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"If my buddies use drugs, will I?" Peer effects on Substance Consumption Among Teenagers☆

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ABSTRACT

During adolescence, interactions with peers influence a teen's attitudes and behaviors. Adolescents seek for peer approval and acceptance, which may bring them to engage in health-risky behaviors such as smoking and drinking. In this study, we estimate the impact of peers on the drug use of Spanish students aged 14 to 18. We focus on the consumption of alcohol and tobacco, the most prevalent substances used at those ages. We estimate the effect of the average classmates' consumption—the measure of peers' use—on individual consumption. Since peers' use affects individual use and vice versa, we correct for this bias using instrumental variables. Results show that peers' consumption increases substantially the probability of using alcohol, while it does not significantly affect tobacco consumption. Our results are not sensitive to using different time spans of consumption. This study shows also novel evidence indicating that the higher the proportion of grade-retained students in the class, the stronger the peer effects, especially for alcohol. This suggests that future reforms of the grade retention policy should also consider the negative effects on non-academic outcomes, such as substance use.

1. Introduction

Peer groups play an important role in adolescents' lives. During adolescence, friendship intensifies and teens start to increasingly interact with peers, shaping their attitudes and character (Bukowski et al., 2013). Identity development and the need for social acceptance make adolescents a population group particularly vulnerable to peer pressure (Dumas et al., 2012). Seeking acceptance from their peer group may thus contribute to explaining teens' engagement in risky social behaviors, such as delinquency and using drugs (see, among others, Donovan, 2004, Bayer et al., 2009, Fletcher, 2010, 2012 and Arduini et al., 2019).

Peers exert a larger influence on social behaviors than on academic outcomes, as shown in the surveys (Sacerdote, 2011, 2014). For substance use among teens, in particular for smoking and drinking, previous studies find a positive and significant relationship between the consumption of these substances in their peer group and the individual's use, especially regarding the consumption of alcohol (Kawaguchi, 2004, Lundborg, 2006, Leatherdale et al., 2006, Fletcher, 2010, 2012, McVicar and Polanski, 2014, Robalino, 2016). For tobacco use, the evidence is less conclusive since some studies find no significant peer effects (Gaviria and Raphael, 2001, Soetevent and Kooreman, 2007).

Substance use is associated with many individual health problems, such as cancer, respiratory diseases, depression, anxiety and morbidity among others (Hart et al., 1999; Band et al., 2002; Schulte and Hser, 2014; Stewart et al., 2016). In addition, it has serious social consequences such as driving under the influence of substances, criminality,

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dropping out of school, aggressive behavior and loss of self-control (Gaviria and Raphael, 2001, Bogstrand et al., 2012, Schulte and Hser, 2014). Negative health and social effects associated with substance use are more severe among teenagers. First, teenagers tend to engage more in risky behaviors as a result of changes in the brain's socio-emotional system, which leads them to increasingly seek their peers' approval (Steinberg, 2017). Second, adolescents' biological characteristics, such as the immature body development, lead to higher substance absorption (Brown and Tapert, 2004). Furthermore, using drugs in adolescence increases the likelihood of substance abuse and addiction in adulthood with negative consequences for health and well-being (Schulte and Hser, 2014).

In this study, we analyze the influence of peers' consumption on adolescents' use of alcohol and tobacco. We rely on data from the 2014 Spanish School Survey on Drug Use (SSSDU), a survey that provides detailed information on substance use for students aged between 14 and 18 years old in Spain, conducted by the Ministry of Health. According to the OEDT (2016) report, which is based on SSSDU data, alcohol and tobacco are the most prevalent substances in that population. For instance, in the year previous to the survey date, 77% and 31% of the students report having consumed, respectively, alcohol and tobacco. SSSDU includes different frequencies of use for these two substances. In our main analysis, we use the substance consumed in the past month as our benchmark measure. Nevertheless, we conduct a sensitivity analysis of the results using both broader – ever in the past year or in lifetime – and narrower – smoking daily and drinking all weekends – time spans of consumption to understand if the main findings about peer effects on alcohol and tobacco may be sensitive to the consumption window used, since, as we discuss below, broader and narrower time spans may have advantages and disadvantages. As the measure of peers' consumption, we use the class-average use (excluding student's own consumption) given that classmates are one of the main reference groups for adolescents. Teenagers spend a lot of time with classmates in the classroom, where they interact on a regular basis and develop their identities (Bukowski et al., 2013). Indeed, Burke and Sass (2013) find that peers exert their influence in the classroom rather than in larger groups, such as the cohort or the school. SSSDU surveys all students in the class, which allow us to build our peer's measure.

In addition to analyze these overall peer effects, we also explore whether the influence of classmates on alcohol and tobacco use is different if grade-retained students are present in the class. Retained students are those students who have repeated a whole grade at least once. Since they are older than the non-retained students in the class they may be seen as role models for alcohol and tobacco use by younger students. This may exacerbate peer effects, especially if the percentage of retained students in the class is large. Among OECD countries, Spain has the second largest retention rate (31%) only after Belgium (34%), while the OECD average is 12% (OECD, 2016). Previous literature documents that having grade-retained students in the class has negative effects on individual academic outcomes and misbehavior, such as disciplinary incidents and psychosocial adjustment (see, for example, Gottfried (2013), Fruehwirth et al. (2016) and Özek (2015), Mathys et al. (2017)). Negative effects from retained students can be also observed on substance use, although the literature about this topic is quite limited (Byrd et al., 1997). In Spain, there is a public debate about the high retention rates and recently, an educational reform has been passed aimed, among other objectives, at reducing these rates.[1] Arguments against the retention policy highlight the negative consequences for academic-related outcomes, such as larger dropout rates, poorer school performance and an increase in inequality since the probability of being retained is higher for students from low socioeconomic backgrounds (García-Pérez et al., 2014, González-Betancor and López-Puig, 2016, Jerrim et al., 2022). Therefore, a better understanding of how the retention rate affects the classmates' social pressure on alcohol and tobacco consumption is relevant both from an educational and health policy perspective.

For our purposes, we specify a linear-in-means model that relates individual consumption to the consumption in the peer group (Manski, 1993; Sacerdote, 2011, 2014). The estimation of peer effects faces two important biases (Manski, 1993; Sacerdote, 2011). First, the bias from the "reflection problem", i.e., from the fact that peers' behavior affects individual's behavior and vice versa. Second, the bias from the non-random choice of the peer group, since adolescents tend to relate to other similar teens. Regarding the bias from the reflection problem, we use the instrumental variable (IV) technique to deal with it. This is a standard approach in the peer effect literature (see, for instance, Gaviria and Raphael (2001), Lundborg (2006), Fletcher (2010, 2012), Duarte et al., 2014). We instrument the effect of peer consumption using measures of tobacco and alcohol consumption in the household, in particular parents' and other household members' consumption. All the instruments are constructed as the class-average of the corresponding variable, excluding the student's own value. As we discuss below, in addition to individual and class-average characteristics, our specification includes also the instrumental variables at the individual level to account for its direct effect on the student's consumption. Therefore, it is reasonable to assume that the class-average of the instrumental variables, excluding the student's own value, will not have a direct effect on individual consumption—aside from the indirect effect through peer consumption—and will be valid instruments.

The bias from the self-selection into the peer group may arise in our analysis from between- and within-school sorting. We control for between-school sorting by including school-fixed effects in our model. Within-school sorting is not an issue, as we discuss below, since Spanish students are frequently allocated to classes following the last name alphabetical order, and parents are not allowed to choose their child's teacher.

To analyze to what extent having grade-retained students in the class may exacerbate peer effects, we estimate peer effects separately for classes with a retention rate below and above the median rate in the sample and below and above retention rates larger than the median. We should notice that being a retained student and the proportion of retained students in the class are accounted for in this separate estimation as well as in the joint estimation explained above.

This study extends the literature on peers and drug use as follows. We contribute to the scarce evidence about peer effects on alcohol and tobacco use among European youth and, in particular, among Spanish adolescents. Most studies use USA data.[2] Among the few works addressing this issue for European countries, we can find Lundborg (2006) for Sweden, Soetevent and Kooreman (2007) for the Netherlands, McVicar and Polanski (2014) for the UK, and McVicar (2011) that estimates peer effects for twenty-six European countries. For Spain, Duarte et al. (2014) analyze peer effects on smoking for an earlier SSSDU wave (SSSDU 2004) by assuming zero contextual effects and, hence, using some contextual characteristics of peers as instrumental variables. As pointed out in the literature, the assumption of zero contextual effects is strong and, therefore, the validity of instruments relying on socio-demographic characteristics, such as income or household composition in the peer group, are put into question (Bramoullé et al., 2009, Argys and Rees (2008), Fletcher (2010, 2012)). Duarte et al. (2011) estimate peer effects on alcohol using also the SSSDU wave from 2004 and considering as instruments variables that measure income, unemployment rate and health outcomes at the province level, which will reduce the data variation to identify peer effects on individual use. In this

[1] Ley Orgánica 3/2020, December 29, 2020, https://www.boe.es/buscar/doc.php?id=BOE-A-2020-17264.

[2] See Gaviria and Raphael (2001), Kawaguchi (2004), Argys and Rees (2008), Bramoullé et al. (2009), Fletcher (2010, 2012), Robalino (2016), Arduini et al. (2019).

paper, we study peer effects on alcohol and tobacco use by relying on instrumental variables that measure tobacco and alcohol consumption in the student's household and that are defined at the reference group level (the class). We also provide results of peer effects on substance use among Spanish adolescents for a more recent SSSDU wave (2014 wave). In addition, by analyzing the Spanish context, our research offers new insights into the influence that peers exert on the drug use of young people in the European context. Studying peer effects in different cultural and legal contexts is crucial for understanding the extent to which they operate and their potential impact on policy decisions. For example, alcohol consumption is more socially acceptable among adolescents in some European countries, like Spain, than in the US, which could potentially affect the size of peer effects on drug use. Differences in the schooling context may also result in different peers' influence. For instance, in Spain, unlike the US, high school students stay with the same classmates in most of the courses during the school year. Students are allocated to a class at the beginning of the schooling level and they remain with these classmates over time (with some minor variations across years due to grade-retained students, new students enrolled, or dropouts). These different school dynamics lead to different reference groups in Spain and in the US (classmates vs grademates), which may in turn affect the size of peer effects. Our study, thus, adds new findings that contribute to a better understanding of peer effects in different contexts.

Finally, we add new evidence on peer effects on alcohol and tobacco consumption. First, previous literature is not conclusive on the impact of peers on smoking behavior. Some papers find significant peer effects (Fletcher, 2010, Lundborg, 2006, Kawaguchi, 2004) while others do not find significant effects (Gaviria and Raphael, 2001, Soetevent and Kooreman, 2007). Second, we show novel evidence on whether peer effects on alcohol and tobacco use vary according to the retention rates in the class. Our analysis, thus, contributes to the still scarce literature on the effects of retained students on substance use.

We find that accounting for the bias from the reflection problem yields a positive and significant peer effect on alcohol use, while the peer effect on tobacco consumption is not significant, in line with previous papers not finding significant effects for smoking. Results show that a 10 percentage point (pp) increase in alcohol use in the peer group would raise the individual probability of drinking by a substantial amount (4.7 pp). Results are similar when we use both broader and narrower time spans to measure drug consumption. When splitting the sample between classes above and below a certain retention rate, our results show that grade-retained students exert a poor influence on using alcohol. Peer effects on alcohol use are stronger in classes with retention rates above the median (or larger) rate. Finally, we also explore peer effects separately for public and private schools to analyze whether within-school peer dynamics are different across type of schools. Our findings show that peer effects on alcohol are stronger in private schools than in public ones. For tobacco, we find significant effects only for students in private schools, which indicates that the lack of significance of the peer effect on tobacco in the full sample may be driven by students in public schools.

2. Data

We use the Spanish School Survey on Drug Use, which is a school-based, biennial and nationally representative survey on drug consumption conducted by the Ministry of Health.[3] The SSSDU interviews adolescents who are enrolled in the last two grades of compulsory education (ninth and tenth grades) and in the first two high school grades. Students' age ranges from 14 to 18 years old.[4] We use the wave of 2014, which collected information on the drug consumption of students enrolled in the school year 2014–2015. Interviews were collected between November 2014 and April 2015.[5]

The questionnaire and sampling design are ex-ante harmonized to other European drug use surveys, allowing results to be internationally comparable. SSSDU uses a two-stage stratified sampling method: first, schools are randomly selected, and, then, classes from the targeted schooling levels – high school and the two last grades of compulsory education – are randomly sampled. SSSDU samples a total of one to four classes out of all the classes in the targeted schooling levels. This means that the survey only selects some classes in each grade. Moreover, since the survey does not aim at selecting at least one class per each targeted grade, in some schools there are grades with zero classes surveyed. Table A.2 in Appendix A shows that two classes were surveyed in around 93% of the schools and that each surveyed class is in a different grade in 95% of the schools. All the students from the selected classes are surveyed. Therefore, SSSDU provides detailed information on the drug use of the student and of all their classmates.[6]

SSSDU collects information about the consumption of alcohol, tobacco and other drugs along with students' socio-demographic characteristics. The information is collected through paper-and-pencil self-reported questionnaires anonymously answered by students during a regular class (45–60 minutes) under the supervision of the survey staff. Paper-and-pencil method is also used in other European drug use surveys. It is a less invasive method and is, therefore, recommendable to reduce under-reporting or social desirability bias when collecting sensitive information. Students are told that their parents will not be informed about their answers in order to also help to reduce under-reporting in drug use. For the 2014 wave, the students' response rate was 85%.

We focus on students who attend general education—compulsory schooling and academic high school.[7] We exclude students enrolled in vocational high school—only 4.2% of the original sample of 37,486 students—as they may not be well represented in the survey. The reason is that the vocational track includes workplace training and students may be at the workplace on the day of the survey. From the sample of 35,902 students who attend compulsory education and academic high school, we exclude (i) classes with an extremely small number of students (three or less), and (ii) schools with only one surveyed class. We apply this second filter for methodological reasons. As we discuss later, our specification includes school fixed effects to account for between-school sorting and, thus, the identification of class-average peer effects requires more than one surveyed class per school.

[3] The Monitoring Centre for Drugs and Addictions in the Ministry of Health is responsible for collecting the SSSDU, "Encuesta sobre Uso de Drogas en Enseñanzas Secundarias en España".

[4] A common limitation of all school-based surveys on drug use is that dropouts and students who decide to not pursue high school education are not included in the sample. This implies that the information on drug use of students older than sixteen – the compulsory schooling age in Spain – is representative only of the school population. However, school-based surveys have the advantage over home-based surveys in that parents are not present, which may reduce drug-use under-reporting.

[5] At the moment of requesting the data for our study, we applied for the 2014 wave because this is the latest possible wave – in order to use recent data to estimate the peer effects – and it includes all the relevant information needed in our analysis. Other more recent waves miss key information such as the questions on household consumption – used to build the instrumental variables – and the question on household composition.

[6] SSSDU excludes the answers of students with special education needs and recently arrived immigrant students whose mother tongue is not Spanish. SSSDU data do not include information on a student who is not present in the classroom on the day of the survey.

[7] After compulsory education, which ends at the age of sixteen, Spanish students may attend high school, which lasts two years and includes academic and vocational tracks. The majority of students pursue an academic career instead of a vocational one because the first allows attending university (Lopez-Mayan, 2018).

Table 1
Prevalence of drug use.

	Compulsory educ.		High school		Full sample	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Alcohol:						
Ever	0.67	0.47	0.87	0.34	0.75	0.43
Past year	0.62	0.49	0.83	0.37	0.70	0.46
Past month	0.51	0.50	0.73	0.44	0.60	0.49
Past month all wknd	0.09	0.29	0.18	0.39	0.13	0.34
Tobacco:						
Ever	0.30	0.46	0.43	0.50	0.36	0.48
Past year	0.25	0.43	0.35	0.48	0.29	0.45
Past month	0.17	0.37	0.24	0.43	0.20	0.40
Past month daily	0.06	0.23	0.09	0.29	0.07	0.26
N	21,225		14,560		35,785	

Sample: 791 schools, 1,689 classes, 35,785 students.

Table 2
Index of social interactions.

Alcohol:	$p(1-p)$	Sample variance	Index: Sample variance/$p(1-p)$
Ever	0.19	0.69	3.69
Past year	0.21	0.79	3.78
Past month	0.24	0.88	3.68
Past month all wknd	0.11	0.31	2.72
Tobacco:	$p(1-p)$	Sample variance	Index: Sample variance/$p(1-p)$
Ever	0.23	0.62	2.69
Past year	0.21	0.51	2.47
Past month	0.16	0.38	2.39
Past month daily	0.07	0.14	2.09

Sample: 791 schools, 1689 classes, 35,785 students. Index of social interactions proposed by Glaeser et al. (1996). The first column is the predicted variance in the absence of social interactions. The index is the ratio of the sample variance to the predicted variance. Sample variance $= \frac{1}{\#classes}\sum_{j=1}^{\#classes}\left[\,(drug\ use\ rate\ class_j - drug\ use\ rate\ total\ sample)\sqrt{class\ size_j}\,\right]^2$.

Table 3
Sources of variation of class-average use.

	Alcohol	Tobacco
Overall variance	0.043	0.019
Between–school variance	0.030	0.012
Within–school variance	0.013	0.007
% of within–school variation	30.99	38.85

Sample: 791 schools, 1689 classes, 35,785 students. Class-average use of alcohol and tobacco in the past month.

Overall, these filters result in the exclusion of only 117 students. The final sample contains 35,785 students distributed across 1689 classes and 791 schools, where 21,225 students (59.3%) are enrolled in compulsory education and the rest in high school.

SSSDU collects information on alcohol and tobacco use over several time spans, such as ever in lifetime, ever in the past twelve months, ever in the past month, smoking daily or drinking all weekends in the past month. Appendix A contains the definitions of these variables. All of them are dummy variables equal to one if the student has used the substance over the respective time span, and zero otherwise. Table 1 shows that alcohol is the most prevalent substance in all time spans. 75% of students have consumed alcoholic beverages ever in their lifetime. The percentages drop as the time span narrows, but even for the narrowest one – using alcohol all weekends in the past month – the prevalence is still 13%. Around one-third of the sample has ever smoked cigarettes or has smoked in the past year, while 7% report the most intense tobacco use—smoking daily in the past month. The use rate is larger for high school students than for students in compulsory education.

As the first descriptive evidence on the degree of social—peer—interactions in drug use among classmates, we calculate the index proposed by Glaeser et al. (1996). This index compares the predicted variance of the drug use rate in the absence of social interactions with the sample variance of the drug use rate across classes (times the square root of the class size). As Glaeser et al. (1996) demonstrates, this ratio should be equal to one in the absence of social interactions, under the assumption of a constant propensity to consume across classes. If some students imitate their classmates, the ratio would be larger than one and it would be a naive estimate of the degree of imitation in drug use.[8] The first column in Table 2 shows the predicted variance, the second column the sample variance and the last column shows the ratio, which is always larger than one. Results point towards larger social interactions in alcohol compared to tobacco, and they also suggest that peer effects are weaker the more intense the drug use. This seems reasonable since smoking daily or drinking all weekends may also reflect addiction. Nevertheless, these results should be interpreted with caution since they have been obtained without accounting for other variables that may affect social interactions.

In our baseline analysis, we consider the time span "past month" as the benchmark for the following reasons. First, the narrowest time spans may reflect addict behavior rather than peer pressure, especially for smoking daily. Second, broader time spans, such as ever in lifetime or ever in the past year, may be subject to larger measurement error than narrower ones as adolescents may not have a good recollection of far events. Although this issue may also affect retrospective information about the use in the past month for some adolescents, it is likely that the reporting error is lower than for the past year and lifetime. Nevertheless, we conduct a sensitivity analysis to assess to what extent estimated peer effects change when we consider time spans larger or smaller than the past month span.

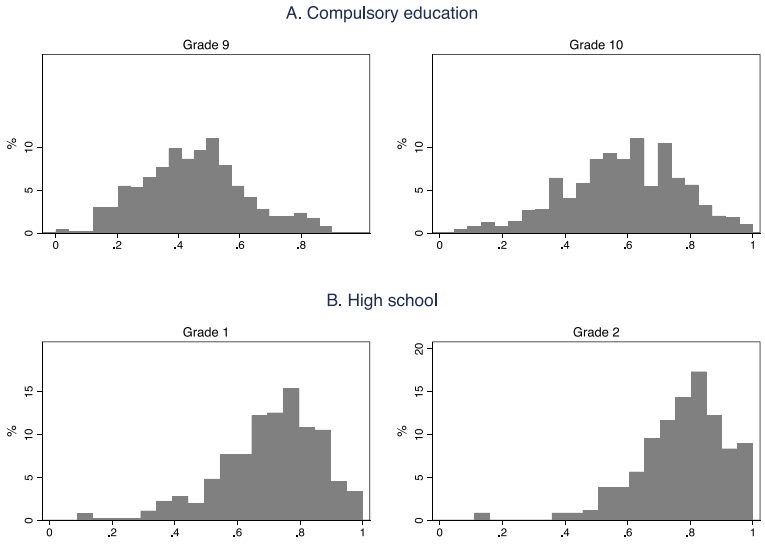
Figs. 1 and 2 show that, as students are older and are enrolled in higher grades, the distribution of the class-average use in the past month shifts rightward, especially for alcohol use. Another striking feature is that the percentage of zero tobacco use in the class falls sharply from grade nine in compulsory education to grade two in high school. Finally, both figures show a large variation in the average use across classes of the same grade. Relatedly, Table 3 reports that 31% and 39% of the class-average variation in alcohol and tobacco use, respectively, arises across classes within the same school. The remaining class variation is originated between schools. The purpose of Figs. 1 and 2 and Table 3 is to show the class-average variation in students' consumption because our identification strategy relies on the within-school variation and the peer use is measured at the class level, as we discuss in more detail below.[9]

3. Empirical strategy

To estimate the influence of peers on using alcohol and tobacco, we need to define a measure of the peer-group use of each substance. As discussed in the introduction, since adolescents spend a large amount of time with classmates, it is reasonable to assume that most of the student's friends are classmates and that the class is, therefore, the relevant reference group (Kooreman, 2007, Bukowski et al., 2013, Burke and Sass, 2013, Wang et al., 2015). We thus define the peer-group use as the

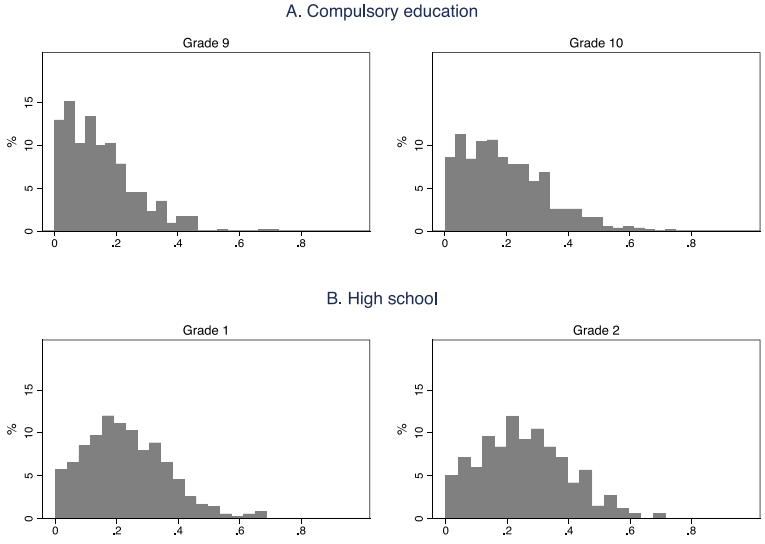
[8] However, as Glaeser et al. (1996) points out, an index larger than one should be interpreted with caution. If for any reason the propensity towards drug use differs across classes, the sample variance (times the square root of the class size) will include social interactions as well as those other systematic differences across classes.

[9] As explained below, the peer measure is not exactly equal to the class-average use because the peer measure excludes the own student consumption to avoid reverse causality.



Sample: 791 schools, 1,689 classes, 35,785 students.

Fig. 1. Distribution of class-average alcohol use in the past month by schooling level and grade.



Sample: 791 schools, 1,689 classes, 35,785 students.

Fig. 2. Distribution of class-average tobacco use in the past month by schooling level and grade.

average consumption of all students in the class, excluding the student's own consumption. Formally, the peer-group use for an individual i in class c in school s is defined as follows:

$$peer_{-ics} = \frac{1}{M-1} \sum_{\substack{m=1 \\ m \neq i}}^{M} y_{mcs} \tag{1}$$

where M is the size of class c, and y_{mcs} is a dummy variable equal to one if classmate m in class c in school s uses the substance of interest and zero otherwise. The variable $peer_{-ics}$ is, thus, the proportion of students who use the substance in class c in school s, excluding student i.

Following the standard approach in the literature (see Manski, 1993 and Sacerdote, 2011, 2014), for each substance we specify a linear-in-means model of peer effects:

$$y_{ics} = \beta_0 + \beta_1 peer_{-ics} + \beta_2 X_{ics} + \beta_3 \overline{X}_{-ics} + \phi_s + \varepsilon_{ics} \tag{2}$$

where y_{ics} is a dummy variable equal to one if student i in class c in school s has consumed the substance in the past month and zero otherwise; X_{ics} is the vector of student's socio-demographic characteristics; $\overline{X}_{-ics}$ is the vector of class-average socio-demographic characteristics, excluding student i; and ϕ_s is the vector of school fixed effects. Since the dependent variable is a dummy variable, we are estimating a linear probability model. Estimates from this model are good proxies for the marginal effects from a probit model (Wooldridge, 2002).

The vector X_{ics} contains a broad set of control variables at personal and family levels. As personal characteristics, we include gender and indicators for not being born in Spain and being a grade-retained student. As for family characteristics, we include household composition, parents' education and employment status. For household composition, we consider dummy variables indicating whether the student lives (i) with grandparents, (ii) in a single-parent household, and (iii) with

siblings. For parents' education, we consider four dummy variables for each parent's schooling level (primary or less, compulsory, upper secondary, university), and a dummy variable for students who report not knowing their parents' education or who leave the question blank. For parents' employment status, we include for each parent a dummy variable indicating whether he/she is employed. The vector $\overline{X}_{-ics}$ contains the class average of those individual variables and class size. Appendix A encloses the definition of these explanatory variables and Table A.1 shows summary statistics.

In the analysis of peer effects, Manski (1993) points out three types of effects to explain the observed fact that individuals from the same group tend to behave similarly. First, the *endogenous effect*, that is, peers' behavior influences an individual's behavior. Second, the *correlated effect*, people tend to behave as their reference group because all of them share similar characteristics. Third, the *contextual or exogenous effect*, that is, individual's behavior is affected by peers' background characteristics. The endogenous peer effect is the parameter of policy interest because it has the potential to create a social multiplier: any policy that affects individual behavior would have multiplying effects on the society through the endogenous peer effect.

The identification of the endogenous peer effect β_1 faces important empirical challenges (Manski, 1993). First, it is difficult to separately identify the endogenous effect β_1 from the contextual effect. We follow the previous literature and interpret the peer effect β_1 in a broad sense, including both the endogenous and the contextual effects (Sacerdote, 2011). The second challenge relates to the non-random allocation of individuals to the peer group. This source of sorting will bias the estimate of the peer effect β_1 since peers' consumption may affect the individual's consumption just because she/he shares similar tastes or characteristics with her/his peers.

In our framework, the bias from the student's self-selection into her peer group—classmates—may arise from between-school sorting and from within-school sorting. Between-school sorting refers to the non-random allocation of students to schools. Parents, for example, may prefer a school with certain characteristics or a school where students share a similar socioeconomic background. This would yield a biased estimate of the peer effect. For instance, students from certain family backgrounds may be more likely to attend certain schools, and thus classmates may be more (or less) prone to consume drugs. As mentioned above, Table 3 shows that 61–69% of the variation in drug use arises between schools, which may reflect between-school sorting. We deal with this potential selection by following the standard approach of including school fixed effects (ϕ_s) in the specification (2) to account for unobserved school characteristics. Therefore, our identification strategy relies on the within-school variation in drug use.

Within-school sorting will arise if certain students are systematically allocated to certain classes within the school. This would lead to the non-random selection of classmates, i.e., the reference group. In our analysis, however, within-school sorting should not be a big concern. In Spain, unlike other countries, students are usually allocated to classes following the alphabetical order of their last names.[10] Moreover, *teacher shopping*—parents choosing their child's class or teacher—is very rare. Nevertheless, $\overline{X}_{-ics}$ includes the above mentioned class socio-demographic characteristics to attenuate potential within-school unobserved heterogeneity that may bias the estimate of the peer effect.

Finally, the estimation of the peer effect β_1 faces the *reflection problem* (Manski, 1993). This refers to the difficulty of identifying the causal effect of the peers' behavior on the individual's behavior because the latter also affects the behavior of the reference group. We deal with the bias from the reflection problem by using the instrumental variables technique, which involves finding variables that influence peers' behavior but without directly affecting the individual's behavior.

Some studies assume that contextual effects are zero ($\beta_3 = 0$ in the specification (2)), which implies that peers' background characteristics would affect individual behavior only through their effect on peers' behavior. Under this assumption, the variables in $\overline{X}_{-ics}$ are used as instruments of the peers' behavior. For instance, Gaviria and Raphael (2001) and Lundborg (2006) follow this approach and use average background characteristics as instruments in addition to other variables that measure parents' involvement, parents' drug use, and parents' encouragement to drink alcohol in the peer group. The assumption of zero contextual effects is strong and the validity of the contextual instruments is called into question in other works. For instance, Fletcher (2010, 2012) include peers' background characteristics in the specification and use only as instruments the peer-group average of variables indicating whether the student has older siblings, whether her/his parents use drugs, and whether alcohol and tobacco are available at home. Bramoullé et al. (2009) base their identification strategy on the background of friends' friends (those with whom the individual does not have direct contact). Argys and Rees (2008) identify peer effects relying on having older peers in the same grade who use alcohol, tobacco and marijuana. All of these works do not assume β_3 is zero.

In line with this literature, we do not assume zero contextual effects. We include the vector of class-average characteristics $\overline{X}_{-ics}$ in the specification (2). We use the information from SSSDU to construct variables that can be used as instruments for peer consumption. Our instruments rely on the consumption of tobacco and alcohol in the household. All the instrumental variables are constructed as the class-average, excluding the own student, of the corresponding individual variable. For tobacco, we construct two instrumental variables based on the dummy variables that indicate whether any parent smokes and whether other household members smoke.[11] For alcohol, we construct an instrumental variable based on whether any parent has consumed alcoholic beverages. Unfortunately, unlike tobacco, SSSDU does not include information on alcohol consumption by other household members. Appendix A contains the definition of all these variables. We consider that they are valid instruments. Notice that we control for the respective variables at the individual level in the specification (2) to account for the fact that the own student's household consumption is likely to be correlated with the individual use. Therefore, it is reasonable to assume that the class-average of the household consumption, excluding the own student, will only affect the individual use through their effect on the average classmates' use, i.e., through the peer effect.

Table A.1 in Appendix A shows that 44% and 22% of the students have, respectively, parents and other household members who smoke, while 71% report that at least one of the parents have consumed alcoholic beverages in the last thirty days. Fig. A.1 in Appendix A presents the class-average of parental consumption across schools. This graph illustrates the disparity in parental consumption at the class level, which serves as a proxy for the instrumental variables. It should be noted that the class-average of parental consumption and other household members' consumption is not precisely equal to the instrumental

[10] The Spanish Education Act (LOE) establishes in articles 80 and 81 the general principle of equity in the allocation of students to classes with the scope to avoid discrimination and segregation of certain type of students in a class (see the LOE here https://www.boe.es/buscar/pdf/2006/BOE-A-2006-7899-consolidado.pdf). Spanish regions implement this equity principle by regulating that students must be homogeneously allocated to classes such that all the classes in the same grade have a similar composition. For example, the regulation in Andalusia, the largest Spanish region, establishes that students must be allocated following the alphabetical order of the first surname and students with special needs must be distributed homogeneously among all the classes (http://www.juntadeandalucia.es/averroes/centros-tic/04003470/helvia/sitio/upload/C._AGRUPAM.pdf).

[11] Regarding tobacco, the survey only considers two separate categories–parents and other family–when asking about household members' consumption. Presumably, for most students, other household members are grandparents or siblings, but unfortunately, SSSDU does not separately collect the siblings' tobacco use.

Table 4
First-stage: OLS results.

	Alcohol	Tobacco
% any parent drinks	0.16***	
	(0.07)	
% any parent smokes		0.06**
		(0.02)
% other household members smoke		0.11***
		(0.03)
F–test of significance of instruments	22.91***	14.44***
Over–identification J–test	–	0.56
R^2	0.73	0.66
Individual characteristics	Yes	Yes
Class–average characteristics	Yes	Yes
School fixed effects	Yes	Yes
N	35,785	35,785

Sample: 791 schools, 1689 classes, 35,785 students. Dependent variables: Alcohol and tobacco consumption ever in the past month. Each column represents a separate regression. All instrumental variables are the class-average variable excluding the own student. See Appendix A for the definition of the variables. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%.

variables, as the latter are calculated by taking the class average after excluding the values of the student in question.

Finally, Table 4 shows summary statistics from the first-stage estimation of the peer use on the instruments and on the variables included in X_{ics} and $\overline{X}_{-ics}$. Instrumental variables are positively and significantly correlated with peer consumption. The F-tests show that we can reject the null hypothesis that the effect of the instruments is zero at the 1% level in both regressions. The over-identification test in the regression for tobacco does not allow us to reject the null hypothesis of excludable instruments.

4. Results

4.1. Full sample

Panel A in Table 5 shows the OLS estimates of the peer effect β_1 in the specification (2). Panel B reports the instrumental variable estimates of the peer effect using the instruments described above. In the regression for alcohol, which is exactly identified, we use two-stage least squares (2SLS) and in the regression for tobacco, which is overidentified, we use the generalized method of moments (GMM). In all regressions, standard errors are clustered at the class level. This is the appropriate level of clustering given the survey design, as discussed in Abadie et al. (2017). Moreover, as pointed out by Duarte et al. (2014), the cluster structure at the class level should be taken into account for efficiency reasons and for computation of the correct standard errors. Standard errors need to be corrected by the fact that individuals in the same class may tend to behave similarly because they share the same teachers and institutional environment.

Results from Panel A show that without accounting for the bias from the reflection problem, individual alcohol use is positively correlated with the peer use, and the correlation is significant at the 1% level.[12] Individual tobacco use, surprisingly, is negatively correlated with peer use. A possible explanation is that the reflection problem, that is, the peers' consumption affecting the student's use of tobacco and vice-versa, is so strong for this substance that the peer effect becomes negative. In Panel B, however, the GMM estimate of the peer effect on tobacco is not significant. Therefore, the peer group does not exert a significant influence on the individual decision of using tobacco once we have accounted for the bias from the reflection problem. This result is in line with the estimated peer effects on smoking in Duarte et al. (2014), which use Spanish data from 2004, an earlier SSSDU wave.

[12] For the sake of brevity, we do not report the estimated coefficients of the individual and class-average variables, but they are available upon request.

Table 5
Peer effects in student's consumption.

A. OLS estimates		
	Alcohol	Tobacco
Peer consumption	0.11***	−0.13***
	(0.03)	(0.04)
R^2	0.15	0.12
B. 2SLS/GMM estimates		
	Alcohol	Tobacco
Peer consumption	0.47***	0.22
	(0.12)	(0.15)
R^2	0.15	0.11
Individual characteristics	Yes	Yes
Class–average characteristics	Yes	Yes
School fixed effects	Yes	Yes
N	35,785	35,785

Sample: 791 schools, 1689 classes, 35,785 students. Dependent variables: Alcohol and tobacco consumption ever in the past month. Each column in each panel represents a separate regression. Instrumental variables are the class average, excluding the own student, of whether any parent has consumed alcohol in the past month, whether any parent currently smokes and whether other household members currently smoke. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%.

They estimate a probit model using the control function approach, but once they cluster the standard errors at the class level, peer effects are no longer significant and are in line with our findings from a linear probability model. Compared with the literature that uses US data, our results are aligned with findings in Gaviria and Raphael (2001), which do not obtain significant effect for smoking either, while others, like Kawaguchi (2004) and Fletcher (2010) find significant effects. As discussed in the introduction, the literature on peer effects on smoking is not conclusive and our results lie on the side of the papers that do not find significant effects.

In the case of alcohol, the peer effect is positive and significant at the 1% level in Panel B, which indicates that the student is more likely to use alcohol as their peer group's consumption increases. The GMM estimate is larger than the OLS estimate. This shows that failing to account for the reflection problem leads to a downward biased peer effect, i.e. to underestimating the influence of peers on individual use. This is in line, for instance, with the findings from Gaviria and Raphael (2001)—which also estimates a linear probability model of social interactions—and from Lundborg (2006)—which estimates a probit model. Like in our paper, both obtain that the OLS estimates are substantially downward biased and that the unbiased peer effects are positive and significant.

The GMM estimate of the peer effect is 0.47, which means that a 10% point increase in peer drinking would rise the likelihood that a student drinks by 4.7 pp. To illustrate the strength of the peer effect, we compare it with the alcohol use rate in the full final sample (0.60 rate, as shown in Table 1). This relative measure points to a strong peer effect since it would be equivalent to increasing the alcohol use rate by 7.8 pp. Our estimated effect is larger than the effects found in Gaviria and Raphael (2001) and in Kawaguchi (2004), 0.35 and 0.26 respectively, both using US data. This may be due to differences in social norms surrounding alcohol in Spain compared to the US, although without further data we need to be cautious about the role of this mechanism.

4.2. Results by retention rate and type of school

To gain a deeper understanding of the influence of classmates' use on individual use, we explore whether the presence of grade-retained classmates may exacerbate peer effects. As explained in the introduction, the Spanish education system, unlike systems from other countries, allows to retain students in the grade, which means that

Table 6
Heterogeneous peer effects (2SLS/GMM estimates).

A. % of grade–retained students in class above & below a certain % in sample				
	Alcohol		Tobacco	
	Below	Above	Below	Above
a. 20.83% (sample median):				
Peer consumption	0.56***	0.64***	0.37*	0.13
	(0.19)	(0.07)	(0.22)	(0.29)
N	18,164	17,621	18,164	17,621
b. 30%:				
Peer consumption	0.48**	0.60***	0.33*	−0.61
	(0.20)	(0.11)	(0.17)	(1.74)
N	24,370	11,415	24,370	11,415
c. 40%:				
Peer consumption	0.42**	0.75***	0.30**	1.67
	(0.19)	(0.11)	(0.15)	(1.08)
N	28,754	7031	28,754	7031
B. Public & private schools				
	Alcohol		Tobacco	
	Public	Private	Public	Private
Peer consumption	0.37**	0.67***	0.16	0.43***
	(0.17)	(0.13)	(0.22)	(0.14)
N	24,656	11,129	24,656	11,129
Individual characteristics	Yes	Yes	Yes	Yes
Class–average characteristics	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes

Sample: 791 schools, 1689 classes, 35,785 students. Dependent variables: Alcohol and tobacco consumption ever in the past month. Each column in each panel represents a separate regression. Instrumental variables are the class average, excluding the own student, of whether any parent has consumed alcohol in the past month, whether any parent currently smokes and whether other household members currently smoke. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%.

Table 7
Peer effects for different time spans of substance use.

A. Intense use in the past month		
	Drinking all weekends	Smoking daily
Peer consumption	0.62***	−0.00
	(0.11)	(0.25)
R^2	0.08	0.10
B. Using ever in the past year		
	Alcohol	Tobacco
Peer consumption	0.58***	0.23
	(0.08)	(0.15)
R^2	0.15	0.11
C. Using ever in lifetime		
	Alcohol	Tobacco
Peer consumption	0.60***	0.15
	(0.07)	(0.17)
R^2	0.14	0.14
Individual characteristics	Yes	Yes
Class–average characteristics	Yes	Yes
School fixed effects	Yes	Yes
N	35,785	35,785

Sample: 791 schools, 1689 classes, 35,785 students. Each column in each panel represents a separate regression. Dependent variables: Consuming alcohol all weekends in past month, consuming tobacco daily in past month, consuming alcohol or tobacco ever in the past year, consuming alcohol or tobacco ever in lifetime. Instrumental variables are the class average, excluding the own student, of whether any parent has consumed alcohol in the past month, whether any parent currently smokes and whether other household members currently smoke. See Appendix A for the definition of the variables. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%. First-stage results are shown in Tables B.1 and B.2 in Appendix B.

Table A.1
Descriptive statistics of explanatory variables.

	Mean	Std. Dev.
Female	0.51	0.50
Grade–retained student	0.24	0.43
Non–Spanish	0.10	0.31
Household composition		
Siblings	0.73	0.45
Single–parent household	0.08	0.28
Grandparents	0.10	0.29
Mother' education		
Primary	0.14	0.35
Compulsory	0.16	0.37
Upper secondary	0.24	0.43
Tertiary	0.28	0.45
"Do not know"	0.17	0.38
Father' education		
Primary	0.15	0.36
Compulsory	0.16	0.37
Upper secondary	0.23	0.42
Tertiary	0.24	0.43
"Do not know"	0.22	0.41
Parental employment status		
Mother employed	0.63	0.48
Father employed	0.79	0.41
Smoking parents	0.44	0.50
Other smoking hh members	0.22	0.42
Parents drink	0.71	0.46
Class size	22.99	6.18
Public school	0.69	0.46

Sample: 791 schools, 1689 classes, 35,785 students.

retained students in the class had to retake a whole grade in previous years. Retained students are, thus, older than non-retained classmates. The presence of retained students in the class may increase the pressure on younger students to use alcohol or tobacco, if they see retained—older—classmates as role models for these type of behaviors.

Using the same set of instruments as above, we estimate peer effects by splitting the sample into the classes that have a percentage of grade-retained students below or above the median retention rate in the sample. We also estimate differences in peer effects for larger percentages of retained students (30% and 40%, respectively) in the class.[13] Panel A in Table 6 presents the results. We find that for each of the three thresholds—median, 30% and 40%—classes with a percentage of grade-retained students above the threshold have higher peer effects on alcohol. This suggests that those students may exert a negative influence on alcohol use in the class, especially when the retention rate is relatively large. For tobacco, peer effects are not significant for the subsample of classes above the corresponding threshold. Only for the classes with a percentage of grade-retained students below the thresholds, peer effects are significant at 5% or 10% level. Therefore, for tobacco, we do not observe a clear pattern relating peer effects and higher percentages of grade-retained students.

Finally, we also analyze whether peer effects are different by type of school, public versus private. As shown in Table A.1 in Appendix A, 69% of the surveyed schools are public. According to the statistics from the Spanish Ministry of Education, in the school year 2014/2015, 54% of the schools that offered compulsory and/or upper secondary education were public.[14] We should clarify that the SSSDU data report in the private category also the semi-private schools—*colegios concertados*, private schools publicly funded—but, unfortunately, the survey does not allow us to distinguish between these two types of schools. Nevertheless, most of the schools will belong to the category of semi-private ones, since the statistics from the Spanish Ministry of Education for the year of the survey show that out of the total private schools, 80% are

[13] Around 68% and 81% of the classes have, respectively, a retention rate equal to or below 30% and 40%.

[14] Data retrieved from https://www.educacionyfp.gob.es/servicios-al-ciudadano/estadisticas/no-universitaria/centros/centrosyunid/2014-2015-rd.html.

Table A.2
Distribution of schools in the final sample.

	By number of surveyed classes			All schools	%
	4 classes	3 classes	2 classes		
Each class from different grades	49	0	704	753	95.2
All classes from same grade	0	0	33	33	4.2
2 classes from same grade, rest different grades	4	1	–	5	0.6
Total schools	53	1	737	791	100.0
%	6.7	0.1	93.2	100.0	

Sample: 791 schools, 1689 classes, 35,785 students.

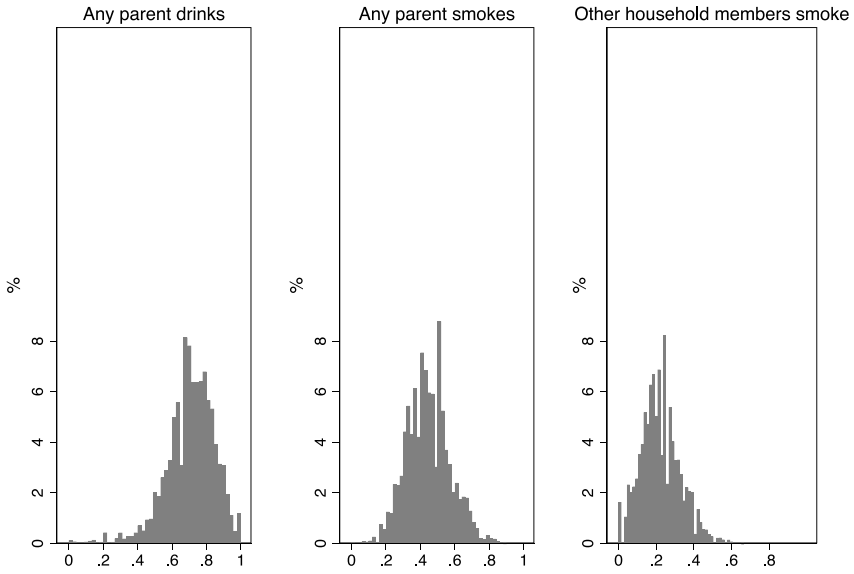


Fig. A.1. Distribution of the class-average of parents' and other household members' consumption. Sample: 791 schools, 1689 classes, 35,785 students.

semi-private schools. Since semi-private schools receive public funding, they are subject to the same rules as public ones. This means that they must accept all types of students, without discriminating them. However, semi-private schools can charge fees for extra-curricular activities, which in practice may generate a certain self-selection of students that can attend these schools. Full-funded private schools are typically located in rich neighborhoods and usually attended by students from high-income families. We should remark, however, that the self-selection of students into public and private schools is accounted for in our approach through the school fixed effects and, thus, it is not a source of bias for the estimation of peer effects. Nevertheless, estimating peer effects separately for students enrolled in public and private schools may provide some insights about whether within-school peer dynamics are different in these types of schools, which in turn may lead to differences in peer effects on alcohol and tobacco. Panel B in Table 6 shows the results from the separate estimation by type of school, using the same instrumental variables as in the joint estimation in Section 4.1 above. We find that peer effects on alcohol use are larger in private schools than in public ones. A 10% point increase in peer drinking would rise the likelihood that a student in private school drinks by 6.7 pp, almost double the probability in a public school (3.7 pp). Peer effects on tobacco are only significant for students in private schools and they are smaller than peer effects on alcohol (0.43 vs 0.67, respectively). These findings suggest that internal dynamics in private schools may lead to higher peer pressure on substance use than internal dynamics in public schools, once accounted for the between-school sorting through school fixed effects. Although we do not have information on SSSDU data to further explore this topic, private schools in Spain are frequently self-characterize as providing a more disciplined environment than public schools. Therefore, one possible explanation is that some parents may choose private schools when their children have low schooling outcomes and/or misbehavior. This sorting is controlled for through the school fixed effect, but if private schools have a higher proportion of students with troublesome behaviors, this can translate into different within-school dynamics, which may affect within-school social acceptance and peer pressure and contribute to explaining our results.

4.3. Sensitivity analysis

As discussed in Section 2, we adopt "past month" as the benchmark time span in our analysis. One reason is that time spans broader than "past month" may be subject to larger measurement error because of adolescents' bad recollections of past events. Another reason is that time spans narrower than "past month" may reflect addict behavior to a larger extent than peer pressure. In this section, we assess the sensitivity of the main findings in Section 4.1 to using alternative time spans of drug use. As broader time spans, we use consumption of alcohol or tobacco "ever in lifetime" and "ever in the past year". As narrower time spans, we use "smoking daily in the past month" and "drinking alcoholic beverages all weekends in the past month" (see Appendix A for the definitions). For each time span of substance use, we estimate the specification (1) using the same instrumental variables as above.

Table 7 shows the results.[15] For tobacco, peer effects are not significant in line with the main results in Table 5. For the time span

[15] Tables B.1 and B.2 in Appendix B show all the first-stage results.

Table B.1
Student's consumption: narrowest time span.

	Drinking all weekends	Smoking daily
% any parent drinks	0.08***	
	(0.02)	
% any parent smokes		0.02
		(0.01)
% other household members smoke		0.05***
		(0.02)
F–test of significance of instruments	15.90***	7.84***
Over–identification J–test		1.30
R^2	0.68	0.66
Individual characteristics	Yes	Yes
Class–average characteristics	Yes	Yes
School fixed effects	Yes	Yes
N	35,785	35,785

Sample: 791 schools, 1689 classes, 35,785 students. Each column represents a separate regression. Instrumental variables are the class average, excluding the own student. See Appendix A for the definition of the variables. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%.

Table B.2
Student's consumption: broader time spans.

A. Ever in the past year

	Alcohol	Tobacco
% any parent drinks	0.19***	
	(0.03)	
% any parent smokes		0.06**
		(0.03)
% other household members smoke		0.13***
		(0.03)
F–test of significance of instruments	35.29***	12.97***
Over–identification J–test		0.54
R^2	0.73	0.66

B. Ever in lifetime

	Alcohol	Tobacco
% any parent drinks	0.19***	
	(0.03)	
% any parent smokes		0.09***
		(0.03)
% other household members smoke		0.12***
		(0.03)
F–test of significance of instruments	34.47***	12.44***
Over–identification J–test		0.11
R^2	0.71	0.69
Individual characteristics	Yes	Yes
Class–average characteristics	Yes	Yes
School fixed effects	Yes	Yes
N	35,785	35,785

Sample: 791 schools, 1689 classes, 35,785 students. Each column represents a separate regression. Instrumental variables are the class average, excluding the own student. See Appendix A for the definition of the variables. Standard errors clustered at the class level in parentheses. Significance levels: *10%, **5%, ***1%.

"drinking all weekends" (Panel A), the peer effect is a bit larger than the impact estimated using the "past month" time span. This may make sense as drinking all weekends may be related to binge drinking and going out at night with friends. In this context, social pressure to drink alcoholic beverages may be quite strong among adolescents. For the time spans "ever in the past year" and "ever in lifetime" (Panels B and C), peer effects are somewhat smaller than for drinking all weekends and a bit larger than for drinking in the past month. The latter may be explained by certain overlapping. Reporting "drinking in the past month" implies reporting "drinking in the past year" and "ever in lifetime". On the contrary, reporting "drinking ever in lifetime" or "ever in the past year" does not imply reporting "drinking in the past month". Consistently with this, Table 1 shows larger percentages of alcohol use in the broader time spans compared to the past month. This certain overlapping may explain why peer effects for broader time spans are somewhat larger than the peer effect in the past month. Another explanation may be that teenagers are subject to strong peer pressure to try alcoholic beverages at least once. After trying, however, some teenagers may decide to not engage regularly in this behavior maybe because they do not like it or they are aware of the negative health effects of regular alcohol use. Our estimated peer effect for drinking in the past year (0.58, see panel B in Table 7) is of equal size as the effect found in Fletcher (2012) with US data. Instead, the peer effect for drinking all weekends in the past month (0.62, see panel A in Table 7) is substantially larger than the effect found in Lundborg (2006), which reports a marginal effect of 0.23 for binge drinking in the past month among Swedish adolescents.

5. Conclusions

In this study, we analyze the influence of peers' consumption on the adolescent's use of alcohol and tobacco using a Spanish survey on drug use of students aged 14 to 18. The peers' use is measured as the average of classmates' consumption, excluding the own student consumption. We address the bias from the reflection problem using instrumental variables that measure parents' and other household members' consumption. The instruments are the class-average of those variables, excluding the own student's value.

We find that peers have a significant and positive influence on individual alcohol consumption, i.e., individuals are more likely to consume alcoholic beverages if their peers do so. However, the peer effect for tobacco is not significant. We also perform a sensitivity analysis using time spans of drug use different from our benchmark (past month) and the conclusions hardly change. When splitting the sample between classes above and below a certain retention rate, our results show that peer effects on alcohol use are stronger in classes with a proportion of grade-retained students above it. Finally, we find that peer effects are larger in private than in public schools.

Understanding to what extent peers influence engagement in the consumption of substances that are dangerous for teenagers' health and society is policy relevant given the severity of health and social problems that result from substance use during adolescence. Accurate knowledge of the peer group influence may guide the policy actions aimed at discouraging drug use among teens. This study shows relevant new evidence about the effect of classmates' consumption on individual use that contributes to the still not conclusive evidence on peer effects on smoking, to the scarce literature on peer effects on smoking and drinking in Spain, and to a better understanding of peer effects in different cultural and legal contexts.

In addition, we show novel evidence of the relationship between peer effects and the retention rate in the class. Aside from the negative effects of retained students on schooling outcomes documented in the literature, our results suggest that those students may also be a poor influence on risky behaviors, such as using alcohol. Spain is among the OECD countries with the highest student retention rates (31%), and it has recently passed a new act that takes some steps towards reducing this rate. Our findings, thus, show additional evidence in favor of revising the grade retention policy, since it may be harmful to both academic and non-academic outcomes.

Data availability

The authors do not have permission to share data.

Appendix A. Definition of variables

Alcohol ever: Dummy variable equal to one if the student has ever drunk alcoholic beverages in her lifetime.
Alcohol past year: Dummy variable equal to one if the student has drunk alcoholic beverages in the past twelve months.

Alcohol past month: Dummy variable equal to one if the student has drunk alcoholic beverages in the past thirty days.
Alcohol past month all wknd: Dummy variable equal to one if the student has drunk alcoholic beverages all weekends in the past thirty days.
Tobacco ever: Dummy variable equal to one if the student has ever smoked cigarettes in her lifetime.
Tobacco past year: Dummy variable equal to one if the student has smoked cigarettes in the past twelve months.
Tobacco past month: Dummy variable equal to one if the student has smoked cigarettes in the past thirty days.
Tobacco past month daily: Dummy variable equal to one if the student has smoked cigarettes daily in the past thirty days.
Female: Dummy variable equal to one if the student is female.
Non-Spanish: Dummy variable equal to one if the student's country of birth is not Spain.
Grade-retained student: Dummy variable equal to one if the student has ever retaken a grade.
Single-parent household: Dummy variable equal to one if the student lives with only one parent.
Siblings: Dummy variable equal to one if the student lives with siblings.
Grandparents: Dummy variable equal to one if the student lives at least with one grandparent.
Parents' education: Four dummy variables indicating the schooling level of each parent: primary or less, compulsory, upper secondary, and tertiary. We also include a dummy variable for the *Do not know* response.
Parental employment status: Two dummy variables, one for each parent, equal to one if the parent is employed.
Public school: Dummy variable equal to one if the school is publicly funded.
Smoking parents: Dummy variable equal to one if any parent smokes.
Other smoking hh members: Dummy variable equal to one if other household members smoke.
Parent drinks: Dummy variable equal to one if any parent has consumed alcoholic beverages in the past month.
Class size: Number of surveyed students in the class.

Appendix B. Sensitivity analysis — First–stage results

See Tables B.1 and B.2.

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