NBER WORKING PAPER SERIES

HIGH SCHOOL ALCOHOL USE AND YOUNG ADULT LABOR MARKET OUTCOMES

Pinka Chatterji
Jeffrey DeSimone

Working Paper 12529
http://www.nber.org/papers/w12529

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 2006

We thank participants in sessions at the 2005 Southern Economic Association and 2006 American Society of Health Economists meetings, especially Sandy Decker and Rey Hernandez, for helpful comments. Chatterji gratefully acknowledges research support from grant K01 AA000328-03 from the National Institute of Alcohol Abuse and Alcoholism. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

High School Alcohol Use and Young Adult Labor Market Outcomes
Pinka Chatterji and Jeffrey DeSimone
NBER Working Paper No. 12529
September 2006
JEL No. I1,J2,J3

ABSTRACT

We estimate the relationship between 10th grade binge drinking in 1990 and labor market outcomes in 2000 among National Educational Longitudinal Survey respondents. For females, adolescent drinking and adult wages are unrelated, and negative employment effects disappear once academic achievement is held constant. For males, negative employment effects and, more strikingly, positive wage effects persist after controlling for achievement as well as background characteristics, educational attainment, and adult binge drinking and family and job characteristics. Accounting for illegal drug use and other problem behaviors in 10th grade eliminates the unemployment effect, but strengthens the wage effect. As the latter is not explicable by the health, income or social capital justifications that are often used for frequently observed positive correlations between adult alcohol use and earnings, we conjecture that binge drinking conveys unobserved social skills that are rewarded by employers.

Pinka Chatterji
Center for Multicultural Mental Health Research
Cambridge Health Alliance
Harvard Medical School
120 Beacon Street, 4th Floor
Somerville, MA 02143
and NBER
pchatterji@charesearch.org

Jeffrey DeSimone
Department of Economics
College of Business Administration
University of South Florida
4202 East Fowler Avenue, BSN 3403
Tampa, FL 33620-5500
and NBER
jdesimon@coba.usf.edu

1. Introduction

Because of its varied potentially harmful consequences in both the short and long terms, there is considerable interest among the public as well as policymakers in limiting underage drinking. National U.S. surveys show that heavy alcohol use is widespread among older adolescents. In the 2005 Monitoring the Future (MTF) study, 28 percent of high school seniors reported having at least one alcohol binge, i.e. five or more drinks in a row, in the past 2 weeks (Johnston, O'Malley & Bachman 2006). In the 2004 National Survey on Drug Use and Health, clinically defined criteria for alcohol abuse or dependence are met by 13.5 percent of 17 year olds, 15.0 percent of 18 year olds, and 17.2 percent of 19 year olds (SAMHSA 2004).

Many teenagers do not view heavy drinking as risky. For instance, in 2005, 55 percent of high school seniors disagreed with the suggestion that binge drinking once or twice each weekend would put an individual at "great risk" for harmful consequences (Johnston, O'Malley & Bachman 2006). Yet, drinking is a primary risk factor for a variety of potentially damaging behaviors. These include drunk driving, physical violence (Markowitz & Grossman 1998), unsafe sexual practices (Markowitz et al. 2005) that can lead to the contraction of sexually transmitted diseases such as AIDS and gonorrhea (Grossman et al. 2004, Carpenter 2005), and suicide attempts (Chatterji et al. 2004) that are sometimes completed (Markowitz et al. 2003, Carpenter 2004). As others have noted (e.g. Dave & Kaestner 2002), these serious health consequences of drinking at least partially justify alcohol control policies aimed at youth.

Beyond these direct and immediate effects, teen drinking may also indirectly impact a variety of longer term outcomes, including those involving the labor market. If alcohol consumption during adolescence lowers academic achievement or educational attainment or raises future alcohol consumption levels, it could potentially affect employment and wages

during adulthood. For instance, Zeigler et al. (2005) describe how adolescents who engage in heavy episodic or binge drinking are at elevated risk of neurodegeneration, particularly in regions of the brain responsible for learning and memory, and link this with poor study habits.

Yet to our knowledge, only one study in the economics literature, Mullahy and Sindelar (1993), has addressed this topic. They find that previously meeting the diagnostic criteria for alcoholism worsens future labor market outcomes, at least in part through negative impacts on human capital accumulation. Even their study does not directly address our question of interest, however. Their drinking measure captures early onset of alcoholism at any time prior to a single interview occurring at age 30–59. In contrast, we are interested more broadly in drinking that is heavy, but does not necessarily meet clinical criteria for alcohol abuse or dependence, and more specifically takes place during adolescence.

Though pioneering, the Mullahy and Sindelar (1993) study uses data that were collected over 25 years ago and are cross-sectional, thus requiring reliance on retrospective information regarding previous drinking. Moreover, they analyze a sample that is small and geographically restricted. These limitations warrant further work on the topic. Other research on long-run human capital effects of adolescent drinking, however, has been restricted to educational outcomes. Conversely, prior work on labor market consequences of alcohol use has focused on the contemporaneous relationship for adults.

The aim of this paper is to empirically investigate the effects of drinking as a teenager on labor market experiences during early adulthood. We examine data from the National Education Longitudinal Study (NELS), which sampled a cohort of 8th graders in 1988 and followed up with them several times over the subsequent 12 years. The analysis regresses employment and wages

in the year 2000, when respondents were about 26 years old, on binge drinking ten years previously, when most respondents were in 10th grade.

Our initial strategy mimics the approach of Mullahy and Sindelar (1993) by successively adding controls for various intermediate outcomes that are apt to both respond to adolescent drinking and influence early adult labor market success. This provides an opportunity to identify indirect pathways linking teen alcohol consumption to adult wages and employment, which yields information regarding a prospective causal aspect of this link.

Our findings differ by gender. Among females, an observed inverse association between teen binge drinking and adult employment disappears when high school academic achievement is held constant, and adult wages are unrelated to teen drinking. For males, in contrast, significant correlations between adolescent alcohol use and adult labor market outcomes persist even after controlling for the above factors as well as background characteristics, educational attainment, and adult binge drinking and family and job characteristics. More remarkably, the sign of the correlation is negative for employment, as hypothesized, but positive for wages.

To further investigate the male results, we add controls for various 8th grade characteristics and 10th grade problem behaviors that are potentially related with both teen drinking and adult labor market performance. Accounting for 10th grade problem behaviors, particularly marijuana use, eliminates the negative employment effect. We interpret this to reflect the presence of unobservable factors that are associated with both more teen binge drinking and poorer adult labor market prospects. However, including these additional 10th grade covariates only reinforces the positive wage effect. Ultimately, among males employed at age 26, the wages of those who binge drank ten years previously are about six percent higher than those of their non-binging peers.

This result is consistent with a recurring observation among previous researchers that some forms of adult drinking are associated with higher contemporaneous earnings. Conventionally offered explanations include health and psychological benefits conveyed by moderate drinking, reverse causation through income effects on alcohol consumption, and a positive effect of drinking on the accumulation of social capital. However, none of these stories is compatible with our finding, particularly considering that our models also control for adult binge drinking. A contribution of our work, therefore, is its implication that unobserved heterogeneity could well be a more important component of the observed positive relationship between adult drinking and earnings than many researchers had previously thought. We are unable to identify the relevant unobserved factors, but posit that the wage premium from adolescent binge drinking represents social skills that are valued by employers.

2. Previous studies of drinking and human capital outcomes

The economics literature on the relationship between alcohol use and labor market success is motivated by the observation that excessive drinking adversely affects physical and mental health, memory, cognition and behavior (e.g. U.S. DHHS 2000). On this basis, drinking that is heavy or intense is expected to impair contemporaneous labor market performance. Moreover, previous physiologically problematic alcohol consumption has the potential to negatively impact current labor market outcomes by reducing human capital accumulated in the interim. This is particularly true given that adolescent drinking is associated with brain damage and neurocognitive deficits, and that the resulting impairments in learning and intellectual development can last into adulthood (Zeigler et al. 2005).

Yet, we know of only one study that has examined the relationship between previous alcohol consumption and current labor market outcomes. Using 1980–1981 data on 555 males age 30– 59 from the New Haven site of the Epidemiologic Catchment Area survey, Mullahy & Sindelar (1993) investigate the earnings impact of previously meeting diagnostic criteria for alcoholism. Their main result is that ever-alcoholics earn 31 percent less than others, but this difference falls to 17 percent when health status, schooling, marital status and non-earned income are held constant. This suggests that alcoholism reduces the subsequent acquisition of productivity-enhancing human capital. The lack of any additional association between current alcoholism and earnings, after controlling for previous alcoholism, further supports this proposition. Mullahy and Sindelar also show that the negative alcoholism gradient is larger for the less educated and less healthy, and that most of the impact of alcoholism is on the likelihood of full-time employment rather than on the wages of those employed full-time.

Considerable recent work has been devoted to examining the contemporaneous relationship between alcohol use and labor market performance during adulthood. Several studies of employment have found deleterious drinking effects after accounting for the potential endogeneity of drinking. Mullahy & Sindelar (1996) and Terza (2002), using data from the 1988 Alcohol Supplement to the National Health Interview Survey, and MacDonald & Shields (2004), analyzing data from the Health Survey of England, each report that problem drinking significantly reduces the probability of employment. Meanwhile, Cook & Peters (2005) estimate reduced form equations in the National Longitudinal Survey of Youth (NLSY), finding that the prevalence of full-time work increases with alcohol prices. On the other hand, in 1979–1995 outgoing rotation files of the Current Population Survey, Dave & Kaestner (2002) estimate a weak and indeterminate relationship between alcohol taxes and both employment and wages.

Similarly, using individual fixed effects models in data from the Russian Longitudinal Monitoring Survey (RLMS), Tekin (2004) finds that alcohol consumption has no significant effect on employment.

In contrast, most prior research on wages and income suggests positive effects of alcohol use, at least for moderate drinking levels. Numerous studies report an inverse U-shaped relationship between earnings and the amount of alcohol consumed, with moderate drinkers earning more than either abstainers or heavy drinkers. These include Berger & Leigh (1988) in the 1972–1973 Quality of Employment Survey, French & Zarkin (1995) in 1991–1993 data from four worksites, Heien (1996) in the 1979 and 1984 National Household Surveys on Alcohol Use, Hamilton and Hamilton (1997) in 1985 Canadian General Social Survey data on prime-age males, and Barrett (2002) in 1989–1990 Australian National Health Survey data on males employed full-time. Several additional studies find drinking wage premiums that are largely invariant to the level of consumption, including Zarkin et al. (1998) in 1991–1992 National Household Survey on Drug Abuse data on prime-age males, Tekin (2004) as documented above, van Ours (2004) in 2001 Dutch survey data on males, and Auld (2005) in 1985 and 1991 Canadian General Social Survey data on prime-age males. Recent estimates of drinking earnings premiums range from 7–12 percent (Zarkin et al. 1998, van Ours 2004, Auld 2005).

The main exceptions to the above, besides Dave & Kaestner (2002) as previously mentioned, are Peters (2004) and Cook & Peters (2005). Peters (2004) finds in NLSY data that positive drinking coefficients are rendered statistically insignificant when individual fixed effects are included. Cook & Peters (2005) estimate a positive association between alcohol prices and the earnings of full-time workers in the NLSY, even though in separate regressions drinking enters earnings regressions positively.

Two particular rationales have been offered to explain how drinking might play a causal role in increasing earnings. First, moderate alcohol use could improve labor market performance because of its beneficial effects on physical and mental health (DHHS 2000). The sizes of these premiums, however, seem implausibly large under this scenario, given that the primary health benefit from drinking is a reduction in the risk of heart disease in middle-aged and older individuals (Dufour 1996). Moreover, there is little reason to believe that heavy drinking would convey any health benefits to offset the well-documented problems that it can create. Second, as authors such as van Ours (2004) and Cook & Peters (2005) describe, drinking could generate productivity-enhancing social capital if it sometimes occurs in situations that lead to career networking. Yet, no study has either directly examined or obtained evidence uniquely consistent with this hypothesis.

Others have posited that the positive relationship is not causal, but rather a manifestation of the endogeneity of drinking in earnings equations. Endogeneity could arise from income effects in models that do not or inadequately control for reverse causation, or from omitted factors that influence both drinking and earnings. Either circumstance would explain the contrast between the reduced form results of Dave & Kaestner (2002) and Cook & Peters (2005), as well as the individual fixed effects models of Peters (2004) and Tekin (2004) for employment, and the remaining studies that use either single equation or instrumental variables models.

Although unobserved heterogeneity is the typical reason for controlling for endogeneity when estimating effects of behavioral variables in general, most authors in this literature have focused on the possibility of reverse causation. We emphasize this because the distinction between unobserved heterogeneity and the other explanations for drinking wage premiums is particularly important for us. A positive effect of adolescent drinking on adult employment or

wages, particularly while controlling for adult drinking, is consistent with the presence of time-invariant unobserved heterogeneity but unlikely to reflect any of the other justifications above. Because of this, our analysis potentially informs the literature on adult drinking and earnings, a point to which we return later.

Another strand of literature to which our work clearly relates is that on the effects of teen drinking on subsequent educational attainment. Using the earlier described New Haven data, Mullahy and Sindelar (1989) find that early alcoholism reduces educational attainment by 1–1.5 years. Estimates from several additional studies using NLSY data support this conclusion. Cook & Moore (1993) report that high school seniors who drink on at least two days in the past week complete 2.3 fewer years of college than their peers. Yamada et al. (1996) find that a 10 percent increase in drinking frequency reduced the probability of high school graduation by 6.5 percent. Koch & Ribar (2001) estimate that delaying alcohol initiation by one year raises completed schooling by up to 0.47 years for men and 0.36 years for women. Koch & McGeary (2005) find that alcohol initiation before age 14 reduces the probability of timely high school completion by 7–22 percent. Chatterji & DeSimone (2005), using NLSY Young Adult data, similarly find that binge or frequent drinking among 15-16 year old students lowers the probability of having graduated or being enrolled in high school four years later by 11 percent. These studies suggest that reduced schooling is one avenue through which youth drinking could reduce adult wages.

On the other hand, neither Chatterji (2006), using NELS data, nor Dee & Evans (2003), using 1977–1992 Monitoring the Future data, find evidence that high school alcohol use affects high school completion, college entrance or college persistence. Similarly, in NLSY data, Bray (2005) observes little relationship between alcohol use and returns to either education or work experience.

Various other intermediate outcomes could provide pathways for adolescent alcohol use to affect adult employment and wages. Wolaver (2002), Williams et al. (2003), and DeSimone & Wolaver (2005) each estimate negative effects of student binge drinking on grades in school, while Jones & Jackson (1990) link grades to earnings. Grossman et al. (1998), Bentzen et al. (1999), Baltagi & Griffin (2002), and Bask & Melkersson (2004) each obtain empirical evidence that alcohol is (rationally) addictive. Finally, Mullahy & Sindelar (1989) show that early alcoholism is associated with lower occupational status, while MacDonald & Shields (2001), in 1992–1996 Health Survey for England data, find positive occupational status returns to moderate levels of drinking that drop off rapidly as consumption levels increase.

3. Methods

Our objective is to estimate the relationship between adolescent drinking and early adult labor market outcomes. Ideally, we would be able to assess the causal nature of any association that we uncover. But definitive causal statements, which are inherently tentative in any empirical study, are made even more speculative in our case by the nature of the question that we ask. Specifically, we would prefer to pursue an instrumental variables approach. But even in NELS, which is a rich source of data on potential confounders of the relationship, it is difficult to conceive of instruments that plausibly influence adolescent drinking but have no separate correlation with young adult employment and wages. This is particularly true given the variety of ways through which adolescent drinking can potentially affect later labor market performance. Because our data on youth alcohol use are purely cross sectional, even if we could identify state policies that altered adolescent drinking behavior but were exogenous with respect to labor

market outcomes, variation in these variables would likely be contaminated by unobserved state-level heterogeneity.

As an alternative, we attempt to exploit the richness of our data on intermediate human capital outcomes by mimicking the approach that Mullahy & Sindelar (1993) used to examine the effect of prior alcoholism on income. We begin by estimating simple regressions of adult employment and wages on adolescent drinking, to establish baseline coefficient values. From there, we sequentially control for additional groups of factors that might mediate the relationship. Changes in the teen alcohol use coefficient indicate the extent to which the observed relationship operates through the group of variables added at each stage. Both these changes, therefore, and the coefficient that remains at the end of the process potentially convey information on the sense in which adolescent drinking might causally effect adult labor market performance.

More formally, we estimate equations of the form

$$L = \alpha_0 + \alpha_1 A_T + \mathbf{X}\boldsymbol{\alpha_2} + \mathbf{Y}\boldsymbol{\alpha_3} + \alpha_4 E + \alpha_5 A_A + \mathbf{Z}\boldsymbol{\alpha_6} + \mathbf{S}\boldsymbol{\alpha_7} + \mathbf{J}\boldsymbol{\alpha_8} + \varepsilon, \quad (1)$$

where terms in bold are vectors. The dependent variable, L, is an adult labor market outcome, either employment or the wage. Teen alcohol use, A_T, is a right hand side variable. The error term, which is potentially correlated with A_T, is ε. The α terms are parameters that we estimate using single equation regression models, i.e. probit for employment and OLS for the wage.

Our analysis first estimates a simple regression of employment and wage on teen drinking, i.e. setting $\alpha_m = 0$ for $m > 1$. We call this model 1. Successive models add one additional (set of) variable(s), moving from left to right in the equation. In our labeling, therefore, model numbers correspond to the subscript of the parameter multiplying the right-most set of variables appearing in the regression.

Model 2 includes a set of presumably exogenous demographic and family background characteristics that are measured when respondents are in 8^{th} or 10^{th} grade (**X**). The coefficient α_1 from model 2 is our baseline estimate. It represents the total association between teen alcohol use and adult employment or wage. A direct effect of drinking lagged 10 years on labor market outcomes, independent of any other determinant of adult productivity, seems implausible. Put differently, therefore, our model 2 estimate represents the net effect of all indirect channels through which adolescent drinking is related with adult employment and wage. It is likely that the model 2 estimate of α_1 captures time-invariant unobserved heterogeneity as well. Unmeasured differences between teens who do and do not binge drink, such as personality traits and adverse events that had occurred by the time of the 10^{th} grade survey, might influence both teen binge drinking status and adult labor market performance.

We proceed by incrementally adding to Model 2 sets of variables that might simultaneously respond to adolescent binge drinking and influence adult labor market success. Significant changes in the estimate of α_1 when inserting a set of variables into the regression would indicate that these variables represent indirect pathways through which teen drinking affects adult employment or wage. For example, suppose that our estimate of α_1 in the wage equation is negative and large before adding educational attainment, but loses both practical and statistical significance once educational attainment is included. This would imply that most of the negative correlation between adolescent drinking and the adult wage is explained by an inverse relationship between adolescent drinking and completed schooling.

Although causality in the latter pathway is not guaranteed, the above finding would at least identify a direct outcome of adolescent drinking, i.e. schooling, for which further investigation of a possible causal relationship would be important. On the other hand, little

change in the α_1 estimate upon controlling for a potential intermediate outcome of teen alcohol use would suggest that the corresponding outcome is not in fact an indirect pathway through which early alcohol use and later labor market outcomes are related.

As implied by the equation 1 notation, we estimate six additional specifications beyond model 2. Specifically, model 3 includes a set of variables measuring high school academic achievement (**Y**), model 4 adds educational attainment (E), model 5 inserts adult drinking (A_A), model 6 incorporates adult personal characteristics (**Z**), model 7 includes state fixed effects, and model 8 controls for job characteristics (**J**). Because job characteristics are observed only for workers, model 8 can be estimated for the wage, but not employment. The following section provides details regarding the specific variables included in each category.

We assume that our empirical representation of each of the explanatory factors in model 8 is adequate, and that model 8 controls for all relevant mechanisms through which adolescent drinking could affect adult employment and wages. Consequently, we interpret a significant model 8 estimate of α_1, regardless of sign, as evidence of unobserved heterogeneity.

In such cases, we further investigate the source of the relationship between adolescent drinking and adult labor market outcomes. Namely, we add two additional sets of variables, each of which proxies for fixed unmeasured characteristics that might be correlated with both youth drinking and adult productivity. The first set consists of behaviors, characteristics and circumstances that existed in 8th grade, two years before teen alcohol use is measured. The second set comprises several other potentially problematic behaviors in 10th grade. A reduction in the association between early drinking and later labor market success upon adding any of these supplementary 8th and 10th grade variables would provide more concrete evidence of unobserved heterogeneity.

4. Data

4.1 The National Education Longitudinal Study

Data for our analysis come from the National Education Longitudinal Study (NELS). The survey initially interviewed students in 8th grade, prior to high school entry, and then followed them at various points for the next 12 years, regardless of interim school enrollment status. In the spring of 1988, a clustered and stratified probability sample of over 1,000 public and private schools was used to collect information from about 25,000 8th graders. Students completed baseline surveys and took curriculum-sensitive cognitive tests in reading, mathematics, science and social studies. Parents, teachers and school principals also completed base year questionnaires. Students were re-interviewed in 1990, 1992, 1994, and 2000. By the last survey, respondents were generally about 26 years old, and those who had never dropped out or repeated a grade had been out of high school for eight years. The weighted response rate for the 2000 survey was 83.8 percent (National Center for Education Statistics, 2002).

Our sample draws from the 12,144 respondents to the 2000 follow-up, which omitted some of the original respondents. We also draw from the original 1988 survey and the first follow-up in 1990, when most respondents were in 10th grade. Henceforth, we refer to the 1988, 1990 and 2000 NELS waves as the 8th grade, 10th grade and adult surveys, respectively.

The analysis sample is limited to the 8,686 respondents who were in school, though not necessarily at grade level, for the 10th grade survey (766 observations lost); completed the 8th and 10th grade surveys (801 observations lost); had available information from 10th grade on binge drinking (576 observations lost), gender (62 observations lost); had available information on employment and wages from the adult survey (466 observations lost); and were in the labor force, i.e. either employed or seeking employment, in the adult survey (787 observations lost).

When information on remaining explanatory variables was missing, sample means were inserted in place of missing values.

4.2 Adult labor market outcomes and teenage drinking

The two adult labor market outcomes we study, from the 2000 survey, are employment and the wage of employed respondents. Employment is represented by a binary indicator of whether the respondent is currently employed, either part or full time. The natural log of the hourly wage rate is converted from pre-tax earnings information, reported in hourly, weekly, bimonthly or annual form. The sample excludes respondents who are neither currently employed nor seeking a job.

NELS respondents answered questions about alcohol use in both the 10^{th} grade and adult interviews. For both conceptual and practical reasons, at each age we focus on a binary indicator of any binge drinking in the past two weeks. Conceptually, binge drinking is more likely than less intense alcohol use to alter behavior, yet is far more prevalent among 10^{th} graders than clinically-defined alcohol abuse or dependence of the type studied by Mullahy and Sindelar (1993). As a practical matter, NELS reported information about the number of drinks consumed in the past month only in very wide intervals, making it difficult to separate infrequent from frequent drinkers. Results that alternatively specify binge drinking frequency both in 10^{th} grade and as adults, though not reported here, are similar.

4.3 Exogenous covariates

We perform separate analyses on the 4,139 males and 4,547 females. For each, a number of exogenous covariates are included in models 2–7. Race/ethnicity is represented by indicators

of being African American, Hispanic, Asian and Native American, with white as the omitted category. For each parent, education level is measured by a set of indicators for high school dropout, some college, and college graduate, with high school graduate (but no college) as the omitted group. Family structure in 10^{th} grade is captured using indicators of having a two-parent household with a step-parent, and having fewer than two parents in the household, with the category having both parents in the household omitted. The number of siblings is included as a separate variable. Family income is represented using indicators for each quartile. Age is controlled for with indicators for having been born in 1972, 1973, 1974 or 1975, with "other" omitted. An indicator for being at grade level in 10^{th} grade is also held constant. Finally, religious affiliation is captured with indicators for being Catholic, Baptist or Methodist, another Christian religion, and a non-Christian religion, with no religious affiliation as the omitted group.

4.4 Indirect pathways

The first indirect pathway we control for is 10^{th} grade academic achievement. Beginning with model 3, we include as explanatory variables GPA, percentile scores on NELS math and reading achievement tests, and weekly number of hours spent on homework at school and at home. GPA was constructed by assigning numerical scores on a four-point scale to self-reported usual grades in math and English classes (e.g. "mostly As" was assigned 4.0, "As and Bs" was assigned 3.5, etc.) and taking the average. Interval midpoints were used to convert categorical information about homework hours into numerical form.

Starting with model 4, we also control for educational attainment. This is measured as the number of years of schooling completed by the adult survey. Because 97 percent of sample

respondents are at grade level at the time of the 10th grade survey, virtually all variation in educational attainment occurs after the adolescent binge drinking variable is determined.

Model 5 adds the previously defined adult binge drinking indicator. Accounting for intertemporal drinking complementarity is important not only to illuminate an indirect pathway through which adolescent drinking might affect adult productivity, but also to ensure that a contemporaneous drinking effect is not misinterpreted as a lagged drinking effect.

In model 6, adult personal characteristics are incorporated. These consist of an indicator for whether the respondent is married and the number of child dependents at the time of the adult interview. Both could be affected by drinking that occurs prior to the adult interview and is related to adolescent drinking.

A set of indicators for state of residence appear in models 7 and 8. Labor market conditions vary across states, and decisions about where to live might be influenced by prior drinking behavior.

Finally, model 8 holds constant several characteristics of the adult job, and hence can be estimated only for wage equations. These include usual weekly hours worked at the current job, weeks worked in the previous year, and binary indicators for 39 detailed occupation categories and employer type. The latter are indicators of being private for-profit, private not-for-profit, local government, state government, federal government or military, with self-employed as the omitted group.

4.4 Unobserved heterogeneity proxies

As described below, the model 8 estimates for males are ultimately suggestive of a spurious correlation between adolescent drinking and both employment and wages as adults. We

therefore gauge whether these estimates are sensitive to further including a number of additional variables that are intended to proxy for omitted factors that might influence both drinking and productivity. These variables can be divided into two sets, one of 8th grade characteristics and another of 10th grade problem behaviors. Each set of variables is inserted first individually, and then as a group. The 8th grade characteristics are an indicator of daily smoking, the number of extracurricular activities in which the respondent participates (such as sports, music, clubs, youth groups and religious organizations), standardized composite measures of self-concept and locus of control, the number of stressful life events that occurred between 8th and 10th grade (including death and illness among close family members, family structure changes, parental job loss, family transition into or out of welfare, sibling school dropout or pregnancy, and becoming homeless), and employment status indicators for each parent. The 10th grade problem behaviors are indicators of past month marijuana use, lifetime cocaine use, and having been arrested and suspended from school in the first half of the school year.

4.5 Descriptive statistics

Table 1 shows descriptive statistics. The unemployment rates of 4.8 percent for males and 7.0 percent for females are somewhat higher than the analogous national rates of 3.9 percent for males and 4.4 percent for females among 25–29 year olds in 2000. The median hourly wage among workers was $14.53 for males and $12.00 for females. Alcohol use was widespread among 10th graders, with 25 percent of males and 20 percent of females reporting at least one binge drinking episode in the past two weeks. These are quite similar to past two week binge drinking prevalence rates among 10th graders in the 1991 Monitoring the Future survey, which is also nationally representative.

Table 2 shows gender-specific means by 10th grade binge drinking status. As adults, 10th grade binge drinkers are less likely to be employed than 10th graders who did not binge drink. Females who binge drank in 10th grade earn slightly lower wages as adults than do 10th grade non-binge drinking females. Adolescent binge drinkers have some characteristics that predispose them to adverse labor market outcomes, such as being more likely to come from a single parent home and below expected grade level in 10th grade. Moreover, high school binge drinkers consistently have lower academic achievement, educational attainment and homework hours than those who did not binge drink in high school. As expected, high school binge drinkers are also much more likely than non-binge drinkers to binge drink as adults.

5. Results

Table 3 summarizes the main regression results. Each cell represents a separate regression, each panel a distinct labor market outcome, and each row a different gender-specific sample. Columns 1–8 represent increasingly richer specifications, as described previously. Entries are marginal effects, calculated at the explanatory variable means, for probits and are coefficients for OLS models. Parentheses contain t-statistics adjusted for heteroskedasticity and clustering by age 26 state of residence.

5.1 Employment

Panel A shows estimates from probit regressions of employment status. The simple regression coefficients in column 1 show that for both genders, 10th grade binge drinking is associated negatively and statistically significantly with age 26 employment. Employment probability reductions from binge drinking of .020 for females and .016 for males might seem

small. But relative to the sample means, these correspond to drinking-related unemployment increases of 29 percent for women and 33 percent for men, which are substantial. In fact, the plausibility that causal effects could be this large is questionable.

Column 2 adds the set of presumably exogenous characteristics to the right hand side. Coefficient magnitudes and significance levels change little, implying total percentage effects of 24 percent for females and 35 percent for males. These are again sufficiently large to suggest that at least some bias from the omission of relevant unmeasured factors is present. This does not eliminate the possibility that a component of the effect is causal, however.

In Column 3, we insert the 10^{th} grade academic achievement measures into the model. This is responsible for the main departure across genders in the relationship between 10^{th} grade binge drinking and adult employment. For females, the 10^{th} grade drinking coefficient falls from .017 to .008 and becomes statistically insignificant. This implies that over half of the employment effect operates through an association between binge drinking and academic achievement while in high school. If binge drinking lowers achievement, as Wolaver (2002), Williams et al. (2003), and DeSimone and Wolaver (2005) find, this coefficient reduction might stem in part from a process in which adult employment falls because of drinking-induced achievement declines. Lower achievers might instead (or additionally) be more likely to binge drink because of unobserved factors, such as personality characteristics or adverse events, which affect both outcomes. Although the policy implication depends greatly on the extent to which of these explanations hold, we do not attempt to distinguish between them. Rather, we simply emphasize that once the negative correlation between 10^{th} grade binge drinking and academic achievement is accounted for, 10^{th} grade binge drinking and age 26 employment are no longer significantly related among females.

In contrast, for males, controlling for 10th grade achievement in column 3 has little impact on the adolescent drinking coefficient. Statistical significance is maintained, and the effect on employment is now twice as large as for females.

Regardless of gender, the further indirect pathways sequentially added in columns 4–6 – educational attainment, adult binge drinking and adult family characteristics – have little bearing on the relationship between 10th grade drinking and adult employment. Column 7 shows a slight further decline in the 10th grade binge drinking coefficient when state of residence is held constant, but this change is small in absolute terms and is of practical significance, in relative terms, just for females. Because job characteristics are only defined for employed respondents, we cannot estimate the column 8 specification in the employment regressions.

Ultimately, therefore, the coefficient on 10th grade binge drinking in the male employment equation is exactly the same, to three decimal places, when all indirect pathways are accounted for as when no other explanatory factors at all are. This coefficient represents a statistically and practically large effect of adolescent drinking on adult employment, despite the inclusion of all indirect pathways that we observe. It seems likely, therefore, that the coefficient primarily reflects unobserved heterogeneity that simultaneously increases high school drinking and lowers the probability of employment ten years later. We further investigate this hypothesis in table 4.

For females, the relatively small size (i.e. seven percent of the average unemployment rate) and statistical insignificance of the column 7 coefficient is consistent with the claim that the indirect pathways we study account for the bulk of the relationship between 10th grade binge drinking and adult employment. It is also clear from table 3 that the primary source of the relationship is the correlation of both with 10th grade academic achievement. Unfortunately, as

noted above, our results do not clarify whether the link between high school drinking and achievement and adult employment reflects a causal pathway or merely common omitted factors.

However, three pieces of evidence point towards the latter explanation. First, DeSimone and Wolaver (2005) estimate that most of the correlation between binge drinking and high school grades is spurious. Second, it seems implausible that high school binge drinking would affect high school achievement enough to have a large deleterious impact on employment ten years later, but have no impact through the other intermediate outcomes, particularly educational attainment. Third, a causal relationship does not appear to exist for males.

5.2 Wage

Panel B contains estimates from OLS log wage equations. As opposed to the case for employment, the column 1 simple regression coefficient signs vary by gender. Adolescent binge drinking is associated with a 4.5 percent lower wage among females, but a 4.1 percent higher wage among males. Although these magnitudes are nontrivial, both estimates are marginally significant at best.

Again unlike the employment results, inserting the exogenous factors in column 2 brings about meaningful changes in the 10^{th} grade binge drinking coefficients, similarly making them less negative (females) or more positive (males). The wage effect of youth drinking falls to a statistically insignificant –1.7 percent for women, but rises to a statistically significant 5.3 percent for men.

The small and insignificant coefficient for females implies the absence of a causal effect. This is reiterated by adding 10^{th} grade academic achievement as a control in column 3. Once again, the result is a large change in the 10^{th} grade binge drinking coefficient that makes it less

negative, in this case flipping sign. As a group, the remaining intermediate outcomes, including job characteristics, have little impact. The coefficient in column 8 is virtually the same as that in column 3, implying that 10^{th} grade binge drinkers earn 2.7 percent higher wages. This wage premium, however, is not statistically significant.

Our interpretation is that females who binge drink in high school differ in unobservable ways from those who do not, and these differences are positively, albeit insignificantly, related to productivity among those working ten years later. We return to a discussion of possible sources of these unobserved differences shortly, in the context of males. In reduced form models, this particular type of unobserved heterogeneity is masked by an offsetting relationship involving academic achievement, in which student binge drinkers are also lower achievers and thus destined to earn less.

The impact of adding the intermediate outcomes in columns 3–7 are similar for males. Inserting academic achievement increases the already positive coefficient by about one-half, but including schooling, adult drinking, family characteristics and state fixed effects does little. Consequently, the column 7 wage premium from adolescent binge drinking is eight percent. This is highly significant and very large in magnitude. By comparison, an additional year of education increases wages by only about 3 percent (not shown). If we have indeed captured all the relevant indirect ways in which high school binge drinking affects the future wage, this estimate provides strong evidence of unobserved heterogeneity, with time invariant omitted factors raising both the propensity to binge drink while in school and the eventual wage. This is the identical scenario to that discussed above for females, but is much stronger for males.

In column 8, we add the job characteristics vector. As these characteristics could be construed as additional labor market outcomes rather than intermediate outcomes of early

drinking that ultimately influence the wage, they are in some sense more endogenous and less defensible to include than those covered by columns 3–7. Even after accounting for job characteristics, though, the wage premium from earlier binge drinking is still a statistically significant five percent. This estimate is arguably more conservative than the one in column 7, yet is still equivalent to the return from nearly two extra years of schooling.

5.3 Sources of confounding for males

Because the 10th grade binge drinking coefficient is insignificant in the fully-specified employment and wage models for females, our remaining analysis is restricted to males. Table 4 investigates potential reasons that 10th grade binge drinking is significantly associated with a lower probability of employment and a higher wage in early adulthood for males. We conduct two separate exercises in which we extend the explanatory variable set of the models in column 7 for employment and column 8 for the wage. Panel A adds 8th grade individual and family characteristics, while panel B adds 10th grade problem behaviors. Columns 1–2 are from employment models and columns 3–4 are from wage models. Each row and pair of columns (1–2 and 3–4) represents a separate regression. Columns 1 and 3 again show the 10th grade binge drinking coefficient, while columns 2 and 4 show the adult binge drinking coefficient for comparison.

The top row replicates the 10th grade binge drinking estimates from the table 3 models with all possible indirect pathways included, which serve as the baseline for the remainder of table 4. It also shows that both adult binge drinking coefficients are positive, albeit barely significant at the 20 percent level for employment and 10 percent level for wage.

There are at least three notable aspects of this result. First, a positive coefficient for adult binge drinking, rather than moderate drinking, is unlikely to be generated by a beneficial contemporaneous impact of alcohol use on health and productivity. Second, the effect of adult drinking on the wage is only about half of that of adolescent drinking. This casts doubt on the social capital interpretation for positive wage effects of contemporaneous drinking. At the very least, because career networking is unlikely to explain much of the 10^{th} grade drinking effect, a completely different explanation would have to apply for 10^{th} grade drinking if social capital acquisition truly was a reason for adult drinking. Third, for employment, the adult and adolescent binge drinking coefficients are opposite in sign. This would seem to provide further evidence that adolescent drinking does not causally reduce employment prospects. It is difficult to conceive of reasons that a negative causal effect on employment would exist for (distant) past but not current drinking, particularly holding constant the most obvious indirect pathways.

In Panel A, we observe that including 8^{th} grade characteristics has hardly any impact on the coefficients of teenage and adult binge drinking in either the employment or wage models. Even in the last row, when all of these characteristics are included together, the effects of drinking are virtually the same as in the baseline model. For employment, this is surprising to us. Time preference, proxied by daily smoking, and stressful life events in particular are two of the main sources of unobserved heterogeneity that we had hypothesized.

Panel B conducts an analogous exercise, but using several other 10^{th} grade problem behaviors that might be associated with binge drinking as additional explanatory variables. Again, there is little effect on the adult binge drinking coefficients. Unlike the 8^{th} grade characteristics, though, the 10^{th} grade problem behaviors have a noticeable downward impact on the magnitude of the negative coefficient for 10^{th} grade binge drinking in the employment

equation. Inserted on their own, three of the four problem behaviors, use of marijuana and cocaine and being suspended earlier in the school year, reduce the 10th grade drinking effect by at least 25 percent, enough to render it statistically insignificant. When all four behaviors are added together, the 10^{th} grade drinking coefficient falls by over two-thirds, from .016 to .005.

An explanation is that 10^{th} graders who binge drink also tend to engage in other potentially destructive behaviors, in particular the use of marijuana and cocaine and behavior that results in school suspension. These problem behaviors are associated with a lower future likelihood of employment, likely because they reflect unobserved time-constant characteristics that are linked with having fewer marketable skills or engaging in anti-social behaviors. The negative effect of teen alcohol use on adult employment is confounded by these behaviors. Upon accounting for them, the negative teen drinking effect disappears. It seems, therefore, that adolescent binge drinking is not causally related to adult employment.

An alternative explanation is that 10^{th} grade problem behaviors are a pathway through which teen drinking reduces labor market performance. Using marijuana use as an example, since its insertion has the largest impact on the teen drinking coefficient, this is possible if alcohol and marijuana consumption are complimentary for 10^{th} graders, marijuana use is intertemporally complementary, and adult marijuana use reduces contemporaneous employment and wages. Even if all three of these relationships are as hypothesized above, however, the effect seems much too large, particularly in the absence of other, presumably more plausible indirect pathways. Also, it is unclear why this causal pathway would not also manifest itself in a negative adult drinking coefficient, unless alcohol and marijuana happen to be substitutes for young adults despite being complements for 10^{th} graders.

Parallel to the employment results, holding constant 10th grade problem behaviors increases the positive effect of teen drinking on the adult wage. Although the relative impact is much smaller in the wage model, the teen drinking coefficient changes in the same direction as in the employment model and by a similar magnitude for all problem behaviors except suspension. When all four behaviors are included, the wage premium associated with drinking in 10th grade rises from 5.1 to 5.9 percent. Thus, rather than eliminating a spurious employment penalty, holding constant teen problem behaviors, especially marijuana and cocaine use, brings about a larger teen wage premium that is apparently unexplained.

We argue that this wage premium must be symptomatic of unobserved heterogeneity. In particular, the lagged nature of adolescent drinking eliminates other commonly offered explanations for wage premiums from contemporaneous drinking. A higher wage at age 26 cannot directly increase drinking at age 16, nor can it respond to health or social capital benefits of alcohol consumed ten years previously. This is particularly true because we also control for adult binge drinking. Thus, the positive adolescent drinking coefficient cannot be spuriously picking up contemporaneous income, health or social capital effects through an intertemporal complementarity of alcohol use. Moreover, there is no evidence that binge drinking offers health benefits, but ample evidence that it has deleterious health and cognitive effects.

An obvious question, then, is: What is the source of the spurious future wage premium from 10th grade binge drinking? Our suspicion is that, after controlling for the type of "problematic" binge drinking in high school that is correlated with behaviors such as illegal drug use, the kind of binge drinking that remains is strongly related to social skills that are relatively constant over time and rewarded on the labor market. It is easy to imagine that teens who binge drink do so largely at parties where socializing with friends is the other primary activity.

Ideally, we would be able to test this hypothesis by adding variables that proxy for popularity or social skills to the wage model and determining whether the teen binge drinking coefficient decreased substantially in size. Unfortunately, the quantity "interpersonal skills" is difficult to define, and we have been unable to identify a suitable proxy in NELS. However, our argument is consistent with some evidence from other contexts. Marmaros and Sacerdote (2002) find that Dartmouth fraternity members earn significantly higher starting salaries even after controlling for networking aspects of fraternity membership, including help from fraternity brothers/sisters and Dartmouth alumni. Also, Sacerdote (2004) estimates that adopted children randomly assigned to higher income families are more likely to both drink and complete more schooling than those assigned to other families.

This is similar to the "social capital" explanation for the "adult/income puzzle," in that we hypothesize that 10^{th} grade binge drinkers on average have better interpersonal skills than 10^{th} graders who do not binge drink. An important distinction, however, is that in its literal sense, the idea behind the social capital explanation is that drinking often occurs with work colleagues, and this leads to higher paying jobs through increased visibility and networking opportunities. Put differently, the usual social capital explanation lays out a causal relationship that is unlikely to apply to drinking lagged by a decade. Our social capital-type story is purely one of unobserved heterogeneity.

An important implication is that unobserved heterogeneity could play a more prominent role in the adult drinking wage premium than has been conceded by most researchers. The importance of individual fixed effects in Peters (2004) points towards an unobserved heterogeneity explanation, which she also attributes in part to social ability. However, most other researchers assume that health improvement from drinking, social capital, or reverse

causation through income effects are the underlying mechanisms generating the positive wage effect. The existence of a wage premium that is almost twice as large for drinking a decade previously as for current drinking, and that pertains to binge rather than moderate drinking, suggests that there is more to the adult relationship than health, networking or income effects.

6. Conclusions

There is little evidence that adult alcohol use, particularly that does not meet diagnostic criteria for disorder, detracts directly from labor market outcomes. Previous researchers, however, have suggested that alcohol use may still negatively affect labor market outcomes through indirect pathways, such as education and academic achievement. Because no prior studies have attempted to link youth drinking to adult labor market outcomes, we address this issue using NELS data, which are longitudinal and contain information on a wide array of potentially confounding factors.

Our findings indicate that 10^{th} grade binge drinking is negatively associated with employment ten years later. For males, this relationship persists even after all indirect pathways are controlled for, but dissipates when 10^{th} grade problem behaviors are inserted into the model. This strongly suggests an unobserved heterogeneity explanation. Among females, a causal pathway is possible, since academic achievement is the primary mediating factor in the relationship between teen drinking and adult employment. However, ancillary evidence is consistent with the possibility that this correlation is at least partially spurious as well.

We find no evidence that adolescent binge drinking is associated with adult wages for females. In contrast, male teens who binge drink earn a five percent wage premium relative to their non-binge drinking peers. This association does not operate through any of the indirect

pathways we specify, is not related to 8th grade characteristics, and is strengthened when we control for 10th grade problem behaviors. Our theory is that some difficult-to-measure trait, such as having good social skills and being popular among peers, underlies this association.

Several of our findings are puzzling. First, the wage premium for adult drinking, which has many more plausible explanations, is only about half the size as that for adolescent drinking. A possibility is that adult binge drinking does in fact reduce current wages, but is more than offset by positive spurious correlation that is difficult to econometrically eliminate. By the same token, the 10th grade problem behaviors that are evidently highly correlated with 10th grade drinking appear unrelated with adult drinking, suggesting that different mechanisms underlie binge drinking behavior at different points in the life cycle.

Second, it is unclear why the teen drinking coefficient is positive in the male wage equation, but negative (albeit ultimately insignificant) in the male employment equation. In light of the impact that 10th grade problem behaviors have, it could be that there are two "types" of male high school binge drinkers. For one type, binge drinking is accompanied by illegal drug use and behaviors that result is school suspension. These binge drinkers are less likely to be employed as adults. For the other type, binge drinking primarily occurs when socializing with friends and largely does not involve other destructive behaviors. Compared with non-binge drinking 10th graders, these students earn a wage premium as adults from social skills that are associated with 10th grade binge drinking.

Whatever the explanation, this result is consistent with evidence from Marmaros and Sacerdote (2002) as well as Mullahy and Sindelar (2003). The former find that fraternity members earn wage premiums relative to non-members, as documented above, but are no more likely to be employed upon graduation. The latter find that negative effects of previous

alcoholism operate primarily through employment, with no significant wage differences among the full-time employed.

Third, in results not shown, adding a control for any 10^{th} grade alcohol use, not necessarily restricted to binge drinking, has no impact on the wage premium from 10^{th} grade binge drinking. The sociability trait, or other unobserved characteristic, that is rewarded on the labor market therefore appears uniquely correlated with binge rather than non-binge drinking during high school.

Finally, we fail to find evidence to support our hypothesis regarding the source of the teen binge drinking wage premium. All told, these unexpected and unexplained results call for further research on the topic.

References

Auld, M. Christopher, "Smoking, Drinking, and Income," Journal of Human Resources, Spring 2005, 40(2), 505–518.

Baltagi, Badi H. and James M. Griffin, "Rational Addiction to Alcohol: Panel Data Analysis of Liquor Consumption," Health Economics, September 2002, 11(6), 485–491.

Barrett, Garry F., "The Effect of Alcohol Consumption on Earnings," Economic Record, March 2002, 78(240), 79–96.

Bask, Mikael and Maria Melkersson, "Rationally Addicted to Drinking and Smoking?" Applied Economics, March 2004, 36(4), 373–381.

Bentzen, Jan, Tor Eriksson and Valdemar Smith, "Rational Addiction and Alcohol Consumption: Evidence from the Nordic Countries," Journal of Consumer Policy, September 1999, 22(3), 257–279.

Berger, Mark C. and Leigh, J. Paul, "The Effect of Alcohol Use on Wages," Applied Economics, October 1988, 20(10), 1343–1351.

Bray, Jeremy W., "Alcohol Use, Human Capital, and Wages," Journal of Labor Economics, April 2005, 23(2), 279–312.

Carpenter, Christopher, "Heavy Alcohol Use and Youth Suicide: Evidence from Tougher Drunk Driving Laws," Journal of Policy Analysis and Management, Fall 2004, 23(4), 831–842.

Carpenter, Christopher, "Youth Alcohol Use and Risky Sexual Behavior: Evidence from Underage Drunk Driving Laws," Journal of Health Economics, May 2005, 24(3), 613–628.

Chatterji, Pinka, "Illicit Drug Use and Educational Attainment," Health Economics, May 2006, 15(5), 489–511.

Chatterji, Pinka, Dave, Dhaval, Kaestner, Robert and Markowitz, Sara, "Alcohol Abuse and Suicide Attempts among Youth," Economics and Human Biology, June 2004, 2(2), 159–180.

Chatterji, Pinka, and DeSimone, Jeff, "Adolescent Drinking and High School Dropout," National Bureau of Economic Research Working Paper 11337, April 2005.

Cook, Philip J. and Moore, Michael J., "Drinking and Schooling," Journal of Health Economics, December 1993, 12(4), 411–429.

Cook, Philip J. and Peters, Bethany, "The Myth of the Drinker's Bonus," National Bureau of Economic Research Working Paper 11902, December 2005.

Dave, Dhaval and Kaestner, Robert, "Alcohol Taxes and Labor Market Outcomes," Journal of Health Economics, May 2002, 21(3), 357–371.

Dee, Thomas S. and Evans, William N., "Teen Drinking and Educational Attainment: Evidence from Two-Sample Instrumental Variables Estimates," Journal of Labor Economics, January 2003, 21(1), 178–209.

DeSimone, Jeff and Wolaver, Amy M., "Drinking and Academic Performance in High School," National Bureau of Economic Research Working Paper 11035, January 2005.

Dufour MC. Risks and benefits of alcohol use over the life span. Alcohol Health and Research World 1996; 20:145-51.

French, Michael T. and Zarkin, Gary A., "Is Moderate Alcohol Use Related to Wages? Evidence from Four Worksites," Journal of Health Economics, August 1995, 14(3), 319–344.

Grossman, Michael, Chaloupka, Frank J. and Sirtalan, Ismail, "An Empirical Analysis of Alcohol Addiction: Results from the Monitoring the Future Panels," Economic Inquiry, January 1998, 36(1), 39–48.

Grossman, Michael, Kaestner, Robert and Markowitz, Sara, "An Investigation of the Effects of Alcohol Policies on Youth STDs," National Bureau of Economic Research Working Paper 10949, December 2004.

Hamilton, Vivian and Hamilton, Barton H., "Alcohol and Earnings: Does Drinking Yield a Wage Premium?" Canadian Journal of Economics, February 1997, 30(1), 135–151.

Heien, Dale M., "Do Drinkers Earn Less?" Southern Economic Journal, July 1996, 63(1), 60–68.

Johnston, O'Malley & Bachman, Monitoring the Future Study, The University of Michigan, www.monitoringthefuture.org.

Jones, Ethel B. and Jackson, John D., "College Grades and Labor Market Rewards," Journal of Human Resources, Spring 1990, 25(2), 253–266.

Koch, Steven F. and McGeary, Kerry Anne, "The Effect of Youth Alcohol Initiation on High School Completion," Economic Inquiry, October 2005, 43(4), 750–765.

Koch, Steven F. and Ribar, David C., "A Siblings Analysis of the Effects of Alcohol Consumption Onset on Educational Attainment," Contemporary Economic Policy, April 2001, 19(2), 162–174.

MacDonald, Ziggy and Shields, Michael A., "Does Problem Drinking Affect Employment? Evidence from England," Health Economics, February 2004, 13(2), 139–155.

MacDonald, Ziggy and Shields, Michael A., "The Impact of Alcohol Consumption on Occupational Attainment in England," Economica, August 2001, 68(271), 427–453.

Markowitz, Sara and Grossman, Michael, "Alcohol Regulation and Domestic Violence towards Children," Contemporary Economic Policy, July 1998, 16(3), 309–320.

Markowitz, Sara, Chatterji, Pinka and Kaestner, Robert, "Estimating the Impact of Alcohol Policies on Youth Suicides," Journal of Mental Health Policy and Economics, March 2003, 6(1), 37–46.

Markowitz, Sara, Kaestner, Robert and Grossman, Michael, "An Investigation of the Effects of Alcohol Consumption and Alcohol Policies on Youth Risky Sexual Behaviors," American Economic Review, May 2005, 95(2), 263–266.

Marmaros, David and Sacerdote, Bruce, "Peer and Social Networks in Job Search," European Economic Review, April 2002, 46(4-5), 870–879.

Mullahy, John and Sindelar, Jody L., "Alcoholism, Work, and Income," Journal of Labor Economics, July 1993, 11(3), 494–520.

Mullahy, John and Sindelar, Jody, "Employment, Unemployment, and Problem Drinking," Journal of Health Economics, August 1996, 15(4), 409–434.

Mullahy, John and Sindelar, Jody, "Life-Cycle Effects of Alcoholism on Education, Earnings, and Occupation," Inquiry, Summer 1989, 26(2), 272–82.

National Center for Education Statistics (NCES), NELS base-year to fourth follow-up data file user's manual, June 2002.

Peters, Bethany, "Is There a Wage Bonus from Drinking? Unobserved Heterogeneity Examined," Applied Economics, November 2004, 36(20), 2299–2315.

SAMHSA, Office of Applied Studies, National Survey on Drug Use and Health, 2004.

Sacerdote, Bruce, "What Happens When We Randomly Assign Children to Families?" National Bureau of Economic Research Working Paper 10894, November 2004.

Tekin, Erdal, "Employment, Wages, and Alcohol Consumption in Russia," Southern Economic Journal, October 2004, 71(2), 397–417.

Terza, Joseph V., "Alcohol Abuse and Employment: A Second Look," Journal of Applied Econometrics, July-August 2002, 17(4), 393–404.

U.S. DHHS, Tenth Special Report to Congress on Alcohol and Health, June 2000.

Van Ours, Jan C., "A Pint a Day Raises a Man's Pay; but Smoking Blows That Gain Away," Journal of Health Economics, September 2004, 23(5), 863–886.

Williams, Jenny, Powell, Lisa M. and Wechsler, Henry, "Does Alcohol Consumption Reduce Human Capital Accumulation? Evidence from the College Alcohol Study," Applied Economics, July 2003, 35(10), 1227–39.

Wolaver, Amy M., "Effects of Heavy Drinking in College on Study Effort, Grade Point Average, and Major Choice," Contemporary Economic Policy, October 2002, 20(4), 415–428.

Yamada, Tetsuji, Kendix, Michael and Yamada, Tadashi, "The Impact of Alcohol Consumption and Marijuana Use on High School Graduation," Health Economics, January-February 1996, 5(1), 77–92.

Zarkin, Gary A., French, Michael T., Mroz, Thomas and Bray, Jeremy W., "Alcohol Use and Wages: New Results from the National Household Survey on Drug Abuse," Journal of Health Economics, January 1998, 17(1), 53–68.

Zeigler, Donald W., Wang, Claire C., Yoast, Richard A., Dickinson, Barry D., McCaffree, Mary Anne, Robinowitz, Carolyn B. and Sterling, Melvyn L., "The Neurocognitive Effects of Alcohol on Adolescents and College Students," Preventive Medicine, January 2005, 40(1), 23–32.

Table 1: Sample Means and Standard Deviations

Variable	Males (N = 4,139)		Females (N = 4,547)	
	Mean	Std. Dev.	Mean	Std. Dev.
Young Adult Labor Market Outcomes (Age 26)				
Employed	.952		.930	
Hourly wage (median)	14.53	13.29	12.00	8.40
Binge Drinking in 10th Grade				
Binge drinking in past 2 weeks	.253		.200	
Number of binge drinking episodes past 2 weeks	.767	1.91	.477	1.37
Demographic, Family and Individual Characteristics in High School				
African-American	.078		.095	
Hispanic	.113		.121	
Asian	.064		.064	
Native American	.034		.034	
Mother high school graduate	.340		.325	
Mother some college	.192		.211	
Mother college graduate	.251		.213	
Father high school graduate	.287		.268	
Father some college	.180		.197	
Father college graduate	.294		.257	
Family structure other than 2 parents (10th grade)	.200		.213	
Step-family (2 parents, 10th grade)	.121		.122	
Family income (8th grade)	37,500		30,000	
Number of siblings	2.17		2.22	
Year of birth (19--)	74.0	.572	73.7	.507
Not at grade level (10th grade)	.035		.026	
Catholic	.290		.292	
Baptist or Methodist	.253		.280	
Other Christian	.268		.275	
Other religion	.082		.082	
Academic Achievement in 10th Grade				
GPA (math & English)	2.80	.765	2.97	.733
Math percentile test score	54.22	13.20	53.48	13.09
Reading percentile test score	52.87	13.32	54.20	12.64
Homework hours in school	2.07	1.55	2.05	1.49
Homework hours at home	2.37	1.71	2.80	1.74
Educational Attainment (Age 26)				
Years of schooling completed	13.93	2.04	13.97	2.07
Young Adult Binge Drinking (Age 26)				
Binge drinking in past 2 weeks	.390		.172	
Number of binge drinking episodes in past 2 weeks	.936	1.71	.317	.881
Young Adult Family Characteristics (Age 26)				
Married	.355		.433	
Number of dependents	.470		.614	.936
Young Adult Job Characteristics (Among Employed Individuals)				
Usual weekly hours worked	43.40	11.20	38.23	1.50
Weeks worked in past year	48.51	8.08	47.15	9.53
Employer is private, for-profit	72.87		69.69	
Employer is non-profit	5.20		1.73	
Employer is local government	4.21		5.55	
Employer is state government	4.64		8.61	
Employer is federal government	1.28		1.74	
Employer is military	3.70		.950	

Additional 8th grade Characteristics, Males		
Smokes daily	.044	
Number of sports teams	1.53	1.01
Number of music activities	.609	.717
Number of clubs	1.42	1.93
Number of religious youth groups	.458	.630
No. stressful life events past 2 years (10th grade)	.913	1.15
Self-concept	.766	7.91
Locus of control	.746	8.21
Father is employed	.931	
Mother is employed	.898	
Additional 10th grade Problem Behaviors, Males		
Used marijuana in past month	.067	
Used cocaine in lifetime	.033	
Suspended out-of-school (first half of year)	.076	
Arrested (first half of year)	.044	

Table 2: Variable Means by High School Binge Drinking Status				
	Males (N = 4,139)		**Females (N = 4,547)**	
	Binged N = 1,048	Didn't binge N = 3,091	Binged N = 3,638	Didn't binge N = 909
Young Adult Labor Market Outcomes (Age 26)				
Employed	.940	.956**	.920	.932**
Hourly wage among employed	17.13	17.71	12.52	13.08*
Demographic, Family and Individual Characteristics in High School				
African-American	.054	.086***	.055	.105***
Hispanic	.124	.111	.130	.119
Asian	.027	.077***	.032	.072***
Native American	.047	.030***	.040	.033
Mother high school graduate	.391	.323***	.345	.320
Mother some college	.187	.194	.227	.207***
Mother college graduate	.222	.261***	.171	.224
Father high school graduate	.292	.285	.286	.263
Father some college	.196	.175	.189	.198
Father college graduate	.260	.305***	.229	.264***
Family structure other than 2 parents	.228	.192***	.255	.202***
Step-family (2 parents)	.135	.116	.152	.114**
Family income	41,832	41,798	40,212	40,435
Number of siblings	2.25	2.14	2.26	2.21
Not at grade level	.055	.028***	.043	.022***
Catholic	.316	.281**	.320	.285**
Baptist or Methodist	.246	.255	.258	.286*
Other Christian	.246	.276*	.271	.275
Other religion	.068	.086*	.059	.087***
Academic Achievement in 10th Grade				
GPA	2.56	2.89***	2.70	3.04***
Math test score	5.51	55.48***	5.67	54.18***
Reading test score	49.22	54.10***	51.11	54.97***
Homework hours at school	1.98	2.10***	2.01	2.06
Homework hours at home	2.03	2.48***	2.33	2.92***
Educational Attainment (Age 26)				
Years of schooling	13.27	13.84***	13.42	14.10***
Young Adult Binge Drinking (Age 26)				
Any binge drinking past 2 weeks	.541	.338***	.270	.148***
No. binge drinking episodes past 2 weeks	1.45	.761***	2.39	.268
Young Adult Family Characteristics (Age 26)				
Married	.343	.360	.415	.438***
Number of dependents	.585	.431***	.769	.575***
Young Adult Job Characteristics (Among Employed Individuals)				
Usual hours worked	44.35	43.07***	37.82	38.08
Weeks worked in past year	48.36	48.56	46.73	46.96
Employer is private, for-profit	.751	.727	.712	.664***
Employer is non-profit	.044	.055	.091	.113
Employer is local government	.042	.042	.046	.059
Employer is state government	.026	.054***	.072	.091
Employer is federal government	.011	.014	.014	.018
Employer is military	.031	.039	.009	.010

*, **, and *** denote statistically significant difference at the .10, .05, and .01 levels, respectively.

Table 3: High School Binge Drinking and Young Adult Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Employed, age 26 – Probit Model							
	Marginal Effect (*t* statistic)							
Females (N = 4,547)	-.020	-.017	-.008	-.007	-.008	-.007	-.005	
	(-2.38)	(-1.97)	(-1.06)	(-.880)	(-1.10)	(-.900)	(-.610)	
Males (N = 4,139)	-.016	-.017	-.016	-.016	-.018	-.017	-.016	
	(-2.08)	(-2.32)	(-2.18)	(-2.19)	(-2.44)	(-2.36)	(-2.17)	
	Panel B: Log of hourly wage, age 26 – OLS Model							
	Coefficient (*t* statistic)							
Females (N = 4,220)	-.045	-.017	.024	.036	.026	.031	.036	.027
	(-1.57)	(-.680)	(.950)	(1.37)	(.950)	(1.14)	(1.26)	(1.01)
Males (N = 3,941)	.041	.053	.080	.083	.077	.075	.081	.051
	(1.67)	(2.35)	(3.69)	(3.75)	(3.36)	(3.25)	(3.49)	(2.48)
Includes:								
8^{th} & 10^{th} grade characteristics		X	X	X	X	X	X	X
Academic achievement, 10^{th} grade			X	X	X	X	X	X
Years of education, age 26				X	X	X	X	X
Binge drinking, age 26					X	X	X	X
Family characteristics, age 26						X	X	X
State fixed effects							X	X
Job characteristics, age 26								X

Each cell shows the estimated marginal effect (employment) or coefficient (wage) of an indicator of past two week binge drinking in 10^{th} grade and is from a separate regression. Parentheses contain *t* statistics adjusted for clustering at age 26 state of residence. 8^{th} & 10^{th} grade characteristics include race/ethnicity, parents' education, family income, number of siblings, year of birth and religion (measured in 8^{th} grade), and family structure and not at grade level (10^{th} grade). Academic achievement in 10^{th} grade includes GPA in math/English, % scores on math and reading achievement tests, and weekly hours spent on homework. Binge drinking at age 26 is a binary indicator of binge drinking in the past 2 weeks. Family characteristics at age 26 include marital status and the number of dependents. State fixed effects correspond to state of residence at age 26. Job characteristics at age 26 include usual hours worked, weeks worked in past year, occupation and type of employer.

Table 4: Inclusion of additional controls, Males

	Employed at age 26 – Probit Marginal Effect (*t* statistic)		Log (age 26 hourly wage) – OLS Coefficient (*t* statistic)	
	(1)	(2)	(3)	(4)
	Binged in 10th grade	Binged at age 26	Binged in 10th grade	Binged at age 26
Table 3:	-.016	.008	.051	.029
Model 7 (employment) or 8 (wage)	(-2.17)	(1.29)	(2.48)	(1.74)
Panel A: 8th grade characteristics				
Model 7 or 8 plus:				
Daily smoking	-.015	.008	.051	.029
	(-2.08)	(1.30)	(2.49)	(1.75)
School and community activities	-.016	.007	.049	.027
	(-2.28)	(1.16)	(2.37)	(1.63)
Self-concept, Locus of control	-.016	.008	.050	.029
	(-2.15)	(1.29)	(2.47)	(1.77)
Stressful life events	-.016	.008	.053	.028
	(-2.19)	(1.29)	(2.61)	(1.69)
Parental employment	-.016	.008	.050	.030
	(-2.21)	(1.29)	(2.45)	(1.76)
All of the above	-.015	.007	.050	.027
	(-2.23)	(1.18)	(2.47)	(1.65)
Panel B: 10th grade problem behaviors				
Model 7 or 8 plus:				
Marijuana use in past month	-.009	.008	.059	.030
	(-.980)	(1.31)	(2.89)	(1.72)
Cocaine use in lifetime	-.012	.008	.057	.029
	(-1.44)	(1.28)	(2.80)	(1.70)
Arrested in first half of school year	-.014	.008	.053	.030
	(-1.94)	(1.27)	(2.52)	(1.75)
Suspended in first half of school year	-.011	.008	.047	.030
	(-1.53)	(1.20)	(2.32)	(1.76)
All of the above	-.005	.007	.059	.030
	(-.560)	(1.20)	(2.85)	(1.73)

Each cell shows the estimated marginal effect (employment) or coefficient (wage) an indicator of past two week binge drinking in 10th grade and is from a separate regression. Parentheses contain *t* statistics adjusted for clustering at age 26 state of residence. Model 7 and 8 covariates are listed in the footnote to table 3. School and community activities include self-reported numbers of sports teams, music activities, clubs and religious youth organizations. Self-concept and locus of control are individual standardized composites of responses to multiple questions. Stressful life events including family deaths and illness, family structure changes, parental job loss, transition into or out of welfare, sibling dropped out of school or became pregnant, and became homeless. Parental employment includes indicators that the mother and father are employed.