles of state dependence and heterogeneity in explaining this persistence. The following three studies attempt to address this issue.

Cook and Moore (2001) use the 1982-1985 and 1988-89 waves of the National Longitudinal Survey of Youth (NLSY) to carry out a reduced form investigation into the existence of habit formation in drinking. The authors investigate how policies in place when respondents were 14 years of age effect current alcohol consumption, measured by participation in drinking in the past month and binge drinking in the past month. Of the three policy variables investigated (beer tax, minimum purchase age and state ethanol use), none had any impact on the probability of current drinking, and only the minimum purchase age affected current binge drinking. Nonetheless, this study provides some evidence that availability of alcohol during adolescence may have an effect on the likelihood of alcohol abuse in later years, consistent with the existence of habit formation.

The two studies that take a structural approach to investigate the intertemporal relationship in alcohol use are, Grossman, Chaloupka and Sirtalan (1998), and Moore and Cook (1995). Grossman et al. (1998) investigates whether there is evidence of rational addiction in the alcohol use of young adults using longitudinal data on 19-27 year olds from the Monitoring the Future survey of high-school seniors, and the subsequent follow-up surveys. They find that both future and past consumption causes current consumption, establishing the existence of habit formation and rational addiction. In terms of the role of heterogeneity, the evidence from this study is mixed. There is some evidence that failure to account for the endogeneity of past and future drinking leads to overestimates of their impact on current drinking.

Moore and Cook (1995) using data from the 1982-1985 waves of the NLSY find evidence of habit formation and rational addiction but no evidence of endogeneity of past and future drinking. The authors also carry out a reduced form investigation into the existence of habit formation, similar in nature to their subsequent paper discussed above. They find that when drinking is measured by the quantity of drinks or participation in drinking, the legal drinking age at fourteen has a persistent effect on female but not male drinking. Early availability, however, does affect the probability of current binge drinking for both males and females. Taken together, the reduced form and structural results provide evidence of habit formation in drinking behavior, but no significant role for heterogeneity.

Overall, this literature provides evidence that drinking patterns of youth and young adults, including college students, are persistent over time. There is also evidence that drinking is habit forming based on data for the general population of youth and young adults, although whether heterogeneity is an issue remains unclear. The nature of the persistence in college students' drinking is yet to be determined, however. Given the concern over this populations' excessive use of alcohol, there is a clear need to better understand the cause of their problematic behavior. This paper contributes to the literature by investigating the role of habit and heterogeneity in college students' drinking.

## 3. METHODOLOGY

In order to determine whether the association between past and current drinking among college students is due to habit formation, or whether it reflects unobserved components of individuals' taste, we employ both structural and reduced form modeling. Underlying the structural approach is the myopic habit formation model.[3] In this model, past consumption contributes to a

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[3] Although the myopic habit formation model recognizes the dependence of current consumption on past consumption, it ignores the dependence of future tastes on current consumption. The rational addiction framework addresses this omission. As the data used in this paper are not longitudinal, the rational addiction model cannot be estimated.

stock of "addictive capital" that impacts current consumption decisions. Habit formation is said to exist when individuals who have consumed a larger quantity of alcohol in the past (and hence have a larger stock of addictive capital) derive a higher utility from current period consumption. This gives rise to an empirical model in which current consumption depends on past consumption.

## 3.1 Conceptual Framework

Given that the College Alcohol Survey contains self-reported data on college students' current drinking and retrospectively reported information on their drinking during high-school, we specify a simple two period empirical model of alcohol consumption. In period 1, individual $i$ is in high-school and in period 2, they are in college. Individual $i$'s latent demand for alcohol in college ($D_{i2}^{*}$) is a function of actual alcohol consumption in high-school ($D_{i1}$), the contemporaneous full price of alcohol ($P_{i2}$), time invariant observable characteristics that affect drinking behavior such as gender and race ($X_i$), time varying observables such as membership in a sorority or fraternity ($Y_{i2}$), and a random disturbance term $\varepsilon_{i2}$.[4] Actual alcohol consumption ($D_{i2}$) in college is observed when latent demand crosses the zero threshold.

$$D_{i2}^{*} = \alpha_0 + \alpha_1 D_{i1} + \alpha_2 P_{i2} + \alpha_3 X_i + \alpha_4 Y_{i2} + \varepsilon_{i2}.$$

$$D_{i2} = 1(D_{i2}^{*} > 0).D_{i2}^{*}$$

The unobservable component of alcohol demand $\varepsilon_{ij}$ ($i=1,\ldots N$, $j=1, 2$) consists of a fixed individual specific component, $u_i$, and a component that varies randomly across individuals and time, $\nu_{ij}$

$$\varepsilon_{ij} = u_i + \nu_{ij}.$$

This model can be viewed as the empirical counterpart to the standard utility maximizing habit formation model, assuming a single period budget constraint, a quadratic utility function, and

However, the availability of retrospective information about drinking during the final year of high-school and current drinking behaviors in the College Alcohol Survey, make it possible to estimate the myopic form of the habit formation model.

a constant marginal utility of wealth. The coefficient on high-school drinking, $\alpha_1$, is of primary interest. If $\alpha_1$ is positive, then habit formation is said to exist.

**3.2 Estimation**

Two issues need to be addressed in order to obtain consistent estimates of the parameters in the model just described. First, the measures of college drinking (discussed in detail in section 4) are non-negative with many observations concentrated at zero, and the survey questionnaire top codes the possible responses. This is addressed by modeling college drinking using a Tobit model with censoring from above and below.

The second issue is that, due to the presence of the unobserved heterogeneity term $u_i$, $D_{i1}$ is correlated with $\varepsilon_{i2}$. Therefore maximum likelihood estimation of the model above would produce a coefficient estimate on $D_{i1}$ that confounds the effects of unobserved heterogeneity with the structural effects of past consumption on current consumption. The most robust approach to the problem of endogenous regressors is to use an instrumental variables estimator. Due to the censoring of college drinking, two stage least squares (2SLS) does not produces consistent coefficient estimates. An IV Tobit model estimated using Amemyia's Generalized Least Squares (AGLS) (Newey, 1987) is the appropriate IV model for this case. We note, however, that the 2SLS estimates are similar to the marginal effects from the IV Tobit model. This is because the 2SLS estimates are approximately equal to the true coefficients scaled by the probability that the observation is not censored. While not the more appropriate estimator in the case of a censored dependent variable, 2SLS has the advantage of providing a natural framework to test the validity of the instruments. For this reason we report 2SLS estimates and perform the overidentification test of the instruments for this framework (Davidson and MacKinnon, 1993). Given the censoring of the

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[4] We are assuming that it is the actual drinking experience rather than latent demand for alcohol in high-school that affects current drinking.

dependent variable, these tests are interpreted as suggestive evidence of the validity of the instruments.

In addition to the structural modeling, reduced form models of habit formation are also explored. In this context, state dependence is said to exist if variables correlated with previous consumption exert a significant influence on current period consumption.

## 4. DATA

### 4.1 The College Alcohol Survey

This research is based on data from the College Alcohol Survey (CAS) conducted by the Harvard School of Public Health. CAS is a nationally representative study of alcohol, tobacco and illicit drug use among full-time students at four-year colleges. Details of the methods used to draw the sample of schools, and the procedure for obtaining the student samples within colleges for the CAS are described in detail in Wechsler et al., 1994, 1998, 2000. The schools captured by the survey are located in 40 states and the District of Columbia, and consist of both public and private schools. Of the original 140 schools contained in the 1993 survey, 130 responded in 1997, providing a sample of 15,685 students responses. The same 130 colleges were resurveyed in 1999, with 128 colleges providing a sample of 14,907 student responses.

The student survey contains information on current drinking behavior (discussed in section 4.2), retrospective information on drinking during the final year of high-school (discussed in section 4.3) as well as demographic, background, and other characteristics of the students (discussed in section 4.4). State and Federal level policy variables, in addition to information collected from administrators about access to alcohol on campus and within the campus neighborhood collected as part of the CAS, are used to measure the full price of alcohol consumption. These data are discussed in section 4.5.

As IV methods are used to estimate the structural relationship between past and current drinking, valid instruments are required for consistency. In addition to enquiring about current and high-school drinking behavior, students surveyed in the CAS are also asked whether the high-school they attended is located in the same state as the college they are currently attending. The latter question is the key to this study because it identifies the state of residence during the final year of high-school for respondents who do not move. Using this information, we are able to merge state level alcohol policies in place during the respondents' last year of high-school to the student level data for those who remained in the same state. Identification of the effect of high-school drinking on college drinking is based on these policies. As information about the location of the respondents' high-school is only collected in the 1997 and 1999 waves, we do not use 1993 survey data. We also restrict the sample to students who attend college in the same state as high-school, as the state of residence during the final year of high-school is known for this group only.[5] A detailed discussion of the set of instruments is given in section 4.6.

## 4.2 Current Drinking Behavior

The outcome of interest in this paper is college drinking behavior. Two variables are used to measure this outcome: the number of drinks the respondent usually had when they drank alcohol in the 30 days prior to survey, and the number of occasions the respondent was drunk in the 30 days prior to survey. A drink was defined in the questionnaire as either a 12-oz bottle or can of beer, a 4-oz glass of wine, a 12-oz bottle or can of wine cooler, or a shot of distilled spirits (either straight or in a mixed drink). Drunk was defined to mean unsteady, dizzy or sick to your stomach. Possible responses to the number of times the respondent drank enough to get drunk are: not at all, 1-2

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[5] Approximately 70% of the sample attended college in the same state as their final year of high-school. A further 27% attended college in a different state, with the balance attending high-school in a different country. I investigated whether there is any systematic relationship between where the respondent went to high-school and drinking behavior in high-school by regressing the usual amount drank in the final year of high-school on the set of determinants of high-school drinking (other than the youth BAC), and indicators for went to high-school in a different state, and went to

occasions (coded as 1.5), 3-5 occasions (coded as 4), 6-9 occasions (coded as 7.5), 10-19 occasions

(coded as 14.5), 20-39 occasions (coded as 29.5), 40 or more occasions (coded as 40). Those

students who did not drink in the 30 days prior to survey were coded as usually drinking zero

drinks, and being drunk zero times.

In the sample used for analysis, 34% of students did not drink in the month prior to survey,

8% reported that they usually had a single drink, 13% usually had 2 drinks, 12% reported having 3

drinks, 10% reported usually having 4 drinks, 8% had 5 drinks, 6% reported having 6 drinks, 3%

reported usually having 7 drinks, 2% usually had 8 drinks, and 4% reported usually having 9 or

more drinks.[6] In terms of the number of occasions the students got drunk in the month prior to

survey, 56% reported never being drunk, 24% reported being drunk 1 or 2 times, 11% reported

being drunk 3-5 times, 5% reported being drunk 6-9 times, 3% reported being drunk 10-19 times,

with less than 0.5% reporting being drunk more often.

## 4.3 Past Drinking Behavior

Past drinking behavior is measured by the number of drinks the respondent usually had

when they drank alcohol in their last year in high-school. As with the measure of college drinking,

this variable ranges from zero to 9, where a zero indicates that the respondent did not drink alcohol

in their final year of high-school, and 9 indicates that they usually drank 9 or more drinks. In the

sample used for analysis, 48% of students did not drink in their final year of high-school, 10%

usually drank a single drink, 10% reported usually consuming 2 drinks, 10% reported drinking 3

drinks, 7% reported usually drinking 4 drinks, 6% drank 5 drinks, 3% reported drinking 6 drinks,

2% reported usually drinking 7 drinks, and 4% usually drank 8 drinks.

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high-school in a different country. The indicators for where the respondent went to high-school were jointly
insignificant in this model. This finding is robust to using the sub-sample who are aged at least 21 years of age.
[6] The questionnaire top codes the number of drinks usually consumed on drinking occasions at 9 or more drinks.

**4.4 Individual and College Characteristics**

In addition to information on college and high-school drinking, the student survey obtained detailed information about socioeconomic and demographic characteristics that are controlled for in the analysis. These are an indicator for gender (male), binary indictors for race (black, Asian, Native American, white is the omitted group), an indictor for ethnicity (Hispanic, non-Hispanic is the omitted group), a set of binary indicators for the religion that they grew up in (Catholic, Jewish, Moslem, Protestant, other religion, no religion is the omitted group), indicators for marital status (married, divorced, separated, widowed, never married is the omitted group), indicators for year in school (sophomore, junior, senior, and $5^{th}$ year and beyond undergraduate students, freshmen omitted), and an indicator for parents' education (at least one parent completed college). We also include an indicator for sorority or fraternity membership, and indicators for living arrangements (living in a single sex residence hall, co-ed residence hall, a sorority or fraternity, other university housing, other type housing, with off-campus housing as the omitted group).

The type of college attended is controlled for with an indicator for the college being a women's college, a historically black college, a commuter college, a small private college, a large private college, a small public campus, with large public campus as the omitted group. A year dummy for 1997, and census region dummies for South, West, and Midwest were also included in all specifications.

**4.5 The Full Price of Alcohol**

The full price of current alcohol consumption is captured using measures of both the monetary and non-monetary costs associated with drinking. The monetary cost of alcohol consumption is measured by the beer tax. This measure reflects both state and federal taxes (measures in cents) on a 12 pack of beer. The federal excise tax rate on beer has been constant since 1991. We obtained the state level tax information from the United States Brewers' Almanac,

an annual publication by the Beer Institute. The tax on beer is converted to constant $1999 prices using the Consume Price Index (CPI) (CPI=100 in 1982-1984). The costs associated with access to alcohol are measured by an indicator for the school having a pub on campus, and the number of off-campus outlets selling alcohol within a mile of campus. This information is collected in a survey of administrators, conducted as part of the CAS. Other non-monetary costs associated with alcohol consumption are measured by the per se illegal blood alcohol concentration (BAC) for driving for adults and the per se illegal BAC for youths at the time of survey.

## 4.6 Instruments for Past Drinking

Identification of the effect of high-school drinking on college drinking requires variables that are correlated with drinking in high-school but have no direct impact on college drinking. Candidates include state level alcohol policy variables in place during the students' final year of high-school. Among the policy variables investigated in this study are minimum drinking age (MDA) laws, youth BAC laws, the beer tax as a proxy for the price of beer, and adult BAC laws.

Since all states had an effective minimum drinking age of 21 in place by the time the CAS sample were completing high-school, MDA laws cannot be used as an instrument in this study. Similarly, there is very little temporal variation in both adult BAC laws and the beer tax over the period between students completing high-school and entering the CAS sample, so we do not use these variables as instruments. Youth BAC laws, however, exhibit substantial variation over the time period during which the sample completed high-school and entered the CAS.[7] 37% of the sample (of students who live in the same state in high-school and college) lived in a state that introduced a youth BAC law after their final year of high-school. (All students lived in states with

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[7] Starting with Maine and North Carolina in 1983, states began to enact reduced BAC levels pertaining specifically to youth. Encouragement to do so was provided by Congress, who passed legislation in 1991 that offered supplemental grants to states that put in place, among other drinking and driving policies, a BAC limit of 0.02 for drivers under the age of 21. Four years later Congress strengthened the federal law. Under a new provision, states that failed to enact a youth BAC limit of 0.02 by October 1 1998 would lose 5% of their federal highway funding. They would lose 10% of

youth BAC laws at the time they were surveyed).  If we limit the sample to students over the age of 21, 55% of students lived in a state that introduced a youth BAC law after their final year of high-school.

In practice, the youth BAC laws alone may not be sufficient to identify the effect of high-school drinking on college drinking.  In part, this is because high-school drinking varies across individuals whereas youth BAC laws in a given year only vary across states.  In terms of potential instruments that are individual specific, the CAS contains information on the students' parents drinking behavior while the students were growing up.  For both mothers and fathers the CAS reports the following information: parent not present, parent heavy drinker or problem drinker, parent moderate to light drinker, parent abstainer or former drinker while the student was growing up.  These variables are candidates for instruments if they are correlated with high-school drinking and, having accounted for their impact on high-school drinking, are uncorrelated with college drinking.  As this is more likely to be true for older students who have lived away from their parents' home for some time than for 18 year-old freshmen, both the full sample and the sub-sample of students who are at least 21 years of age are examined in the empirical analysis.

Descriptive statistics for the pooled sample of the 1997 and 1999 waves of the CAS, along with price and policy variables for the full sample and the sub-sample of students at least 21 years old are reported in Table 1.  The sample size of 15,414 and 6,664 reflect the number of observations on students' aged 18 to 24 and 21 to 24 for which we have non-missing data, and for students who went to high-school in the same state as they currently attend college.

5.  RESULTS

Two main issues are of interest in discussing these analyses.  First, does college drinking exhibit habituation.  Second, what effects do interventions that increase the full price of alcohol

their highway funds for each following year until a 0.02 youth BAC limit was in place.  By July 1 1998, all states had

have on alcohol consumption?  The empirical investigation draws on both reduced form and structural modeling techniques to answer these questions.

As both estimation strategies rely on the availability of variables that identify the effect of high-school drinking, this section begins by examining the relationship between high-school drinking and the instrument set.  Section 5.2 reports the reduced form results, and section 5.3 presents the results from structural modeling.  All models are estimated for the full sample, and the sub-sample of respondents at least 21 years of age.  In light of the discussion on instruments for pst drinking in section 4.6, attention is focused on the results for the older sample, noting differences that arise for the full sample.[8]  The main results are robust to the sample used for estimation.

## 5.1  Correlation Between High-school Drinking and The Instrument Set

The results for models exploring the correlation between the number of drinks consumed on a typical drinking occasion in high-school and the instrument set for the sub-sample of respondents at least 21 years of age and the full sample and are contained in tables 2A and 2B, respectively.  The results in table 2A (2B) shows that students who lived in a state with a youth BAC law usually drank about one fifth (one tenth) of a drink less in their final year of high-school compared to students who lived in a state without a youth BAC law.  Given that the average number of drinks usually consumed in the final year of high school is 1.87 for the older sample (and 1.85 for the full sample), this represents a 10% (6%) reduction in the number of drinks usually consumed.  Moreover, this effect is statistically significant in models based on both the full and older sub-sample.  The drinking behavior of the respondent's mother and father is found to have a significant

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enacted a 0.02 youth BAC limit (Wagenaar et al., 2000).

[8] In addition to the results reported, which are based on the number of drinks typically consumed and the number of times drunk in the past 30 days as measures of current drinking, models using currently binge as the college outcome were also investigated.  The results for the models based on binge drinking are not qualitatively different to those contained in the paper.  I also considered, as an alternative measure of drinking in high-school, an indicator for the usual number of drinks being at least 5 for males and 4 for females.  These levels are typically used to define binge drinking.  The findings are robust to this alternative measure.  For space considerations, these results have been omitted from  the paper.  They are available form the author upon request.

and quantitatively similar impact on drinking behavior in high-school. Compared to students'

whose father (mother) abstained or was a former drinker while the respondent was growing up,

having a father (mother) who drank increases the number of drinks usually consumed in the final

year of high-school by about half a drink. Students who grew up without a father in their household

usually drank about 0.6 of a drink more on a typical drinking occasion in the last year of high-

school than their peers who did have a father while growing up.

Overall these results indicate that reported high-school drinking is correlated with the set of

instruments. In particular, they show that living in a state with a youth BAC law has a sizeable

moderating effect on high-school drinking behavior, in contrast with Wagenaar et al. (2001) who

find no significant effect.

**5.2 Reduced Form Results**

Tables 3A and 3B report the reduced form results for the habit formation model for the

sample of respondents at least 21 years of age and the full sample. In these models, the potentially

endogenous measure of high-school drinking is replaced by its exogenous determinants – an

indicator for living in a state with a youth BAC law during the last year of high-school, and

indicators for parental drinking behavior. The two measures of current drinking are average number

of drinks consumed and the number of times drunk in the past 30 days.

Beginning with the proxies for past drinking, we find that living in a state with a youth BAC

law in place during the final year of high-school has a negative impact on both measures of current

drinking. However, this effect is only weakly significant in the model of the number of drinks

usually consumed estimated over the older sub-sample. In contrast, parental dinking behavior is

significantly related to both measures of current drinking. Specifically, students whose father drank

while they were growing up consume about half a drink more on a typical occasion, and get drunk

more often in the past 30 days compared to students whose father was a former drinker or abstainer.

Growing up without a father is associated with drinking 0.6 more drinks per occasion, and a greater number of occasions of getting drunk. Having a mother who drank infrequently or moderately is associated drinking about almost half a drink more per drinking occasion, and getting drunk on more often.

In terms of the effect of contemporaneous policy variables, we find that consumption of alcohol is sensitive to the full price. Specifically, the number of drinks usually consumed is negatively related to beer taxes. In terms of access to alcohol on or close to campus, the number of drinks usually consumed and number of occasions drunk are also increasing in the number of off-campus bars and alcohol outlets within a mile of campus. All else being equal, students drink about one fifth of a drink more and get drunk more often if they attend a college with a pub on campus. These effects are significant across all specifications except for the effect of a campus pub on the average number of drinks equation estimated over the full sample.

Overall, these results provide evidence that is consistent with the existence of habit formation. Both the presence of youth BAC laws during high-school and parents' drinking behavior are found to exert a significant influence on college drinking behavior, although the results are stronger in the case of parents' drinking behavior. We now turn to the structural results for corroborating evidence.

**5.3  Structural Model Results**

Tables 4A and 4B report the results from structural estimation of the myopic habit formation model, where past alcohol use is measured by the average number of drinks consumed on a drinking occasion during the respondents' final year of high-school. We use an IV Tobit framework to accommodate the censoring of observations that is estimated using Amemyia's Generalized Least Squares (AGLS) (Newey, 1987). This framework permits testing the exogeneity of high-school drinking using the test proposed by Smith & Blundell (1986).

In order to examine the validity of the instrument set, two stage least squares estimates (2SLS) are also provided for the models in tables 4A and 4B. The exogeneity and overidentification tests associated with the 2SLS estimator proposed by Davidson and MacKinnon (1993) are reported for these models. Tobit models estimated by maximum likelihood are also reported. The estimates from these models serve as a benchmark for gauging the bias that results from ignoring the potential endogeneity of past drinking. Tables 4A and 4B report results using the sub-sample of respondents aged at least 21 years of age and the full sample, respectively.

Before interpreting the structural model results, the question of exogeneity of past drinking behavior is addressed. In all models the null hypothesis that high-school drinking is exogenous is rejected. This implies that failing to account for the endogeneity of past drinking will lead to biased and inconsistent estimates of the effect of past drinking on current drinking. Moreover, comparison of the Tobit and IV Tobit results suggests that the unobservables associated with high-school and college drinking are negatively related. Consequently, failure to account for the endogeneity of past drinking results in a downward bias in the estimated effect of high-school drinking on college drinking. A possible interpretation of the negative correlation between unobserved characteristics effecting high-school and college drinking is that the experience of early drinking reduces the novel value of drinking in college as well as in providing experience for better judging the intoxicating effects of using alcohol.

As weak instruments are also associated with biased and inconsistent results, we next consider the validity of the instrument set used. For all models in tables 4A and 4B, the null hypothesis that the model is overidentified cannot be rejected at the 5% level or better. Bearing in mind that the censored nature of the dependent variable means that the instrument tests are only suggestive, we now turn to interpreting the results from the structural models. The results are remarkably consistent across both measures of college drinking and the two samples. In all models

there is evidence of habit formation, with past drinking having a positive and statistically significant effect on college drinking. On average, increasing the usual number of drinks consumed on a typical drinking occasion in high-school by one increases the number of drinks usually consumed in college by one, and increases the number of times drunk in the past 30 days by one.

The results also confirm that current monetary and non-monetary components of cost affect the use of alcohol. Specifically, the tax on beer has a negative and significant effect on the average number of drinks consumed. The evidence is somewhat weaker for the number of times drunk. In terms of access, a greater number of bars and alcohol outlets close to campus increase the average number of drinks consumed and the number of times the respondent is drunk. Students at colleges with a pub on campus consume more drinks and get drunk more often on average, compared to students at colleges without a pub on campus

## 6. DISCUSSION

Concern over college students' drinking behavior has escalated over recent years. Despite the difference in the prevalence of drinking across college and non-college populations, both groups share an observed persistence in their drinking behavior. In this paper it is found that, as with the general population of young adults, the persistence exhibited in the sample of college students' drinking is attributable to habit formation. This suggests that policies that successfully target youth drinking should also reduce their drinking in college through the habit formation mechanism. However, heterogeneity is found to work in the opposite direction so that the net result is a smaller reduction in college drinking in response to a reduction in high-school drinking than would be expected in the absence of heterogeneity. Specifically, the results suggest that the pure habit formation effect implies a one for one reduction in the number of drinks usually consumed at college in response to a reduction in the number of drinks usually consumed at high-school. Taking into account heterogeneity, the net effect is a reduction of 0.4 of a drink in the usual amount

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consumed in college in response to a one unit reduction in high-school. A possible explanation for the moderating effect of heterogeneity on college drinking is that the experience of early drinking reduces the novel value of drinking in college as well as providing experience in judging the intoxicating effects of using alcohol.

A few cautions are important to note when interpreting these results, however. Importantly, retrospective information on high-school drinking behavior is used in this study. Retrospective information may be subject to telescoping or other forms of reporting bias, and it is unclear how this would affect the results. Another important caveat is that the sample is limited to students who went to high-school and college in the same state. This is done in order to use alcohol policies in place during the students' final year of high-school to identify the effect of high-school drinking on college drinking. However, if students choose college location on the basis of how liberal a state's drinking laws are, then sample selection becomes an issue and the findings cannot be interpreted as representing the general college population.

Bearing in mind these cautions, the finding of the significant impact of youth BAC laws on youthful drinking and the existence of habit formation suggests that the youth BAC laws have a long lived effect on college students' drinking habits. There is also evidence that contemporaneous policies that raise both the monetary and non-monetary price of alcohol reduced college students drinking. From a policy standpoint, these findings suggest that problematic drinking behaviors of college students' can be addressed (in the long term) by policies that successfully reduce youthful drinking, such as minimum drinking age laws and youth BAC laws, as well as by more general policies that increase the full cost of contemporaneous alcohol use, such as raising the beer tax. A benefit of policies that target youthful drinking is that they do not impose a cost on responsible (as well as irresponsible) adult drinkers. By contrast, the costs associated with more general policies are borne by all, and not just college students. Whether general policies that impact all drinkers are

socially optimal depends on both the costs associated with these policies and their effectiveness.

Evaluating these costs and benefits remains a task for future research.

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## Table 1: Summary Statistics
## Full Sample and Sub-Sample of Over 20 Years of Age

| Variable | FULL SAMPLE (N=15,414) | | | | OVER 20 YEARS OLD (N=6,664) | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev | Min | Max | Mean | Std. Dev | Min | Max |
| usual number of drinks* | 2.62 | 2.62 | 0.00 | 9.00 | 2.64 | 2.43 | 0.00 | 9.00 |
| number of times drunk * | 1.80 | 3.59 | 0.00 | 40.00 | 1.74 | 3.40 | 0.00 | 29.50 |
| high-school usual number of drinks | 1.85 | 2.32 | 0.00 | 8.00 | 1.87 | 2.34 | 0.00 | 8.00 |
| Indicator for living in a state with a youth BAC law in final year of high-school | 0.60 | 0.49 | 0.00 | 1.00 | 0.41 | 0.49 | 0.00 | 1.00 |
| no father present | 0.03 | 0.16 | 0.00 | 1.00 | 0.03 | 0.17 | 0.00 | 1.00 |
| father infrequent or moderate drinker | 0.63 | 0.48 | 0.00 | 1.00 | 0.62 | 0.49 | 0.00 | 1.00 |
| father heavy or problem drinker | 0.10 | 0.30 | 0.00 | 1.00 | 0.11 | 0.31 | 0.00 | 1.00 |
| no mother present | 0.00 | 0.07 | 0.00 | 1.00 | 0.01 | 0.07 | 0.00 | 1.00 |
| mother infrequent or moderate drinker | 0.59 | 0.49 | 0.00 | 1.00 | 0.58 | 0.49 | 0.00 | 1.00 |
| mother heavy or problem drinker | 0.02 | 0.14 | 0.00 | 1.00 | 0.02 | 0.14 | 0.00 | 1.00 |
| beer tax | 1.82 | 0.37 | 1.45 | 3.83 | 1.83 | 0.38 | 1.45 | 3.83 |
| Current adult bac limit | 0.09 | 0.01 | 0.08 | 0.10 | 0.09 | 0.01 | 0.08 | 0.10 |
| Current youth bac limit | 0.02 | 0.02 | 0.00 | 0.10 | 0.02 | 0.02 | 0.00 | 0.10 |
| less than 21 | 0.57 | 0.50 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| pub on campus | 0.27 | 0.45 | 0.00 | 1.00 | 0.28 | 0.45 | 0.00 | 1.00 |
| no. of alcohol outlets/bars within a mile | 7.10 | 3.41 | 0.00 | 10.00 | 7.13 | 3.38 | 0.00 | 10.00 |
| Male | 0.39 | 0.49 | 0.00 | 1.00 | 0.42 | 0.49 | 0.00 | 1.00 |
| Hispanic | 0.07 | 0.26 | 0.00 | 1.00 | 0.08 | 0.27 | 0.00 | 1.00 |
| african american | 0.05 | 0.22 | 0.00 | 1.00 | 0.05 | 0.21 | 0.00 | 1.00 |
| Asian | 0.06 | 0.24 | 0.00 | 1.00 | 0.07 | 0.25 | 0.00 | 1.00 |
| native american | 0.01 | 0.07 | 0.00 | 1.00 | 0.01 | 0.08 | 0.00 | 1.00 |
| other race | 0.08 | 0.27 | 0.00 | 1.00 | 0.08 | 0.27 | 0.00 | 1.00 |
| sophomore | 0.23 | 0.42 | 0.00 | 1.00 | 0.05 | 0.21 | 0.00 | 1.00 |
| Junior | 0.24 | 0.43 | 0.00 | 1.00 | 0.32 | 0.47 | 0.00 | 1.00 |
| Senior | 0.20 | 0.40 | 0.00 | 1.00 | 0.45 | 0.50 | 0.00 | 1.00 |
| senior2 | 0.08 | 0.27 | 0.00 | 1.00 | 0.18 | 0.38 | 0.00 | 1.00 |
| raised catholic | 0.37 | 0.48 | 0.00 | 1.00 | 0.37 | 0.48 | 0.00 | 1.00 |
| raised jewish | 0.02 | 0.15 | 0.00 | 1.00 | 0.02 | 0.15 | 0.00 | 1.00 |
| raised moslem | 0.01 | 0.07 | 0.00 | 1.00 | 0.01 | 0.08 | 0.00 | 1.00 |
| raised protestant | 0.35 | 0.48 | 0.00 | 1.00 | 0.35 | 0.48 | 0.00 | 1.00 |
| raised other religion | 0.14 | 0.34 | 0.00 | 1.00 | 0.13 | 0.34 | 0.00 | 1.00 |
| Married | 0.03 | 0.17 | 0.00 | 1.00 | 0.06 | 0.24 | 0.00 | 1.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Divorced | 0.00 | 0.05 | 0.00 | 1.00 | 0.01 | 0.08 | 0.00 | 1.00 |
| Separate | 0.00 | 0.04 | 0.00 | 1.00 | 0.00 | 0.05 | 0.00 | 1.00 |
| Widowed | 0.00 | 0.01 | 0.00 | 1.00 | 0.00 | 0.01 | 0.00 | 1.00 |
| live in a single sex dorm | 0.12 | 0.33 | 0.00 | 1.00 | 0.06 | 0.23 | 0.00 | 1.00 |
| live in a co-ed dorm | 0.24 | 0.42 | 0.00 | 1.00 | 0.11 | 0.31 | 0.00 | 1.00 |
| live in other university housing | 0.03 | 0.17 | 0.00 | 1.00 | 0.03 | 0.17 | 0.00 | 1.00 |
| live in afraternity/sorority house | 0.03 | 0.18 | 0.00 | 1.00 | 0.04 | 0.18 | 0.00 | 1.00 |
| other housing | 0.06 | 0.24 | 0.00 | 1.00 | 0.07 | 0.25 | 0.00 | 1.00 |
| Member of a fraternity of sorority | 0.16 | 0.36 | 0.00 | 1.00 | 0.17 | 0.37 | 0.00 | 1.00 |
| one parent completed college | 0.80 | 0.40 | 0.00 | 1.00 | 0.79 | 0.40 | 0.00 | 1.00 |
| Womens college | 0.03 | 0.18 | 0.00 | 1.00 | 0.04 | 0.19 | 0.00 | 1.00 |
| african american college | 0.01 | 0.08 | 0.00 | 1.00 | 0.01 | 0.07 | 0.00 | 1.00 |
| commuter college | 0.15 | 0.35 | 0.00 | 1.00 | 0.17 | 0.38 | 0.00 | 1.00 |
| small private college | 0.10 | 0.29 | 0.00 | 1.00 | 0.09 | 0.29 | 0.00 | 1.00 |
| large private college | 0.09 | 0.29 | 0.00 | 1.00 | 0.09 | 0.28 | 0.00 | 1.00 |
| small public college | 0.19 | 0.39 | 0.00 | 1.00 | 0.17 | 0.38 | 0.00 | 1.00 |
| South | 0.31 | 0.46 | 0.00 | 1.00 | 0.30 | 0.46 | 0.00 | 1.00 |
| West | 0.17 | 0.37 | 0.00 | 1.00 | 0.19 | 0.39 | 0.00 | 1.00 |
| Midwest | 0.34 | 0.47 | 0.00 | 1.00 | 0.33 | 0.47 | 0.00 | 1.00 |
| year of survey is 1997 | 0.52 | 0.50 | 0.00 | 1.00 | 0.53 | 0.50 | 0.00 | 1.00 |

*The number of non-missing observation for the usual number of drinks is 15,117 for the full sample and 6,553 for the sample aged at least 21. The number of non-missing observation for the number of times drunk is 14,994 for the full sample and 6,492 for the sample aged at least 21.

**Table 2A: Reduced Form Tobit Model For High-school Drinking- Sample >20 years old***

| | Usual Number of Drinks | |
| --- | --- | --- |
| | Coefficient (Standard Error) | Marginal Effect |
| Indicator for living in a state with a youth BAC law in final year of high-school | -0.340 [a] (0.121) | -0.172 |
| No father present | 1.138 [a] (0.349) | 0.576 |
| father infrequent or moderate drinker | 0.705 [a] (0.152) | 0.357 |
| father heavy or problem drinker | 1.103 [a] (0.209) | 0.558 |
| No mother present | 0.242 (0.773) | 0.122 |
| mother infrequent or moderate drinker | 0.788 [a] (0.130) | 0.399 |
| mother heavy or problem drinker | 1.040 [a] (0.380) | 0.527 |
| | | |
| R2 | 0.0314 | |
| | | |
| p value for joint significance of instruments | <0.001 | |

a. Statistically significant at 1%, two-tailed test

*Although not reported, the following control variables were included in all models: gender, ethnicity, race, religion the respondent grew up in, at least one parent college educated, and regional indicators

**Table 2B: Reduced Form Tobit Model For High-school Drinking -Full Sample\***

| | Usual Number of Drinks | |
|---|---|---|
| | Coefficient (Standard Error) | Marginal Effect |
| Indicator for living in a state with a youth BAC law in final year of high-school | -0.205[a] (0.075) | -0.103 |
| No father present | 1.063[a] (0.237) | 0.534 |
| father infrequent or moderate drinker | 0.795[a] (0.100) | 0.399 |
| father heavy or problem drinker | 1.266[a] (0.142) | 0.635 |
| No mother present | -0.034 (0.542) | -0.017 |
| mother infrequent or moderate drinker | 0.778[a] (0.086) | 0.390 |
| mother heavy or problem drinker | 0.897[a] (0.261) | 0.450 |
| R2 | 0.029 | |
| p value for joint significance of instruments | <0.001 | |

\*See notes for table 2A

## Table 3A:  Reduced Form Model For College Drinking- Sample >20 years old*

| | Usual Number of Drinks | | Number of Times Drunk | |
|---|---|---|---|---|
| | Coefficient (standard error) | Marginal effect | Coefficient (standard error) | Marginal effect |
| youth BAC law in last year of high-school | -0.174 [c] (0.091) | -0.123 | -0.144 (0.193) | -0.061 |
| No father present | 0.822 [a] (0.247) | 0.583 | 1.897 [a] (0.524) | 0.805 |
| father infrequent or moderate drinker | 0.627 [a] (0.106) | 0.445 | 0.497 [b] (0.228) | 0.211 |
| father heavy or problem drinker | 0.655 [a] (0.148) | 0.464 | 0.993 [a] (0.317) | 0.422 |
| No mother present | -0.693 (0.563) | -0.492 | -0.948 (1.303) | -0.402 |
| mother infrequent or moderate drinker | 0.373 [a] (0.091) | 0.265 | 0.810 [a] (0.196) | 0.344 |
| mother heavy or problem drinker | 0.295 (0.274) | 0.209 | 1.145 [b] (0.580) | 0.486 |
| beer tax | -0.285 [b] (0.134) | -0.202 | -0.296 (0.285) | -0.126 |
| Current adult BAC limit | 4.310 (5.168) | 3.058 | -7.022 (10.876) | -2.981 |
| pub on campus | 0.263 [a] (0.091) | 0.186 | 0.787 [a] (0.193) | 0.334 |
| no. of alcohol outlets/bars within a mile | 0.038 [a] (0.013) | 0.027 | 0.088 [a] (0.029) | 0.037 |
| R2 | 0.0525 | | 0.0449 | |
| p value for joint significance of instruments | <0.001 | | <0.001 | |

a. Statistically significant at 1%, two-tailed test
b. Statistically significant at 5%, two-tailed test
c. Statistically significant at 10%, two-tailed test
d. Statistically significant at 10%, one-tailed test
*Although not reported, the following control variables were included in all models:  gender, ethnicity, race, religion the respondent grew up in, at least one parent college educated, and regional indicators, year at college, marital status, living arrangements, membership in a sorority or fraternity, college characteristics and a year dummy for 1997.

## Table 3B:  Reduced Form Tobit Model For College Drinking – Full Sample*

|  | Usual Number of Drinks | | Number of Times Drunk | |
|---|---|---|---|---|
|  | Coefficient (standard error) | Marginal effect | Coefficient (standard error) | Marginal effect |
| youth BAC law during final year of high-school | -0.090 (0.079) | -0.056 | -0.027 (0.147) | -0.011 |
| No father present | 0.871 [a] (0.206) | 0.542 | 1.558 [a] (0.389) | 0.641 |
| father infrequent or moderate drinker | 0.777 [a] (0.086) | 0.484 | 0.740 [a] (0.163) | 0.304 |
| father heavy or problem drinker | 0.899 [a] (0.123) | 0.559 | 1.206 [a] (0.233) | 0.496 |
| No mother present | -0.844 [b] (0.478) | -0.525 | -1.519 [d] (0.968) | -0.625 |
| mother infrequent or moderate drinker | 0.622 [a] (0.075) | 0.387 | 1.025 [a] (0.141) | 0.422 |
| mother heavy or problem drinker | 0.570 [b] (0.230) | 0.355 | 1.865 [a] (0.423) | 0.768 |
| beer tax | -0.352 [a] (0.112) | -0.219 | -0.371 [c] (0.211) | -0.153 |
| Current adult BAC limit | -4.757 (4.180) | -2.961 | -20.889 [a] (7.764) | -8.597 |
| Current youth BAC limit | 0.417 (1.769) | 0.260 | 1.446 (3.296) | 0.595 |
| less than 21 | -0.524 [a] (0.107) | -0.326 | -0.651 [a] (0.202) | -0.268 |
| pub on campus | 0.074 (0.074) | 0.046 | 0.333 [b] (0.138) | 0.137 |
| no. of alcohol outlets/bars within a mile | 0.047 [a] (0.011) | 0.029 | 0.101 [a] (0.021) | 0.042 |
|  |  |  |  |  |
| R2 | 0.0446 |  | 0.0400 |  |
|  |  |  |  |  |
| p value for joint significance of instruments | <0.001 |  | <0.001 |  |

*See  notes for table 3A

## Table 4A:  Structural Models of College Drinking- Sample >20 years old*

| | AGLS | | 2SLS | Tobit | |
|---|---|---|---|---|---|
| **Usual Number of Drinks** | coefficient | marginal effect | | coefficient | marginal effect |
| **(N=6553)** | (std. error) | | | (std. error) | |
| High-school usual number of drinks | 1.426 [a] | 1.030 | 0.836 [a] | 0.553 [a] | 0.394 |
| | (0.173) | | (0.111) | (0.015) | |
| beer tax | -0.424 [a] | -0.335 | -0.206 | -0.346 [b] | -0.247 |
| | (0.148) | | (0.094) | (0.119) | |
| Current adult BAC limit | 1.264 | 0.105 | 1.599 | 4.112 | 2.933 |
| | (5.739) | | (3.725) | (4.614) | |
| pub on campus | 0.150 [d] | 0.307 | 0.112 [c] | 0.244 [a] | 0.174 |
| | (0.102) | | (0.066) | (0.081) | |
| no. of alcohol outlets/bars within a mile | 0.043 [a] | 0.031 | 0.026 [a] | 0.042 [a] | 0.030 |
| | (0.015) | | (0.009) | (0.012) | |
| exogeneity test | <.001 | | <.001 | ----------- | |
| overidentification test | ----------- | | 0.3093 | ----------- | |
| **Number of Times Drunk (N=6492)** | | | | | |
| High-school usual number of drinks | 2.41 [a] 2 | 1.026 | 0.949 [a] | 0.867 [a] | 0.367 |
| | (0.363) | | (0.17) | (0.033) | |
| beer tax | -0.591 [b] | -0.265 | -0.231 [d] | -0.460 [d] | -0.194 |
| | (0.306) | | (0.143) | (0.266) | |
| Current adult BAC limit | -14.098 | -6.239 | -10.114 [c] | -9.523 [d] | -4.028 |
| | (11.739) | | (5.667) | (10.131) | |
| pub on campus | 0.558 [a] | 0.241 | 0.273 [a] | 0.734 [a] | 0.310 |
| | (0.211) | | (0.101) | (0.180) | |
| no. of alcohol outlets/bars within a mile | 0.095 [a] | 0.042 | 0.038 [a] | 0.096 [a] | 0.040 |
| | (0.031) | | (0.014) | (0.027) | |
| exogeneity test | <.001 | | 0.002 | ----------- | |
| overidentification test | ----------- | | 0.4923 | ----------- | |

 a. Statistically significant at 1%, two-tailed test
b. Statistically significant at 5%, two-tailed test
c. Statistically significant at 10%, two-tailed test
d. Statistically significant at 10%, one-tailed test
*Although not reported, the following control variables were included in all models:  gender, ethnicity, race, religion the respondent grew up in, at least one parent college educated, and regional indicators, year at college, marital status, living arrangements, membership in a sorority or fraternity, college characteristics and a year dummy for 1997.

## Table 4B:  Structural Models of College Drinking- Full Sample*

| | AGLS | | 2SLS | Tobit | |
|---|---|---|---|---|---|
| **Usual Number of Drinks** | coefficent | marginal effect | | coefficent | marginal effect |
| **(N=15117)** | (std. error) | | | (std. error) | |
| High-school usual number of drinks | 2.002 [a] | 1.284 | 1.079 [a] | 0.778 [a] | 0.484 |
| | (0.144) | | (0.078) | (0.012) | |
| beer tax | -0.314 [b] | -0.217 | -0.147 [b] | -0.358 [d] | -0.223 |
| | (0.129) | | (0.070) | (0.097) | |
| Current adult BAC limit | 1.088 | 0.246 | 0.027 | -2.195 | -1.366 |
| | (4.857) | | (2.680) | (3.634) | |
| Current youth BAC limit | -5.269 [a] | -3.295 | -2.802 [b] | -1.637 | -1.019 |
| | (2.003) | | (1.101) | (1.472) | |
| less than 21 | -0.363 [a] | -0.241 | -0.126 [c] | -0.451 [a] | -0.281 |
| | (0.122) | | (0.067) | (0.092) | |
| pub on campus | 0.151 [c] | 0.089 | 0.066 [d] | 0.143 | 0.089 |
| | (0.086) | | (0.047) | (0.064) | |
| no. of alcohol outlets/bars within a mile | 0.042 [a] | 0.027 | 0.024 [a] | 0.049 [a] | 0.030 |
| | (0.012) | | (0.007) | (0.009) | |
| | | | | | |
| p-value for exogeneity test | <.001 | | <.001 | ----------- | |
| p-value for overidentification test | ----------- | | 0.0530 | ----------- | |
| **Number of Times Drunk** | | | | | |
| **(N=14994)** | | | | | |
| High-school usual number of drinks | 2.933 [a] | 1.226 | 1.046 [a] | 1.143 [a] | 0.465 |
| | (0.257) | | (0.112) | (0.023) | |
| beer tax | -0.360 [d] | -0.160 | -0.096 | -0.428 | -0.174 |
| | (0.228) | | (0.100) | (0.194) | |
| Current adult BAC limit | -12.796 [d] | -5.808 | -9.860 [a] | -17.671 [a] | -7.186 |
| | (8.494) | | (3.815) | (7.131) | |
| Current youth BAC limit | -8.188 [b] | -3.068 | -3.727 [b] | -3.050 [d] | -1.240 |
| | (3.509) | | (1.564) | (2.898) | |
| less than 21 | -0.501 [b] | -0.177 | -0.151 [d] | -0.604 [b] | -0.245 |
| | (0.217) | | (0.096) | (0.183) | |
| pub on campus | 0.422 [a] | 0.167 | 0.207 [a] | 0.424 [a] | 0.173 |
| | (0.150) | | (0.067) | (0.127) | |
| no. of alcohol outlets/bars within a mile | 0.090 [a] | 0.038 | 0.033 [a] | 0.100 [a] | 0.041 |
| | (0.022) | | (0.010) | (0.019) | |
| | | | | | |
| p-value for exogeneity test | <.001 | | <.001 | ----------- | |
| p-value for overidentification test | ----------- | | 0.3752 | ----------- | |

*See  notes for table 4A

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