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THE IMPACT OF PRICE,  
AVAILABILITY, AND ALCOHOL CONTROL  
POLICIES ON BINGE DRINKING  
IN COLLEGE

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ABSTRACT

The effects of beer prices, alcohol availability, and policies related to driving under the influence of alcohol on drinking and binge drinking among youths and young adults are estimated using data from a nationally representative survey of students in U.S. colleges and universities. Drinking participation, participation in binge drinking and level of drinking equations are estimated using appropriate econometric methods. The estimates indicate that the drinking practices of college students are sensitive to the price of beer, with an average estimated price elasticity of drinking participation of  $-0.066$  and an average estimated price elasticity of binge drinking of  $-0.145$ . However, when dividing the sample by gender, one finds that the effects of prices on drinking are limited to young women. In addition, a significant negative relationship is found for the strength of policies related to drinking and driving among youths and young adults and drinking by college students. However, the results indicate that many elements of campus life, (including participation in a fraternity or sorority, living on campus, and the ready availability of alcoholic beverages) are among the most important determinants of drinking and binge drinking among college students.

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## **I. Introduction**

During the past two decades, significant progress has been made in reducing the use and abuse of alcoholic beverages. This has been particularly true among youths and young adults. For example, heavy drinking occasions among high school seniors fell by 14 percent between 1981 and 1993, while binge drinking among 19 to 22 year olds not in college fell by nine percent. Youths and young adults have been targeted by policymakers because of their relatively high levels of alcohol abuse (Grant, et al., 1991). For example, motor vehicle accident fatalities are the leading cause of death among persons under 35 years of age, and alcohol is involved in over half of these deaths. Moreover, the use and abuse of alcohol by youths and young adults appears to lead to alcohol abuse later in life (Rachal, et al., 1980). Thus, targeting policies at youths and young adults is important, since reducing excessive drinking in this population could be the most effective means to achieve long run reductions in alcohol abuse and its consequences in all segments of the population.

The most widely used policy tool in the campaign against youth and young adult alcohol abuse has been higher minimum legal drinking ages. After a downward trend in legal drinking ages that began when the voting age was lowered from 21 to 18 years in 1970, alcohol abuse among youths and young adults increased significantly. This led states, beginning with Minnesota in 1976, to start raising legal drinking ages. Between 1976 and 1984, an additional 27 states increased their legal drinking ages. The Reagan Administration became involved in the campaign against youth alcohol abuse in the early 1980's, prompting Congress to pass the Federal Uniform Drinking Age Act of 1984. This act forced every

state to raise its minimum legal drinking age for all alcoholic beverages to 21 years or face the loss of a substantial portion of its Federal highway funding. After an unsuccessful challenge of the constitutionality of the law, all states had raised their drinking age to 21 by 1987 (although grandfather clauses in some states kept the effective age below 21 until mid-1989).

Other policies in the anti-drinking campaign targeted all drinkers. For example, Public Law 100-690 mandated that, beginning in November 1989, a label warning of the dangers of drinking and driving and drinking while pregnant appear on all alcoholic beverage containers. Similarly, the Alcohol Traffic Safety Act of 1983 encouraged states to enact stronger laws related to driving under the influence of alcohol. Ross (1990) suggests that over 500 new state and local laws increasing the probabilities of arrest and conviction and imposing more severe penalties for drunken driving resulted from the 1983 act. More recently, states have targeted underage drinking drivers by easing the standards required for conviction for driving under the influence and increasing the penalties imposed upon conviction.<sup>1</sup>

One policy, however, which has been generally ignored in the anti-drinking campaign is the increased taxation of alcoholic beverages. By raising prices, higher alcohol taxes could significantly reduce alcohol abuse among youths and young adults, as well as in other segments of the population. Federal taxes on beer and wine were constant in nominal terms

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<sup>1</sup> For example, while most states have a *per se* illegal blood alcohol concentration of between 0.08 and 0.10 percent for older drivers, several states have reduced this to 0.04 percent or lower for drivers under the age of 21. Indeed, the most restrictive laws targeted at underage drinking drivers make it an offense if a young driver's blood shows any trace of alcohol.

from 1951 until 1991, when they were raised as part of a deficit reduction package which also increased the tax on distilled spirits for only the second time since 1951. Moreover, with the exception of the wine tax increase, these tax hikes fell far short of the increases necessary to offset the impact of inflation since 1951. Similarly, state and local governments have raised alcohol taxes only modestly and infrequently over time, usually with the intent of raising revenues rather than discouraging alcohol abuse. Due largely to the stability of these taxes, the real prices of alcoholic beverages have declined significantly over time. This downward trend was reversed only temporarily by the 1991 tax hikes. Thus, if alcohol use and abuse is sensitive to price, then policies which allow the real price of alcoholic beverages to fall over time exacerbate the problems associated with alcohol abuse.

While alcohol abuse has fallen sharply in many youth and young adult groups, the same reductions have not been observed among college students. Between 1981 and 1993, binge drinking rates among students in U.S. colleges and universities fell by a paltry 2.6 percent. In addition to affecting their own health, school performance, and more, binge drinking students impose considerable costs for other students. For example, Wechsler, et al. (1994) find that binge drinking among college students is associated with a variety of consequences, including greater probabilities of injury, unsafe sexual activity, health problems, victimization (of assaults or rape), sexual harassment, impaired sleep and study time, and more.

Given their persistently high rates of binge drinking, even as alcohol abuse in most other segments of society has fallen sharply, it is important to understand the determinants of drinking among college students. This paper examines the effects of alcoholic beverage

prices and availability, as well as laws related to drinking and driving by youths and young adults on drinking by college students. This is a particularly important population to examine given the relatively high levels of alcohol use and, more importantly, excessive alcohol use in this population and the traditionally unique place alcohol occupies in campus life (Wechsler, et al., 1994).

## **II. Selected Review of Econometric Studies of Youth and Young Adult Alcohol Use**

Over the past decade, numerous econometric studies of alcohol demand and related outcomes among youths and young adults have been published.<sup>2</sup> The studies have employed diverse data and methods to estimate the impact of prices, taxes, and other alcohol control policies on various outcomes. The first significant work in this area was conducted by Grossman and his colleagues in the late 1980's. Grossman, Coate, and Arluck (1987) used the First National Health and Nutrition Examination Survey to look at the impact of beer prices and minimum legal drinking ages on beer consumption by persons ages 16 through 21 years. Similarly, Coate and Grossman (1988) used the Second National Health and Nutrition Examination Survey to study the effects of beer excise taxes and drinking ages on beer consumption in the same age group. Both studies found that higher drinking ages or higher beer taxes led to significant reductions in the frequency of youth and young adult drinking.

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<sup>2</sup> For a detailed review of econometric and other studies focusing on all segments of the population, in addition to youths and young adults, see Chaloupka (1993) and the volume edited by Hilton and Bloss (1993). For a more detailed discussion of the studies focusing on youths, see Grossman, et al. (1994).

Moreover, these effects were not limited to infrequent drinkers. Instead, the fraction of youths and young adults who were either frequent and fairly frequent drinkers fell more in absolute and percentage terms than the fraction of infrequent drinkers in response to higher drinking ages and prices.

Similarly, Laixuthai and Chaloupka (1993) used data from the 1982 and 1989 surveys of high school seniors conducted by the University of Michigan's Institute for Social Research as part of its Monitoring the Future project. They too found that increases in beer prices led to substantial reductions in the frequency of youth alcohol consumption as well as binge drinking episodes among youths. Moreover, their policy simulations indicated that a policy indexing the Federal beer tax to the rate of inflation since 1951 led to greater reductions in youth drinking and heavy drinking than one which raised drinking ages from a uniform 18 years to a uniform 21 years. However, they found that the price sensitivity of youth drinking fell between 1982 and 1989.

Likewise, Kenkel (1993) used data from the 1985 National Health Interview Survey to compare the price sensitivity of youth and young adult heavy drinking to that of adults. He found that heavy drinking in all age groups was inversely related to the prices of alcoholic beverages. Moreover, he found that heavy drinking by youths and young adults was more sensitive to price than heavy drinking by adults, with heavy drinking by young women much more sensitive to price than heavy drinking by young men. Finally, he concluded that increases in legal drinking ages also reduced drinking by those under 21 years of age.

Finally, Grossman, Chaloupka, and Sirtalan (1995) used the panel data sets from the Monitoring the Future surveys to apply the Becker and Murphy (1988) model of rational

addictive behavior to drinking by youths and young adults ages 17 through 27 years. They found that alcohol consumption in this age range is an addictive behavior, in the sense that increases in past drinking lead to higher current drinking. In addition, they found that young drinkers do not behave myopically. Finally, their estimated long run price elasticities of demand were about twice as large as those obtained when the addictive aspects of drinking are ignored.

In addition to examining youth and young adult drinking, a number of researchers have studied outcomes related to youth alcohol abuse. For example, Saffer and Grossman (1987) and Chaloupka, Saffer, and Grossman (1993) looked at the effects of alcohol control policies on drinking and driving among youths and young adults, as measured by motor vehicle accident fatality rates. Both studies found a negative and significant relationship between beer excise taxes and 18 through 20 year old motor vehicle accident fatality rates. Similarly, both found that higher legal drinking ages would significantly reduce the probability of a fatal youth motor vehicle accident. Finally, Chaloupka, Saffer, and Grossman concluded that many of the state policies related to drinking and driving do successfully deter youths from driving under the influence of alcohol.

Similarly, Kenkel (1993) and Chaloupka and Laixuthai (1994) used self-reported drinking and driving and involvement in non-fatal traffic crashes, respectively, to examine the impact of various alcohol control policies on drinking and driving by youths and young adults. Both found strong evidence that higher beer prices led to significant reductions in drinking and driving by youths and young adults. Similarly, Kenkel found that higher legal drinking ages and at least some state laws related to drunken driving reduced the likelihood

that youths and young adults would drink and drive.

Finally, Cook and Moore (1993) and Kenkel and Ribar (1994) used the National Longitudinal Survey of Youth to examine the impact of alcohol use and abuse by youths and young adults on several other outcomes, as well as the effects of various alcohol control policies on these outcomes. For example, Cook and Moore found that college completion rates were inversely related to alcohol abuse and that these rates could be increased by raising beer taxes. Similarly, in their sophisticated instrumental variables models, Kenkel and Ribar found that problem drinking had an adverse impact on the probability of being married and on earnings. Coupled with their findings that both alcohol dependence and alcohol abuse were significantly reduced by higher prices, they concluded that higher alcohol taxes could increase productivity and earnings.

This study is the first to look at the effects of alcohol control policies on drinking by college students in a nationally representative sample of students in 140 U.S. colleges and universities. In particular, this study focuses on the effects of these policies on the incidence of heavy, or binge drinking associated with a number of consequences in this population.

### **III. Data and Methods**

The data for this study are taken from the 1993 Harvard College Alcohol Study, a nationally representative sample of 17,592 students at 140 U.S. four-year colleges and universities.<sup>3</sup> In addition to obtaining a variety of socio-demographic information on the

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<sup>3</sup> For details on this survey, see Wechsler, et al., 1994.

respondents, data was collected on binge drinking behavior. In this survey, binge drinking was defined as drinking five or more drinks on a single occasion for men and drinking four or more drinks on a single occasion for women. Finally, data on various aspects of the 140 colleges and universities were collected.

All respondents were asked about their current/past drinking patterns. A level of drinking variable was created based on self-reported drinking, which could be reported in one of the following four categories: abstention or did not drink in the past year (drinking variable defined as zero); drank in the past year but did not engage in binge drinking in the past two weeks (defined as one); binged once or twice in the past two weeks (defined as two); and binged three or more times in the past two weeks (defined as three). In addition, two dichotomous indicators were also defined based on the self reported drinking data. The first is an indicator of drinking participation, defined as one for respondents who drank any alcoholic beverages in the past year and zero otherwise. The second is an indicator of binge drinking, defined as one for respondents who indicated any binge drinking in the two weeks prior to the survey and zero otherwise.

Based on the individual level survey data, a variety of independent variables were constructed to control for other factors affecting drinking and binge drinking. These include: age and age squared, as well as a detailed set of indicators for the age of the respondent (separate indicators for less than or equal to 18, 19, 20, 21 - omitted, 22, 23, 24, 25, and 26 or older<sup>4</sup>; indicators of race/ethnicity<sup>5</sup>; indicators of marital status (single - omitted,

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<sup>4</sup> Separate indicators were defined for each year (with the exception of the 18 and under and 26 and older categories) so as to allow for a non-linear impact of age on consumption as well as to examine the effects of the minimum legal drinking age (21 everywhere during this sample)

married, divorced, separated, and widowed); an indicator of gender (equal to one for males and zero for females); an indicator of importance of religion (equal to one if the respondent indicates that participating in religious activities at college is important to him/her and zero otherwise); an indicator for individuals who have at least one parent with a four year college degree; an indicator for respondents living on campus; an indicator for respondents who are members of fraternities or sororities; and an indicator for employed college students. In addition, to prevent the loss of a large number of students, indicators were created for respondents with missing data for any of these variables.<sup>6</sup>

Similarly, a variety of indicators of parental drinking were constructed from the survey data for each respondent. Each of the following was defined separately for both mother's drinking and father's drinking: parent not present; parent abstains (omitted category); parent infrequent or light drinker; parent moderate drinker; parent heavy drinker; parent problem drinker (separately for former and current problem drinkers); and parent's drinking unknown.

In addition, several variables are constructed to reflect the characteristics of the college/university for each respondent. Two of these variables reflect the availability of

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on consumption.

<sup>5</sup> These include indicators for Hispanics, Blacks, and Asians, (Whites omitted) as well as a more detailed set for White-Hispanics, Black-Hispanics, Black non-Hispanics, Asian-Hispanics, Asian non-Hispanics, other race Hispanics, and other race non-Hispanics (White non-Hispanics omitted).

<sup>6</sup> For example, if the marital status of the respondent is unknown, each of the marital status indicators takes on a value of zero, while an additional indicator (for unknown marital status) takes on a value of one. This additional indicator is zero for all respondents whose marital status is known.

alcoholic beverages to college students. The first is an indicator equal to one if the student's college/university had a bar on campus, and is equal to zero otherwise. The second is a measure of the number of outlets licensed to sell alcoholic beverages located within one mile of the respondent's campus. In addition, other college/university specific variables include: an indicator for coed colleges/universities; and indicator for all-Black colleges/universities; an indicator for colleges/universities which are primarily commuter schools; an indicator for rural colleges/universities; an indicator for colleges/universities with at least one fraternity or sorority; and an indicator for private colleges/universities. Finally, a set of region indicators (South - omitted, West, Northeast, and Midwest) are included.

Based on the location of the college/university, site specific beer prices were added to the survey data.<sup>7</sup> These price data were taken from the American Chamber of Commerce Researchers' Association's (ACCRA) quarterly Inter-City Cost of Living Index. This report includes the retail price (excluding deposits) of a six-pack of either Budweiser or Miller Lite for over 250 cities in each quarter. These prices include state and local excise taxes applied to beer. The price from the nearest city (in the same state) in the ACCRA sample is matched to each of the colleges/universities.<sup>8</sup> In addition, a site specific local cost-of-living

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<sup>7</sup> Site-specific wine and distilled spirits prices were also added to the survey. However, given that beer is the beverage of choice among all drinkers, and particularly among young drinkers, all estimates presented below use the beer price.

<sup>8</sup> A set of indicators was constructed reflecting the quality of the price match - i.e. a perfect match; a high-quality match (ACCRA city less than 25 miles from the college); a good match (ACCRA city 25-75 miles from the college); and a relatively poor match (ACCRA city more than 75 miles from the college). All estimates presented below were also obtained for more limited samples based on the quality of the price match. Given that the source of most of the variation in price results from differences in state excise taxes and that the price measure for each site always comes from a city within the same state, it was not surprising that the results

index, taken from the ACCRA reports, is also added to the survey in the same manner. All price data are then deflated by this local cost-of-living index.

Finally, based on the state in which the college/university is located, an index reflecting the restrictiveness of the state's drunken driving laws focusing on youths and young adults is added to the survey data. This variable is constructed based on the "grade" each state received for its drunken driving laws from the Mothers Against Drunk Driving (MADD).<sup>9</sup>

After eliminating observations with missing or inconsistent data, the sample size was 16,277 students. Table One contains descriptive statistics for each of the dependent and independent variables employed.

Given the limited nature of the dependent variables, ordinary least squares techniques are inappropriate. Instead, two alternative approaches are used. For the ordered, level of drinking variable, ordered probit methods are employed. These methods will provide some general sense of the relationships between beer prices, alcohol availability, and drunken driving laws targeted at youths and young adults, and drinking. Finally, dichotomous probit methods are used to estimate the equations using the dichotomous indicators of drinking and binge drinking participation.

#### **IV. Results**

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for the limited samples were essentially the same as those for the full sample.

<sup>9</sup> States could receive a grade ranging from A+ to F. These grades were converted to a simple scale ranging from 0 (F) to 12 (A+). Alternative constructs produced essentially the same results.

Table Two contains coefficient estimates for the three basic models of drinking by college students. Column one of Table Two contains the ordered probit estimates for the level of drinking dependent variable, while columns two and three contain the comparable dichotomous probit estimates for the drinking participation and binge drinking participation equations, respectively. Table Three contains comparable estimates for models using the expanded set of age variables and race/ethnicity indicators, as well as the detailed indicators of parental drinking.

Past research has found significant differences between young men and women with respect to their responses to changes in prices and other alcohol control policies. For example, Kenkel (1993) found that the price elasticity of young women's participation in heavy drinking was nearly four times as large as that for young men. To explore this possibility, each of the equations presented in Tables Two and Three are estimated separately for male and female college students. These estimates are contained in Panels A and B of Table Four for male students and female students, respectively.

The price of beer is found to have a negative and statistically significant impact on drinking by college students in all six of the equations estimated for the full sample. Similarly, all three measures of drinking by female college students are negatively and significantly related to beer prices in both model specifications. Among male college students, the effect of beer prices on the three measures of drinking is also negative. However, this relationship is statistically significant at at least the ten percent level in just one of the six equations (the basic model specification for drinking participation).

Table Five contains estimates of the price elasticities of drinking and binge drinking

participation, based on the estimates presented in Tables Two, Three, and Four. For the full sample, the average estimated price elasticity of drinking participation is -0.066, while the average estimated price elasticity of binge drinking participation is -0.145. This suggests that substantial increases in the beer excise tax, if passed on in the form of higher prices, would lead to reductions in both drinking and binge drinking among college students. For example, a policy which would have equated the tax on the alcohol in beer to that on the alcohol in distilled spirits in 1951 and indexed the tax to the rate of inflation since 1951 (over a tenfold increase in the current tax) would have reduced drinking participation among college students by nearly six percent, while participation in binge drinking would have fallen by almost 13 percent. Given the insignificance of the price variable in the equations for male college students, almost all of these reductions in drinking would occur among female students, for whom participation in binge drinking would fall by approximately 20 percent.

In contrast to the mixed effects of price on drinking among college students, alcohol availability has a strong positive and significant impact on all measures of drinking and binge drinking in both specifications for the full sample as well as for the gender specific subsamples. That is, the level of drinking, drinking participation, and participation in binge drinking are all significantly higher among college students when the number of licensed outlets for alcoholic beverages near campus is greater. The marginal effect, however, of having a bar on campus, while generally positive, is generally not statistically significant.

The observed positive relationship between alcohol availability and drinking, particularly binge drinking, among college students may, however, reflect unobserved factors which are difficult to control for in these data. That is, outlets licensed to sell alcoholic

beverages may locate near a college campus given the relatively high demand for alcoholic beverages by college students. In general, these location decisions are likely to have occurred well before the timing of the survey. Thus, they may be related to past drinking on campus rather than current drinking. However, this past drinking may be one of the elements of the college's reputation which current students considered when making their college choice. Thus, while it is likely that greater availability of alcoholic beverages will lead to more drinking and binge drinking, the estimates presented in the tables may overstate this relationship.

Strong state level policies related to drinking and driving by youths and young adults significantly reduce all measures of drinking in both specifications for the full sample as well as the gender specific subsamples. Thus, these results suggest that increasing the probability of arrest, easing the standards for arrest and conviction, and raising the penalties upon conviction for youth and young adult driving under the influence will reduce both drinking and binge drinking among college students.

In general, a positive relationship is observed between each of the three measures of drinking and age, through the early 20's. Both drinking participation and participation in binge drinking appear to peak around age 21, where they remain steady for several years, eventually falling after age 25. Given that drinking ages are 21 everywhere at the time of this sample, little can be said about the impact of minimum legal drinking ages on drinking by college students. However, it is clear from the data that there is a considerable amount of both drinking and binge drinking by underage drinkers in this sample.

Briefly reviewing the results of the other independent variables: with respect to

gender, young men are significantly more likely to drink and to engage in binge drinking than young women, confirming the conventional wisdom. With respect to race and ethnicity, whites generally drink significantly more than other races. Similarly, Black Hispanics and Asian Hispanics drink significantly more than their non-Hispanic counterparts.

With respect to marital status, married people are least likely to drink or binge drink. Similarly, divorced college students are significantly less likely to engage in binge drinking than single, separated, or widowed students. No significant differences in drinking, however, were observed for single, separated, or widowed college students.

No good income measure was available in the survey data. Instead, a number of proxy variables were used in an attempt to capture the effects of income on drinking by college students. These include: an indicator for working college students, an indicator for students with at least one parent with a four year college degree, an indicator for private colleges, and others. In general, the results for these variables were mixed. Working college students were significantly less likely to engage in binge drinking than nonworking students, but just as likely to engage in any drinking. This may reflect a negative relationship between income and heavy drinking, if employed students have higher incomes. Alternatively, the responsibilities associated with working and attending college may deter working students from heavy drinking. On the other hand, it could suggest a positive relationship if college students who are not employed have greater resources than those who work while attending college. Students with at least one parent with a four year college degree (expected to reflect higher family income) are found to much more likely to participate in both any drinking as well as binge drinking. In general, the other possible

proxy variables for income were not significant.

With respect to parental drinking, students whose mother and/or father abstains from drinking are significantly less likely to engage in binge drinking than all other students, while those with at least one parent who is a heavy drinker or who has a current or former alcohol problem are most likely to binge drink.

Students indicating that participation in on campus religious activities is important are significantly less likely to drink or to engage in binge drinking than those who do not find these activities important. Not surprisingly, members of fraternities or sororities are much more likely to drink and to drink heavily than students who are not members. Similarly, both drinking participation and participation in binge drinking are significantly higher among students attending a college with at least one fraternity or sorority. Likewise, participation in binge drinking among students at co-ed colleges is much higher than among students at all-male or all-female institutions, although no differences are observed for drinking participation. Similarly, while there are no differences in drinking participation, participation in binge drinking is significantly higher among students living on campus than it is among commuters. Likewise, students attending a predominantly commuter college are both less likely to drink and much less likely to participate in binge drinking than those attending colleges where a greater fraction of the students reside on campus.

With respect to region, students at western colleges and universities are both least likely to drink and least likely to binge drink, while those at midwestern institutions are most likely to drink and to binge drink. No differences were observed in drinking participation among students in southern and northeastern schools, although those in the northeast were

significantly more likely to engage in binge drinking. Finally, the drinking behavior of students at rural or private colleges is not significantly different from that of students at urban or public colleges.

## V. Discussion

The results described above indicate that increases in beer prices, which could be achieved by raising excise taxes on beer, would lead to reductions in both drinking participation and participation in binge drinking among college students. However, these estimates indicate that male college students are virtually unresponsive to price. Thus, the impact of price increases would be limited to reducing heavy drinking among female students. While participation in binge drinking is high among female college students (nearly 40 percent indicate at least one binge drinking incident in the two weeks prior to the survey), it is particularly problematic among male students (half of whom participated in binge drinking shortly before the sample). Moreover, although the estimated price effects are statistically significant, the estimates imply that substantial increases in taxes would be necessary to achieve relatively modest reductions in binge drinking by female students. For example, a doubling of the current Federal beer tax to 64 cents per six-pack would lead to less than a two percent reduction in binge drinking participation rates among female students.

Instead, these results indicate that many aspects of the campus environment contribute to binge drinking. In particular, the ready availability of alcoholic beverages, membership in fraternities and sororities, and living on campus are among the most significant determinants

of participation in binge drinking. These results suggest that the "Animal House" type mentality which is widespread at many colleges and universities may be very difficult to change. Indeed, college policies may contribute to creating an environment in which excessive and abusive drinking is tolerated to a greater extent than is generally true in other segments of society. Individuals who are not a part of this culture (those who live off campus, are employed, and/or are not members of fraternities/sororities) are significantly less likely to engage in binge drinking.

The results presented above, however, do suggest that some policies may be effective in reducing binge drinking by college students. Strong restrictions on the availability of alcoholic beverages to college students are likely to lead to significant reductions in heavy drinking. Similarly, aggressive policies targeting outcomes related to excessive or abusive drinking by youths and young adults may be very effective in reducing participation in heavy drinking. For example, as discussed above, laws which ease the standards for arrest and conviction associated with drinking and driving by youths and young adults, as well as those which raise the penalties for drinking and driving do lead to significant reductions in binge drinking by college students. Nevertheless, unless aggressive efforts to change the campus environment which tolerates, or perhaps promotes, binge drinking are implemented, it is likely that excessive and abusive drinking on campus will remain a problem at U.S. colleges and universities.

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Table One  
Descriptive Statistics

	Mean	Standard Deviation
<b>DEPENDENT VARIABLES - FULL SAMPLE</b>		
Drinking Participation	0.844	0.363
Binge Drinking Participation	0.437	0.496
Level of Drinking	1.476	0.976
<b>DEPENDENT VARIABLES - MALE SAMPLE</b>		
Drinking Participation	0.850	0.357
Binge Drinking Participation	0.499	0.500
Level of Drinking	1.575	0.998
<b>DEPENDENT VARIABLES - FEMALE SAMPLE</b>		
Drinking Participation	0.839	0.367
Binge Drinking Participation	0.390	0.488
Level of Drinking	1.402	0.952
<b>PRICE AND POLICY VARIABLES</b>		
Beer Price	3.746	0.521
Licensed Establishments Near College	2.849	0.531
Licenses Unknown	0.009	0.095
College Bar	0.350	0.477
College Bar Unknown	0.013	0.112
Drunk Driving Law Index	6.865	2.237

	Mean	Standard Deviation
<b>INDEPENDENT VARIABLES</b>		
Age	21.170	2.385
Age Squared	453.870	105.170
Age Less Than or Equal to 18	0.110	0.314
Age 19	0.164	0.370
Age 20	0.173	0.378
Age 22	0.131	0.337
Age 23	0.064	0.246
Age 24	0.034	0.181
Age 25	0.023	0.149
Age Greater Than or Equal to 26	0.114	0.317
Male	0.428	0.495
Hispanic	0.067	0.249
Black	0.062	0.241
Asian	0.066	0.248
White Hispanic	0.019	0.138
Black Hispanic	0.001	0.036
Black non-Hispanic	0.054	0.226
Asian Hispanic	0.001	0.036
Asian non-Hispanic	0.065	0.247
Other Hispanic	0.038	0.192
Other non-Hispanic	0.021	0.145
Hispanic Unknown	0.007	0.081
Race Unknown	0.015	0.120
Married	0.088	0.283
Divorced	0.021	0.144
Separated	0.004	0.066

	Mean	Standard Deviation
Widowed	0.002	0.043
Marital Status Unknown	0.005	0.071
No Father	0.037	0.189
Father Former Problem Drinker	0.017	0.128
Father Light Drinker	0.412	0.492
Father Moderate Drinker	0.194	0.395
Father Heavy Drinker	0.057	0.231
Father Current Problem Drinker	0.061	0.239
Father's Drinking Unknown	0.030	0.171
No Mother	0.014	0.118
Mother Former Problem Drinker	0.005	0.068
Mother Light Drinker	0.489	0.500
Mother Moderate Drinker	0.084	0.278
Mother Heavy Drinker	0.013	0.113
Mother Current Problem Drinker	0.016	0.125
Mother's Drinking Unknown	0.022	0.148
Fraternity or Sorority Member	0.159	0.365
Live on Campus	0.377	0.485
Live on Campus Unknown	0.002	0.050
Religion Important	0.639	0.480
Religion Important Unknown	0.006	0.075
Parent(s) College Educated	0.527	0.499
Parent(s) College Educated Unknown	0.023	0.150
Work	0.580	0.494
Work Unknown	0.021	0.145
Midwest	0.299	0.458
Northeast	0.199	0.399

	Mean	Standard Deviation
West	0.195	0.396
Coed College	0.974	0.159
Commuter College	0.171	0.377
Private College	0.695	0.460
Rural College	0.344	0.475
Black College	0.017	0.128
Fraternity or Sorority on Campus	0.827	0.379

NOTE: The total sample size is 16,277.

Table Two

Estimates of Drinking and Binge Drinking Equations - Basic Models

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Beer Price	-0.043 (-2.22)	-0.076 (-2.61)	-0.045 (-1.89)
Licensed Establishments Near College	0.302 (14.56)	0.315 (11.97)	0.257 (9.78)
College Bar	0.046 (2.23)	0.041 (1.30)	0.030 (1.20)
Drunk Driving Law Index	-0.022 (-5.19)	-0.044 (-6.79)	-0.016 (-3.04)
Age	0.668 (9.74)	1.111 (11.37)	0.523 (6.20)
Age Squared	-0.015 (-9.51)	-0.024 (-10.82)	-0.012 (-6.16)
Male	0.116 (6.56)	-0.051 (-1.94)	0.225 (10.50)
Hispanic	-0.002 (-0.08)	0.084 (1.58)	-0.040 (-0.90)
Black	-0.649 (-15.44)	-0.553 (-10.64)	-0.826 (-14.37)
Asian	-0.686 (-19.12)	-0.682 (-15.16)	-0.715 (-15.42)
Married	-0.494 (-13.37)	-0.366 (-7.24)	-0.657 (-13.49)
Divorced	-0.155 (-2.38)	-0.050 (-0.52)	-0.269 (-3.27)
Separated	-0.085 (-0.66)	-0.134 (-0.76)	-0.017 (-0.10)

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Widowed	-0.219 (-1.08)	-0.386 (-1.54)	-0.119 (-0.47)
Fraternity or Sorority Member	0.532 (21.74)	0.574 (12.76)	0.592 (19.98)
Live on Campus	0.076 (3.51)	0.052 (1.59)	0.071 (2.71)
Religion Important	-0.243 (-13.15)	-0.451 (-15.22)	-0.197 (-8.75)
Parent(s) College Educated	0.095 (5.28)	0.079 (2.96)	0.106 (4.87)
Work	-0.085 (-4.65)	0.029 (1.08)	-0.120 (-5.37)
Midwest	0.069 (2.74)	0.111 (2.92)	0.070 (2.30)
Northeast	0.093 (3.01)	0.065 (1.38)	0.098 (2.64)
West	-0.247 (-8.38)	-0.243 (-5.71)	-0.248 (-6.84)
Coed College	0.169 (2.72)	0.007 (0.08)	0.226 (2.91)
Commuter College	-0.181 (-6.68)	-0.138 (-3.48)	-0.243 (-7.22)
Private College	0.025 (1.00)	-0.039 (-1.02)	0.046 (1.53)
Rural College	0.048 (2.30)	0.037 (1.15)	0.032 (1.26)
All Black College	-0.140 (-1.85)	-0.155 (-1.69)	-0.072 (-0.71)
Fraternity or Sorority on Campus	0.076 (2.55)	0.178 (4.02)	0.038 (1.05)

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Intercept	-6.604 (-8.79)	-11.280 (-10.539)	-6.225 (-6.74)
Mu (2)	1.310 (95.05)		
Mu (3)	2.086 (127.69)		

Notes: Sample size is 16,277 persons. All models include indicators for missing data on alcohol availability, race and ethnicity, marital status, work status, living status, parental education, and importance of religion. Asymptotic t-ratios are in parentheses. The critical values for the t-ratios are 2.58 (2.33), 1.96 (1.64) and 1.64 (1.28) at the one, five, and ten percent significance levels, respectively, based on a two-tailed (one-tailed) test. All equations, based on a Chi-square test of the  $-2 \times \log$ -likelihood ratio are significant at better than the one percent significance level.

Table Three

Estimates of Drinking and Binge Drinking Equations - Full Models

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Beer Price	-0.038 (-1.94)	-0.070 (-2.32)	-0.041 (-1.72)
Licensed Establishments Near College	0.267 (12.74)	0.259 (9.44)	0.230 (8.62)
College Bar	0.024 (1.17)	0.007 (0.21)	0.013 (0.53)
Drunk Driving Law Index	-0.019 (-4.35)	-0.040 (-5.93)	-0.013 (-2.47)
Age Less Than or Equal to 18	-0.251 (-7.38)	-0.525 (-10.28)	-0.138 (-3.35)
Age 19	-0.229 (-7.66)	-0.448 (-9.58)	-0.140 (-3.87)
Age 20	-0.163 (-5.68)	-0.328 (-7.01)	-0.113 (-3.25)
Age 22	-0.036 (-1.16)	0.018 (0.33)	-0.031 (-0.84)
Age 23	-0.039 (-0.99)	-0.048 (-0.73)	0.020 (0.41)
Age 24	-0.077 (-1.50)	0.003 (0.04)	-0.037 (-0.58)
Age 25	-0.098 (-1.61)	-0.012 (-0.12)	-0.077 (-1.03)
Age Greater Than or Equal to 26	-0.258 (-6.41)	-0.279 (-4.65)	-0.280 (-5.51)
Male	0.140 (7.88)	-0.021 (-0.77)	0.246 (11.35)
White Hispanic	0.067 (1.07)	0.128 (1.23)	0.040 (0.54)

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Black Hispanic	-0.880 (-3.60)	-0.60 (-1.93)	-1.66 (-3.19)
Black non-Hispanic	-0.648 (-14.98)	-0.533 (-9.82)	-0.823 (-14.03)
Asian Hispanic	0.083 (0.35)	-0.252 (-0.79)	0.078 (0.28)
Asian non-Hispanic	-0.635 (-17.16)	-0.593 (-12.55)	-0.683 (-14.23)
Other Hispanic	-0.092 (-2.03)	0.011 (0.17)	-0.143 (-2.55)
Other non-Hispanic	-0.201 (-3.38)	-0.199 (-1.40)	-0.253 (-3.45)
Married	-0.464 (-12.39)	-0.313 (-5.99)	-0.625 (-12.63)
Divorced	-0.144 (-2.18)	-0.020 (-0.21)	-0.250 (-2.97)
Separated	-0.062 (-0.48)	-0.104 (-0.58)	0.010 (0.06)
Widowed	-0.173 (-0.85)	-0.352 (-1.40)	-0.051 (-0.20)
No Father	0.317 (6.12)	0.330 (4.50)	0.297 (4.63)
Father Former Problem Drinker	0.270 (3.88)	0.178 (1.81)	0.323 (3.84)
Father Light Drinker	0.316 (11.70)	0.431 (11.41)	0.251 (7.51)
Father Moderate Drinker	0.417 (13.28)	0.521 (11.17)	0.359 (9.30)
Father Heavy Drinker	0.448 (10.32)	0.433 (6.57)	0.427 (8.01)
Father Current Problem Drinker	0.305 (7.32)	0.309 (5.08)	0.298 (5.82)

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
No Mother	-0.273 (-3.50)	-0.473 (-4.96)	-0.088 (-0.89)
Mother Former Problem Drinker	0.210 (1.64)	-0.071 (-0.39)	0.277 (1.82)
Mother Light Drinker	0.171 (7.82)	0.328 (9.99)	0.119 (4.47)
Mother Moderate Drinker	0.208 (5.81)	0.345 (5.77)	0.147 (3.37)
Mother Heavy Drinker	0.357 (4.57)	0.464 (3.30)	0.340 (3.56)
Mother Current Problem Drinker	0.138 (1.95)	-0.075 (-0.74)	0.205 (2.39)
Fraternity or Sorority Member	0.521 (21.17)	0.561 (12.10)	0.585 (19.59)
Live on Campus	0.074 (3.41)	0.038 (1.14)	0.068 (2.59)
Religion Important	-0.196 (-10.46)	-0.381 (-12.43)	-0.153 (-6.73)
Parent(s) College Educated	0.083 (4.60)	0.055 (2.00)	0.103 (4.63)
Work	-0.079 (-4.30)	0.043 (1.54)	-0.118 (-5.25)
Midwest	0.049 (1.95)	0.075 (1.90)	0.056 (1.80)
Northeast	0.069 (2.22)	0.003 (0.06)	0.084 (2.24)
West	-0.253 (-8.53)	-0.263 (-5.97)	-0.254 (-6.92)
Coed College	0.209 (3.34)	0.069 (0.76)	0.256 (3.27)
Commuter College	-0.161 (-5.88)	-0.109 (-2.68)	-0.226 (-6.65)

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
Private College	0.024 (0.95)	-0.044 (-1.13)	0.042 (1.40)
Rural College	0.052 (2.46)	0.036 (1.08)	0.039 (1.51)
All Black College	-0.136 (-1.78)	-0.167 (-1.79)	-0.067 (-0.65)
Fraternity or Sorority on Campus	0.078 (2.61)	0.175 (3.85)	0.043 (1.18)
Intercept	0.503 (4.28)	0.978 (5.54)	-0.822 (-5.69)
Mu (2)	1.345 (94.80)		
Mu (3)	2.132 (127.35)		

Notes: Sample size is 16,277 persons. All models include indicators for missing data on alcohol availability, race and ethnicity, marital status, work status, living status, parental education, parental drinking and importance of religion. Asymptotic t-ratios are in parentheses. The critical values for the t-ratios are 2.58 (2.33), 1.96 (1.64) and 1.64 (1.28) at the one, five, and ten percent significance levels, respectively, based on a two-tailed (one-tailed) test. All equations, based on a Chi-square test of the  $-2 \times \log$ -likelihood ratio are significant at better than the one percent significance level.

Table Four

Estimates of Drinking and Binge Drinking Equations

Panel A: Male Sample

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
<b>Basic Models</b>			
Beer Price	-0.033 (-1.09)	-0.066 (-1.46)	-0.014 (-0.40)
Licensed Establishments Near College	0.286 (8.69)	0.302 (7.13)	0.231 (5.70)
College Bar	0.033 (1.08)	0.019 (0.41)	0.017 (0.47)
Drunk Driving Law Index	-0.023 (-3.56)	-0.042 (-4.35)	-0.020 (-2.58)
<b>Full Models</b>			
Beer Price	-0.025 (-0.82)	-0.055 (-1.17)	-0.009 (-0.26)
Licensed Establishments Near College	0.253 (7.58)	0.249 (5.61)	0.207 (5.01)
College Bar	0.013 (0.43)	-0.018 (-0.36)	-0.002 (-0.05)
Drunk Driving Law Index	-0.021 (-3.18)	-0.038 (-3.74)	-0.018 (-2.30)

Panel B: Female Sample

Variable	Level of Drinking	Drinking Participation	Binge Drinking Participation
<b>Basic Models</b>			
Beer Price	-0.051 (-1.94)	-0.086 (-2.21)	-0.067 (-2.11)
Licensed Establishments Near College	0.319 (11.88)	0.324 (9.58)	0.286 (8.18)
College Bar	0.054 (1.95)	0.052 (1.24)	0.037 (1.07)
Drunk Driving Law Index	-0.021 (-3.74)	-0.045 (-5.18)	-0.013 (-1.85)
<b>Full Models</b>			
Beer Price	-0.046 (-1.76)	-0.077 (-1.93)	-0.063 (-1.97)
Licensed Establishments Near College	0.285 (10.47)	0.268 (7.60)	0.258 (7.28)
College Bar	0.032 (1.15)	0.023 (0.52)	0.020 (0.60)
Drunk Driving Law Index	-0.017 (-2.96)	-0.040 (-4.45)	-0.009 (-1.33)

Notes: Sample size is 6,972 for the male sample and 9,305 for the female sample. All models contain all other independent variables included in the models for the full sample. The results for these variables are available upon request. Asymptotic t-ratios are in parentheses. The critical values for the t-ratios are 2.58 (2.33), 1.96 (1.64) and 1.64 (1.28) at the one, five, and ten percent significance levels, respectively, based on a two-tailed (one-tailed) test. All equations, based on a Chi-square test of the  $-2 \cdot \log$ -likelihood ratio are significant at better than the one percent significance level.

**Table Five**  
**Price Elasticities of Drinking and Binge Drinking Participation**

	Drinking Participation	Binge Drinking Participation
<b>Basic Models:</b>		
Full Sample	-0.071*	-0.151*
Male Sample	-0.057	-0.043
Female Sample	-0.081*	-0.242*
<b>Full Models:</b>		
Full Sample	-0.061*	-0.138*
Male Sample	-0.045	-0.028
Female Sample	-0.067*	-0.227*

Notes: Estimated price elasticities are based on the estimates in Tables Two, Three, and Four and the sample specific means. A \* indicates an estimated price elasticity based on a price coefficient which is significant at at least the five percent significance level.