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Binge Drinking and Violence among College Students: Sensitivity to Correlation in the Unobservables

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Abstract:

This paper examines the relationship between binge drinking and violence-related outcomes among college students. Drawing on data from the 1997 and 1999 waves of the Harvard School of Public Health Alcohol College Study, we examine four violence-related outcomes that include: arguing, damaging property, trouble with the campus or local police, and injury to oneself. We estimate a bivariate probit model to undertake sensitivity analyses based on different assumptions on the correlations of disturbances between drinking and violence. The bivariate probit results show that once we control for endogeneity based on $\rho = 0.1$, binge and frequent binge drinking significantly affect all four violence-related outcomes but the magnitude of these effects is smaller than those suggested by the single-equation probit model by a factor of almost two for the binge drinking and by a factor of five in the frequent binge model. Our sensitivity analyses reveal that in order to conclude that binge and frequent binge drinking have no effect on violence-related outcomes, the correlation between the unobservables would have to be very large, approximately 0.4 to 0.5.

1   Introduction

There is almost no place of greater concern regarding binge drinking than among college campuses. Indeed, a recently released nationwide poll by the American Medical Association shows that college binge drinking is among parents' top concerns. Of the parents surveyed, 95 percent said that excessive drinking is a serious threat to their children and the study cited numerous examples of excessive drinking related to injuries, car accidents, violence, and deaths among college students. (American Medical Association, 2001)

While the prevalence of alcohol consumption among college students is concerning with annual and thirty-day prevalence rates of 83.6% and 69.6%, respectively, it is the drinking patterns among this population that are particularly alarming. Binge drinking in the previous two weeks among college students, in 1999, was found to be 44.1%, while the prevalence of frequent binge drinking (3 or more times in the previous two week period) was found to be 22.7%. (Wechsler, Lee, Kuo and Lee, 2000)

As in the general population, the excessive use of alcohol by youths and young adults creates adverse outcomes in both the short- and long-run. Some particularly concerning negative alcohol-related outcomes for the young population include: risky sexual behavior (often leading to unplanned pregnancies, birth defects, human immunodeficiency virus and other sexually transmitted adult diseases); lower levels of human capital acquisition (educational attainment and career advancement); interpersonal and family violence (sexual and physical assault); criminal activities (theft and vandalism); increased risk of alcohol poisoning and overdosing; increased risk-taking and sensation-seeking behavior (drunk driving). (NIAAA, 1997) Indeed, alcohol is one of the most costly legal drugs consumed in the United States. In 1998, the estimated cost of alcohol use amounted to $185 billion. Of this total, 14 percent was used to pay for alcohol-related health care and medical treatment, 47 percent was lost to decreased worker productivity, and 20 percent was attributed to premature deaths due to

alcohol use. Another 18 percent of costs are associated with crime and alcohol related traffic accidents. (NIAAA, 2001)

The focus of this study is on the relationship between binge and frequent binge drinking behavior and violence-related outcomes among college students. Previous research in this field has examined the relationship between alcohol consumption and the incidence of violence at both the aggregate and individual level.[1] At the aggregate level, using annual cross-sections of state-level data, Cook and Moore (1993) and Chaloupka and Saffer (1992) find that increasing the state beer tax significantly reduces a number of different criminal offenses. More recently, several studies have used individual level data to examine the effects of alcohol consumption and related prices on various violence-related behaviors including child abuse (Markowitz and Grossman, 1998), victimization among women (Markowitz, 2000a) and spousal abuse (Markowitz, 2000b). These studies all suggest that raising the price of alcohol to reduce alcohol consumption levels is an effective means of reducing the incidence of violence.

Only one study to date examines the incidence of alcohol-related violence on college campuses. Grossman and Markowitz (1999) focus on the effects of variations in alcoholic beverage prices and alcohol availability policies on the incidence of violence among college students drawing on the 1989-1991 Core Alcohol and Drug Surveys of College Students. Measures of violence include dichotomous indicators for trouble with campus or local police; damaged property or pulled a fire alarm on campus; engaged in an argument or a fight; taken sexual advantage of another person or has been taken advantage of sexually. Two-stage least squares results suggest that alcohol consumption measured by the average number of drinks consumed in a week causes college students to engage in violent activities and that alcohol price increases can effectively reduce the incidence of all four violent behaviors. Due to data limitations, the authors are unable to incorporate the impact of college characteristics and

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[1]See Miczek et al. (1994) for an extensive review of the alcohol and violence literature.

college and state-level alcohol policies into their analyses.

This is the first paper to specifically examine the relationship between binge and frequent binge drinking and violence-related outcomes. We examine four violence-related outcomes that include: arguing, damaging property, trouble with the campus or local police, and injury to oneself. It is important to establish a causal link between our alcohol and violence measures, given that the observed correlation between binge (or frequent binge) drinking behavior and acts of violence may be due to unobserved individual characteristics such as risk-taking that may also exist among students who engage in excessive alcohol consumption. That is, there are likely to exist correlations in the unobservables between our drinking and violence measures. In this case, based on a probit model that treats drinking as an exogenous measure, estimates of the impact of binge (or frequent binge) drinking on violent behavior may be biased and inconsistent. Our goal is to determine the extent to which increasing levels of correlation in the unobservables affect the direct impact of binge and frequent binge drinking on our violence measures. Hence, we estimate a bivariate probit model to undertake sensitivity analyses based on different assumptions on the correlations of disturbances between drinking and violence.

The remainder of the paper is structured as follows. In the next section, we discuss the importance of controlling for endogeneity and we outline the implementation of our bivariate probit model. Section 3 describes our data which are drawn from the 1997 and 1999 waves of the Harvard School of Public Health College Alcohol Study. We present our estimation results in section 4. Section 5 concludes the paper with some policy suggestions to reduce excessive drinking and violent behaviors.

2 Modeling Alcohol Use and Violence-related Outcomes

It is hypothesized that through a pharmacological mechanism alcohol consumption alters brain functions that normally suppress aggressive behaviors and also impairs information processing which may lead to violence as a result of misinterpretation or over-reaction. (Fagan, 1990; Miczek et al., 1997) The observed correlation between drinking and violence, however, also may be due to "reverse causality". That is, individuals who plan on becoming violent consume alcohol to lower the potential costs associated with violence by using drunkenness as an excuse. Or, it may simply be the case that the observed relationship between drinking and violence-related behavior is explained by the fact that individuals' unobservables between drinking and violence are correlated. Hence, in order to assess the extent to which alcohol-related policies may effectively reduce violence-related outcomes, it is important to establish a causal relationship between alcohol use and violence by controlling for the potential endogeneity of drinking.

In our model, we examine the relationship between binge drinking and the incidence of four violence-related outcomes among college students that include: arguing [ARGUE], damaging property [DAMAGE], trouble with the campus or local police [TROUBLE], and injury to oneself [INJURY]. We specify the probability of engaging in a violence-related outcome as follows:

$$V_i = \beta_B B_i + \beta'_X X_i + \epsilon_i \tag{1}$$

where V_i is a dichotomous violence-related outcome equal to one if the student engaged in a violent outcome and equal to zero otherwise. V_i is specified as a function of the binge (or frequent binge) drinking behavior of the student, B_i, and a vector of individual and college campus characteristics, X_i. Binge and frequent binge drinking is expected to increase the likelihood of all four of the violence-related outcomes.

The probability that an individual is a binge (or frequent binge) drinker is given by:

$$B_i = \beta_P Pi + \beta'_C C_i + \beta'_S S_i + \beta'_X X_i + u_i \tag{2}$$

where P_i is the price of alcohol, the vector C_i includes campus measures related to access to alcohol, the vector S_i includes state level alcohol-related policies, and the vector X_i includes individual and college campus characteristics. We expect the variables that increase the cost of alcohol consumption to reduce the probability of binge drinking. Again, B_i is a dichotomous outcome equal to one if the individual is a binge (or frequent binge) drinker and zero otherwise.

More formally, the potential problem of endogeneity may arises due to the fact that it is likely that the error terms ϵ_i and u_i are correlated – that is, individuals who have an unobserved propensity to drink greater amounts of alcohol may be more likely to engage in violence-related acts. Hence, estimating equation (1) directly based on a probit equation may result in a biased and inconsistent estimate of the parameter β_B in equation (1). Further, given that both the observed violence-related behavior and the observed binge drinking decisions are dichotomous outcomes, a two-stage estimation procedure that accounts for an endogenous right-hand-side variable but assumes a linear first stage would not be appropriate.[2]

Hence, we estimate a bivariate probit model to allow for correlation in the unobservables in order to produce an unbiased estimate of the effect of binge (or frequent binge) drinking (β_B) on violence-related behavior. We examine the extent to which the impact of binge and frequent binge drinking on our violence-related outcomes is affected by different assumptions on the correlations between ϵ_i and u_i. That is, we estimate our bivariate probit model fixing

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[2]However, since our results rely on the validity of our instruments, we estimate a 2SLS model which will produce consistent though inefficient estimates of our dichotomous outcomes variables, to allow us to test the validity of our instruments. (Davidson and MacKinnon, 1993)

the value of rho (ρ), the covariance between the two error terms, across the range of 0.1 to 0.5.[3] We also present probit results (which assumes $\rho = 0$) as a comparison to our sensitivity analyses based on the bivariate probit results.

3   Data Description

The data used for this analysis are drawn from the 1997 and 1999 waves of the College Alcohol Study (CAS) conducted by the Harvard University School of Public Health.[4] The CAS student survey was administered to a random sample of full-time students at colleges and universities from across the United States. The CAS is the first survey to focus on drinking patterns in a nationally representative sample of college students. In 1997, 15,685 students from 130 colleges responded to the survey and, in 1999, 14,907 students from 128 colleges completed and returned the CAS student questionnaires.[5]

The dependent variables in our analysis include four violence-related outcomes. Based on self-reported information by students who drank within the last year, we construct 0-1 dichotomous outcome indicators based on whether or not their drinking resulted in the following outcomes: arguing (26%), damaging property (12%), trouble with the campus or local police 6%), and injury to oneself (14%).[6]

With respect to our focus on the relationship between excessive drinking and violent out-

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[3]Given that we are primarily concerned about the extent to which the impact of binge and frequent binge drinking on our violence-related outcomes differs depending on the extent of correlation in the unobservables, we opt to restrict the value of rho in our estimation procedure. Further, we should note that when we estimated an unrestricted bivariate probit model, our trouble with police model did not converge – this is not surprising given the relatively low counts on that dependent variable.

[4]The first CAS was administered in 1993 but did not collect alcohol price data that is particularly well-suited to our study of binge drinking behavior. Hence, we draw on the 1997 and 1999 surveys.

[5]See Wechsler, Davenport, Dowdall, Moeykens and Castillo (1994), Wechsler, Dowdall, Maenner, Gledhill-Hoyt and Lee (1998), and Wechsler, Lee, Kuo, and Lee (2000) for a detailed description of the sampling methods and survey design of the CAS.

[6]The CAS only asked the violence-related questions to those students who drank within the last year. Therefore, our outcome measures and, hence, our estimation sample, is conditional on drinking. We condition our sub-sample on those students who drank in the last 30 days as this reflects the best overlap between our violence and drinking measures as permitted by the survey design.

comes, the survey provides information on binge drinking episodes defined for males(females) as those individuals who report having 5(4) or more drinks in a row on at least one occasion during the last two weeks prior to the survey.[7] We are also able to examine frequent binge drinking defined as an individual who engaged in binge drinking three or more times in the past two weeks.[8] In our sample, conditional on drinking, 64% and 20% of students are binge and frequent binge drinkers, respectively.

In order to identify our binge and frequent binge drinking measures in our bivariate probit analyses, we rely on several measures that account for the full price of alcohol. Given our focus on binge drinking behavior, we take advantage of two price measures that we can construct from the student questionnaires of the 1997 and 1999 waves of the CAS surveys. We construct two college level price measures: the average real college price paid per alcoholic drink and the proportion of students who pay a fixed fee for all they can drink. Students were asked to report the amount that they typically pay for a single alcoholic drink. Possible responses included: do not drink; pay nothing - drink free; under $.50; between $.51 and $1.00; between $1.01 and $2.00; between $2.01 and $3.00; $3.01 or more; pay a set fee. Based on this information, we construct the average college price as the campus mean of non-zero prices (using mid-points) paid for a single alcoholic drink as reported by students from each school. We use the consumer price index to denote our alcohol price measure in real 1990 dollars. The proportion of students who pay a fixed fee for all they can drink is defined as the percentage of students who drink within each campus, who when asked about how much they typically pay for a single alcoholic drink, reported typically paying a set fee to drink alcohol. This latter measure allows us to account for the impact on binge drinking of facing zero marginal cost after the first drink.

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[7]See Wechsler, Dowdall, Davenport, and Rimm (1995) for a discussion related to gender-specific measures of binge drinking.

[8]Given that the time reference for our violence outcomes and our drinking measures is not the same (and even if they did fall into the same time frame, we could not determine the exact sequencing of events), we assume that our observed data on drinking reflects the students' general drinking behavior.

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To further account for the full cost of alcohol, we include measures drawn from the CAS Administrator questionnaires to construct variables that reflect the availability of alcohol at each of the campuses. The first indicator equals one if there is a pub on campus and equals zero otherwise. The second variable indicates if there is one or more outlets licensed to sell alcoholic beverages located within one mile of the campus. We also take advantage of state-level alcohol control laws that were merged with our CAS data. Our two state-level policy variables capture information pertaining to whether or not a campus state imposes restrictions (either regulation or prohibition of) on happy hours at bars and pubs and dram shop laws which hold a bar or the owner of the establishment responsible for damages incurred from heavy or excessive drinking. These measures are dichotomous indicators set equal to a value of one if a state mandates a particular alcohol control policy and equal a value of zero otherwise.

The remaining independent variables that we use in our analyses reflect student, parental, and college characteristics. Based on the detailed demographic and socioeconomic information on each of the respondents available from the student questionnaires, we include the following control variables: the age of the respondent; an indicator for gender (one for males and zero for females); race (White - omitted, African American, Asian, Native American and Other race); ethnicity (Hispanic); religious affiliation (None or atheist - omitted, Catholic, Judaism, Islam, Protestantism, Other); living arrangements (single sex residence hall, co-ed residence hall, other university housing, fraternity/sorority housing, off-campus housing - omitted, and other type of housing); current year in school (freshman - omitted, sophomore, junior, senior, 5th year or beyond). The CAS survey also obtained detailed background information on the parents of the respondents. Parental information includes an indicator for parental education (college attended), as well as an indicator for both mothers' and fathers' past alcohol use (defined separately for both mother and father: parent not present, parent is a former problem drinker, parent abstains from alcohol - omitted, parent is an infrequent

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or moderate drinker, parent is a heavy drinker or current problem drinker).

Finally, drawing on the CAS Administrators' questionnaire, a number of variables reflecting characteristics of each student's college or university were also added to the college samples. Information on the type of campus (all female, traditionally African-American, small private, large private, commuter campus, small public or large public) and its regional location (South, West, Northeast or Midwest) were included in the analysis.

Tables 1 and 2 provide detailed summary statistics on the pooled 1997 and 1999 waves of our CAS data. We describe our full sample of 16599 observations based on our CAS subsample of students who drank in the last 30 days and for which we have non-missing data. We also provide sample means by binge drinking status and our violence-related outcomes.

4   Estimation Results

Tables 3 and 4 present selected key results from our estimation models. In Table 3, we present the estimates of the effects of our identifying variables on the probability of binge and frequent binge drinking behavior. This set of price and policy variables are expected to directly affect drinking behavior but not our violence-related outcomes.[9]

Our results from Table 3 reveal that, as expected, an increase in the average college price paid per alcoholic drink significantly reduces the probability of both binge and frequent binge drinking behavior by college students.[10] We also find that the probability of binge drinking increases when students are more likely to face zero marginal cost for the consumption of

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[9]The Davidson and MacKinnon (1993) over-identification tests based on our 2SLS models suggest that our set of instruments are valid. Note that if we did not include these regressors in the binge (and frequent binge) equations in our bivariate probit model, identification would be based solely on functional form.

[10]Similarly, Laixuthai and Chaloupka (1993) find that higher beer prices reduce binge drinking episodes by youths and Kenkel (1993) finds that heavy drinking by younger persons is more price sensitive compared to their adult counterparts. However, examining the drinking practices of colleges student by gender and age, Chaloupka and Wechsler (1996) find only the binge drinking behavior of under-aged females to be sensitive to the price of beer. None of these studies examine the impact of fixed fee payment schemes on alcohol consumption.

additional drinks. That is, students who attend colleges where there is greater access to fixed sum payments for "all you can drink" are significantly more likely to engage in binge drinking by almost 30%. This variable is not significant when we examine the subset of frequent binge drinkers compared to non-binge and infrequent binge drinkers.

With respect to our alcohol access variables, we find that on-campus pubs neither increase or decrease binge drinking. While the close proximity of drinking establishments to college campuses (one or more bars located within a mile of the campus) is found to encourage binge drinking, it is not significant based on our robust standard errors. Finally, with respect to our state law alcohol restrictions, we find that happy hour and dram shop law restrictions significantly reduce the probability of binge and frequent binge drinking, respectively.

Turning to our results for our violence-related outcomes, in Table 4, we present bivariate probit results based on different assumptions of the correlation of disturbances where ρ ranges from 0.1 to 0.5 and we present single-equation probit results of the effects of binge and frequent binge drinking on our four violence outcomes related to arguing, damaging property, trouble with the campus or local police, and injury to oneself.

Based on the assumption that the excessive drinking behavior indicators are exogenous, our single-equation probit estimates uniformly suggest a significant positive relationship between both binge and frequent binge drinking and all four of our violence-related outcomes. Binge drinking is estimated to increase the probability of our violence measures ARGUE, DAMAGE, POLICE, and INJURE by 21.1%, 10.2%, 5.5%, and 13.2% respectively, while the corresponding increase in violence rates due to frequent binge drinking are estimated to be 24.1%, 15.9%, 7.6%, and 15.2%. However, given that these results do not account for the potential endogeneity between the drinking patterns and violence measures, we cannot interpret these results as providing causal evidence that the practice of binge drinking leads to violent acts, nor can we assume that the implied magnitude of these results are unbiased.

To assess the sensitivity of these results to the fact that unobservable characteristics may

be correlated across drinking patterns and violent behavior, we estimate a bivariate probit model that allows for correlation across the error terms of our dichotomous drinking and violence outcomes, assuming increasing levels of correlation.

The bivariate probit results show that once we control for endogeneity where $\rho = 0.1$, binge and frequent binge drinking still significantly affect all four violence-related outcomes. The magnitude of these effects, however, is smaller than those suggested by the single-equation probit model. The bias is found to be greater in our frequent binge model: the single-equation probit model over-estimates the effects by a factor of almost two for the binge model and by a factor of about five in the frequent binge model. Based on the bivariate probit model where $\rho = 0.1$, excessive drinking is estimated to increase the probability of our violence measures ARGUE, DAMAGE, POLICE, and INJURE, respectively, by 11.5%, 7.1%, 3.8%, and 8.0% for binge drinking and 3.7%, 3.3%, 1.5%, and 2.4% for frequent binge drinking. For both drinking measures, the effect on trouble with the local or campus police is lower relative to the other three violence measures.

Our results show that even at an assumed level of correlation of $\rho = 0.3$, binge drinking significantly increases probability of arguing, vandalism and injury to oneself by about 4-5%, with a smaller impact on trouble with the police. Overall, our sensitivity analyses reveal that in order to conclude that binge and frequent binge drinking has no effect on violence-related outcomes, the correlation between the unobservables would have to be quite large, approximately 0.4 to 0.5.

5   Conclusions

Not unlike the parents of college students, college administrators are also concerned with excessive drinking patterns at American campuses and related problems such as violence. In this regard, prevention efforts are currently being made to reduce binge drinking. In

particular, Wechsler et al. (2000) showed that practices such the education of alcohol, policies to limit access to alcohol, restrictions on advertising at sporting events, and an increase in the availability of alcohol-free dorms are already being implemented across some college campuses, while being considered at other colleges.

Our empirical results indicate that additional strides in the fight against binge drinking on college campuses may be made by prohibiting the sale of alcohol on a flat fee basis. This college-alcohol restriction would eliminate the possibility that students face zero marginal cost as they consume additional alcoholic beverages. In addition, the imposition of local ordinances to prohibit the sale of alcohol on a flat fee basis would be an effective measure to reduce binge drinking off-campus. Our results also indicate that state laws are an effective means of tackling the college drinking problem. Higher alcohol prices which can be increased via higher levels of taxation were shown to have a clear negative impact on binge drinking. Further, states that impose restrictions on pricing via happy hours regulations and those that impose dram shop laws were also found to be effective as a means of reducing binge drinking.

Examining the impact of binge and frequent binge drinking on violence-related outcomes, our bivariate probit results show that once we control for endogeneity where $\rho = 0.1$, binge and frequent binge drinking still significantly affect all four violence-related outcomes. The magnitude of these effects, however, is smaller than those suggested by the single-equation probit model by a factor of almost two for the binge model and by a factor of about five in the frequent binge model. Our sensitivity analyses show that to conclude that binge and frequent binge drinking have no effect on violence-related outcomes, the correlation between the unobservables would have to be very large, approximately 0.4 to 0.5. Hence, overall, our results suggest that alcohol control measures that successfully reduce binge drinking can be expected to reduce violence among college students.

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Table 1: Means of Demographic, Campus, and State Policy Variables

	Full Sample	Binge Drinker	Frequent Binge Drinker
Male	41.20%	45.10%	73.94%
Age	20.95	20.70	20.70
White	83.84%	86.87%	89.76%
African American	3.54%	2.07%	1.56%
Asian	5.11%	4.00%	2.58%
Native American	0.51%	0.59%	0.46%
Other Race	7.00%	6.47%	5.64%
Hispanic	6.74%	6.39%	5.49%
Freshman	20.40%	22.38%	22.23%
Sophomore	20.50%	21.74%	21.46%
Junior	24.54%	24.69%	24.46%
Senior	23.96%	22.07%	21.77%
5th Year or Beyond	10.59%	9.13%	10.09%
Atheist	13.48%	12.78%	11.68%
Catholic	41.12%	43.63%	45.92%
Jewish	3.87%	3.74%	3.49%
Moslem	0.40%	0.38%	0.31%
Protestant	30.41%	29.13%	29.31%
Other Religion	10.71%	10.35%	9.29%
At least one parent attended college	82.58%	84.11%	85.87%
No Father	2.28%	2.15%	1.90%
Father Former Problem Drinker	2.49%	2.67%	2.30%
Father Abstainer	15.04%	14.59%	13.89%
Father Infrequent/Moderate Drinker	69.00%	70.08%	71.98%
Father Heavy/Problem Drinker	11.18%	10.51%	9.93%
No Mother	0.43%	0.39%	0.37%
Mother Former Problem Drinker	0.89%	0.81%	0.80%
Mother Abstainer	28.57%	27.74%	26.49%
Mother Infrequent/Moderate Drinker	67.43%	68.58%	70.29%
Mother Heavy/Problem Drinker	2.51%	2.47%	2.05%
Live off-campus	52.50%	50.25%	51.62%
Unisex dorm	11.18%	10.78%	9.23%
Co-ed dorm	25.65%	27.79%	26.76%
Other university housing	3.07%	2.94%	2.70%
Live in fraternity/sorority	3.75%	5.05%	7.42%
Other housing	3.87%	3.19%	2.27%
Woman's college	4.52%	3.17%	1.32%
African American college	0.89%	0.46%	0.25%
Commuter college	12.74%	10.26%	7.51%
Small private campus	10.40%	10.27%	9.99%
Large private campus	14.85%	16.01%	17.32%
Small public campus	15.57%	16.38%	16.62%
Large public campus	41.03%	43.46%	47.00%
Northeast	24.56%	24.29%	23.88%
South	28.36%	28.32%	29.18%
West	15.19%	13.26%	11.68%
Midwest	31.90%	34.13%	35.25%
Avg College Price	131.66	129.16	136.18
Fraction pay fixed sum for drinks	4.50%	4.87%	3.84%
Pub on Campus	30.62%	30.29%	31.21%
Bar within 1 mile	92.25%	92.80%	91.27%
Happy hour restrictions	52.42%	52.44%	52.40%
Dram law restrictions	79.79%	79.22%	80.82%
Number of observations	16599	10677	5922

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Table 2: Demographic and Campus Variables by Violence-related Outcome

	Argue	Damage	Police	Injured	No Violence
Male	44.98%	72.60%	59.85%	45.63%	37.91%
Age	20.57	20.30	20.04	20.30	21.19
White	87.51%	89.38%	89.78%	88.20%	81.88%
African American	2.10%	1.45%	1.67%	1.42%	4.39%
Asian	3.51%	3.26%	3.44%	3.56%	5.89%
Native American	0.65%	0.41%	0.65%	0.62%	0.47%
Other Race	6.24%	5.49%	4.46%	6.19%	7.37%
Hispanic	6.19%	5.18%	3.90%	5.92%	7.08%
Freshman	23.38%	27.65%	33.55%	27.20%	18.02%
Sophomore	23.06%	25.01%	26.86%	23.37%	19.17%
Junior	24.22%	21.70%	21.38%	24.89%	24.85%
Senior	20.52%	18.54%	13.38%	18.03%	26.11%
5th Year or Beyond	8.82%	7.09%	4.83%	6.50%	11.84%
Atheist	11.70%	13.57%	14.87%	13.00%	13.92%
Catholic	45.58%	45.47%	45.54%	46.04%	39.06%
Jewish	3.19%	3.06%	3.25%	4.01%	4.11%
Moslem	0.37%	0.36%	0.37%	0.27%	0.40%
Protestant	28.90%	29.21%	27.79%	26.85%	31.50%
other Religion	10.26%	8.34%	8.18%	9.84%	11.01%
At least one parent attended college	83.57%	86.85%	86.99%	86.42%	81.61%
No Father	2.51%	2.02%	2.42%	1.96%	2.24%
Father Former Problem Drinker	2.68%	2.80%	4.00%	2.49%	2.38%
Father Abstainer	14.59%	15.17%	14.68%	12.73%	15.49%
Father Infrequent/Moderate Drinker	69.57%	70.69%	70.26%	71.55%	68.28%
Father Heavy/Problem Drinker	10.66%	9.32%	8.64%	11.26%	11.61%
No Mother	0.60%	0.62%	0.93%	0.45%	0.38%
Mother Former Problem Drinker	0.81%	1.29%	1.39%	1.20%	0.84%
Mother Abstainer	27.43%	26.67%	27.97%	23.46%	29.79%
Mother Infrequent/Moderate Drinker	68.66%	68.70%	67.29%	72.35%	66.53%
Mother Heavy/Problem Drinker	2.49%	2.74%	2.42%	2.54%	2.47%
Live off-campus	49.12%	44.85%	37.45%	44.21%	54.95%
Unisex dorm	10.63%	10.93%	11.06%	11.67%	11.25%
Co-ed dorm	28.99%	33.04%	39.96%	33.08%	23.25%
Other university housing	2.79%	2.90%	4.00%	2.80%	3.21%
Live in fraternity/sorority	5.65%	6.47%	5.76%	6.37%	2.71%
Other housing	2.82%	1.81%	1.77%	1.87%	3.21%
Woman's college	2.75%	1.76%	0.74%	2.54%	5.53%
African American college	0.58%	0.18%	0.37%	0.27%	1.10%
Community college	9.52%	7.04%	6.04%	6.72%	14.75%
Small private campus	10.14%	9.53%	9.57%	9.22%	10.65%
Large private campus	15.24%	19.42%	18.59%	18.52%	14.21%
Small public campus	17.05%	16.83%	21.00%	16.56%	14.94%
Large public campus	44.72%	45.21%	43.68%	46.17%	38.83%
Northeast	23.92%	27.34%	24.72%	27.47%	24.30%
South	29.74%	26.77%	27.88%	24.84%	28.28%
West	13.03%	12.43%	12.73%	13.22%	16.22%
Midwest	33.32%	33.45%	34.67%	34.46%	31.20%
Avg College Price	128.45	126.73	125.68	127.38	133.49
Fraction pay fixed sum for drinks	4.84%	5.36%	5.18%	5.50%	4.23%
Pub on Campus	30.04%	31.90%	29.18%	31.70	30.40%
Bar within 1 mile	92.14%	93.42%	90.33%	92.79%	92.20%
Happy hour restrictions	52.12%	51.89%	49.53%	52.40	52.61%
Dram law restrictions	78.66%	79.86%	79.18%	80.28	52.61%
Number of observations	4298	1931	1076	2246	10699

Table 3: The Effects of the Excluded Variables on the Probability of Binge and Frequent Binge Drinking Behavior

	Binge	Frequent Binge
Average College Price	$-0.001^{\ddagger}$	$-0.001^{\ddagger}$
Fraction pay fixed sum for drinks	$0.289^{\ddagger}$	0.027
Pub on Campus	-0.017	-0.007
Bar within 1 mile	0.026	0.014
Happy hour restrictions	$-0.022^{\star}$	-0.000
Dram law restrictions	-0.111	$-0.021^{\star}$

Notes: This table presents the marginal effects based on a probit model for binge and frequent binge drinking. We obtain similar results based on the bivariate probit models estimated within our sensitivity analyses presented in Table 4. Controls for age, sex, race, ethnicity, religious affiliation, year in school, parents education, parents drinking patterns, living arrangements, type of college, region, and year are included but are not shown in the table. The symbols $\star$, $\dagger$, and $\ddagger$ represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, based on robust standard errors clustered at the college level.

Table 4: The Effects of Binge and Frequent Binge Drinking on Violence-related Outcomes

| | Results from the Binge Models | | | |
	Argue	Damage	Police	Injured
Probit Model:	$0.211^{\ddagger}$	$0.102^{\ddagger}$	$0.055^{\ddagger}$	$0.132^{\ddagger}$
Bivariate Probit Model:				
ρ=0.1	$0.115^{\ddagger}$	$0.071^{\ddagger}$	$0.038^{\ddagger}$	$0.080^{\ddagger}$
ρ=0.2	$0.086^{\ddagger}$	$0.057^{\ddagger}$	$0.029^{\ddagger}$	$0.064^{\ddagger}$
ρ=0.3	$0.051^{\ddagger}$	$0.041^{\ddagger}$	$0.016^{\ddagger}$	$0.044^{\ddagger}$
ρ=0.4	0.010	$0.017^{\ddagger}$	-0.002	$0.016^{\ddagger}$
ρ=0.5	$-0.038^{\ddagger}$	$-0.014^{\dagger}$	$-0.028^{\ddagger}$	$-0.021^{\ddagger}$

| | Results from the Frequent Binge Models | | | |
	Argue	Damage	Police	Injured
Probit Model:	$0.241^{\ddagger}$	$0.159^{\ddagger}$	$0.076^{\ddagger}$	$0.152^{\ddagger}$
Bivariate Probit Model:				
ρ=0.1	$0.037^{\ddagger}$	$0.033^{\ddagger}$	$0.015^{\ddagger}$	$0.024^{\ddagger}$
ρ=0.2	$0.025^{\ddagger}$	$0.025^{\ddagger}$	$0.010^{\ddagger}$	$0.016^{\ddagger}$
ρ=0.3	$0.012^{\ddagger}$	$0.016^{\ddagger}$	$0.003^{\star}$	$0.006^{\ddagger}$
ρ=0.4	-0.003	$0.005^{\dagger}$	$-0.005^{\ddagger}$	$-0.006^{\ddagger}$
ρ=0.5	$-0.019^{\ddagger}$	$-0.008^{\ddagger}$	$-0.016^{\ddagger}$	$-0.020^{\ddagger}$

Notes: Marginal effects are presented for the bivariate probit and probit model. Controls for age, sex, race, ethnicity, religious affiliation, year in school, parents education, parents drinking patterns, living arrangements, type of college, region, and year are included but are not shown in the table. The symbols $\star$, $\dagger$, and $\ddagger$ represent statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively, based on robust standard errors clustered at the college level.

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