The Effects of Merit-Based Financial Aid on Drinking in College

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Abstract

We study the effect of state-level merit aid programs (such as Georgia's HOPE scholarship) on alcohol consumption among college students. Such programs have the potential to affect drinking through a combination of channels–such as raising students' disposable income and increasing the incentive to maintain a high GPA–that could theoretically raise or lower alcohol use. We find that the presence of a merit aid program in one's state generally leads to an overall increase in (heavy) drinking. This effect is concentrated among men, students with lower parental education, older students, and students with high college GPA's. Our findings are robust to several alternative empirical specifications including event-study analyses by year of program adoption. Furthermore, no difference in high-school drinking is observed for students attending college in states with merit-aid programs.

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1 Introduction

Heavy drinking among U.S. college students remains widespread even after several decades of efforts aimed at curbing young people's alcohol use (Hingson, 2010). Researchers have made significant progress toward understanding how public policies designed to discourage (risky) alcohol use shape youth drinking patterns (see, for example, Carpenter et al., 2007), but other policies that indirectly affect youths' drinking may not be as well understood.[1] Perhaps surprisingly, few studies have examined how student financial aid affects drinking behavior among college students.[2] Though alcohol appears to be a normal good in the general population (Ruhm and Black, 2002) and among young adults (Nelson, 2008), little is known about college students in particular. Government and institutional financial aid programs are not only an important determinant of student disposable income but may create other incentives that influence alcohol use (by affecting time allocation, for example). Because these effects are subtle, financial aid programs may affect college drinking in ways that are currently unknown to policymakers.

This paper examines how one type of financial aid policy, state-level "merit aid" programs, affects alcohol use among college students. We believe we are the first to examine

[1] Those policies that explicitly address drinking include the minimum legal drinking age, policies affecting driving under the influence, and alcohol taxes. In addition, a budding literature on how peers affect substance use (including drinking) has made strides toward understanding that dimension of youth risky behavior (see, for example, Kremer and Levy, 2008 and Eisenberg et al., 2014).

[2] Recent studies that examine the relationship between income and drinking among teenagers include Adams et al. (2012), who find that higher minimum wages are associated with an increase in alcohol-related traffic fatalities among teens. Markowitz and Tauras (2009) estimate a substantial effect of adolescent allowances from parents on drinking participation–a $1,000 annual increase in allowance is associated with a 2.2-7.1 percentage point increase in the probability of drinking. Grossman and Markowitz (2001) is one of the only studies to estimate an income elasticity (albeit with state-level income per capita rather than individual income measures) of alcohol use (number of drinks) for college students–they find that this elasticity is 0.63. In addition, Delaney et al. (2008) use cross-sectional Irish data to show that college students' disposable income is positively related to alcohol expenditure but not to drinking participation or degree of excessive drinking.

the effect of these policies–which began being implemented in the early 1990's and now disburse billions in aid to students every year–on any health behavior or outcome.[3] A large literature documents the rise of broad-based merit aid programs in the U.S. and their effects on human-capital accumulation.[4] The most prominent example of these programs is the Georgia HOPE scholarship, initiated in 1993, which provides a full tuition/fee waiver at state institutions to Georgia students who achieve a 3.0 GPA in high school. Since that time, many states have modeled their own programs after the HOPE scholarship to varying degrees.[5] There are several hallmarks of merit-aid programs. First, they only provide aid to students who attend in-state institutions. Second, scholarships are awarded for "merit"–students achieve eligibility based on their high-school GPA and sometimes their SAT/ACT score or class rank. Third, in order to retain a merit-aid scholarship during college, students must maintain a minimum GPA (typically between 2.75 and 3.0; see Sjoquist and Winters, 2014). Lastly, there is generally no means test for eligibility and award amounts do not differ by family income or wealth.[6] We review basic features of merit-aid programs and their growth as a fraction of college financial aid in Appendix A.

We exploit the rollout of these programs by state and over time to isolate their effect on college alcohol use.[7] In doing so, we extend the literature on how merit aid affects student behavior while in college. Cornwell et al. (2005) find that students decrease course

[3]For a comparison of all merit-based and need-based state-level financial aid programs, see Baum et al. (2012).

[4]See Hu et al. (2012) for a review of the literature on how merit-aid programs affect college enrollment and other outcomes.

[5]For a description of these programs, which vary in their generosity, see Dynarski (2004); Sjoquist and Winters (2012, 2014).

[6]The HOPE program contained an income cap on eligibility for its first 2 years of existence, but this feature was eliminated in 1995 (Dynarski, 2004).

[7]Alcohol abuse is among the largest public health concerns for individuals in the college demographic. See http://pubs.niaaa.nih.gov/publications/CollegeFactSheet/CollegeFact.htm (last accessed: July 28, 2014).

enrollments and increase withdrawals in response to HOPE, perhaps to keep their GPA above the scholarship renewal threshold. Sjoquist and Winters (2014) estimate that merit-aid scholarships reduce the number of college students in STEM majors, likely due to their higher degree of difficulty (Dee and Jackson, 1999). Cornwell and Mustard (2007) find that the advent of HOPE led to an increase in car sales in wealthier Georgia counties, presumably because the scholarship is simply a rent payment to families who were planning to send children to college in the first place. Indeed, income effects associated with merit-aid programs are expected to be large for many families since the vast majority of those students who qualify very likely would have gone to college even in the absence of the program (Cornwell et al., 2006).

Student disposable income might increase as a result of a merit-aid program if parents and children share the financial gain associated with not having to pay tuition. Other things equal, this should lead to an increase in drinking if alcohol is a normal good among college students. However, the preceding paragraph makes it clear that merit-aid programs have the potential to affect drinking through channels other than a simple income effect: for example, since these programs increase the incentive to maintain a GPA above the minimum renewal point in one's state, merit aid could *discourage* drinking (particularly for those individuals who are near or expect to be near the GPA cutoff). Indeed, recent research (for example, Williams et al., 2003; Carrell et al., 2011; Lindo et al., 2012) suggests that alcohol use has a negative causal effect on academic performance. If individuals recognize the link between drinking and grades, they may choose to curb their alcohol use in order to keep their merit scholarship.

Another pathway by which merit aid might affect college alcohol use is through changes

in the allocation of time. Previous research suggests these programs affect choice of major, which could in turn affect time spent studying. It is conceivable that these programs also affect decisions about how much to work for pay or engage in various extracurricular activities, any of which could in turn influence drinking behavior. Lastly, the added stress associated with trying to maintain their scholarship could cause some students to drink more as a way of self-medicating (see, for example, Economos et al., 2008).

A disadvantage of our study, due to limitations on the variables available in the data, is that we cannot pinpoint the exact mechanism by which merit aid affects alcohol consumption. However, we believe this is offset by several advantages. Our data for this project, the College Alcohol Study (CAS), was designed to capture nationally representative detailed data on the drinking habits of college students. Furthermore, the 1990's saw several states adopt large-scale merit-aid programs at various points. Because CAS data was collected in 1993, 1997, 1999, and 2001, we are able to observe drinking in non-merit and merit states both before and after the implementation of several of these policies. Thus, we believe our study is ideal for measuring the overall effect on drinking of merit-aid scholarship programs.

We consistently find that large-scale merit aid programs led to an increase in drinking among college students living in states that adopt programs. Our preferred specification indicates that the arrival of a merit-aid program leads to an 18% increase in the number of days a male student had 5 or more drinks in a row in the past 2 weeks. Effects for female students overall are generally smaller or even negative (sex differences in our results is something we discuss in detail in Section 4). We also find that the effects are strongest for students with lower parental education, older students, and students with high college grades (recall that a sufficiently high GPA is necessary to maintain a merit scholarship).

Our identification strategy rests on the assumption that unobservable trends across merit-aid states and non-merit states are the same–if this is the case, the differential drinking trends in merit-aid states are due to the programs themselves. To guard against the possibility that unseen factors are responsible for the results, we examine the robustness of our results with respect to the set of control variables used (including state and region-specific trends) as well as the sample of states used in estimation (for example, only southern states or only states that eventually adopt a merit-aid program). In addition, we explictly analyze how drinking trends in merit-aid states compare to other states in an event-study framework. Our main results are robust to all of these specification changes.

Lastly, we are mindful of the fact that since we only observe individuals' states of residence while they are in college, there is a possibility that drinking at institutions in merit-aid states increases simply because the composition of enrollees changes relative to institutions in non-merit states (if this were the case, the adoption of a merit-aid program might increase alcohol use at certain institutions but would not have caused any individual student to change her drinking habits).[8] We can examine this issue indirectly because we have data on college students' (retrospective) drinking behavior in high school. We find that students who are eligible (based on their age) and live in merit-aid states do not report relatively higher levels of high-school alcohol use (even though they do, of course, report more drinking as college students). This is evidence that the positive drinking effects we find are not simply due to institutions in merit-aid states admitting a greater share of heavier-drinking students after

[8]Our sample consists of students at four-year institutions, which are generally likely to become more competitive, if anything, after the adoption of merit aid since some students who would have gone out-of-state for college now remain in-state (Cornwell et al., 2006 finds this is true in Georgia). Since higher-achieving high-school students drink less than their peers on average (e.g. Balsa et al., 2011), this could bias our (positive) estimates toward zero.

the program is adopted.

2 Empirical Model

As we argue in Section 1, a merit-aid scholarship program in one's state of residence has the potential to change a student's disposable income, the "full" price of consuming alcohol (because alcohol use may lower academic performance, which in turn raises the risk of losing the scholarship), time allocation, and other factors related to drinking. We observe neither parental nor student income in our data and very little on time allocation. Furthermore, we do not observe students' expectations on how alcohol consumption affects their grades. As a result, we are constrained to examine the "reduced-form" effect of merit-aid programs on college students' alcohol use:

$$AC_{icst} = \zeta MA_{ist} + \alpha_s + \beta_t + X_{it}\gamma + Z_{st}\lambda + \epsilon_{icst}, \tag{1}$$

where AC_{icst} is alcohol consumption by individual i at college c in state s in year t. MA_{ist} is an indicator for the presence of a merit-aid program in state s in year t for those who were college freshman in the year of implementation or after.[9] α_s is a state fixed effect, β_t is a year fixed effect, X_{it} are pre-college individual characteristics, Z_{st} are state characteristics, and ϵ_{icst} is the regression error.

ζ is identified by comparing the (regression-adjusted) difference in alcohol consumption between the pre-law and post-law periods in states that adopt programs with the same difference in non-adopting states (including states that have yet to adopt a program but do

[9] We do not observe merit scholarship receipt at the individual level in our data.

eventually). As described in Section 4, we use a variety of controls and falsification exercises to account for the possibility that drinking trends in merit-aid states may have been different than those in non-adopting states even in the absence of a program.

As described in Sjoquist and Winters (2012, 2014), the merit-aid programs adopted by states over the time period in this study are heterogeneous in terms of generosity. Some programs, such as the HOPE scholarship in Georgia, offer relatively large amounts of aid to a majority of high-school graduates. Many other programs are much smaller in scope (either going to only the very most elite students, providing significantly smaller subsidies, or both). These latter programs are obviously not expected to have as large of an impact as the bigger programs. Sjoquist and Winters (2014) classify programs into "strong" and "weak" categories, and we follow their definition in this paper. We include Table 1 from their paper in our Figure 1, which provides details on the 9 strong programs and lists the 18 weak programs adopted since the early 1990's.

Like Sjoquist and Winters (2014), Dynarski (2008), and Hickman (2009), we define our treatment according to whether an individual is eligible (a college freshman in the first year the program goes into effect or after) to receive merit aid in a state with a strong merit-aid program. We include individuals from states with weak programs in the control group but also perform specifications in which they are excluded from the analysis.[10] Of the 9 "strong" merit-aid states, 6 see a change in merit-aid status in the CAS data (Georgia, Florida, Kentucky, Louisiana, New Mexico, and South Carolina) because Tennessee and

[10] An alternative is to include separate dummies for both strong and weak merit-aid eligibility. We also tried this specification and found it made little difference in the treatment effect of strong merit aid. Another possibility is to examine the effect of merit aid on the intensive margin by using award amounts (per undergraduate, for example) on the right-hand side. However, awards per undergraduate are fairly similar across strong-merit states and often do not vary much within a state over time (though there are exceptions). Thus, we focus on the presence of a large-scale merit-aid program as our variable of interest.

West Virginia change status after the last year of CAS (2001) and there are no observations from Nevada in the data.[11]

An important question related to the size of the income effect generated by these programs is whether merit-aid scholarships crowd out other forms of aid or lead to increases in higher education costs that are not covered by the scholarship (e.g. room and board). Indeed, Long (2004) finds some evidence of an acceleration in higher education costs due to merit-aid programs. However, Dynarski (2004) argues that total educational spending in Georgia rose substantially following the passage of HOPE, while Doyle (2010) finds that merit-aid programs have not led to a reduction in need-based aid among adopting states. This may partly be due to the fact that large merit-aid programs have often been funded by newly established lotteries (Dynarski, 2004). Singell Jr et al. (2006) actually find that total Pell Grant awards increased in Georgia following the passage of HOPE, suggesting that merit aid has been useful in leveraging more need-based support for poorer students (rather than crowding out such aid). Nevertheless, to the extent that institutional or other government need-based aid is crowded out by merit aid, we would expect the largest income effects of merit-aid programs to accrue to wealthier students' families (who are also most likely to be inframarginal with respect to the decision to attend a four-year institution).

Another relevant question concerning how much student income rises under a strong merit-aid program is how parents and children split the windfall that accompanies a program. Certainly parents may reduce their total level of financial support when their child is given a full tuition/fee waiver, but what likely matters most with respect to alcohol consumption is what happens to the child's *disposable* income. To extract a larger share of the merit-aid

[11] We take up issues related to statistical inference when the number of treatments is small in Section 4.1.

rents for themselves, students with generous parents in merit-aid states can threaten to go to an out-of-state institution (in which case the parental financial burden rises significantly). This should cause parents to give their children "a better deal" to stay in their home state for college.

3 Data

The dataset used throughout our analysis is the College Alcohol Study (CAS). CAS is a nationally representative cross-sectional survey of four-year, full-time college students in 1993, 1997, 1999, and 2001. In each year, the sample is comprised of roughly 14,000 students from 120 institutions in 40 states.[12] CAS has a long history in economic and public health research (see Wechsler and Nelson, 2008). CAS is ideal for this study in that it contains detailed information on college students' drinking behavior and it coincides with a period of rapid expansion of merit-aid programs in the United States. We provide additional details on the survey design in Appendix B.

Our principal measure of alcohol consumption (our dependent variable) is a measure of heavy or "binge" drinking: the number of days in the past 2 weeks in which a student had 5 or more alcoholic drinks in one sitting.[13] This kind of drinking has been found to be especially associated with harmful behaviors and outcomes (see, for example, Wechsler et al., 2002). In robustness checks, we use other measures of consumption: a binary variable indicating whether the individual engaged in binge drinking in the past 2 weeks, a binary variable

[12] See http://archive.sph.harvard.edu/cas/About/index.html (last accessed: July 28, 2014).

[13] Possible answers to this question in CAS were 0, 1, 2, 3-5, 6-9, and 10 or above. We re-code these as 0, 1, 2, 4, 7.5, and 10, respectively.

indicating whether the student drank alcohol in the past month, and the total number of drinks a student had in the past month (days drank alcohol in the past month multipled by average number of drinks per day in which drinking occurred).

CAS allows us to use a rich set of control variables in our analysis. In most of our specifications, we include controls for individual characteristics that are plausibly "pre-determined" at college entry: dummies for age, race/ethnicity, sex, year in school, father's college attendance, mother's college attendance, and religious affiliation. To deal with the possibility that strong merit-aid states differ from other states in unobserved ways, we include state and year fixed effects in all specifications and additional state and region trends in some specifications (this is described in the next section). We also include time-varying state characteristics that may affect alcohol use: median income, unemployment rate, and tax rate on liquor.

In limited robustness checks, we control for individual and institutional characteristics that are likely determined after merit-aid receipt ("post college"): dummies for marital status, living off-campus, being a member of a fraternity/sorority, current college GPA (dummies for A, A-, B+, B, B-, C+, C, C-, and D), whether the institution is public, whether it is rural, whether it is a commuter school, whether it has a religious affiliation, school size (4 categories), and school competitiveness (8 categories). These variables are potentially endogenous to the treatment (merit aid adoption) and are thus only used to examine the robustness of our main results. Descriptive statistics on all variables used in our regression analysis are shown for all college students as well as males and females separately in Table 1.

Since CAS is not a well-known data source in the economics literature, we compare our drinking measures to those reported for college students in Monitoring the Future (MTF) and several student characteristics to those reported for college students in the National

Longitudinal Survey of Youth, 1997 cohort (NLSY97). In Table 2, we display the percentage of college students who drank in the past month and the percentage reporting at least one episode of binge drinking (5+ drinks) in the past 2 weeks in both CAS and MTF. For each year, the MTF figures come from Tables 9-3 and 9-4 in Johnston et al. (2004).[14] As seen in the table, both drinking and binge drinking rates are fairly stable over the sample period (1993-2001) and are very similar across the two datasets.

Table 3 shows how drinking measures and student demographics compare between the 1999 and 2001 waves of CAS and the same years of the NLSY97. We chose these two years because a significant number of NLSY97 respondents were college-aged in 1999 and 2001 (and they overlap with the last two waves of CAS). Our NLSY97 sample is restricted to those who were attending four-year colleges in those years. As seen in Table 3, we calculated means of drinking and demographic variables that were common across the surveys. The NLSY97 figures are weighted to account for the fact that it oversamples certain subgroups (e.g. minorities).

Once again, drinking measures (consuming alcohol in the previous month, total number of drinks in the previous month) are similar across the surveys overall.[15] When the results are broken out by gender, it appears that CAS women drink somewhat less than NLSY97 women. Both studies indicate a large gender difference in total number of drinks, a result that is consistent with other studies (Wilsnack et al., 2009). Demographics are also similar across the data sources, with females having slightly higher representation in CAS while blacks have lower representation. Since there are more Hispanics in CAS, perhaps part

[14]The number of binge days is not reported in Johnston et al. (2004), so we cannot compare those figures with ours.

[15]The NLSY97 asks individuals about binge drinking over the previous month rather than 2 weeks (as in CAS), so those figures are not directly comparable.

of these differences are due to variations in how the two studies elicit race and ethnicity. CAS students are a little more likely to have had parents who attended college (particularly fathers). Region representation is fairly consistent across CAS and the NLSY97. Overall, we believe CAS is similar to these other (more familiar) data sources, both in terms of alcohol use and other variables, such that the results that follow are not particular to the dataset chosen for this analysis.

4 Results

4.1 Baseline results

The baseline results of the paper–with number of heavy drinking days in the past 2 weeks as the dependent variable–are shown in Table 4. All models are estimated with CAS data via OLS. Each column shows the effect of merit aid on drinking (for all students, just males, and just females) from a model with a different set of controls and/or sample, as indicated in the table.[16] All models include observations from weak-merit states in the control group. Appendix Table 1 displays merit-aid effects from regressions in which these individuals are excluded from the regressions, and the results are very similar to those contained in Table 4.

Standard errors based on the usual asymptotic approximation (but clustered at the state level and robust to heteroskedasticity) are reported in parentheses. Asterisks assigned to coefficients denote statistical significance at various levels based on these standard errors. However, Conley and Taber (2011) note that inference can be misleading when the number

[16]Chow Tests of the null hypothesis that male coefficients are the same as female coefficients are typically rejected at better than the 1% level in our models. Thus, we always estimate the entire regression model separately for males and females when examining the results by gender.

of policy changes in the data is small (such that the usual asymptotic approximation is not appropriate). This critique may be applicable to our study because of the small number of states (6) that change their merit-aid policy over our sample frame. As a result, in addition to calculating standard errors based on the usual asymptotic assumptions, we also follow Conley and Taber (2011) in generating 90% confidence intervals that are based on keeping the number of treatment groups fixed as an assumption.[17] These are reported in brackets below the coefficients and traditional standard errors.

The first column of Table 4 shows results from a specification with state and year fixed effects but no additional covariates (other than the merit-aid indicator). There is a statistically significant (at the 5% level) positive effect of strong merit aid on heavy drinking overall, and this effect is slightly larger for men (though the point estimates are not significant at conventional levels for men or women individually). Column 2 adds a set of pre-determined (pre-college) characteristics as discussed in the previous section. Pre-college variables are added to the model to account for the possibility that selection into colleges changed following the passage of merit-aid programs in a way that affected alcohol use (this issue is discussed further when we examine how these characteristics were affected by merit-aid programs in Section 4.3). In this specification, an economically meaningful gender difference in the treatment appears (with only males experiencing a statistically significant effect at the 10% level).

With state and year fixed effects in the model, we have controlled for both time-invariant

[17]We thank John Winters for providing us with his code for performing the Conley-Taber procedure. Under the standard difference-in-differences assumption (random assignment of treatment conditional on group and time effects), the random error terms for treatment and control groups have the same distribution. As explained in Conley and Taber (2011) and Sjoquist and Winters (2014), the procedure uses the control groups to estimate the CDF of the treatment effect under a specific null hypothesis. Confidence intervals are based on the appropriate quantiles of this distribution.

state-level differences in binge drinking across merit and non-merit states as well as secular changes in drinking over time. However, the possibility remains that trends in young people's drinking behavior would have been different in strong merit-aid states than in control states even in the absence of the programs. For example, because strong merit-aid states are concentrated in the south, it may be the case that merit-aid programs are simply masking a broader differential in trends between southern states and the rest of the U.S. To guard against this possibility, we add state-specific linear time trends to the model (Column 3 of Table 4). This results in a substantial separation of the merit-aid effect for men and women, with men experiencing a larger positive effect and women actually experiencing a negative effect (though the Conley-Taber 90% confidence interval overlaps zero in the female case). The gender difference in coefficients is statistically significant at the 5% level (based on standard asymptotic inference) in Column 3.

Columns 4-7 of Table 4 display results from additional models that further scrutinize the notion that merit-aid states are different from control states in unobserved ways. Region-by-year dummies are added to the right-hand side in Column 4, and the results change very little relative to Column 3. The same is true of Column 5, in which only southern states are included in the regression sample (the empirical model is the same as in Column 3). Column 6 reports results from the same model as Column 3 but only with observations from the 6 strong-merit states included in the analysis (Conley-Taber intervals are not reported here because all states in the sample are treatment states). It is still possible to identify the merit-aid effect in this case because treatment states adopt strong merit-aid programs in different years. Once again, the result are highly consistent with Column 3. Lastly, in Column 7, the full sample of states is again used but post-college enrollment individual

and school characteristics, which are potentially endogenous to merit-aid receipt, are added to the Column 4 model. The rationale for including this "saturated" model is again the possibility that the composition of college students in merit states is changing (relative to non-merit states) over time in a way that might be partially captured by these additional characteristics. We find yet again that the results first found in Column 3 are highly robust to the inclusion of these variables.

The results in Columns 3-7 of Table 4 mitigate the concern that treatment states are fundamentally different from other states and would have experienced a differential trend in college alcohol use even in the absence of merit aid. Once state-specific trends are included in the model, the result that males experience a large, positive increase in binge drinking following merit-aid adoption (and that the effect for females is negative, if anything) is highly robust. We do not know precisely why the magnitude of the coefficients change significantly when state-specific trends are controlled for (going from Column 2 to 3), but we note that their inclusion does reduce the variation in the merit-aid variable with which to estimate the treatment effect. Nevertheless, the results in Column 2 (without these trends) are qualitatively similar to those in Column 3 even though the magnitudes differ.

As a whole, the results in Table 4 suggest that males increase their heavy drinking in response to a strong merit-aid program but females do not. Conley-Taber 90% confidence intervals do not overlap zero in 6 out of the 7 specifications for males but contain zero in all specifications for females. Because once state-specific time trends are added to our regression model the results change very little, we adopt the model described in Column 3 (using the full sample and with controls for state and year fixed effects, pre-determined individual and state characteristics, and state-specific linear time trends) as our preferred specification for

the remainder of the paper. This specification implies that a merit-aid program increases male-binge drinking days by about 18% at the mean.

4.2 Other drinking measures

In Table 5, we examine how strong merit aid affects alcohol consumption using alternative drinking measures: whether the individual consumed alcohol in the past month (Column 1), the number of drinks in the past month (Column 2), and whether the individual engaged in binge drinking in the past 2 weeks (Column 3). The last column (4) of Table 5 is simply Column 3 of Table 4 (with number of binge occasions in the past 2 weeks as the dependent variable), reproduced for convenience. All models are estimated using our preferred specification as described in the previous section. As shown in the table, there is essentially no effect of the treatment on either drinking or binge drinking at the extensive margin for either gender (Columns 1 and 3). As in the case of binge drinking, however, there is positive and significant (at the 5% level) effect of merit aid on the intensive margin of drinking (total number of drinks in the past month) for males. This shows that men in merit-aid states do not offset more binge drinking with less casual drinking, since the total number of drinks increases as well. Since we find total number of drinks to be responsive to merit-aid adoption in our preferred specification, we include results from our full set of specifications (as in Table 4 for binge-drinking occasions) for this dependent variable in Appendix Table 2. The pattern of results is very similar to the pattern for heavy-drinking days, with total drinks increasing by about 16% at the mean following treatment for males.

4.3 The composition of students

In this section, we address the possibility that merit-aid programs changed the composition of the student body in four-year institutions (relative to non-merit states). Indeed, Cornwell et al. (2006) find that SAT scores among incoming freshmen in Georgia public schools improved relative to the national average following the passage of HOPE, and Henry and Rubenstein (2002) find evidence of scholastic improvement in the student body in strong-merit states. If changes in student composition were correlated with drinking behavior, our results may be due to a changing student body rather than changes in drinking at the individual level.

Using our preferred empirical specification, we examine how merit-aid programs affects individual pre-college characteristics in Table 6.[18] These programs seem to have no effect on gender, age, or mother's college status. However, the probility of a student indicating her race as "white" rises and the probability of a student's father having attended college falls with merit-aid adoption. These effects are small: the increase in the likelihood of being white is 5% and the decrease in the likelihood of father's college attendance is 4% at their respective means. Nevertheless, they indicate some compositional changes that may influence our results. Importantly, however, our preferred specification controls for these pre-college factors and still finds a substantial effect on drinking due to merit aid (for men). The fact that adding a host of additional right-hand side variables that reflect both pre- and post-college decisions (Column 7 of Table 4) does not affect our results is further evidence

[18] In addition to individual characteristics, it would be worthwhile to examine whether merit-aid implementation affects a student's propensity to attend college in particular geographic location (i.e. in a merit-aid state) or at a particular type of institution (e.g. public instead of private). Unfortunately, CAS's design, which surveys the same schools over time and samples the same number of individuals at most schools, prevents this type of analysis. See Appendix B for more details.

that differences in composition are not responsible for our estimates.

We can also indirectly examine whether merit-aid states were more likely to attract students with a higher propensity to engage in (binge) drinking by looking at the *high-school* drinking habits of individuals who attend college in merit-aid states versus those who do not (the last column of Table 6). In CAS, respondents are asked how many times, on average, they drank alcohol per month while still in high school (this is the only question on high-school drinking). This data is retrospective, so it is subject to some recall bias. Nevertheless, it provides us with an opportunity to see whether high-school drinking trends follow the same pattern as college ones–if that were the case, it would suggest that our estimates may simply be due to changes in the make-up of the sampled student population in merit-aid versus non-merit states.[19]

As seen in the last column of Table 6, the effect of merit aid on high-school drinking days is close to zero for all youth and males and females separately. In fact, this result is not specific to our preferred specification but is true of all specifications shown in Table 4 (these results are available upon request). These findings lend credence to the notion that

[19]This analysis is subject to some caveats. First, because drinking for high-school aged students is illegal, and because the vast majority of them are living with parents or other caretakers, it is possible that there are many "would-be" drinkers in the data that are more likely to attend college in merit-aid states after programs are adopted, which this analysis would fail to pick up (since we can only measure actual rather than latent drinking). However, over 60% of the students in our sample report at least some positive amount of monthly drinking in high school, so we believe this problem is not serious.

Second, it is theoretically possible that merit aid programs affect high-school drinking if teenagers are aware of their existence and are planning to use them. A merit-aid program raises expected lifetime income for those who expect to receive aid (possibly leading to an increase in alcohol consumption) and increases the incentive to maintain good grades in high school for those who expect to be near the GPA cutoff (which may encourage such students to curb their drinking). It seems unlikely that high-school students are able to "borrow" against future college aid in a substantial way, but it may be the case that students drink less to better their chances at a scholarship. Cowan (2011) finds that increased college attendance expectations (through more affordable two-year college tuition) cause teenagers to engage in less risky behavior (including heavy drinking). In the case of merit aid, the great majority of students who receive a scholarship would have gone to college even without it (Cornwell et al., 2006), which implies this mechanism is likely to play only a minor role.

our earlier results reflect true causal effects of merit-aid programs on college drinking; since high-school drinking does not follow the same pattern, it is more doubtful that our results can be explained by changes in college-student composition.

4.4 Event-study analysis

Though our preferred specification discussed in the previous sections includes controls for state-specific trends, we have not yet explicitly analyzed whether pre- and post-program trends were different in treatment and control states. To this end, we perform an event-study analysis and report the results in Table 7. Since the strong-merit states in our sample adopted programs in different years, we produce a separate analysis for each year in which at least one state adopted a strong merit-aid program (Georgia in 1993, Florida and New Mexico in 1997, Louisiana and South Carolina in 1998, and Kentucky in 1999). For each of those four treatment groups, we compare the state(s) adopting treatment to all control states (i.e. we exclude states adopting strong merit aid in other years).

Because our treatment is based on cohort (i.e. year of freshman enrollment), we examine trends in drinking by cohort relative to each policy change.[20] Cohort groupings are made based on when treatment occurred since, for example, there are only a few cohorts in the data that preceded treatment in Georgia (but several cohorts that followed treatment), and Kentucky has the opposite situation. For Georgia, we look at four groups: cohorts 1-3 years prior to the policy change, 1-3 years after, 4-6 years after, and 7 or more years after. For both Florida/New Mexico and Louisiana/South Carolia, our four groups are: cohorts 4 or

[20]Because we only observe an individual's year in college at the time she is sampled, we calculate year of freshman enrollment (and thus cohort) as the "current year - 1" for sophomores, "current year - 2" for juniors, "current year - 3" for seniors, "current year - 4" for 5th year seniors, and "current year - 5" for those in their 6th year or above.

more years prior to the policy change, 1-3 years prior, 1-3 years after, and 4 or more years after. Finally, when looking at Kentucky, we have four groups that are the "mirror image" of the ones for Georgia: cohorts 7 or more years prior to the policy change, 4-6 years prior, 1-3 years prior, and 1-3 years after.

Table 7 shows results of regressions that contain state fixed effects, dummies for each of four cohort groupings (which change depending on the year of treatment, as described above), and the interaction between the cohort grouping dummies and treatment (which is "1" for the strong merit-aid state(s) in question and "0" otherwise). Each column in the table shows results for a different treatment group (depending on year of treatment). The omitted category in every case is "cohorts 1-3 years prior to the policy change." Because the treatment samples are so much smaller in this analysis, we do not perform the regressions separately by gender.

We first look at pre-treatment trends. There is some evidence that heavy drinking is increasing in control states early on (recall that the coefficients are relative to the effect for the "1-3 cohorts prior to the policy change" group) but no evidence that those trends are different in treatment states (see the interactions between cohort groups that fall prior to the policy change and "strong merit program"). After treatment, there is no clear heavy drinking pattern in control states; however, there is a sharp, statistically significant (at the 5% level) increase in drinking in treatment states (relative to control states) for the "1-3 cohorts following the policy change" group in 3 of 4 cases (with Louisiana and South Carolina in 1998 being the exception). Interactions between "strong merit program" and subsequent cohort groups are also generally positive, though smaller and less precisely estimated than for the first three cohorts following policy changes.

Although the case of Louisiana/South Carolina is an exception in this specification, the broad pattern in the trends presented in Table 7 is supportive of the notion that it was indeed merit-aid programs (rather than some unobservable factor) that led to an increase in heavy drinking in strong merit-aid states overall. In the next section, we consider how the effects of merit-aid programs differ across individual characteristics.

4.5 Result heterogeneity

In Section 4.1, we establish that in most of our specifications (including our preferred one) males appear to experience a larger (positive) drinking response to the introduction of merit aid than do females. We are also interested in whether our results vary along other dimensions. We initially examine whether there is heterogeneity in the results by pre-determined characteristics, including race, age, and parental education (Table 8) and then by post-college characteristics, including college GPA, fraternity/sorority status, and public/private institution type (Table 9). In each case, our preferred empirical model is used to generate results for all students as well as men and women separately. Standard errors clustered at the state level are reported in parentheses.[21]

4.5.1 Results by pre-college factors

Table 8 shows that the positive effect of merit aid on heavy-drinking days for males is stronger among whites, students who are 21 or older (the legal drinking age), and students whose mothers did not attend college. The last two results are especially pronounced. A natural explanation for the age difference is that student drinking is more susceptible to additional

[21] Because inference based on asymptotic methods and the Conley-Taber method do not differ substantially in our baseline specification, we choose to focus on standard asymptotic inference in this section of the paper.

disposable income when drinking is legal. However, reported binge-drinking days are similar for underage and legally aged males, so this is likely not the full explanation. Another part of the story may be that younger students, who are typically underclassmen, have more to lose by failing to renew their scholarship (since they have more college years in front of them), which would make the *grade performance* incentive more important for them.

Strikingly, the positive effect of strong merit aid on heavy drinking is highly concentrated among males whose mothers did not attend college (the corresponding difference in effects by father's college attendance is much weaker). Such students are more likely to be first-generation college students (clearly) and come from lower-income families (Terenzini et al., 1996). The results presented in Table 6 indicate that the probability of having a college-educated mother did not change with the adoption of merit-aid programs. Rather, students with less-educated mothers appear to be most susceptible to the incentives for more heavy drinking that merit-aid programs create.

4.5.2 Results by post-college factors

Because post-college factors including GPA, fraternity/sorority status, and institution type may themselves be influenced by merit-aid receipt, the results in this section must be treated with some caution. Nevertheless, we choose to examine how results differ according to these variables to further examine our identification strategy (in the case of GPA) and to gain further insight into the mechanism(s) by which aid affects college drinking.

We begin by examining how the effects of strong merit-aid eligibility vary by college GPA. Because merit aid is renewed only for those college students who maintain a minimum GPA

(see Figure 1), we expect these effects to vary over the GPA distribution.[22] To examine whether this is the case, we divide all students into 3 GPA classifications: 3.4 (B+) or above, 2.7-3.0 (B- to B), and 2.4 (C+) or less. The first group is most likely to be on scholarship (a 3.4 GPA qualifies for renewal in all strong merit states) and might also be relatively unconcerned with scholarship loss, since (marginal) reductions in grades due to increased alcohol consumption would likely not move them below the GPA threshold for renewal (generally between 2.5 and 3.0 depending on the state and year in school).[23]

The next group is the "marginal" group (2.7-3.0): many of these individuals would be eligible for merit aid in strong states, but poor performance could cause one's GPA to dip below the renewal point, so the *grade performance* effect may be more important than it is for the first group. Lastly, many of those in the third category (2.4 or less) will not be on merit scholarship, either because they never received it initally or have since lost it (renewal is determined annually in most states). Some states with strong merit programs allow individuals who have lost the scholarship to regain it by raising their GPA above the renewal threshold; for this reason, individuals in this category who live in strong merit states might have an incentive to reduce their alcohol consumption to improve their grades.

The results from regressions run separately by GPA category are contained in Table 9. Once again, large differences in the coefficients are observed for men and women. Men in the highest GPA category experience a large, significant (at the 1% level) increase in heavy

[22] Unfortunately, CAS does not contain data on high-school grades, which determine initial receipt of merit aid.

[23] Another way of thinking about this analysis is as a difference-in-differences in which the control group is students who *would have* been eligible for merit aid had they lived in a state with a strong merit-aid program. Unfortunately, a regression discontinuity design, in which students just above and just below the renewal GPA cutoff are compared, is not feasible here because we lack sufficient precision in our GPA measure and have no data on individual receipt of the scholarship.

drinking days. This is in line with there being a relatively large boost to income for this group without much concern for falling below the scholarship renewal point. The point estimate for men in the middle GPA category is actually a bit higher than the one for the high category, though it is less precisely estimated. Men in the bottom GPA category experience a negative but statistically insignificant effect of merit aid on heavy drinking. Thus, the pattern in the results for men is largely consistent with what we would expect given how incidence of the scholarship should be concentrated among individuals with higher college GPA's.

The story for women is clearly different, as no GPA group of female students show positive, statistically significant merit-aid effects. Furthermore, point estimates are actually somewhat larger for those with lower grades. Though an in-depth analysis of the gender difference in drinking response to merit aid is beyond the scope of this paper, we note some facts that are likely to be relevant. Female and male drinking habits differ markedly, with males typically drinking more often and more heavily in many countries (Wilsnack et al., 2009).[24] Researchers have found gender differences in drinking responses to interventions other than changes in financial aid–for example, Kremer and Levy (2008) find that males are more susceptible than females to being assigned a heavily drinking roommate in college. Our results may be the result of a difference in income elasticities for alcohol between men and women or differences in the relative size of the *income*, *grade performance*, and/or other incentives of merit-aid programs across sex. Other researchers have found large gender differences in how underage youths obtain alcohol, with males being much more likely to get it from a commercial outlet and females being more likely to get it from someone age 21

[24]In our data, female alcohol consumption is about half of male alcohol consumption by both intensive measures (number of days of 5 or more drinks and total number of drinks in the past month).

or older (Wagenaar et al., 1996). This could translate into differences in income elasticity, though we do not know of estimates that support or fail to support that possibility. This is a question for future research.

The remainder of Table 9 shows how our results vary by fraternity/sorority membership and institution type (public or private). We find that the positive heavy drinking effect of merit aid are concentrated among non-greek males (i.e. those *not* in a fraternity). In our sample, both men and women who hold greek membership drink about twice as much, on average, as do non-greek students. Furthermore, Walker et al. (2014) finds that greek students come from higher-income families than do non-greek students. Our results are consistent with the notion (not tested in this paper) that there is more scope for merit aid to affect the disposable income and drinking behavior of non-greek youths.

Lastly, students at public institutions experience drinking increases after merit aid while students at private institutions do not. It is notable that though most strong-merit states provide merit-aid subsidies for private (in-state) college attendance, they are typically smaller than those for public attendance, often in absolute terms and as a fraction of tuition (Dynarski, 2004).

Because we lack the data in CAS, we cannot directly examine how our baseline results compare for students in different family income brackets. However, the results in this section–including the findings that heavy drinking responses are stronger for students who do not belong to fraternities/sororities, have mothers who did not attend college, and are enrolled in public institutions–may be indicative of merit aid having a larger effect on the behavior of student with more modest family incomes. This could be happening for several reasons, among them the possibility that merit aid raises the disposable income of these students,

while students from richer families may already have (relatively) high disposable incomes to begin with and thus do not see much change with the passage of merit-aid laws.

5 Conclusion

We study the effects of state-level merit-based scholarship programs on the drinking behavior of college students. We find that, on average, a strong merit-aid program leads to an increase in male alcohol consumption according to two measures: the number of days in the past 2 weeks that an individual had 5 or more drinks on one occasion and the total number of alcoholic drinks over the past month. These effects are not uniform across the student population; rather, they are especially concentrated among men, students with high GPA's, students with non-college mothers, and older students.

Based on the information on strong merit-aid programs provided in Sjoquist and Winters (2014) (reproduced in Figure 1 of this paper), the (population-weighted) average subsidy in strong merit states is roughly $1,000 per student (or roughly $3,000 per recipient). We find that a strong merit-aid program raises male heavy drinking by about 18%. However, we cannot derive an income elasticity (or semi-elasticity) of alcohol use among college students because merit-aid programs have the potential to affect drinking through several alternative pathways (e.g. by changing time-use incentives) and our data is limited. Nevertheless, we view this paper as a step toward understanding how financial aid programs affect risky behavior among college students, a topic that is largely unexplored in the literature. Future work on merit-aid programs could disentangle how *income* and *grade performance* incentives as well as other factors account for higher drinking in merit-aid states. Furthermore, because

other financial aid programs differ in structure and incentives (for example, need-based aid), more work is needed to comprehend how financial aid can be designed to minimize deleterious effects on student risky behavior as it strives to meet its primary objectives.

A Appendix: Background information on merit-aid programs

U.S. federal grant aid for college is heavily based on financial need (for example, Dynarski, 2004 states that 90% of dependent students who receive federal grants grew up in families with annual incomes of less than $40,000). State-based financial aid was also traditionally based on need–roughly 90% was at least partly need-based in 1992-93–but with the adoption of large-scale merit-based financial aid programs in several states since that time, that percentage had fallen to about 70% as of 2010 (Baum et al., 2012).

Merit-aid programs are designed to provide funding to the highest-achieving students in order to keep the "best and brightest" in their home state for college (Zhang and Ness, 2010). These programs typically do not consider financial need as a criterion for award receipt. One of the earliest and best-known examples is the Georgia Helping Outstanding Pupils Educationally (HOPE) scholarship, which provides a full tuition waiver at in-state public institutions for students who receive a qualifying 3.0 GPA in high school (smaller awards are also available at in-state private institutions). The Georgia Student Finance Commission states that $5.8 Billion have been distributed since 1993 through the HOPE scholarship program to approximately 1.4 million students.[25] Merit-aid programs in other states differ

[25]See http://www.gsfc.org/gsfcnew/HopeProgramm.cfm (last accessed: February 20, 2015).

in terms of qualification criteria and the size of awards, but they are overwhelming tied to in-state college attendance (though at least one program, the Louisiana TOPS program, is a partial exception to this). As of 2012, 24 states awarded scholarships through a merit-based aid program, though programs varied greatly in size (Sjoquist and Winters, 2012).

The bulk of the academic literature on merit-aid programs focuses on their effects on 1) in-state college attendance and residence after schooling is completed, 2) overall college enrollment, and 3) overall college completion. This literature is reviewed in Hu et al. (2012). Our reading of the literature is that merit-aid programs do seem to increase in-state retention of students (even after college, at least modestly–see, for example, Hickman, 2009); however, the effect of aid on overall enrollment and (especially) completion is mixed. For example, Dynarski (2008) find positive completion effects (of HOPE), but Sjoquist and Winters (2012) find no such effects when examining all large-scale merit-aid programs. Typical estimates are that large merit-aid programs raise college enrollment/completion by less than 10 percentage points, if at all; thus, the vast majority of affected students are infra-marginal with respect to college attendance (Cornwell et al., 2006).

B Appendix: Background information on the College Alcohol Study

A full description of the survey design for the College Alcohol Study is contained in Wechsler et al. (1994). CAS began with 179 accredited four-year college institutions chosen with probability proportionate to enrollment size. 140 of these institutions participated. Because

smaller schools (enrollment less than 1,000) were less likely to participate, an over-sample of smaller institutions was added to the study. A sample of 215 full-time, undergraduate students was drawn from most CAS schools but 108 students were drawn from the very smallest schools. Roughly 70 percent of sampled students completed the initial (1993) survey.

In subsequent surveys (1997, 1999, and 2001), students were again sampled (using similar procedures) from the same institutions that participated in the 1993 survey. The vast majority of institutions continued to participate, and though a small number were dropped due to insufficient response rates, binge drinking was found to be very similar with and without those that were dropped (Wechsler et al., 1998, 2000, 2002). These subsequent CAS surveys again represented a national cross section of four-year colleges in their respective years (Wechsler et al., 1998, 2000, 2002).

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Figure 1: Sjoquist and Winters (2014), Table 1

Table 1: States Adopting Strong Merit Aid Programs

Program Name	First Cohort	Initial Requirement	Renewal GPA	Award Amount	Award per Recipient, 2010	Recipients as a Percent of Undergraduates, 2010
Florida Bright Futures Scholarship	1997	3.0-3.5 HS GPA and 970-1270 SAT/20-28 ACT	2.75-3.00	75-100% of tuition & fees	$2,381	31.9
Georgia HOPE Scholarship	1993	3.0 HS GPA	3.00	tuition & fees	$3,877	43.0
Kentucky Educational Excellence Scholarship	1999	2.5-4.0 HS GPA plus ACT bonus	2.50-3.00	$500-$3000	$1,381	44.7
Louisiana TOPS Scholarship	1998	2.5 HS GPA and 20 ACT	2.30-2.50	tuition & fees	$3,050	22.6
Nevada Millennium Scholarship	2000	3.0 HS GPA	2.60-2.75	$80 per credit	$1,279	23.8
New Mexico Lottery Success Scholarship	1997	2.5 first semester college GPA	2.50	tuition & fees	$2,388	19.6
South Carolina LIFE Scholarship	1998	3.0 HS GPA and 1100 SAT/24 ACT	3.00	$5000-$7500	$4,675	23.2
Tennessee HOPE Scholarship	2003	3.0 HS GPA or 1000 SAT/21 ACT	2.75-3.00	$2500-$4000	$3,423	33.5
West Virginia PROMISE Scholarship	2002	3.0 HS GPA and 1000 SAT/21 ACT	2.75-3.00	tuition & fees	$4,943	12.1

Sources: Dynarski (2004), Heller (2004), the Brookings Institution, and state agency websites.

Note: Eighteen other states adopted "weak" merit aid programs. These include Alaska, Arkansas, California, Idaho, Illinois, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, New Jersey, New York, North Dakota, Oklahoma, South Dakota, Utah, and Washington. For several states the renewal GPA increases after the first renewal point, hence the range given.

Table 1: Selected summary statistics: 1993-2001 CAS

	All college students		Males		Females	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Drinking measures						
Drank 5+ drinks in one sitting in past 2 weeks	0.39	0.49	0.49	0.50	0.33	0.47
Number of days drank 5+ drinks in past 2 weeks	1.16	2.00	1.63	2.34	0.86	1.66
Drank alcohol in past month	0.68	0.47	0.71	0.45	0.66	0.47
Total number of drinks in past month	20.83	38.73	29.79	49.12	14.93	28.50
Number of times drank per month in high school	3.54	6.60	4.22	7.39	3.09	5.99
Pre-determined individual characteristics						
Age	20.94	2.19	21.12	2.20	20.82	2.18
Female	0.60	0.49	---	---	---	---
Race: white	0.79	0.41	0.79	0.40	0.78	0.41
Race: black	0.06	0.24	0.05	0.22	0.07	0.26
Race: asian	0.07	0.26	0.08	0.27	0.07	0.26
Race: other	0.08	0.27	0.08	0.27	0.08	0.26
1st year of college	0.22	0.42	0.21	0.41	0.23	0.42
2nd year of college	0.21	0.41	0.21	0.40	0.21	0.41
3rd year of college	0.24	0.43	0.25	0.43	0.24	0.43
4th year of college	0.23	0.42	0.23	0.42	0.23	0.42
5th year of college or higher	0.09	0.29	0.11	0.31	0.08	0.27
Hispanic ethnicity	0.07	0.25	0.07	0.25	0.07	0.25
Father attended college	0.70	0.46	0.73	0.45	0.69	0.46
Mother attended college	0.66	0.47	0.67	0.47	0.66	0.47
Not religious	0.13	0.34	0.14	0.35	0.12	0.33
Catholic	0.36	0.48	0.36	0.48	0.36	0.48
Jewish	0.03	0.17	0.03	0.18	0.03	0.17
Muslim	0.01	0.10	0.01	0.11	0.01	0.08
Protestant	0.38	0.48	0.37	0.48	0.38	0.49
Other religion	0.09	0.29	0.08	0.28	0.10	0.29
Post-enrollment individual characteristics						
Married	0.10	0.30	0.08	0.27	0.11	0.31
Lives off-campus	0.56	0.50	0.58	0.49	0.54	0.50
Greek member	0.14	0.35	0.15	0.36	0.14	0.34
GPA	3.20	0.59	3.13	0.61	3.24	0.58
Public institution	0.68	0.47	0.71	0.46	0.67	0.47
Rural location	0.31	0.46	0.32	0.47	0.30	0.46
Commuter school	0.14	0.35	0.14	0.35	0.14	0.35
Religious institution	0.15	0.36	0.13	0.34	0.16	0.37
State characteristics						
Eligible for merit aid in "strong" merit state	0.04	0.20	0.04	0.19	0.04	0.20
Region: northeast	0.23	0.42	0.22	0.42	0.24	0.43
Region: south	0.29	0.45	0.28	0.45	0.29	0.45
Region: midwest	0.30	0.46	0.30	0.46	0.30	0.46
Region: west	0.18	0.38	0.19	0.39	0.17	0.37
State median income	43,103	8,075	42,606	7,931	43,429	8,152
State unemployment rate	5.10	1.58	5.15	1.60	5.07	1.56
State liquor tax (%)	2.78	2.03	2.70	2.04	2.83	2.02

Notes: N=53,891 (21,388 males and 32,503 females). Variables not shown but used in some regressions include school size dummies (4) and school competitiveness dummies (8).

Table 2: Comparison of drinking rates in CAS and MTF

	Percent who drank alcohol in past month		Percent who drank 5+ drinks in past 2 weeks	
Year	CAS	MTF	CAS	MTF
1993	0.71	0.70	0.40	0.40
1997	0.67	0.66	0.38	0.41
1999	0.67	0.70	0.40	0.40
2001	0.68	0.67	0.39	0.41

Notes: CAS (College Alcohol Study) figures come from authors' calculations. MTF (Monitoring the Future) figures come from Tables 9-3 and 9-4 in Johnston et al. (2004).

Table 3: Comparison of drinking and demographic variable means in CAS and NLSY97

	All individuals		Men		Women	
	CAS	NLSY97	CAS	NLSY97	CAS	NLSY97
Drank alcohol in past month	0.67	0.69	0.70	0.68	0.66	0.69
Total number of drinks in past month	21.25	23.74	30.71	30.73	15.56	18.69
Female	0.62	0.58	---	---	---	---
Black	0.07	0.10	0.06	0.08	0.07	0.12
Hispanic	0.07	0.05	0.07	0.06	0.07	0.05
Mother attended college	0.71	0.68	0.71	0.69	0.71	0.67
Father attended college	0.73	0.68	0.76	0.73	0.72	0.64
Region: northeast	0.23	0.22	0.22	0.25	0.24	0.20
Region: midwest	0.30	0.33	0.31	0.33	0.30	0.32
Region: south	0.29	0.30	0.29	0.26	0.29	0.32
Region: west	0.17	0.16	0.18	0.15	0.17	0.16

Notes: Mean values for each variable are displayed for the 1999 and 2001 CAS (College Alcohol Study) and NLSY97 (National Longitudinal Survey of Youth, 1997). CAS samples students attending 4-year institutions (N=23,732). The NLSY97 sample is restricted to individuals who report being currently enrolled in a 4-year institution and have non-missing observations on all listed variables (N=1,646). The NLSY97 means are weighted to account for oversampling of certain subgroups.

Table 4: The effects of merit aid on number of heavy drinking days, 1993-2001 CAS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Both sexes	0.123**	0.095**	0.031	0.040	0.050	0.046	0.036
	(0.053)	(0.042)	(0.061)	(0.057)	(0.068)	(0.068)	(0.064)
	[-0.089, 0.398]	[-0.077, 0.341]	[-0.021, 0.111]	[-0.013, 0.115]	[-0.034, 0.150]	---	[-0.016, 0.115]
Males	0.136	0.164*	0.307*	0.311*	0.348*	0.341	0.296*
	(0.085)	(0.086)	(0.157)	(0.159)	(0.172)	(0.201)	(0.153)
	[-0.034, 0.481]	[0.064, 0.537]	[0.106, 0.663]	[0.108, 0.660]	[0.168, 1.222]	---	[0.136, 0.668]
Females	0.102	0.060	-0.132*	-0.125*	-0.128	-0.139	-0.119
	(0.083)	(0.086)	(0.076)	(0.073)	(0.096)	(0.114)	(0.072)
	[-0.068, 0.425]	[-0.085, 0.354]	[-0.237, 0.136]	[-0.232, 0.139]	[-0.376, 0.073]	---	[-0.243, 0.134]
State dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-determined controls	No	Yes	Yes	Yes	Yes	Yes	Yes
State * linear time trends	No	No	Yes	Yes	Yes	Yes	Yes
Region * year dummies	No	No	No	Yes	No	No	Yes
Southern states ONLY	No	No	No	No	Yes	No	No
Post-enrollment controls	No	No	No	No	No	No	Yes
Strong merit states	Treatment	Treatment	Treatment	Treatment	Treatment	Treatment	Treatment
Weak merit states	Control	Control	Control	Control	Control	Excluded	Control
Non-merit states	Control	Control	Control	Control	Control	Excluded	Control

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Bracketed terms show Conley-Tabler 90% confidence intervals. N=53,891 (21,388 males and 32,503 females) overall; N=15,491 with only southern states included; N=6,109 with only treatment states included. Dependent variable is number of times drank 5 or more drinks in one sitting in past 2 weeks. "Pre-determined controls" include dummies for year of age, sex, race/ethnicity, year in school, mother's and father's education, and religion, and state characteristics. "Post-enrollment controls" include dummies for marital status, living arrangement (on or off campus), fraternity/sorority status, college GPA, and school characteristics. See the text for additional details.

Table 5: The effects of merit aid on alternative drinking measures, 1993-2001 CAS

	Dependent variable			
	Drank alcohol in past month	Total number of drinks in past month	Drank 5+ drinks in past 2 weeks	Number of days 5+ drinks in past 2 weeks
Both sexes	0.019	0.868	-0.007	0.031
	(0.011)	(1.375)	(0.017)	(0.061)
Males	-0.011	4.680**	0.012	0.307*
	(0.013)	(2.125)	(0.024)	(0.157)
Females	0.037	-1.405	-0.018	-0.132*
	(0.022)	(1.888)	(0.028)	(0.076)

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Bracketed terms show Conley-Tabler 90% confidence intervals. N=53,891 (21,388 males and 32,503 females). All models include controls for state and year dummies, pre-determined controls, and state time trends. "Pre-determined controls" include dummies for year of age, sex, race/ethnicity, year in school, mother's and father's education, and religion, and state characteristics.

Table 6: The effects of merit aid on pre-college student characteristics, 1993-2001 CAS

	Dependent variable					
	Sex=Female	Age (in years)	Race=White	Mother attended college	Father attended college	High-school drinking
Both sexes	-0.026	0.024	0.041*	-0.010	-0.026**	-0.087
	(0.027)	(0.091)	(0.023)	(0.022)	(0.011)	(0.394)
Males	---	-0.062	0.022	-0.013	-0.030*	0.042
		(0.063)	(0.036)	(0.018)	(0.016)	(0.616)
Females	---	0.077	0.046**	-0.008	-0.019	-0.143
		(0.128)	(0.021)	(0.028)	(0.015)	(0.326)

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. N=53,891 (21,388 males and 32,503 females). All models include controls for state and year dummies, pre-determined controls, and state time trends. See Table 4 for additional details. "High-school drinking" is measured as the reported number of times per month the student drank alcohol while in high school.

Table 7: The effects of merit aid on number of heavy drinking days by year of program adoption, 1993-2001 CAS

	1993 treatment states (GA)	1997 treatment states (FL and NM)	1998 treatment states (LA and SC)	1999 treatment states (KY)
7 or more cohorts prior to policy change	---	---	---	-0.053
				(0.034)
4-6 cohorts prior to policy change	---	---	---	-0.085**
				(0.032)
4 or more cohorts prior to policy change	---	-0.001	-0.058**	---
		(0.027)	(0.026)	
1-3 cohorts following policy change	-0.033	0.078***	-0.011	-0.045
	(0.030)	(0.024)	(0.028)	(0.038)
4 or more cohorts following policy change	---	-0.049	-0.063	---
		(0.042)	(0.055)	
4-6 cohorts following policy change	0.053	---	---	---
	(0.034)			
7 or more cohorts following policy change	0.007	---	---	---
	(0.053)			
(7 or more cohorts prior to policy	---	---	---	-0.000
change)*(strong merit-aid program)				(0.108)
(4-6 cohorts prior to policy change)*(strong	---	---	---	0.213
merit-aid program)				(0.329)
(4 or more cohorts prior to policy	---	0.015	-0.043	---
change)*(strong merit-aid program)		(0.092)	(0.173)	
(1-3 cohorts following policy change)*(strong	0.290**	0.153**	0.007	0.190***
merit-aid program)	(0.109)	(0.062)	(0.121)	(0.044)
(4 or more cohorts following policy	---	0.114	0.000	---
change)*(strong merit-aid program)		(0.080)	(0.148)	
(4-6 cohorts following policy change)*(strong	0.065	---	---	---
merit-aid program)	(0.066)			
(7 or more cohorts following policy	0.126**	---	---	---
change)*(strong merit-aid program)	(0.061)			
Observations	49,940	51,185	50,226	49,405

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Dependent variable is number of times drank 5 or more drinks in one sitting in past 2 weeks. Other control variables include state dummies (not shown). Reference group in all specifications is the last 3 cohorts prior to policy change. Cohort defined based on calculated freshman year of college enrollment (computed as ("current year" -1) for sophomores, ("current year"-2) for juniors, etc.). Cohort bins are made in accordance with the timing of treatment (e.g. for early adopting states, the data contain many more cohorts post-treatment than pre-treatment). In each specification, only those state(s) adopting a strong merit-aid program in a particular year are compared against all control states (i.e. strong-merit aid states not adopting treatment in that year are excluded).

Table 8: The effects of merit aid on heavy drinking by pre-college student characteristics, 1993-2001 CAS

	By race		By age		By mother's education		By father's education	
	Non-white	White	Less than 21	21 and older	Mother did not attend	Mother did attend	Father did not attend	Father did attend
Both sexes	0.071	0.026	0.033	0.178*	0.296**	-0.144	0.178	-0.047
	(0.078)	(0.078)	(0.134)	(0.096)	(0.114)	(0.121)	(0.110)	(0.120)
	N=11,451	N=42,440	N=26,297	N=27,594	N=18,077	N=35,814	N=15,938	N=37,953
Males	0.123	0.359*	0.152	0.741***	0.578**	0.108	0.401	0.264
	(0.137)	(0.189)	(0.315)	(0.227)	(0.242)	(0.171)	(0.367)	(0.169)
	N=4,407	N=16,981	N=9,599	N=11,789	N=7,112	N=14,276	N=5,856	N=15,532
Females	0.043	-0.183	0.002	-0.206**	0.130	-0.297**	0.073	-0.258**
	(0.064)	(0.114)	(0.209)	(0.078)	(0.130)	(0.132)	(0.146)	(0.119)
	N=7,044	N=25,459	N=16,698	N=15,805	N=10,965	N=21,538	N=10,082	N=22,421

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Dependent variable is number of times drank 5 or more drinks in one sitting in past 2 weeks. All models include controls for state and year dummies, pre-determined controls, and state time trends. See Table 4 for additional details.

Table 9: The effects of merit aid on heavy drinking by post-enrollment student characteristics, 1993-2001 CAS

	By grade point average (GPA)			By fraternity/sorority status		By institution type	
	GPA<2.7	2.7<=GPA<3.4	GPA>=3.4	Non-greek	Greek	Private	Public
Both sexes	-0.132	0.311***	0.009	0.025	-0.280	-0.155***	0.072
	(0.275)	(0.108)	(0.076)	(0.052)	(0.229)	(0.044)	(0.063)
	N=7,253	N=17,745	N=28,246	N=46,244	N=7,647	N=17,170	N=36,721
Males	-0.446	0.665**	0.491***	0.306***	-0.351	0.097	0.326*
	(0.388)	(0.298)	(0.131)	(0.108)	(0.628)	(0.078)	(0.171)
	N=3,457	N=7,563	N=10,133	N=18,174	N=3,214	N=6,290	N=15,098
Females	0.156	0.098	-0.247*	-0.145**	-0.170	-0.239***	-0.092
	(0.284)	(0.138)	(0.133)	(0.064)	(0.219)	(0.046)	(0.100)
	N=3,796	N=10,182	N=18,113	N=28,070	N=4,433	N=10,880	N=21,623

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Dependent variable is number of times drank 5 or more drinks in one sitting in past 2 weeks. All models include controls for state and year dummies, pre-determined controls, and state time trends. See Table 4 for additional details.

Appendix Table 1: The effects of merit aid on heavy drinking days excluding weak-merit states, 1993-2001 CAS

	(1)	(2)	(3)	(4)	(5)	(6)
Both sexes	0.110*	0.100**	0.034	0.040	0.045	0.017
	(0.058)	(0.047)	(0.063)	(0.062)	(0.068)	(0.071)
	[-0.182, 0.487]	[-0.144, 0.431]	[-0.051, 0.142]	[-0.047, 0.138]	[-0.086, 0.206]	[-0.085, 0.119]
Males	0.120	0.192*	0.357**	0.359**	0.351*	0.315*
	(0.094)	(0.094)	(0.168)	(0.172)	(0.178)	(0.159)
	[-0.101, 0.598]	[0.050, 0.764]	[0.077, 0.786]	[0.062, 0.764]	[-0.191, 0.794]	[0.085, 0.765]
Females	0.094	0.050	-0.172**	-0.170**	-0.134	-0.176**
	(0.087)	(0.087)	(0.075)	(0.075)	(0.089)	(0.083)
	[-0.149, 0.522]	[-0.192, 0.426]	[-0.315, 0.176]	[-0.309, 0.168]	[-0.256, 0.434]	[-0.324, 0.119]
State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Pre-determined controls	No	Yes	Yes	Yes	Yes	Yes
State * linear time trends	No	No	Yes	Yes	Yes	Yes
Region * year dummies	No	No	No	Yes	No	Yes
Southern states ONLY	No	No	No	No	Yes	No
Post-enrollment controls	No	No	No	No	No	Yes
Strong merit states	Treatment	Treatment	Treatment	Treatment	Treatment	Treatment
Weak merit states	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded
Non-merit states	Control	Control	Control	Control	Control	Control

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Bracketed terms show Conley-Tabler 90% confidence intervals. N=29,651 (11,965 males and 17,686 females) overall; N=12,888 with only southern states included. Dependent variable is number of times drank 5 or more drinks in one sitting in past 2 weeks. "Pre-determined controls" include dummies for year of age, sex, race/ethnicity, year in school, mother's and father's education, and religion, and state characteristics. "Post-enrollment controls" include dummies for marital status, living arrangement (on or off campus), fraternity/sorority status, college GPA, and school characteristics. See the text for additional details.

Appendix Table 2: The effects of merit aid on total number of drinks, 1993-2001 CAS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Both sexes	2.119	2.230	0.868	0.829	1.207	1.628	0.658
	(1.997)	(1.854)	(1.375)	(1.292)	(1.467)	(1.099)	(1.328)
	[-1.791, 8.750]	[-1.185, 8.648]	[0.032, 2.196]	[-0.021, 2.055]	[-0.195, 2.781]	---	[-0.205, 1.944]
Males	2.295	3.586	4.680**	4.101*	4.573	5.871*	3.718**
	(2.315)	(2.496)	(2.125)	(2.156)	(2.674)	(2.810)	(1.710)
	[-0.250, 10.137]	[2.320, 11.620]	[0.175, 13.316]	[-0.495, 11.930]	[-0.437, 21.284]	---	[0.023, 11.935]
Females	1.807	1.548	-1.405	-1.292	-0.854	-1.029	-1.293
	(2.095)	(2.131)	(1.888)	(1.810)	(2.166)	(1.856)	(1.768)
	[-1.217, 9.063]	[-1.263, 8.841]	[-3.364, 5.127]	[-3.546, 5.160]	[-6.435, 3.919]	---	[-0.240, 5.019]
State dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-determined controls	No	Yes	Yes	Yes	Yes	Yes	Yes
State * linear time trends	No	No	Yes	Yes	Yes	Yes	Yes
Region * year dummies	No	No	No	Yes	No	No	Yes
Southern states ONLY	No	No	No	No	Yes	No	No
Post-enrollment controls	No	No	No	No	No	No	Yes
Strong merit states	Treatment	Treatment	Treatment	Treatment	Treatment	Treatment	Treatment
Weak merit states	Control	Control	Control	Control	Control	Excluded	Control
Non-merit states	Control	Control	Control	Control	Control	Excluded	Control

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses are clustered by state of college attendance. Bracketed terms show Conley-Tabler 90% confidence intervals. N=53,891 (21,388 males and 32,503 females) overall; N=15,491 with only southern states included; N=6,109 with only treatment states included. Dependent variable is total number of alcoholic drinks in past month. "Pre-determined controls" include dummies for year of age, sex, race/ethnicity, year in school, mother's and father's education, and religion, and state characteristics. "Post-enrollment controls" include dummies for marital status, living arrangement (on or off campus), fraternity/sorority status, college GPA, and school characteristics. See the text for additional details.