# GENDER AND THE INFLUENCE OF PEER ALCOHOL CONSUMPTION ON ADOLESCENT SEXUAL ACTIVITY 

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#### Abstract

I consider the alcohol consumption of opposite-gender peers as explanatory to adolescent sexual intercourse and demonstrate that female sexual activity is higher where there is higher alcohol consumption among male peers. This relationship is robust to school fixed effects, cannot be explained by broader cohort effects or general antisocial behaviors in male peer groups, and is distinctly different from any influence of the alcohol consumption of female peers which is shown to have no influence on female sexual activity. There is no evidence that male sexual activity responds to female peer alcohol consumption. (JEL J13, I12)


## I. INTRODUCTION

Given the nature of coital relations, there is little reason to doubt that opposite-gender peers matter in some broad sense. Whether and how the alcohol consumption of these peers matters, however, is an important empirical question on which the literature has heretofore been silent. By considering this potential contributor to adolescent sexual activity, I move the literature toward a better understanding of the importance of peer effects, generally, and inform policy makers in an area where the benefits to mitigating negative influences are potentially large.

While teenage childbearing and sexually transmitted diseases are among the most obvious risks associated with adolescent sexual activity, there is growing evidence of other negative outcomes arising systematically with adolescent sexual activity. For example, adolescent sexual activity has been linked to increased risk of depression, and social and psychological turmoil (e.g., Hallfors et al. 2005; Joyner and Udry 2000; Rector et al. 2002), which is likely to propagate in other longer-run outcomes. Identifying the potential peer effects in this area is clearly integral to our understanding of adolescent health and well-being.

[^0]In more recent work, Rees and Sabia (2009) also show that younger age at first intercourse decreases the probability that females graduate high school and, while there is little evidence that the number of sexual partners adversely affects human-capital acquisition in boys, Sabia and Rees (2009) show that promiscuity in female adolescents is negatively related to educational attainment. Beyond their role in explaining adolescent health, then, understanding how peer effects may promote sexual activity in youth is integral to understanding educational production, and to the analysis of education-related policy (e.g., zero tolerance policies, single-sex schooling). Again, in this area, the benefits to identifying and subsequently mitigating any negative peer effects are potentially large.

The focus of this analysis considers the relationship between alcohol and sexual activity from a different perspective than has been considered in the literature thus far, and the resulting empirical considerations are therefore somewhat different. For example, while there are examples in the related literature that show that alcohol consumption and sexual intercourse correlate positively in adolescents, establishing any mechanism through which alcohol might encourage such behavior has been somewhat challenging. One obvious difficulty in establishing a causal role for alcohol arises with the potential that one's consumption of alcohol and one's sexual activity both vary with some common attribute

[^1]that is unobserved by the econometrician (e.g., low risk aversion, high discount rates). Yet, without establishing the existence and nature of any causal relationships, policy analysis on important education and health outcomes might be considered incomplete and the policy prescriptions imprecise.

Here, I specifically focus on the potential influence of the alcohol consumption of opposite-gender peers. Compared to the existing literature, this is both a broader perspective on what might constitute the relevant alcoholrelated influences on adolescent sexual activity and, unlike previous literature, a cleaner empirical environment. In particular, I am not asking whether one's own alcohol consumption increases one's own propensity to engage in sexual intercourse but, rather, whether this propensity increases with the drinking behavior of one's opposite-gender peers. Given the difficulty posed in finding credible identification strategies to bring to bear on the question of whether one's own alcohol consumption increases one's own propensity to engage in sexual intercourse, the arguable exogeneity of the key variable of interest here partially mitigates the challenges that have plagued previous studies and may speak back into the broader question of causality running from alcohol use to sexual activity, albeit indirectly and from a slightly different perspective.

In the end, I show that the alcohol consumption of opposite-gender peers matters to one's sexual activity but that this relationship is strongly gender dependent. In particular, in both pooled and within-school identification strategies I find that the sexual activity of adolescent females systematically varies with the alcohol consumption of their male peers, and that no such pattern exists for adolescent males. In sensitivity analyses, I report that this relationship is distinctly different from any influence of same-gender-peer alcohol consumption. In fact, comparable measures of female peer drinking contribute very little to explaining female sexual activity. More general antisocial male behaviors also fail to explain sexual behavior in female adolescents, suggesting all the more that the alcohol consumption may be causing increases in female sexual activity.

While I will keep from making claims of having identified an estimate of the causal relationship, the evidence I present is compelling and the causal story remains a viable candidate for explaining the empirical regularities in the
data. In the following section, I briefly consult the most relevant literature in order to provide some context for interpreting the analysis and, in Section III, I describe the data to be used-the "In-Home" component of the National Longitudinal Study of Adolescent Health (i.e., Add Health). ${ }^{1}$ In Section IV, I present the empirical strategy more formally and discuss the challenges to identification that commonly arise in the peer-effects literature, followed by a presentation of the empirical results in Section V. In Section V, I also report the results of several sensitivity analyses which collectively speak to the robustness of the baseline specifications, with some additional discussion provided in Section VI. A concluding discussion appears in Section VII.

## II. OTHER RELATED LITERATURE

While a large literature exists outside of attempts to determine the role for alcohol in sexual activity, the recent literature has focused more on the unpacking of this relationship, and with somewhat mixed results. For example, adopting an instrumental-variables approach (i.e., instrument for drinking with state-level variation in alcohol-related policy and expenditures), Rees, Argys, and Averett (2001) offer some evidence of causation running from alcohol use to sexual intercourse in the male Add Health sample, but include that "the positive correlation between substance use and risky sexual behavior can, more often than not, be attributed to the influence of unobservables." Likewise, controlling for the potential endogeneity, Sen (2002) offers evidence that own alcohol use is causally predictive of an increased likelihood of sexual intercourse in adolescents in the 1997 National Longitudinal Study of Youth (NLSY97). While these arguments for a causal role are suggestive, certainly, Rashad and Kaestner (2004) call each into question on methodological grounds, and argue against the identification strategies in both the studies

1. The Add Health project is a program designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01HD31921 from the National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from the National Longitudinal Study of Adolescent Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516-2524 (http://www.cpc.unc.edu/addhealth/contract.html).
of Rees, Argys, and Averett (2001) and Sen (2002), ultimately concluding that "in spite of recent attempts to estimate the causal relationship between substance use and sexual behavior, the causal relationship [...] remains unknown." ${ }^{2}$

With such a view maintained, related literatures and much public policy-where it is already quite common to operate under the assumption that a causal role does exist-might be seen as somewhat ahead of our current understanding of the relationship. For example, Chesson, Harrison, and Kassler (2000) exploit variation in alcohol taxes and legal drinking ages to investigate risky sexual activity, with the operating presumption being that a more restrictive alcohol policy reduces alcohol consumption, which in turn decreases risky sexual activity. More recently, Carpenter (2005) has also suggested a causal role for alcohol in adolescent sexual activity as he documents a systematic relationship between state-level "zero tolerance" drunk driving laws and reductions in gonorrhea rates in treated populations of youth. Of course, for these and other empirical strategies (e.g., Dee 2001; Lacruz, Lacruz, and Moreno 2009; Sen 2003), the mechanism by which drinking and sexual behavior evolves is less important than whether there is an empirical relationship at all, conditional on covariates.

I see the current investigation as informing this underlying relationship in important ways that both sheds light on a potential mechanism through which these relationships unfold and may justify new empirical strategies that exploit the information contained in oppositegender peer behaviors. For example, it may be a somewhat myopic view to consider that variation in alcohol-related policy influences one's sexual outcomes through the policy's influence on one's own drinking behavior. In a relatively clean empirical setting, I demonstrate that there is explanatory power specifically in opposite-gender alcohol use, and that
2. Using bivariate probit and individual fixed effects within the NLSY97 sample, Markowitz, Kaestner, and Grossman (2005) also find no causal role for alcohol use in determining whether a teenager has sex, but do find some evidence that alcohol use lowers the use of contraception among sexually active teens. Grossman and Markowitz (2005) have also suggested that while alcohol use does not increase the likelihood of having sex or of having multiple partners, it can be associated with unprotected sex among sexually active teens in a causal way. Similarly, one might consider the existing research associating alcohol with other outcomes or with risky behaviors more generally (e.g., Bray 2005; Clark and Loheac 2007; Heckman, Pinto, and Wang 2008; Krauth 2005; Renna 2007).
the underlying mechanism may be operating in the interaction of gender-specific relationships between sexual relations and alcohol consumption.

## III. DATA

For our purpose, the National Longitudinal Study of Adolescent Health is a particularly fitting collection of information on adolescent behaviors as it is designed to investigate adolescent health and risk behaviors. The "Add Health" project is widely considered to be the largest and most comprehensive survey of adolescents ever undertaken, with a stratified sample of 80 high schools collectively representative of the U.S. school system with respect to region of country, urbanicity, school size, school type, and ethnicity. For each of these schools, "feeder" schools (52 in total) were selected on the basis of student contributions to the chosen high school. An in-school questionnaire was administered to almost all students in sampled schools between September 1994 and April 1995, and a random sample was selected from each of these schools for more detailed interviews, conducted in the respondents' homes between April and December 1995. It is this detailed "In-Home Survey" that I adopt. A total of 20,745 adolescents were interviewed for the Wave I In-Home Survey. Of these, however, 376 have no school identities and an additional 504 have uninterpretable grade levels. As these attributes are crucial to identification, they are removed from the analysis.

Of the 19,865 respondents with school and grade-level information, several did not answer key questions, such as "Over the past 12 months, on how many days did you drink five or more drinks in a row?" or "... on how many days have you gotten drunk or 'very, very high' on alcohol?" The sample adopted constitutes roughly $94 \%$ of the usable data. ${ }^{3}$ Summary statistics by
3. While Add Health does not directly inquire about the sexual orientation of survey respondents, the intersection of two survey questions may overlap with such an orientationthe questions being "Have you ever had a romantic attraction to a female?" and "Have you ever had a romantic attraction to a male?" Although results are not sensitive to their inclusion, I drop from the analysis 73 males ( 136 females) who respond "No" ("Yes") to the first question and "Yes" ("No") to the second question. See Waddell (2010) for suggestive evidence that these individuals are less responsive to opposite-gender alcohol consumption. This sample size also reflects that I dropped all (nine) 11-year-old respondents, none of which had reported any alcohol consumption or having had sexual intercourse. Sample weights are available to correct for design effects and the unequal probability of an individual's selection. All results reported are robust to estimating with sample weights.

TABLE 1
Summary Statistics

|  | Male |  | Female |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Mean | SD | Mean | SD |
| Sex in the last year, Grade 7 | 0.08 | 0.27 | 0.06 | 0.23 |
| Sex in the last year, Grade 8 | 0.16 | 0.37 | 0.15 | 0.35 |
| Sex in the last year, Grade 9 | 0.24 | 0.43 | 0.26 | 0.44 |
| Sex in the last year, Grade 10 | 0.34 | 0.47 | 0.35 | 0.48 |
| Sex in the last year, Grade 11 | 0.45 | 0.50 | 0.45 | 0.50 |
| Sex in the last year, Grade 12 | 0.51 | 0.50 | 0.55 | 0.50 |
| Age (at interview) | 15.73 | 1.71 | 15.56 | 1.72 |
| White | 0.51 | 0.50 | 0.51 | 0.50 |
| Black | 0.21 | 0.41 | 0.23 | 0.42 |
| Asian/Pacific | 0.08 | 0.27 | 0.07 | 0.25 |
| Hispanic/Latino | 0.17 | 0.38 | 0.16 | 0.37 |
| Other Non-White | 0.01 | 0.10 | 0.01 | 0.10 |
| GPA in four core classes | 2.47 | 0.99 | 2.76 | 0.92 |
| Parent education: Less than high school | 0.13 | 0.34 | 0.14 | 0.35 |
| Parent education: High school | 0.25 | 0.43 | 0.25 | 0.44 |
| Parent education: Some college | 0.26 | 0.44 | 0.25 | 0.43 |
| Parent education: College | 0.12 | 0.33 | 0.12 | 0.32 |
| Parent education: Graduate/Professional | 0.08 | 0.26 | 0.08 | 0.27 |
| Religious attendance: Weekly | 0.37 | 0.48 | 0.41 | 0.49 |
| Religious attendance: Monthly | 0.20 | 0.40 | 0.20 | 0.40 |
| Religious attendance: Some | 0.17 | 0.38 | 0.18 | 0.39 |
| Sex included in ideal relationship | 0.54 | 0.50 | 0.35 | 0.48 |
| Proportion urban (county) | 0.65 | 0.39 | 0.65 | 0.39 |
| Proportion rural (county) | 0.24 | 0.27 | 0.24 | 0.27 |
| Unemployment rate (county) | 0.07 | 0.02 | 0.07 | 0.02 |
| Grade 7 | 0.13 | 0.33 | 0.13 | 0.34 |
| Grade 8 | 0.13 | 0.34 | 0.13 | 0.34 |
| Grade 9 | 0.18 | 0.38 | 0.18 | 0.38 |
| Grade 10 | 0.20 | 0.40 | 0.19 | 0.39 |
| Grade 11 | 0.20 | 0.40 | 0.19 | 0.39 |
| Grade 12 | 0.16 | 0.37 | 0.17 | 0.38 |
| Number in cohort (school-grade) | 97.13 | 149.3 | 91.25 | 142.9 |
| Number in female cohort (school-grade) | 47.92 | 72.04 | 44.89 | 68.87 |
| Number in male cohort (school-grade) | 49.21 | 77.47 | 46.36 | 74.26 |
| Observations |  |  |  |  |

gender are shown in Table 1. As I am relying on self-reported participation in potentially sensitive areas of disclosure, I note that for sensitive topics (e.g., sexual behavior and alcohol use) survey respondents listened to prerecorded questions through earphones and entered their answers directly on laptops in order to maintain confidentiality and to minimize the potential for interviewer or parental influence. Also lending a certain confidence is that rates of risky behaviors reported in Add Health are consistent with those measured in other sources (see Mocan and Tekin 2005, 2006; Tekin and Markowitz 2008).

## IV. EMPIRICAL MODEL

I follow the existing literature in running specifications separately by gender. ${ }^{4}$ In particular, I model the individual's sexual behavior in a form such as,
(1) $\operatorname{Sex}=\beta_{0}+\beta_{1}$ OwnDrink

$$
+\beta_{2} \text { PeerDrink }+\gamma X+\epsilon
$$

where $S e x=1$ will capture that the individual reports having had sexual intercourse within
4. Separating reference groups by sex is also common when considering peer effects in single behaviors (e.g., Clark and Loheac 2007; Kling, Ludwig, and Katz 2005; Kooreman 2007; Soetevent and Kooreman 2006).

TABLE 2
Measures of Alcohol Use

|  | Mean | SD | Min | Max |
| :---: | :---: | :---: | :---: | :---: |
| Male ( $n=9,032$ ) |  |  |  |  |
| Over the past 12 months: |  |  |  |  |
| Did drink alcohol | 0.48 | 0.50 | 0 | 1 |
| Did drink alcohol until very, very high | 0.30 | 0.46 | 0 | 1 |
| Did drink alcohol until very, very high monthly | 0.12 | 0.33 | 0 | 1 |
| Number of days each week drank alcohol until very, very high | 0.24 | 0.84 | 0 | 6 |
| Female ( $\boldsymbol{n}=\mathbf{9 , 3 4 6}$ ) |  |  |  |  |
| Over the past 12 months: |  |  |  |  |
| Did drink alcohol | 0.47 | 0.50 | 0 | 1 |
| Did drink alcohol until very, very high | 0.27 | 0.44 | 0 | 1 |
| Did drink alcohol until very, very high monthly | 0.08 | 0.26 | 0 | 1 |
| Number of days each week drank alcohol until very, very high | 0.12 | 0.54 | 0 | 6 |
| Number of days each week had five or more alcoholic drinks | 0.15 | 0.63 | 0 | 6 |

12 months of the interview date. Specifically, the available survey question queries sexual relationships by following the query "Have you ever had sexual intercourse?" with the qualifier, "When I say sexual intercourse, I mean when a male inserts his penis into a female's vagina." As such, there is arguably little if any uncertainty in how Sex is to be (or was) interpreted.

In Equation (1), the individual's own drinking behavior will be captured by OwnDrink, while PeerDrink will capture the drinking behavior of the individual's opposite-gender peers. OwnDrink is included as it will remain important to hold constant one's own drinking behavior as I draw out of the data how sexual activity varies with PeerDrink. However, note that interpreting this relationship is challenging given the suspected endogeneity plaguing $\hat{\beta}_{1}$. (Given this expected endogeneity, I perform sensitivity tests on the variable of interest, $\hat{\beta}_{2}$, by the inclusion of OwnDrink, and find $\hat{\beta}_{2}$ is very stable across specifications that include or do not include OwnDrink.) In Equation (1), $X$ will capture individual and other aggregate characteristics that have been used in previous analysis or are otherwise expected to explain variation in sexual activity and $\epsilon$ is the error term, which includes age fixed effects. (In specifications that use variation across schools, grade-level fixed effects will also be included.) Throughout the analysis, standard errors are corrected for clustering at the school level.

## A. Defining OwnDrink

Within the Add Health data set are several alternatives to how one might measure drinking
behaviors-both OwnDrink and PeerDrink. With little defensible reason for choosing one over another, I report results across five specifications that adopt alternative measures. Roughly half of all respondents report to have never had a drink of beer, wine, or liquor. Among the participants, however, the adopted drinking measures span an intensity of alcohol attachment in an appealing way. Reporting results across such a range will also provide some information about the influence of various drinking intensities. These measures are defined in Table 2, with summary breakdowns provided by gender. ${ }^{5}$
5. On one end of the spectrum of intensity are those who responded with (1) " 1 or 2 days" or more when asked, "During the past 12 months, on how many days did you drink alcohol?" This may be closest to what most would consider admitting to "dabbling" with alcohol consumption. From there, the progression is not prescribed. That said, a reasonable range of categorizations might be, (2) the respondent replied with at least " 1 or 2 days" when asked, "Over the past 12 months, on how many days have you gotten drunk or 'very, very high' on alcohol?"'(3) the respondent replied with either "once a month or less" or " $2-3$ days a month" to the same question, (4) the average number of days in a week that the individual reports being drunk, and (5) the average number of days in a week that the individual consumes "five or more drinks in a row." This fifth alternative is particularly attractive as it does not depend on the respondent's own determination of drunkenness, which may introduce a source of variation that could result in imprecision or bias. These measures account for alternatives I report below as OwnDrink. In both continuous measures of drinking behavior, the responses come in the following form: "every day or almost every day," "3-5 days a week," " 1 or 2 days a week," " 2 or 3 days a month," "once a month or less (3-12 times in the past 12 months)," or " 1 or 2 days in the past 12 months." As such, I define OwnDrink in these cases as the implied average number of days in 1 week.

## B. Defining Peer Groups and PeerDrink

Within the peer effects literature, broadly defined, one must commonly address several empirical challenges to identification. First, if own and peer outcomes are determined simultaneously, it is difficult to distinguish the effect that peers have on the individual from the effect the individual has on the peers-the "reflection problem" of Manski (1993). Second, if individuals self-select into peer groups, it is impossible to determine whether some observed outcome of interest is caused by the peers or just the reason the individual joined the peer group to begin with (Hoxby 2002). Third, the existence of common shocks can confound estimated peer effects, because separating the peer effect from other shared treatment effects can be difficult (Lyle 2007).

While formally defining the peer group is central to considering the potential challenges to interpreting the estimated peer effect, recall that I am considering the influence of a peer attribute (i.e., alcohol use) on a different behavior (i.e., sexual activity) and not, for example, the effect of peer sexual behavior on one's own sexual behavior or the effect of peer alcohol consumption on one's own alcohol consumption. Furthermore, not only are the left- and right-hand-side behaviors different in this case, but the peer group to which I am allowing $i$ to respond is not an aggregation of the behavior of other $j \neq i$ individuals in the model, but of opposite-gender individuals who themselves do not otherwise contribute to the model. In short, given gender-specific reference groups and specifications run separately by gender, there is no error term through which the path from $i$ 's sexual behavior can transmit back to peer drinking. As such, reflection is less a concern in this context than in many peer-effect studies. ${ }^{6}$

While the Add Health survey design provides measures of each individual's friendships (i.e., the reporting of up to five same-gender friends and five opposite-gender friends), adopting this set of friends as the individual's peers introduces some empirical concerns. Even ignoring the potential measurement error (e.g., one's friends may exceed five in number, one's friends need
6. These points aside, in terms of reflection some will argue that individual $i$ 's sexual activity is not likely to influence the drinking of opposite-gender classmates, or that if there was a potential feedback loop where a student's sexual activity causes opposite-gender peers to drink, the anticipated reverse-causality story would likely bias down the estimated peer effect.
not fall within the Add Health survey), that friends are chosen is problematic from a selfselection standpoint. For example, were the attributes or behaviors of one's declared friends (e.g., their drinking patterns) to correlate with one's behavior (e.g., being sexually active), it would be difficult to distinguish between the attributes of these friends having some influence over outcomes as opposed to the friends having been chosen for their attributes. Moreover, adopting chosen friends as a peer group potentially worsens the common shocks problem, as small groups of friends may well experience other shared treatment effects that are unobserved by the econometrician. While a growing body of work adopts the existence of friends in the Add Health data as an opportunity to analyze the influence of friends on outcomes, these relationships should be considered in light of the potential roles played by reflection, selfselection, and common shocks. ${ }^{7}$

I define individual $i$ 's opposite-gender peer group as all opposite-gender students in the sample who are in the same grade and school as $i$. Specifically, in female (male) samples, I allow the sexual activity of individual $i$ to vary with the drinking behavior of the average male (female) student in the same grade at the same school. ${ }^{8}$ Given these definitions, Equation (2) can be thought of as implying the estimation of sexual activity as a function of FemalePeerDrink $c_{c}$ or MalePeerDrink ${ }_{c}$, with each being measured at the cohort level (i.e., Add Health respondents of opposite gender within the same grade and school as $i$ ) and independent of $i$. This independence helps with the interpretation of $\hat{\beta}_{2}$ (unlike $\hat{\beta}_{1}$, which remains plagued by more serious endogeneity concerns).

As suggested above, self selection and common shocks would be of greater concern if I were to identify the peer effect off of variation peer groups that are defined by friendship nominations. ${ }^{9}$ To the contrary, selection is not a concern in the current environment if one is
7. See the study of Evans, Oates, and Schwab (1992) for additional discussion. For a clever use of the friendship information see the study of Babcock (2008), where broad cohort "connectedness" is linked to educational outcomes.
8. As opposite-gender peers are of particular interest to the analysis, the sample size also reflects that I have dropped all respondents who have no same-grade, sameschool contemporaries of the opposite gender within the In-Home Survey.
9. As it turns out, common shocks will also have to be very particular if they are to explain away the empirical regularities developed below.
willing to assume that any observed effect of drinking peers on one's sexual activity is not because of sexually active students (or their parents) selecting systematically into alcohol-rich environments. To overcome any potential selfselection, however, I control for a full set of individual characteristics as well as grade and age fixed effects. In subsequent models, I then restrict the identification further-to withinschool variation-relying only on idiosyncratic shocks to the proportion of opposite-gender peers who consume alcohol (to various degrees) across grade cohorts within schools.

## C. Control Variables

In specifications that include only age and grade-level fixed effects, female adolescents can be up to $25 \%$ more likely to be sexually active where their male classmates are consuming alcohol. While I am focusing on the possible effect of opposite-gender peers, it will be important to capture individual and school characteristics that have been used in previous analysis or may otherwise be expected to explain variation in sexual activity. Included in $X_{i c}$ are race (i.e., black, Asian, Hispanic, other), parent education (i.e., indicator variables for less than high school, high school, some college, bachelor, graduate/professional), academic performance (i.e., grade-point average across the four more recent classes in English, mathematics, history or social studies, and science), and county-level measures of the proportion urban, the proportion rural, and the unemployment rate. In order to control for the cohort environment or possible social norms related to sexual activity, I also include measures of the religious participation of same-gender peers (i.e., the proportion of same-gender peers that attend religious services) and of their general views regarding sexual intercourse (i.e., the proportion of samegender peers who include sex as part of their "ideal romantic relationship"). ${ }^{10}$

[^2]
## V. RESULTS

Here, I first consider some baseline specifications separately for each gender across the five alternative measures of drinking behavior. Even though the within-school design (which I subsequently present in Section B) arguably offers a cleaner source of identification, I begin by reporting the results of both pooled and then present the fixed-effect specifications. As part of a sensitivity analysis, presented in Section C, I build a case for considering that the alcohol consumption of opposite-gender peers matters to sexual activity by also considering the drinking behavior of same-gender peers, and the possible responses to other antisocial peer behaviors. For brevity, however, I also address these as part of a separate discussion of sensitivity analyses.

## A. Baseline Specifications

Results of linear-probability models of the form in Equation (1) are reported separately for male and female respondents in Table 3. (Results are robust to modeling assumptions that reflect the discrete nature of the dependent variable.)

OwnDrink. Across all specifications, the expected relationship between one's own drinking and a higher incidence of sexual intercourse is evident. From column 1 of panel A (in Table 3), boys reporting to have consumed alcohol within 12 months of the interview date have a predicted likelihood of reporting to have had sexual intercourse of .418 , compared to a likelihood of .219 for those who have not consumed alcohol. Column 2 implies a larger difference in the predicted probabilities of being sexually active.493 for drinkers versus .236 for nondrinkerslikely explained by the more intense alcohol consumption (i.e., having drunk "until very, very high"). Column 3 again suggests a slight increase in this separation, where more regular drinking patterns are captured in an indicator for having drunk "until very, very high" monthly within the last year. These results are similar in the female population, with the simple measure of drinking (from column 1 of panel B) implying a 22 percentage point increase in the probability of engaging in sexual intercourse (over 21\%)
estimates are slightly more conservative with the inclusion of these controls, the qualitative results are not sensitive to their inclusion-nor to their own responses to these questions. Point estimates are somewhat higher with the exclusion of this variable.

TABLE 3
Sexual Activity and the Drinking Behavior of Opposite-Gender Peers

|  | (1) <br> Did Drink <br> Alcohol in <br> Last Year | (2) <br> Did Drink until Very High | (3) <br> Drinks until Very High Monthly | (4) <br> Days in Week Drinks until Very High | (5) <br> Days in Week Drinks Five or More Drinks |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Panel A: Male sample ( $\boldsymbol{n}=\mathbf{9 , 0 3 2 \text { ) }}$ |  |  |  |  |  |
| FemalePeerDrink | $\begin{gathered} 0.012 \\ (0.038) \end{gathered}$ | $\begin{gathered} -0.023 \\ (0.037) \end{gathered}$ | $\begin{gathered} -0.046 \\ (0.071) \end{gathered}$ | $\begin{gathered} -0.010 \\ (0.034) \end{gathered}$ | $\begin{gathered} -0.005 \\ (0.036) \end{gathered}$ |
| OwnDrink | $\begin{aligned} & 0.199^{* * *} \\ & (0.010) \end{aligned}$ | $\begin{aligned} & 0.257^{* * *} \\ & (0.011) \end{aligned}$ | $\begin{aligned} & 0.270^{* * *} \\ & (0.015) \end{aligned}$ | $\begin{aligned} & 0.279^{* * *} \\ & (0.017) \end{aligned}$ | $\begin{aligned} & 0.229^{* * *} \\ & (0.017) \end{aligned}$ |
| OwnDrink ${ }^{2}$ |  |  |  | $\begin{gathered} -0.044^{* * *} \\ (0.004) \end{gathered}$ | $\begin{gathered} -0.033^{* * *} \\ (0.003) \end{gathered}$ |
| Panel B: Female sample ( $n=\mathbf{9 , 3 4 6}$ ) |  |  |  |  |  |
| MalePeerDrink | $\begin{gathered} 0.004 \\ (0.031) \end{gathered}$ | $\begin{gathered} 0.004 \\ (0.036) \end{gathered}$ | $\begin{gathered} 0.107 * \\ (0.057) \end{gathered}$ | $\begin{aligned} & 0.066^{* * *} \\ & (0.024) \end{aligned}$ | $\begin{aligned} & 0.048^{* *} \\ & (0.021) \end{aligned}$ |
| OwnDrink | $\begin{aligned} & 0.235 * * * \\ & (0.012) \end{aligned}$ | $\begin{aligned} & 0.274^{* * *} \\ & (0.013) \end{aligned}$ | $\begin{aligned} & 0.275^{* * *} \\ & (0.019) \end{aligned}$ | $\begin{aligned} & 0.346^{* * *} \\ & (0.022) \end{aligned}$ | $\begin{aligned} & 0.289^{* * *} \\ & (0.026) \end{aligned}$ |
| OwnDrink ${ }^{2}$ |  |  |  | $\begin{gathered} -0.060^{* * *} \\ (0.005) \end{gathered}$ | $\begin{aligned} & -0.046^{* * *} \\ & (0.005) \end{aligned}$ |


#### Abstract

Notes: The dependent variable is equal to one if the respondent reports having had sexual intercourse during the interview month or in the 12 months prior, and equal to zero otherwise. Reported are estimated coefficients from linear-probability models.

All specifications also include county-level measures of the proportion urban, proportion rural, and the unemployment rate, and individual-level indicators for race/ethnicity (i.e., Black, Asian, Hispanic, other non-White), parent education (i.e., less than high school, high school, some college, bachelor, graduate/professional), and the proportion of same-gender peers that attend religious services and who include sex as part of their "ideal romantic relationship." Standard errors (in parentheses) are corrected for clustering at the school level. ${ }^{*} p<.1,{ }^{* *} p<.05,{ }^{* * *} p<.01$.


and small increases in this difference when the additional information in the specifications of columns 2 and 3 is taken into account.

In the last two columns, I employ the fourth and fifth alternative measures of drinking behavior. In both cases, OwnDrink is entered with a quadratic term, allowing for movement in the data that is missed with more blunt associations. This fits the data well in both male and female samples, where Sex is quadratic in OwnDrink, with sexual activity becoming marginally less likely at higher-intensity drinking. ${ }^{11}$

While these relationships are to be considered with some caution, because of the potential simultaneity of alcohol consumption and sexual activity, these results point to the potential for the intensity of consumption to be considered in explaining the link. This is seen in two dimensions, both across alternative measures of alcohol consumption (i.e., intensity increasing from column to column within each table) and in the continuous measures of consumption (i.e., in columns 4 and 5).
11. The inflection points fall within the sample data (i.e., roughly 3 days per week) although such drinking intensities are rare within the sample of respondents.

PeerDrink. At this point, I wish to discuss the key relationship of interest, the influence of opposite-gender PeerDrink on sexual activity. Immediately evident, however, is that the sexual activity of male adolescents does not vary with the alcohol consumption of their female peers (i.e., FemalePeerDrink in panel A of Table 3). In the male sample, point estimates are small and inconsistent in sign across all measured drinking intensities of female peers. There is little statistical justification to consider such a relationship economically meaningful and I conclude that female drinking behaviors are not contributing to male sexual activity, or that they contribute only through the effect of a male's own drinking behavior. ${ }^{12}$

That said, there is a very different story suggested by the empirical regularity revealed by the analysis in the female sample of respondents, in panel B of Table 3. First, note that
12. It is not uncommon to find asymmetries in peer effects by gender. For example, Carrell and Hoekstra (2010) consider the effects of having troubled peers on test scores and behavior, and find that their results are driven primarily by troubled boys in the cohort. They also find that these effects are largest on other boys in the classroom, however.
point estimates across alternative measures of MalePeerDrink are uniformly positive, consistent with the drinking of male peers increasing the likelihood that female adolescents report having engaged in sexual intercourse. However, estimates relying on the less-intense alcohol measures (e.g., columns 1-3), standard confidence intervals include zero. As the variation in MalePeerDrink is contributed to by multiple peers, this may suggest that in a blunt pass at capturing alcohol consumption, the influence of any drinking peer(s) is mitigated by that of any nondrinking peer(s). Alternatively, this may simply reflect that there are no substantive behavioral responses to such casual drinking (e.g., a peer drank alcohol, even once, within the last year).

Turning to measures that better discriminate the alcohol-related behavior of peers reveals a very different story. In fact, adopting continuous measures of peers' drinking intensities-"Days in week drinks until very, very high" and "Days in week had five or more drinks"-reveals a strong and statistically significant influence of MalePeerDrink on female sexual activity. From the estimates of column 4, across the innerquartile range of MalePeerDrink (i.e., . 05 days weekly to .35 days weekly), female sexual activity increases $6.8 \%$, from a predicted probability of .307 to a predicted probability of .328 . Similar patterns are also evident in column 5, where drinking patterns are much less subjectively revealed, which suggests that the underlying pattern is robust to the subjectivity afforded to respondents in their consideration of what constitutes "very, very high" on alcohol. The similarity is also consistent with there being little systematic difference between the frequency of perceived drunkenness (i.e., days being "very, very high" in a typical week) and the frequency of consuming "five or more" alcoholic drinks in a typical week. Overall, the data are clearly revealing a sensitivity in female adolescent sexuality to the drinking intensity of their male peers. ${ }^{13}$

In no case do I find that interacting PeerDrink and OwnDrink is significant. Although point estimates of this relationship are positive, there is no meaningful complementarity evident between one's own drinking and the drinking

[^3]behavior of peers in driving one's proclivity toward sexual activity.

Other Covariates. Before continuing to the comparable model with school-fixed effects, I report briefly on some of the movement in Sex explained by other covariates, many of which have been preciously documented. For example, sexual intercourse occurs less in environments that are less religious (as measured by attendance). Academic performance is also predictive of less sexual activity, with the difference between a 2.0 GPA and a 4.0 GPA associated with almost a $30 \%$ decline in the probability of having intercourse for males. Among previously established results, I also find a higher incidence of sexual intercourse occurring for black and Hispanic/Latino adolescents, in higher grade levels, and for students with parents who report lower levels of education.

## B. Controlling for School-level Unobserved Heterogeneity

Recall the earlier discussion of the estimated relationship between $O w n D r i n k i$ and one's own sexual activity, where one might be concerned that the estimated coefficient is biased (upward) because of the omission of unobserved individual heterogeneity that systematically drives both $O w n D r i n k i$ and Sexic. This is the standard challenge to existing analysis of the effect of one's own drinking behavior on one's own sexual activity. However, as MalePeerDrink $c_{c}$ is arguably exogenous to the female Sexic being modeled-or likewise FemalePeerDrink $c_{c}$ to male Sex ${ }_{i c}$-a similar objection should not be raised. That said, one should not rule out that the estimated coefficients on MalePeerDrink ${ }_{c}$ in pooled samples can reflect a different source of unobserved heterogeneity.

In particular, the type of unobserved heterogeneity that would defeat the pooled-sample estimates is that which would cause males in particular grades within particular schools to drink while also causing females in those same grades and schools to engage in sexual intercourse (and that was not already absorbed by the female's own drinking patterns, being held constant by $O w n D r i n k k_{i}$ ). While this already implies a fairly particular source of variation, not to mention that age fixed effects are also included, one can speak to any concern that such a bias exists by re-estimating the models while absorbing school-level unobserved heterogeneity into

TABLE 4
Within-School Variation in Sexual Activity and the Drinking Behavior of Opposite-Gender Peers

|  | (1) | (2) | (3) | (4) | (5) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Did Drink <br> Alcohol in <br> Last Year | $\begin{aligned} & \text { Did Drink } \\ & \text { until } \\ & \text { Very High } \end{aligned}$ | Drinks until Very High Monthly | Days in Week Drinks until Very High | Days in Week Drinks Five or More Drinks |
| Panel A: Male sample ( $\boldsymbol{n}=\mathbf{9 , 0 3 2 \text { ) }}$ |  |  |  |  |  |
| FemalePeerDrink | $\begin{gathered} 0.007 \\ (0.041) \end{gathered}$ | $\begin{gathered} 0.008 \\ (0.046) \end{gathered}$ | $\begin{gathered} -0.007 \\ (0.073) \end{gathered}$ | $\begin{gathered} -0.036 \\ (0.037) \end{gathered}$ | $\begin{gathered} -0.034 \\ (0.036) \end{gathered}$ |
| OwnDrink | $\begin{aligned} & 0.203^{* * *} \\ & (0.010) \end{aligned}$ | $\begin{aligned} & 0.261^{* * *} \\ & (0.011) \end{aligned}$ | $\begin{aligned} & 0.268^{* * *} \\ & (0.015) \end{aligned}$ | $\begin{aligned} & 0.280^{* * *} \\ & (0.017) \end{aligned}$ | $\begin{aligned} & 0.233^{* * *} \\ & (0.017) \end{aligned}$ |
| OwnDrink ${ }^{2}$ |  |  |  | $\begin{gathered} -0.044^{* * *} \\ (0.004) \end{gathered}$ | $\begin{gathered} -0.033^{* * *} \\ (0.003) \end{gathered}$ |
| Panel B: Female sample ( $n=\mathbf{9 , 3 4 6}$ ) |  |  |  |  |  |
| MalePeerDrink | $\begin{gathered} 0.073 \\ (0.045) \end{gathered}$ | $\begin{gathered} 0.103^{* *} \\ (0.047) \end{gathered}$ | $\begin{gathered} 0.156^{* *} \\ (0.061) \end{gathered}$ | $\begin{gathered} 0.055^{* *} \\ (0.024) \end{gathered}$ | $\begin{aligned} & 0.056^{* *} \\ & (0.022) \end{aligned}$ |
| OwnDrink | $\begin{aligned} & 0.240^{* * *} \\ & (0.012) \end{aligned}$ | $\begin{aligned} & 0.281^{* * *} \\ & (0.013) \end{aligned}$ | $\begin{aligned} & 0.280^{* * *} \\ & (0.019) \end{aligned}$ | $\begin{aligned} & 0.356^{* * *} \\ & (0.022) \end{aligned}$ | $\begin{aligned} & 0.300 * * * \\ & (0.027) \end{aligned}$ |
| OwnDrink ${ }^{2}$ |  |  |  | $\begin{gathered} -0.062^{* * *} \\ (0.005) \end{gathered}$ | $\begin{gathered} -0.048^{* * *} \\ (0.005) \end{gathered}$ |

[^4]the error structure. In Table 4, school fixed effects are included, which will control both for unobserved characteristics that might be shared by adolescents within schools and for any influence of the school itself on the behavior of these youth (e.g., the "contextual effects" of Manski 1993). Using school-level fixed effects should eliminate a majority of group unobservables (e.g., Hanushek et al. 2003; Hoxby 2000), and if families choose schools based on timeinvariant school characteristics, controlling for school fixed effects controls for the main source of selection into schools. As identification is achieved off of the variation in PeerDrink $c_{c}$ across grades within schools, I drop the gradelevel fixed effects and capture level differences in sexual activity with the age fixed effects.

As a very strong test of the robustness of the patterns already identified, the baseline results from pooled samples are indeed robust to the inclusion of school-level fixed effects, which eliminates a key source of omitted variation in the above specifications as an explanation for the empirical regularity observed. Furthermore, within-school considerations now suggest that
female Sex systematically varies with even the blunt measures of MalePeerDrink in columns $1-3$. Were the prior results driven by the type of unobserved heterogeneity described above or by some nonrandom sorting, one would expect an attenuation of the coefficient estimates with such controls added to the model. Clearly, then, females within individual schools with alcohol-consuming opposite-gender peers reveal a higher proclivity toward sexual activity. Likewise, accounting for unobserved schoolspecific heterogeneity does not change that there is no explanatory power in FemalePeerDrink in explaining male sexual activity.

In terms of effect size, estimates in column 2 imply that a ten percentage-point increase in the proportion of male peers who have drunk until very high increases the propensity for girls to be sexually active by $3.6 \%$ of a standard deviation. Column 3 implies that a similar increase in the proportion of male peers who drink monthly increases the propensity for girls to be sexually active by $3.6 \%$ of a standard deviation. Using the more intensive drinking estimates in column 5 , the comparable measure is $1.3 \%$ of a standard
deviation. ${ }^{14}$ As an alternative intuition, consider that adding one additional "regular drinker" for every 20 male peers results in a $2 \%$ increase in the propensity for female students to be sexually active.

Approximately $40 \%$ of women aged 15-19 years were sexually active in the first year of the Add Health survey (1995). In the same year, the number of pregnancies among sexually active adolescent girls was 211.8 per 1,000 . The estimates I derive above therefore imply that a ten percentage-point increase in the proportion of male peers who do so monthly, increases the U.S. pregnancy rate among adolescent females from 83.6 to 84.9 per 1,000 . Adding one additional "regular drinker" for every 20 male peers implies an increase in the number of pregnancies per 1,000 women of this age by 1.7 per 1,000 .

## C. Sensitivity Analysis

At this point, it pays to consider that the above analysis may not have estimated the magnitude of any causal role for male alcohol consumption in explaining female sexual activity. Yet, it is a fairly peculiar story required in order to explain the patterns in the data without employing that MalePeerDrink may well cause female Sex. Even so, some scope remains for considering confounding factors insofar as attributes of the female subjects' environments are jointly determining Sex and MalePeerDrink. For example, if data do not allow one to fully control for local attributes, one could observe the behavior of student $i$ "changing" with that of $i$ 's opposite-gender peers even in the absence of a true peer effect, simply because some unobserved local attributes are systematically driving both. ${ }^{15}$ Below, I discuss a series of additional robustness tests, which I then follow with some concluding remarks.

[^5]As a matter of brevity, I report only the key variables of interest, noting that there are no significant differences in the estimated influence of control variables from the baseline equations. In no specification on the male sample do significant patterns emerge. Thus, I also refrain from reporting additional results from the sample of male adolescents.

Does Female Peer Drinking Have a Similar Effect? Even though the causal estimate may escape the above analysis, one might propose that the effect of MalePeerDrink on female Sex would only be interpretable as causal to the extent that the drinking of same-gender peers did not similarly contribute to female sexual activity. To find that female peers have similar "influence" on female sex, for example, would cast doubt on any attempt to unpack the alcohol-leading-to-sex relationship further. As a sensitivity test, then, I include just such a measure, which allows one to rule out that the opposite-gender result is simply a proxy for the broader peer environment the individual is found in. Table 5 includes this measure for both pooled and within-school specifications, with the strong suggestion that there is something quite unique in the nature of MalePeerDrink's influence on female sexual activity. In short, the comparable FemalePeerDrink does not contribute to explaining female sexual activity in either pooled samples or in models that exploit only within-school variation. In particular, across all measures of drinking behavior, point estimates are inconsistent in sign and, in the preferred identification of panel B , do not fall outside of standard confidence intervals.

In a different context, Clark and Loheac (2007) look across cohorts and find that in alcohol consumption, both boys and girls follow the behavior of boys from older cohorts, and that female cohorts do not influence younger cohorts of either boys or girls. While speaking to a different question, girls' sexual activity being responsive to male behaviors and not to female behaviors is arguably consistent with the asymmetry of Clark and Loheac (2007), and may be the subject of future research.

Do Other Antisocial Male Peer Behaviors Have Similar Effect? To rule out that the inclusion of male drinking is merely a proxy for a male peer "type" rather than for actual variation that relates to their alcohol-induced behaviors (e.g., lowered inhibitions), I analyze an alternative measure of

TABLE 5
Does Female Peer Drinking Have a Similar Effect on Female Sexual Activity?

|  | $(\mathbf{1})$ <br> Did Drink <br> Alcohol in <br> Last Year | (2) <br> Did Drink <br> until <br> Very High | $(\mathbf{3})$ <br> Drinks until <br> Very High <br> Monthly | $(\mathbf{4})$ <br> Days in Week <br> Drinks until <br> Very High | (5) <br> Days in Week <br> Drinks Five or <br> More Drinks |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Panel A: Pooled sample $(\boldsymbol{n = 9 , 3 4 6 )}$ |  |  |  |  |  |
| MalePeerDrink | 0.020 | 0.035 | $0.107^{*}$ | $0.066^{* * *}$ | $0.048^{* *}$ |
|  | $(0.032)$ | $(0.040)$ | $(0.058)$ | $(0.024)$ | $(0.021)$ |
| FemalePeerDrink | -0.065 | $-0.104^{* *}$ | -0.001 | -0.001 | -0.013 |
|  | $(0.042)$ | $(0.046)$ | $(0.080)$ | $(0.036)$ | $(0.029)$ |
| Panel B: School fixed effects $(\boldsymbol{n = 9 , 3 4 6 )}$ |  |  |  |  |  |
| MalePeerDrink | $0.078^{*}$ | $0.110^{* *}$ | $0.154^{* *}$ | $0.055^{* *}$ | $0.056^{* *}$ |
|  | $(0.046)$ | $(0.047)$ | $(0.061)$ | $(0.024)$ | $(0.022)$ |
| FemalePeerDrink | -0.029 | -0.049 | 0.075 | 0.001 | -0.027 |
|  | $(0.041)$ | $(0.049)$ | $(0.077)$ | $(0.037)$ | $(0.030)$ |


#### Abstract

Notes: The dependent variable is equal to one if the respondent reports having had sexual intercourse during the interview month or in the 12 months prior, and equal to zero otherwise. Reported are estimated coefficients from linear-probability models.

All specifications controls for own drinking, as in previous tables. All specifications also include school and age fixed effects and county-level measures of the proportion urban, proportion rural, and the unemployment rate, and individual-level indicators for race/ethnicity (i.e., Black, Asian, Hispanic, other non-White), parent education (i.e., less than high school, high school, some college, bachelor, graduate/professional), and the proportion of same-gender peers that attend religious services and who include sex as part of their "ideal romantic relationship." Standard errors (in parentheses) are corrected for clustering at the school level. ${ }^{*} p<.1,{ }^{* *} p<.05,{ }^{* * *} p<.01$.


peers' antisocial behaviors for additional evidence that the documented relationship is actually something alcohol related. In particular, I consider the reported tobacco use of oppositegender peers as a potential falsification exercise. In so doing, I find that point estimates are generally positive but not different from zero. Ultimately, there is no ability to claim that there is a significant influence of male peer tobacco use on female sexual activity. Clearly, the estimated influence of MalePeerDrink in earlier models is not merely separating out certain peer "types" in the way that any antisocial measure of peer behavior would. In other words, female interaction with general antisocial behavior in their male peers is not driving the pattern uncovered. These results are reported in Table 6.

The Effect of MalePeerDrink on Exogenous Characteristics. In Table 7, I present tests of randomness with respect to covariates, conditional on school and age fixed effects. To test the randomness assumption, I (separately) regress exogenous student characteristics (OwnDrink, male-cohort size, race, parent education, urban and rural, unemployment, and the measures of possible social norms related to sexual activity) on the MalePeerDrink

TABLE 6
Is Female Sexual Activity Responsive to Other Antisocial Behaviors Exhibited by Male Peers?

|  | $(\mathbf{1})$ <br> Pooled | (2) <br> Within School |
| :--- | :---: | :---: |
| MalePeerSmoke | 0.048 | 0.057 |
|  | $(0.041)$ | $(0.048)$ |
| OwnSmoke | $0.238^{* * *}$ | $0.237^{* * *}$ |
|  | $(0.011)$ | $(0.011)$ |
| Observations | 9,346 | 9,346 |

Notes: The dependent variable is equal to one if the respondent reports having had sexual intercourse during the interview month or in the 12 months prior, and equal to zero otherwise. Reported are estimated coefficients from linearprobability models.

In column 1, the reported specification replicates that of Table 3, panel B, column 3 with MalePeerDrink and OwnDrink replaced with MalePeerSmoke and OwnSmoke. In column 2, the reported specification replicates that of Table 4, panel B, column 3 with MalePeerDrink and OwnDrink replaced with MalePeerSmoke and OwnSmoke. Standard errors (in parentheses) are corrected for clustering at the school level.
${ }^{*} p<.1,{ }^{* *} p<.05,{ }^{* * *} p<.01$.
variable including school and age fixed effects and controlling for own alcohol consumption. Conditional randomness, or the absence of

TABLE 7
The Effect of Male Peer Drinking on Exogenous Characteristics

|  | (1) <br> OwnDrink | (2) <br> Male <br> Cohort Size | (3) <br> Black | (4) <br> Parent <br> College | (5) <br> Urban |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MalePeerDrink | $\begin{gathered} 0.052 \\ (0.044) \end{gathered}$ | $\begin{gathered} \hline-4.977 \\ (4.962) \end{gathered}$ | $\begin{gathered} \hline 0.031 \\ (0.052) \end{gathered}$ | $\begin{gathered} \hline 0.069 \\ (0.058) \end{gathered}$ | $\begin{gathered} 0.009 \\ (0.014) \end{gathered}$ |
| Observations | 9,346 | 9,346 | 9,346 | 9,346 | 9,346 |
|  | (6) | (7) | Among Female Peers |  |  |
|  | Rural | Unemployment Rate | Sex in Ideal Relationship | Religious Weekly | Religious <br> Monthly |
| MalePeerDrink | $\begin{gathered} -0.007 \\ (0.010) \end{gathered}$ | $\begin{gathered} -0.001 \\ (0.001) \end{gathered}$ | $\begin{aligned} & 0.241^{* * *} \\ & (0.062) \end{aligned}$ | $\begin{gathered} -0.031 \\ (0.057) \end{gathered}$ | $\begin{gathered} -0.072 \\ (0.049) \end{gathered}$ |
| Observations | 9,346 | 9,346 | 9,346 | 9,346 | 9,346 |

Notes: Each estimate represents a different regression. All specifications include school and age fixed effects and control for own alcohol consumption. Standard errors (in parentheses) are corrected for clustering at the school level.
${ }^{* * *} p<.01$.
self selection, is consistent with zero correlation between this variable and the covariates.

These tests imply that the effect of MalePeerDrink on these attributes are both economically and statistically insignificant, with the single exception being the "sexual openness" of other females in one's peer group, which has a sign that is consistent with the relationship we would anticipate, given the results above. Collectively, these results provide evidence that the results presented above are not because of nonrandom selection into or out of school-grade cohorts. ${ }^{16}$

## VI. DISCUSSION

Before concluding, there are several outstanding issues that can be briefly addressed, each being less about the robustness of the above result and more about the extent to which one can learn about other patterns. Specifically, I will consider whether there are discernible grade-level effects in the data, whether peers of different ages matter to sexual activity, and whether the nature of the sexual experience is different in alcohol-rich environments.

First, one might consider the extent to which the pattern identified is generally held across grade levels. Doing so, I have no strong prior

[^6]as to where the measured influence of peers should be larger. On one hand, it would seem reasonable to anticipate that if younger students are more impressionable (even though, in levels, they are less likely to participate) they may be more strongly influenced by drinking peers and thus appear more responsive at the margin. Yet, the young may be farther from the margin of engaging in sexual relationships and therefore less responsive to any encouraging influence. In ancillary analysis, I interacted MalePeerDrink with the respondent's grade level while controlling for a linear relationship in grade level itself. The point estimates suggest that the influence of male peers attenuates with grade level. However, estimates are imprecise and one could reasonably conclude that there are no significant differences in the marginal influence of PeerDrink across grade levels.

Second, I note that there is some suggestive evidence that females are more sexually active where the drinking of male peers in lower grades is higher. However, this pattern is only evident in across-school specifications, and there is no indication that such patterns exist within schools. Acknowledging that power is somewhat limited as the sample size falls off (i.e., first and last grades within schools have no younger or older cohorts), I conclude that there are no significant across-grade effects. Re-running similar specifications on male samples also reveals no patterns in either pooled or within-school specifications.

Third, it is reasonable to consider that any sexual intercourse facilitated in any way by alcohol may also be a different type of experience. That is, the nature of sexual relations may also change in the presence of alcohol. I find no evidence that there is a decrease in the use of contraception where male peers consume alcohol. I also find no direct evidence that females are significantly more likely to be forced to have sexual intercourse where male peers consume alcohol. ${ }^{17}$ That is, while point estimates are positive (and can be large), any increase in forced sex associated with MalePeerDrink is not statistically significant. As I am focussing here on the influence of oppositegender peers, this lack of evidence could be seen as a contrast (or a limit) to existing results in the literature that suggest that the nature of sex might change with alcohol (e.g., Grossman and Markowitz 2005; Markowitz, Kaestner, and Grossman 2005). Indirectly, there is at least a suggestion that the nature of sexual relations changes with alcohol, as male adolescents who themselves drink alcohol are more likely to report having forced someone to have sexual intercourse. Yet, such specifications reintroduce a more severe endogeneity concern and the causal implications of such a pattern are not clear. This may prove to be a fruitful area for future research.

## VII. CONCLUSION

With detrimental outcomes being associated with promiscuity, there remains need for us to better understand the underlying determinants of risky adolescent behaviors. Through this analysis, I have aimed at better understanding the potential role of peers' alcohol use in determining the propensity for adolescent youth to engage in sexual intercourse. This is a broader perspective on what constitutes the relevant alcohol-related causes of adolescent sexual activity than has been considered in the existing literature.

In particular, this analysis has exploited the bilateral nature of sexual intercourse-that intercourse involves both a male and female participant-and has provided evidence that would be consistent with the alcohol consumption of male peers having some influence on

[^7]the sexual activity of females. The analysis also points to this relationship being strongly gender dependent, as there is no evidence of female peer drinking influencing male sexual activity. This stark asymmetry is interesting in light of the patterns demonstrated in the studies of Rees and Sabia (2009) and Sabia and Rees (2009), where sexual promiscuity is shown to impinge on female human-capital acquisition.

This relationship is most evident in withinschool specifications and is robust to several additional considerations. For example, the systematic patterns in female sex and male peer drinking are shown to be distinctly different from any influence that same-gender peers may have on sexual activity. In fact, female peer drinking is found to contribute very little to explaining female sexual activity. This suggests that the pattern is not being driven by broader cohort-level effects, but specifically through relationships that cross genders. The apparent influence of alcohol-consuming male peers is also not seen in general antisocial peer behaviors, which themselves fail to explain female sexual activity. Further research into the mechanisms by which these and other behaviors are transmitted across gender lines seems warranted.

With respect to physiology, human consumption of alcohol initially serves as a stimulant, then induces feelings of relaxation and reduced anxiety, and can impair judgment, lower inhibitions, and induce mild euphoria. In considering the influence of alcohol on sexual relations, it is also worth noting that men have a higher ability to both dilute and metabolize alcohol. If anything, this supports the prior that volumeconstant alcohol consumption by males will have less influence on female sexual activityworking against the documented patterns. To the extent one anticipates that alcohol acts on sexual relations through reduced inhibitions, then, the empirical results can be interpreted as suggesting that male inhibitions may initially be a greater impediment to adolescent sexual activity than female inhibitions, ceteris paribus.

With the motivations for sexual activity being different across gender, the Add Health survey offers some opportunity to consider these motives as explanatory to this influence. In ancillary analysis, there are some indications that the mechanism at play is working in spite of certain priors respondents have about the underlying margins of importance. For example, in within-school empirical strategies, girls who "agree" or "strongly agree" with the statements,
"If you had sexual intercourse, your partner would lose respect for you," "..., afterward, you would feel guilty," or "..., it would upset your mother/father," are less inclined to be sexually active, on average, and are influenced less at the margin by the presence of alcohol-consuming male peers. While not accounting for the potential that these stated positions may be influenced by sexual activity itself, this is suggestive of the influence of alcohol-consuming male peers working quite systematically on female youthmore on those who imply lower costs to sexual activity and less on those who are inclined to associate costs with sexual activity. ${ }^{18}$

The data also suggest that the more agreeable girls are to the statements, "If you had sexual intercourse, it would give you a great deal of pleasure," or "..., it would relax you," the more inclined they are toward being sexually active and are more strongly influenced they are by alcohol-consuming male peers, at the margin. Although the empirical regularities suggest that the factors and interactions related to sexual activity are complex, that adolescents are following these patterns is somewhat encouraging. For example, if anticipated pleasure is driving female behavior to this extent, policy that encourages female adolescents to delay the pleasure they expect from sexual activity is a reasonable prescription. If the anticipated costs (e.g., upsetting one's mother or father) are mitigating the influence of male peers, systematically increasing such costs may lower adolescent female sexual activity.

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[^1]:    ABBREVIATION
    NLSY97: 1997 National Longitudinal Study of Youth

[^2]:    10. In-Home survey participants answer a series of questions that has them consider the component parts of their ideal romantic relationship "were they to have one in the next year." To the extent such views are generally held within schools, including such indicators in the model will work against attributing to peer drinking what may be spuriously explained by simple variation in social norms. Made evident in the summary statistics of Table 1 are the significant gender differences in responses to this question. In particular, $35 \%$ of girls are inclined to include "We would have sex" among the things that would happen in the perfect relationship, while $54 \%$ of boys include the same. While the
[^3]:    13. In neither column 4 nor column 5 , do $I$ find any extra explanatory power in including a quadratic in MalePeerDrink. I therefore exclude the quadratic from the model.
[^4]:    Notes: The dependent variable is equal to one if the respondent reports having had sexual intercourse during the interview month or in the 12 months prior, and equal to zero otherwise. Reported are estimated coefficients from linear-probability models.

    All specifications include school and age fixed effects and county-level measures of the proportion urban, proportion rural, and the unemployment rate, and individual-level indicators for race/ethnicity (i.e., Black, Asian, Hispanic, other non-White), parent education (i.e., less than high school, high school, some college, bachelor, graduate/professional), and the proportion of same-gender peers that attend religious services and who include sex as part of their "ideal romantic relationship." Standard errors (in parentheses) are corrected for clustering at the school level.
    ${ }^{* *} p<.05,{ }^{* * *} p<.01$.

[^5]:    14. These estimates are in keeping with the estimated effect sizes of Lavy and Schlosser (2007), who consider the gender balance among peer groups in determining test scores, and somewhat larger than those of Hoxby (2000).
    15. A second possibility exists, although I suspect does not much matter to our particular context. It is possible that $i$ and $i$ 's opposite-gender peers decide to attend the same school-grade because they like the same local attribute, which in turn influence their behaviors in the way required, or because they both like to be near individuals with similar characteristics. In these cases, the supposed effect of peers would instead be the result of sorting according to these attributes.
[^6]:    16. Bifulco, Fletcher, and Ross (2011) use Add Health data to consider the role of cohort racial composition, where across-cohort variation in peer composition is also shown to not explain predetermined student attributes.
[^7]:    17. Specifically, females were asked, "Were you ever physically forced to have sexual intercourse against your will?" while males were asked, "Did you ever physically force someone to have sexual intercourse against her will?"
