Does Friends' Gender Matter for Students' Academic Performance? *

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Abstract

This paper investigates the effects of same-sex and opposite-sex friends on academic achievement in the context of China. To address the endogeneity of friendship formation, we rely on the variations in school-level average numbers of same-gender and opposite-gender friends, the share of opposite-gender schoolmates and parents' strictness with friends making to obtain exogenous variations in the numbers of same-gender and opposite-gender school friends for a student. The results indicate that having one additional same-gender friend reduces scores in all three individual subjects, i.e., Chinese, math and English, and the total scores, while having an additional opposite-gender friend reduces scores only in Chinese, English and the total scores, not in math. We conduct several robustness checks and find that our results are robust against alternative specifications. We also show that the negative effects are especially strong for female students. We explore the possible channels through which the gender of friends affects academic achievement and find that building friendship increases the time spent on social interactions, which crowds out activities that improve academic performance. Furthermore, being popular with schoolmates of the opposite gender significantly increases the probability of being in a romantic relationship, while being popular with schoolmates of the same gender improves students' feelings about school climate.

Keywords: gender peer effect, same-gender friends, opposite-gender friends, academic achievement

1　Introduction

Academic performance is an essential determinant of higher wages (Moretti, 2004), better health (Cutler and Lleras-Muney, 2006), and other positive outcomes (Arrow, 1997). Coleman (1968) is the first to relate various inputs affecting students' learning outcomes to students' outputs in the Coleman Report, and Bowles (1970) applies the economic concept of a production function to the field of education. Since then, extensive research has attempted to employ the educational production function to identify the factors influencing students' academic performance. Besides the individual-level factors, school factors (Sweetland and Hoy, 2000), family factors (Gonzales et al., 1996), peer factors (Hanushek et al., 2003; Gonzales et al., 1996), and neighborhood factors (Ainsworth, 2002) have also been shown to affect academic performance.

In the peer effects literature, the effect of gender composition has been widely studied due to its significant policy relevance. Among them, extensive research has attempted to quantify the causal effect of peers' gender composition on educational outcomes. Peers of a student are defined using the unweighted linear mean of an aggregated level in most cases, such as other students in the same class (Ladd et al., 2008; Lee et al., 2014; Gong et al., 2019), grade (Dewan et al., 2017) or dorm (Sacerdote, 2001). However, such a broad reference group specification cannot capture the effects generated from social interactions among the students. Students self-select into friendship networks and choose with whom to make friends. Therefore, students are likely to be more significantly influenced by their friends, rather than equally by every other member in the same class, grade or dorm (Lin, 2010).

Especially during the transition from childhood to adulthood, friends help adolescents understand and adapt to the biological changes they are experiencing (Douvan et al., 1966). And spending time with friends rather than family members help adolescents build social identity (Csikszentmihalyi et al., 1977; Fuligni et al., 2001; Cook et al.,2007). More importantly, having both same-sex and opposite-sex friends allows teenagers to interact with

people from more diverse background, which help meet the growing psychological needs and cultivate optimism. Different from previous studies on opposite-gender peer effects, which focus on love psychology and behavior (Knox and Wilson, 1981, Lefkowitz et al., 2004), sexual behavior (Billy and Udry,1985; Jaccard et al., 2005), contraception and STD prevention (Pouget et al., 2010; Ali and Dwyer, 2011), and the like, we try to identify the different effects generated by same-gender and opposite-gender friends on academic outcomes. In particular, we use the numbers of same-gender and opposite-gender friends in a school-level friendship network to investigate the effects of the number of friends as well as the gender of friends.

Understanding the spillover effects generated by peers is vital for developing countries including China, where the limited resources call for more efficient allocation of education inputs, including peers. Studying the causal effect of friends' gender is of particular policy relevance in China as few teenagers have brothers or sisters to interact with in their families due to the One-child Policy. We divide a student's friends in the same school into two groups, i.e., same-gender and opposite-gender friends, and identify the impacts of same-gender and opposite-gender friends on students' achievements respectively. As pointed out by Manski, (1993), the fundamental challenge for peer effects estimation is the non-random formation of the peer groups. For example, outgoing students may actively participate in extracurricular activities, resulting in more gender-balanced friendship groups, and these personal characteristics may also have a direct effect on grades. In order to overcome the endogeneity of peer group formation, many studies rely on randomized experiments (Hoxby, 2000; McKenzie, 2003; Sacerdote, 2001; Duflo et al., 2011; Carrell et al., 2013; Lee et al., 2014; Feld and Zölitz, 2017; Gong et al., 2019).

In this paper, we employ an instrumental variable (IV) approach to address the endogeneity of friends' gender composition, relying on the variations of school-level average numbers of same-gender and opposite-gender friends, the share of opposite-gender schoolmates and parents' strictness with friends making. This obtains exogenous variations in the numbers

of same-gender and opposite-gender school friends after controlling for the county fixed effect. A student is more likely to make opposite-gender friends in the school network if many students in the same school have opposite-gender friends or if he/she is in a school with a higher share of opposite-gender schoolmates. The gender composition of schoolmates and the school-level average number of same- or opposite-gender friends, on the other hand, do not directly influence academic achievement. Parents' strictness with friends making is also associated with the gender composition of an adolescent's friends. Under the influence of Confucianism in China, it is generally the case that the stricter the parents are with their child's friendship choice, the less likely the child has opposite-gender friends. [1]

Data are from the China Education Panel Survey (CEPS), which contains detailed information on a sample of nearly 20,000 middle school students in China. For our purpose, the most unique and valuable feature of the data is that students were asked to list up to five best friends along with friends' gender. Although linkable friends' identifiers are not available, we do have information on friends' gender for each respondent. Therefore, unlike previous studies which specify peers at a broad level of class, grade or dorm, our peers are specified based on the real friendship networks within a school, and as a result, the peer effects we identified are due to direct social interactions among the friendship network members.

The findings indicate that one standard deviation increase in the number of same-gender friends causes approximately one-fifth of standard deviation decline in standardized total score. And having one more same-gender friend decreases Chinese, Mathematics, and English by 1.0782, 1.2194 and 1.3629 points, respectively, while having an additional opposite gender friend lowers Chinese, English and total scores by 1.9793, 2.4147 and 5.2456 points, respectively. These findings are consistent with the literature using friendship networks (Mihaly, 2009; Hill, 2015) but distinct from the literature on cohort gender effects, which generally finds that a higher proportion of girls is related to better academic outcomes.

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[1]A possible concern is that if a child performs well (poorly) academically, then a parent may become less (more) restrictive on a child's activity. We take advantage of the rich information in our data to demonstrate that parents' strictness on friends making has no direct effect on a child's academic performance except indirectly through the child's friendship choice. More detailed discussions on this are provided in Section 4.

We also find that students in Grade 7 or female students are more vulnerable. Furthermore, we explore the possible channels through which the gender of friends affects academic achievement. We find that an increase in the number of friends, regardless of gender, largely reduces the time spent on coursework-related activities and increases hours spent on hanging out with friends, implying that building and maintaining friendships are time-consuming and crowd out activities that improve academic performance. Moreover, being popular with the opposite gender significantly increases the probability of being in a romantic relationship. On the other side, being popular with the same gender benefits students' feelings about the class and school, which positively impacts academic performance. This channel provides an explanation why the negative influence of same-sex friends is smaller than it is of opposite-sex friends. Understanding the mechanisms through which gender peer effects operate is meaningful for students, teachers, parents and policymakers.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 introduces the primary education in China and describes the data. Section 4 discusses the empirical strategy. Empirical results are presented in Section 5. Section 6 conducts several robustness checks, and Section 7 presents the heterogeneous effects based on the grade level and gender. Section 8 explores the potential mechanisms through which gender peer effects might operate. Section 9 concludes.

2 Literature Review

Existing studies investigating gender peer effects on academic outcomes mostly focus on the proportion of girls in a relevant group. The publications cover almost all educational stages: elementary school (Hoxby, 2000), middle school (Lu and Anderson, 2014; Gong et al., 2019), high school (Lavy and Schlosser, 2011; Hill, 2015) and college (Hill, 2017). However, there is no consistent definition for the relevant group in the literature and the conclusions are mixed. Many studies define the relevant group as classmates, grade-mates or schoolmates due to data

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availability, implicitly assuming a student is equally affected by everyone else in the group. For example, Hoxby (2000), the pioneer in studying gender peer effects, finds that both males and females perform better in math in classrooms with a higher share of females even though females' math performance is about the same as males'. Using data from Tennessee's Project STAR experiment, Whitmore (2005) suggests that female students have a positive effect on both male and female students' achievement in kindergarten through second grade. In the third grade, however, male students perform worse if they are in a class with a higher fraction of female students. Lavy and Schlosser (2011) also shows that a higher proportion of girls in a school improves both boys' and girls' cognitive outcomes. However, Antecol et al. (2016) does not find any effect of the female proportion in the classroom on achievement, irrespective of students' gender. Eren (2017) uses data from a randomized experiment and demonstrates that having a higher proportion of female peers in the classroom improves girls' math test scores only in less-advanced courses. Dewan et al. (2017) uses a new administrative dataset with an all-India presence and finds that the proportion of female classmates in a student's cohort has a significant and sizable positive effect on achievement levels of both male and female students. In addition, there is suggestive evidence of non-linearity in the peer effect as the test scores of students are found to be related to the proportion of female classmates in a concave pattern. Goulas et al. (2018) exploits within-school and neighborhood idiosyncratic variations in gender composition share and finds that a higher share of females in a school or neighborhood improves both genders' scholastic performance. Other studies focus on roommates. For instance, Stinebrickner and Stinebrickner (2006), uses the administrative data in Berea college and defines roommates as peers. They show that college students spend 21.66 hours per week with his/her roommates on average, along with a positive relationship between a student's ACT score and his/her peers' ACT scores.

For studies target students in China, Lu and Anderson (2014) exploits random seat assignment in a Chinese middle school to estimate how the gender of neighboring students affects a student's academic achievement and shows that being surrounded by more female

students increased girls' test scores. Boys, however, are not affected or even hurt by the greater presence of female students. Using the same dataset as in our paper, Gong et al. (2019) defines peer group as all the other students in the same class. It relies on schools with random assignment to identify the effects of the female share in a class, resulting in significant observation loss.

Several recent studies have switched to an individual's friendship network using Add Health data. Calvó-Armengol et al. (2009) finds that increasing centrality in the network leads to a significant increase in academic achievement. Mihaly (2009) finds a negative relationship between student popularity and academic achievement using the interaction of individual demographic characteristics and the grade by gender composition of these characteristics as instrumental variables. Hill (2015) shows that an increase in the share of opposite-gender school friends reduces academic achievement. Skiera et al. (2015) finds students located in densely connected networks earn better grades.

Many studies also try to uncover the channels through which gender peer effects on academic achievement might operate. Stinebrickner and Stinebrickner (2006) finds that peers' actions and beliefs may change a student's effort in studying and his/her use of time and beliefs. In addition, females may be more accepting of roommates from different backgrounds. As a result, they may spend more time with their assigned roommates than males. Duflo et al. (2011) finds in the context of Kenyan primary schools that teachers provide more effort, as measured by teacher absenteeism when they are randomly assigned to a class of high-achieving as compared to low-achieving students. Lavy and Schlosser (2011) exhibits the academic gains are mediated through lower levels of classroom disruption and violence, improved inter-student and student-teacher relationships, and lessened teachers' fatigue. Feld and Zölitz (2017) provides evidence for peer effects on group functioning and but not on teacher functioning. Eren (2017) proposes two possible mechanisms: lower gender stereotype influences and changes in gender-specific attitudes toward competition. Gong et al. (2019) suggests that possible mechanisms include how teachers' behavior, classroom

environment, and student behavior may change when more female students are in the class-room.

3   Middle School Education in China and Data Summary

In China, the nine-year compulsory education includes six years of primary education (elementary school), starting at age six or seven, and three years of middle school education for ages 12 to 15. According to the Ministry of Education of the People's Republic of China, the Gross Enrollment Ratio (GER) of middle schools in China is 100.9% in 2018. [2] Middle school education focuses on Chinese, Mathematics, English, Physics, and Chemistry. Chinese and Mathematics are introduced in the first year of primary education. English is usually introduced in the 3rd grade of elementary school. After students finish primary education, Physics is usually introduced in the second year and Chemistry in the third year of middle school education. An academic year runs from September in a calendar year to June in the following year. In all three years of junior middle school, students are given a midterm and a final exam every semester on all subjects taught in that semester. In China, the score is not only an important indicator of student academic performance, but also the only factor that determines whether students progress to higher education.

The Senior High School Entrance Examination, or commonly known as Zhongkao, is held annually in June, towards the end of grade 9, which is the last year of junior middle school. This examination is not only a comprehensive assessment of the nine-year compulsory education, but also a prerequisite for entrance into almost all education institutions at the senior high school level, such as common senior high schools, secondary skill schools, vocational high schools, and technical high schools. Chinese society places an extraordinar-

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[2]GER is the ratio of the number of students who live in that country to those who qualify for the particular grade level.

ily high value on education, students have to spend a lot of time and effort to prepare for Zhongkao. Entering good high schools becomes the most important goal for many junior middle students' learning. Our analysis focuses on the test scores on Chinese, Mathematics and English, the three subjects that attract the most attention from students, teachers and parents (Wu, 2015), as these three subjects are taught in all three years and account for a large proportion in Zhongkao.

The China Education Panel Survey (CEPS) conducted by the National Survey Research Center (NSRC) at Renmin University of China is a nationally representative sample of nearly 20,000 Chinese middle school students in 438 classrooms, 112 schools from 28 counties and city districts. The baseline survey was conducted in the 2013-2014 academic year, including 19,487 students from two cohorts: 10,279 students from the 7th grade and 9,208 students from the 9th grade respectively. The follow-up survey was conducted in the subsequent academic year to track the students' educational progress. The overall follow-up rate is 91.5%. The 7th graders in the baseline sample were in their 8th grade and the 9th graders in the baseline sample had finished compulsory education and left the original school. Up to now, only data that track the 7th graders in the baseline sample have been released. CEPS has 5 questionnaires that were given to students, parents, head teachers, teachers and principals, respectively.

There are several advantages of the CEPS. First of all, it provides detailed information on students' demographic characteristics. All students are asked questions on their relationship with parents, teachers and classmates, which enables us to adjust for observable characteristics that affect outcomes, and study the mechanisms through which the peer gender effects work. Secondly, it contains standardized scores in three core subjects, i.e., Chinese, Mathematics and English. Each of the three has a mean of 70 and a standard deviation of 10, making scores across schools comparable.[3] Thirdly, all students are asked information about their best five friends, including basic demographics such as friends' gender, *hukou*

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[3]In contrast, raw scores of these exams are based on school-specific tests and not comparable across schools.

status, and whether he/she is in the same school and class as the respondent.[4] Friends' behaviors, such as studying hard, expecting to go to college, skipping classes, criticized or punished for violating school rules, etc., are also available. Last but not least, students in the sample are from junior middle school. On the one hand, compared with high school students and college students, the factors affecting the academic outcomes of junior middle school students are relatively simple. On the other hand, compared with primary school students, the self-awareness of junior middle school students is enhanced, which tends to foster more friendships. After deleting the observations with missing key information (e.g., all friends' gender information), we have 18,457 observations in the final sample. We primarily focus on data from Wave 1 of the survey.[5]

Table 1 summarizes the respondents' answers to the question: "who will be the first one for you to turn to in the following situations?". Situations consist of when you want to chat with someone, when you are in trouble and when you need help. A large percentage (83.17%) of students choose to turn to their schoolmates or good friends to chat. About a half of students choose to turn to their schoolmates or good friends when they are in trouble or when they need help.

Table 2 cross-tabulates the nominated friends and friends in the same school. Figure 1 visualizes Table 2, and the bars show the number of friendship nominations. Most students nominate five friends. Student nominating zero friends are dropped from the sample. The greyscales in the bars exhibit how many friends out of the nominations are from the same school. The percentage values are listed. For example, for those who nominate five friends, 56.43% of students have all five friends from the same school. Only 3.41% of students nominate five friends but have no school friends. In Figure 2, the left panel gives the number

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[4]As in many surveys, there is a restriction on the maximum number of friend nominations. This restriction, although standard and facilitates subjects' responses, may cause some bias in our estimation due to censoring in the data. However, we perform some robustness checks by including additional types of friends, i.e. non-school friends, and find that our results are robust. More details can be found in Section 6. Therefore, the potential bias induced by this restriction should not be a serious concern in our sample.

[5]Wave 2 is used to investigate the effect of friends' gender on school outcomes in the following academic year.

of friendship nominations within a school. Zero friends in the figure results from restricting friendships to the same school. The right panel of Figure 2 shows the distribution of the share of friendship nominations within a school. We see that almost 60% of the friends are from the same school. The frequency distributions of the numbers of both same-gender and opposite-gender friends are shown in Figure 3. The number of same-gender friends has an uptrend while the number of opposite-gender friends has a downtrend. More than 80% of the students do not have friends of the opposite sex.

Table 3 describes the descriptive statistics of the variables for the analysis sample. On average, a student has 3.3868 same-sex school friends and has 0.2593 opposite-sex school friends. The dependent variables considered are standardized midterm scores for three core subjects: Chinese, Mathematics and English, as well as the total score. Each score is standardized to have a mean of 70 and a standard deviation of 10, and the total score has a mean of 210.6265 and a standard deviation of 25.5769. Thanks to comprehensive information contained in the data, we are able to include a wide range of variables that may significantly impact friendship formation and academic outcomes at various levels, including individual, class and school levels.

With regard to individual characteristics, our covariates include grades, gender, ethnic identity, *hukou* status[6], parents' strictness with grades, whether the only child in the family, family socioeconomic status, highest years of schooling of parents, parents' strictness with grades, baseline cognitive ability and whether attended preschool. Grade 9 is an indicator for the 9th grade, it will be 1 if a student is in the 9th grade, and 0 if in the 7th grade. Gender is a binary variable with male denoting 1 and female meaning 0. About 50.72% of the sample are male students. The ethnic majority in China is the Han population, which makes up about 92% of the sample. The non-Han Chinese population are ethnic minorities in China. Survey respondents reported their *hukou* type at the time of the survey as agricultural or

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[6] *Hukou* system is a unique feature in China, which was introduced in 1958 as the only means of population registration. Each citizen is classified as agricultural or non-agricultural *hukou*. Accessing many public services, including compulsory education, is linked to household registration.

non-agricultural and whether their *hukou* is local or not. "Rural *hukou*" is a binary variable with 1 representing agricultural and 0 indicating non-agricultural *hukou*. 54.88% of the students are from rural areas according to the *hukou* system. "Local *hukou*" is a dummy variable with 1 denoting non-migrants and 0 meaning migrants. 82.34% of the students in our sample are local. We also include whether a respondent is the only child in the family. [7] In our sample, about 43.51% of the students are from the only-child family.

With regard to family socioeconomic status, students were asked to choose one of the five categories: very poor (3.70%), poor (17.23%), average (73.05%), rich (5.70%) and very rich (0.31%). Parents' strictness with grades is recoded into three categories including strict, care but not strict and not care, which enables the comparison of the average grade for each strictness level to that of the reference group of "not care". 47.25% of respondents' parents do care but are not strict with grades, and almost 50% of the parents are strict with their children's grades. Baseline cognitive ability is the standardized scores from the cognitive assessment. The number ranges from -2.0290 to 2.7099, with a lower number indicating worse performance. Attended preschool is a dummy variable indicating whether a student has ever attended a kindergarten/preschool. [8] In the sample, about 4 out of 5 students have attended kindergarten/preschool. For parents' education, we use the years of schooling completed (none = 0; elementary school = 6; junior high school = 9; vocational/high school = 12; junior college = 15; bachelor's degree = 16; master's or higher = 19).[9]

In addition, we also control a wide range of characteristics at the class and school levels. Specifically, the average class size is 48.4938 with a minimum of 9 and a maximum of 88. Class ranking is a categorical variable with 5 levels: among the worst, below average, average, above average and among the best. About 3.33% of classes are in the category of "among the worst", which is also the reference level. The other four categories are "below average",

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[7]Under the One-child Policy, a couple usually can only has one child in China. However, in certain areas, a second child is allowed (Ebenstein, 2010).

[8]China requires kindergartens to accept children aged 3-6. Some studies show that attending kindergarten program is beneficial to children's development (Lau and Li, 2018).

[9]We take the higher level of the parents' educational achievement for each student.

"average", "above average" and "among the best", consisting of 13.33%, 34.84%, 37.58% and 10.92% in the sample. Gong et al. (2019) shows that head teachers' gender plays an important role in students' performance. About 36.7% of the head teachers in our sample are male. On average, they are 37.2229 years old, with 15.6415 years of experience. Middle school students spend most of their time within the classroom. Therefore, we include the share of female students in a class as a control variable. The average proportion of girls in a class is 48.51%. Other peers' characteristics included in the class-level are the average proportion of non-immigrants (82.26%) and the average proportion of rural *hukou* (54.91%).

At the school level, although the number of private schools in China is growing, only 7.29% schools are private in our sample. Similar to class ranking, school ranking is an indicator of a school's quality, which consists of five levels as well: among the worst, below average, average, above average and among the best, accounting for 0.90%, 6.77%, 11.52%, 58.14% and 22.66% of the schools.

4   Empirical Strategy

Consider a reduced-form specification of an education production function given as:

$$y_{ics} = \alpha_0 + \alpha_1 \text{FSS}_{ics} + \alpha_2 \text{FOS}_{ics} + X'_{ics}\alpha_3 + C'_{cs}\alpha_4 + S'_s\alpha_5 + \alpha_{\text{county}} + \varepsilon_{ics}, \tag{1}$$

where y_{ics} is outcome of interest for student i in class c and school s, which refers to students' standardized scores in Chinese, Mathematics or English or the total score of the three core subjects. FSS_{ics} is the number of same-gender friends from the same school. It also ranges from 0 to 5. FOS_{ics} specifies the number of opposite-gender friends from the same school, ranging from 0 to 5. X_{ics} is a vector of observable variables for individual i, which include grade, gender, academic ranking in primary school, ethnic identity, *hukou* status, whether the only child in the family, family socioeconomic status, parents' education, parents' strictness with grades, baseline cognitive ability, and whether attended preschool/kindergarten, as

listed in Table 3. C_{sc} is a vector of observable class-level characteristics, such as class size, teacher experience, and the like. S_s is a vector of observable school-level characteristics, such as public or private, school ranking, and so on. α_{county} is county fixed effects. Standard errors are clustered at class level to account for potential correlation in outcomes for students in the same class.

The most challenging problem that plagues the empirical research on the effects of friends is endogeneity, induced by individuals selecting friends based on unobserved characteristics, including parental inputs, personality traits, noncognitive skills, among others. Suppose these unobserved factors also affect academic outcomes, for example, supportive parents may encourage participation in a wide range of extracurricular activities, resulting in more gender-balanced friendship groups, as well as greater academic achievement (Hill, 2015), OLS results may be biased.

An instrumental variable strategy allows the identification of causal relationships via an instrument that influences the independent variable but does not directly affect the outcome, except through its effect on the independent variable. The model can be estimated using the two-stage least squares (2SLS) estimator. The first stage equation is given by running an OLS regression for each of the endogenous variables, FSS and FOS, on all instrumental variables and exogenous variables:

$$\text{FSS}_{ics} = \eta_0 + \eta_1 Z_{ics} + X'_{ics}\eta_2 + C'_{cs}\eta_3 + S'_s\eta_4 + \eta_{\text{county}} + u_{ics}, \tag{2}$$

$$\text{FOS}_{ics} = \theta_0 + \theta_1 Z_{ics} + X'_{ics}\theta_2 + C'_{cs}\theta_3 + S'_s\theta_4 + \theta_{\text{county}} + v_{ics}, \tag{3}$$

where Z_{ics} denoting a vector of instruments for the gender composition in the friendship network for student i in class c and school s. The predicted FSS and FOS are then inserted into regression equation (1) to carry out a 2SLS estimation to identify the gender peer effects

on students' academic achievement. The second stage equation is given by:

$$y_{ics} = \alpha_0 + \alpha_1 \hat{\text{FOS}}_{ics} + \alpha_2 \hat{\text{FFS}}_{ics} + X'_{ics}\alpha_3 + C'_{cs}\alpha_4 + S'_s\alpha_5 + \alpha_{\text{county}} + \epsilon_{ics}. \qquad (4)$$

5 Results

In this section, we systematically examine the effects of having friends of the same gender and opposite gender on middle school students' academic achievement. As a starting point, we carry out the ordinary least squares (OLS) estimates after controlling the individual, class and school level characteristics, as well as the county fixed effect. Next, we deal with the endogenous friendships network formation with an instrumental variable (IV) strategy and quantify the causal effects of same-gender and opposite-gender school friends on students' academic achievement.

5.1 OLS results

Table 4 shows the OLS results from the baseline model, with each column representing a specific outcome. The coefficients on the number of opposite-gender friends are all positive and most are significant at the 1% or 10% level. The coefficients on the number of same-gender friends are positive and significant for English scores at the 1% level and the total score at the 10% level. Having an additional friend in the same school is associated with better performance in English and total scores regardless of the gender of the friend.

For the individual demographic characteristics, all estimated coefficients have the expected signs. Boys perform worse than girls academically, which is consistent with previous studies (Arnot et al., 1999; Rowe and Rowe, 2002; Van de gaer et al., 2004). Being the only kid in the family does not significantly affect Chinese grades, but improves the grades in the other two subjects and the total grades. With regard to household income, students from poor or average income family perform better than students from the reference group of very

poor income families in general. But students from very rich families perform much worse than all the other groups. Ethnicity does not appear to have a significant impact, while students with rural or non-local *hukou*, or attended kindergarten tend to have better grades on average. Parents' education level is also positively correlated with the academic achievement of a student. Students with parents strict with their grades perform better in Chinese, compared to students with parents not caring about their grades. But students with more moderate strict parents do not appear to benefit. Baseline cognitive ability also plays an important role: higher baseline cognitive ability is associated with better academic performance in middle school. In order to control for the possible confounding effects generated by various factors at different levels, we also incorporate class-level characteristics including the head teacher's gender, age and teaching experience and class size, class ranking, proportion of girls, local *hukou* and rural *hukou*; school-level characteristics including school ranking, private or public school as well as the county fixed effect all model specifications.

5.2   IV estimates

As discussed in Section 4, OLS estimators are likely to be biased due to the endogeneity of friendship formation. In order to identify the causal effect of friends' gender on academic outcomes, we need a set of instruments that are correlated with friendship network formation but are not directly associated with students' academic outcomes. We consider four instrumental variables: parents' strictness with friends making, the share of opposite gender schoolmates, school-level average number of same-gender friends and school-level average number of opposite-gender friends.

We rely on the variations within the county in the set of instrumental variables to obtain exogenous variations in the number of friends, both same gender and opposite gender. First, the gender composition of schoolmates is random as compulsory education in China is largely based on students' *hukou* registration. Therefore, it is not likely for parents to choose a school based on the gender ratio in the district. Second, friendship is a mutual relationship.

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Students in a school where most people make friends with the opposite gender are more likely to have more opposite-gender friends and vice versa. Last, parents are likely to influence their children's friendship networks through their reactions to the children's social behaviors, and the values they convey through their relationships with others (Rubin and Sloman, 1984).

We demonstrate the validity of the proposed instrumental variables in several steps. First, in the survey, students also answer "do your parents care and are they strict with you about your homework and exams", which we believe is directly related to students' academic outcomes. We include parents' strictness with grades in all models. Correlations between these eight strictness measures are listed in Table A.1 in the Appendix. It shows that the correlation between parents' strictness on homework and parents' strictness on friends' choice is low, suggesting that parental strictness on friendship networks captures a certain dimension of parents' strictness which is not likely to be directly related to students' academic performance. Second, if the assumption that the instrumental variables only influence the students' grades through making friends is correct, then the relationship between instrumental variables and outcomes should not exist for students who do not have school friends. We undertake this falsification test using a subset of data whose number of school friends is zero. [10] Table A.3 reports the reduced-form estimates of the relationship between parental strictness with making friends and the share of female schoolmates and four outcomes with county fixed effects only. As expected, the estimates are statistically insignificant. Third, from the first-stage results reported in Table A.4, where Column (1) presents the results of regressing the number of same-gender friends on the instruments along with other controls, Column (2) presents the results of regressing the number of opposite-gender friends on the instruments and other variables, we find that the proposed instrumental variables are significant, with the F statistics being 57.984 and 36.909, respectively. [11]

Table 3 also provides details on the instrumental variables. On average, the school-

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[10]We do not exclude students who do not nominate friends for the falsification test.

[11]As a robustness check, we also include other strictness measures in the analysis in Section 6. Furthermore, as demonstrated in Figure 4, the proposed instrumental variables exhibit considerable amount of variations.

level number of same-gender friends is 3.3755 while the number of opposite-gender friends is 0.2588. The average share of opposite-gender schoolmates is 0.4943. Similar to parents' strictness with grades, parents' strictness with friends has three levels. 18.98% of respondents' parents are "not care". 49.66% of respondents' parents do care but are not strict with grades, and 31.35% of the parents are strict with their children's decisions to make friends.

We report IV estimates for each of the academic performance in Table 5. Column (4) reveals that an additional same-gender friend reduces the standardized total score by 3.6113 points. Given the standard deviations for the number of same-gender friends and standardized total score are 1.5402 and 25.5760, respectively, the estimated coefficient of -3.6113 means that 1 standard deviation increase in the number of opposite-gender friends causes approximately one-fifth standard deviation decline in the standardized total score. Similarly, one additional same gender friend reduces Chinese, Mathematics and English by 1.0782, 1.2194 and 1.3629 points, which are about 0.1711, 0.1909 and 0.2135 of their standard deviation, respectively. At the same time, an additional opposite gender friend reduces standardized total score by 5.2456 points, indicating that 1 standard deviation increase in the number of opposite-gender friends causes 0.05 standard deviation decline in standardized total score. Similarly, one additional opposite gender friend reduces Chinese and English by 1.9793 and 2.4147 points, respectively, which are about 0.05 of their standard deviation as well. The effect on standardized Mathematics scores is not significant. The results are consistent with previous studies that the effects of peers are more strongly correlated with verbal or language test scores than with math test scores (Contini, 2013; Zimmerman, 2003). There are no significant changes in coefficients of the other covariates after instrumenting. Overall, the 2SLS estimations are consistently of the opposite sign of the OLS estimations, as well as being larger in magnitude. The OLS-IV difference confirms the importance of controlling for the endogeneity of group formation when estimating the effects of the friendship networks. The overidentification test statistics reported in the last row of Table 5 confirm the validity of our instrumental variables.

It is worth noting that we also include the share of girls in a class as a class level control variable, as many previous studies on gender peer effect use it as a measure of the peer group. Our results indicate that after controlling for the numbers of opposite gender and same-gender friends, the effect of girls share in a class is only significant for the math score, not for the other subjects or the total score, which is in sharp contrast with previous findings that more girls in a class benefit both boys and girls.[12]

6 Robustness Checks

In this section, we conduct several robustness checks to explore the sensitiveness of our results to alternative model specifications.

6.1 Alternative sample

Previous studies using CEPS data primarily focus on the subset of schools which randomly assign students into classes at the beginning of grade 7 and no further reassignment. Those schools which do not have random classes assignment are dropped out of the analysis. In contrast, in this paper, we exploit the instrumental strategy to deal with the endogeneity of friendship formation, and as a result, both schools with and without random classes assignment can be included in our analysis. To gauge the sensitivity of the results with respect to alternative sample construction, we conduct a robustness check using only the subsample of students from schools with random classes assignment. As a result, the sample size drops from 18,457 to 12,286. [13] As shown in Table 6, the results are consistent with the findings of the baseline model in Table 5 except for regressing the standardized math scores

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[12]For instance, Gong et al. (2019) finds that the effect of girls proportion in a class is positive and significant at the 1% level across all subjects.

[13]The survey anonymously asked school administrators and teachers questions about rules that how they replaced students into classrooms. First, the school administrators were asked which one of the following rules they used to assign students into classrooms at the beginning of grade 7. We keep schools with random assignment. Second, the principle confirmed that school will not rearrange the students in grade 8 or 9 into different classes.

on the number of same-gender friends. This may result from the smaller sample size.

6.2 Alternative friends

In this paper, we focus on the effects generated by school friends. However, as summarized in Table 2, students list not only their school friends, but also non-school friends in the survey. In this subsection, we evaluate the effect of having friends, including school friends and non-school friends, of the same and opposite sex on the academic outcomes. We estimate the baseline model with school friends replaced by the total numbers of same-sex friends and opposite-sex friends and report the results in Table 7. In all the specifications, having more friends has a negative and statistically significant impact on grades. These results are consistent with those of the baseline model in Table 5.

6.3 Additional controls

We additionally control for individuals' characteristics and the characteristics of friends. The results in Table 8 demonstrate that the baseline results are robust to the inclusion of additional control variables.

6.3.1 Friend gender or friend quality

One concern is that the gender peer effects could be confounded with spillover effects from peers' ability. In Figure 5, we plot the distribution of grades by gender with girls represented by the blue lines and boys by the red lines. Girls outperform boys in Chinese, English and the total scores, whereas girls and boys perform similarly in Mathematics. Therefore, for female students, having friends of the opposite gender implies that it is highly likely to have a friend with worse academic performance as male students tend to perform worse than female students. Consequently, the effects generated by friends' gender may capture the spillover of female students' academic ability and performance. In order to control for the academic ability of friends, we use a question in the students' questionnaire that "How many of your

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best friends mentioned above (up to 5) doing well in academic performance?". Students could circle one of the following three: "None of them", "One or two of them", "or Most of them"[14]. We extend the model to control for friends' quality and present the results in Column (2) of Table 8. We replicate the baseline IV results in Column (1) for comparison.

Consistent with our baseline results, the coefficients of the number of same-gender friends remain to be negative and statistically significant across all subjects and the total grade, the coefficients of the number of opposite-gender friends remain to be negative and statistically significant for math grade, suggesting that friends' gender impacts students' academic achievements, independent of friends' ability.

6.3.2   Other strictness measures

CEPS provides parents strictness measures in eight dimensions: grades, behaviors at school, school attendance, when to go home after school, making friends, daily clothing, using the Internet and watching TV. All strictness measures have three levels. "Not care" is assigned a value of 1, "Care but not strict" is assigned a value of 2, and "Strict" is assigned a value of 3. Among them, strictness with grades is already included in the model as it is expected to directly influence students' academic performance. Parents' strictness with friends making is used as one of the instruments and we have shown that it does not affect academic performance except indirectly through its impact on friendship networks. Now we add the rest six strictness measures to the model to probe the robustness of the results, as well as the impacts of these strictness measures on academic achievements. As shown in Column (3) in Table 8, the effects of the number of same-sex friends and the number of opposite-sex friends are quite robust, remaining to be negative and statistically significant, except for the effect of the number of the opposite sex friends on Mathematics.

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[14] "None of them" is assigned a value of 1. "One or two of them" is assigned a value of 2. "Most of them" is assigned a value of 3.

7 Heterogeneous Effects

In this section, we investigate whether and how the effects of having one additional same-gender and opposite-gender friend vary by grade level and gender.

7.1 Grade level

We first explore how the effects of friends' gender vary by grade level. CEPS covers two grade levels, i.e., Grade 7 and Grade 9, and the differences between the two cohorts arise from two aspects: age and familiarity with schoolmates. First, students in Grade 7 are younger and thus are more likely to be immature in friendship. Immature adolescents may get upset more easily. Second, students in Grade 7 are still in transit from primary school to middle school. Most classmates or schoolmates are new to them. However, students in Grade 9 have already had at least two years to be familiar with other people in the same school.

Panels A, B and C in Table 9 represent the results for seventh graders (2013-2014 academic year), seventh graders in the following academic year (2014-2015 academic year), and ninth graders (2013-2014 academic year) respectively.[15] For Grade 7 students (2013-2014 academic year), we find similar results as the baseline results but in larger magnitude. Specifically, having one more same-gender friend lowers the Chinese, math and English scores by 1.0782, 1.2194 and 3.6113 points respectively, whereas having one more opposite-gender friend lowers Chinese score by 1.9793 points and English score by 2.4147 points. Moreover, having an additional same-gender friend significantly lowers the total score by 3.6113 points. Having an additional opposite-gender friend significantly lowers the total score by 5.2456 points. Nevertheless, none of these effects of having an additional same-gender friend are found to be significant for Grade 7 students in the following academic year, as shown in Panel B. But the effects of having an additional opposite-gender friend are still significant

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[15]The main results in Table 5 are replicated in the top panel of Table 9 for comparison. The results on all coefficients are reported in Tables A.5 - A.7.

for Chinese, English and total scores. From Panel C of Table 9, we can see none of these effects are found to be significant for Grade 9.

The results provide evidence that the impacts of friends of different gender appear to be different for students of different ages. Younger students are more severely impacted by their friends. The results also suggest that the negative impacts of friends only occur when building friendships but not when maintaining friendships, especially for friends of the same gender.

7.2 Gender

As demonstrated in several studies (Richards et al., 1998), boys and girls have different development patterns and may experience heterogeneous impacts generated by friendship networks. From Figure 5, we can see that girls have better grades in Chinese, English and the total scores, but boys and girls tend to perform similarly in Mathematics.

Table 10 reports the heterogeneous effects of friends' gender on girls and boys.[16] We can see that the signs of the effects of friends' gender on girls do not differ from the baseline results, but the magnitudes are larger except for the effect of one additional same-sex friend on the Chinese score. Particularly, one additional male friend leads to a decrease of 2.3369 points in Chinese, 2.7144 points in English, and 6.6234 points in the total score for girls, compared to a decrease of 1.9793 in Chinese, 2.4147 in English, and 5.2456 in the total score with one additional opposite-gender friend in the whole sample. One additional female friend leads to a decrease of 0.8606 points in Chinese, 1.9118 points in Mathematics, 1.3908 points in English, and 4.1185 points in the total score for girls, compared to a decrease of 1.0782 in Chinese, 1.2194 in Mathematics, 1.3629 in English, and 3.6113 points in the total score with one additional same-gender friend in the whole sample. However, friends' gender does not appear to affect boys' academic performance. Therefore, it appears that female students are more vulnerable to friendships building and maintenance.

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[16]The main results in Table 5 are replicated in the top panel of Table 10 for comparison. The full sets of results are reported in Tables A.8 - A.9

8 Mechanisms

In this section, we investigate several possible channels through which friends' gender impacts students' grades. We consider hours students allocate on different activities, students' activities and behaviors, and how students feel about class and school environment. To study the channels through which having friends of the same and opposite gender might affect academic achievement, we estimate Equation (4) with the outcomes being possible mechanisms, i.e.,

$$m_{ics} = \gamma_0 + \gamma_1 \mathrm{F\hat{O}S}_{ics} + \gamma_2 \mathrm{F\hat{F}S}_{ics} + X'_{ics}\gamma_3 + C'_{cs}\gamma_4 + S'_s\gamma_5 + \gamma_{county} + r_{ics} \tag{5}$$

where m_{ics} are the possible mechanisms that are affected by friends' gender, which in turn impact academic performance. A significant estimate of γ_1 (γ_2) identifies the mechanism through which the number of same-/opposite-gender friends operates. We investigate several candidate mechanisms for m_{ics}, including hours students allocate on different activities, students' activities and behaviors, and how students feel about class and school environment. Table 11 provides the summary statistics of these potential mechanisms, and Table 12 summarizes the estimated results. [17]

8.1 Time allocation

Associating with friends affects the time use of a student (Stinebrickner and Stinebrickner, 2006). The information about how many hours students allocate to a certain activity is reported in the top panel of Table 11. Students were asked, "How much time on average did you spend on the following activities from Monday to Friday last week?" and "How much time on average did you spend on the following activities last weekend?" in the survey. We use hours per week as the measurement in our estimation by converting minutes to hours

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[17]The full sets of results are reported in Table A.10, Table A.11 and Table A.12.

and then times days. We trim values of hours following the IQR criterion. [18] Activities include doing homework assigned by teachers at school, doing homework assigned by parents, taking cram schools related to schoolwork, playing sports, reading (not including textbook), watching TV, surfing on the Internet and playing video games, and helping with housework. From Table 11, we can see that, for example, the average time spent on homework assigned by teachers at school is 16.4237 hours per week, and the average hours spent on helping with housework each week is 5.2040.

The first mechanism for the effects of making friends operate on academic performance can be described as follows: it takes time to build and maintain friendships, for instance, watching TV, surfing the Internet and playing games with friends, which crowds out other activities related to coursework and could negatively impact academic performance. From Panel A of Table 12, we can see that an additional same-gender friend leads to an increase of 0.7370 hours in watching TV and of 0.3675 hours in surfing the Internet and playing games. Moreover, an additional same-gender friend leads to a decline of 1.1379 hours in helping with housework. In addition, one more opposite-gender friend leads to a significant decrease of 3.1983 hours in doing homework assigned by teachers at school per week and a significant reduction of 1.3362 hours in playing sports. It also positively influences the hours spent on surfing the Internet and playing games; negatively influences the hours spent on helping with housework. But being popular with the opposite gender results in increased hours spent on reading, on average 1.0323 hours per week. There is no significant effect on the hours of doing homework assigned by parents and taking cram schools related to schoolwork.

8.2   Activities and behaviors

A second possible mechanism is that being popular tends to affect what activities or behaviors students perform after school. To measure the frequencies of activities student might do, we use the answers to the questions: "What hobbies do you have?", "How often do you

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[18]A data point is an outlier if it is more than 1.5×IQR above the third quartile or below the first quartile.

visit museums, zoos, science museums, etc., either alone or with your schoolmates?" and "How often do you go out to watch movies, shows, sports games, etc., either alone or with your schoolmates?". The hobbies include playing musical instruments, vocal or/and dance performance, Chinese calligraphy, drawing, chess, sports or others. The average number of hobbies in our sample is 1.6096, with a minimum value of 0 and a maximum value of 7. For the other two questions, we divide the frequencies into five categories, with never (1), once every year (2), every six months (3), every month (4), and more than once a month (5). The average number of visiting museums and zoos is 1.9293, while the mean number of watching movies and games is 2.2887 in the sample. We also take the answers to the question that asks each student if he/she often takes part in the class or school activities. The answers are categorized into: strongly disagree (1), some what disagree (2), somewhat agree (3), and strongly agree (4). The average value of the answers is 2.7546.

With respect to behaviors, we use two measures of misbehaviors in the class, one for the probability of being involved in a romantic relationship, as well as one for the sleeping time. Two questions in CEPS are asked students to rate how much they agree with, "I am often late for class." and "I often skip class.", on a scale from strongly disagree (1) to strongly agree (4). As the survey did not collect information about whether a student was in a romantic relationship, we use the answers to the question "How many of your best friends have had or are having a romantic relationship" as a proxy. Students could circle one of the following three: "None of them", "One or two of them" or, "Most of them". "None of them" is assigned a value of 1. "One or two of them" is assigned a value of 2. "Most of them" is assigned a value of 3. It implicitly assumes that a student is more likely to have a romantic relationship if more of his/her friends have had a romantic relationship. Regarding sleeping time, we use the self-reported sleeping time in hours per night. Students in the sample sleep for about 8 hours on average.

Being popular with friends, regardless of gender, increases the involvement with the activities together with friends listed in Columns (10) and (11) in Panel B of Table 12,

including visiting museums, zoos, science museums, etc. and going out to watch movies, shows, sports games, etc. However, being popular does not affect the number of hobbies. In particular, having an additional friend increases the frequency of visiting museums, zoos, science museums, etc. by 0.5171 if of the same gender, and by 0.1171 if of the opposite gender. And having one additional friend increases the frequency of watching movies, shows, sports games, etc. by 0.1816 if of the same gender, and by 0.6210 if of the opposite gender. Being popular with the opposite gender also increases the frequency of taking part in the class or school activities while being popular with the same gender does not.

With respect to behaviors, Columns (13) and (14) show that having more friends is not related to misbehaviors in the classroom. However, having more opposite-gender friends significantly increases the probability of being in a romantic relationship as shown in Column (15). Specifically, one additional opposite-gender friend raises the probability of being in a romantic relationship by 0.1648. At the same time, having one more opposite-gender friend decreases the sleeping time by 0.2415 hours.

8.3 Class and school environment

Feld and Zölitz (2017) discuss how peer composition affects students' feelings about the school environment. The bottom panel of Table 11 includes questions of how students feel in or about the class and school: "Most of my classmates are nice to me."; "I think I am easy to get along with."; "My class is in good atmosphere."; "I feel close to people in this school."; "I feel bored in this school."; "I hope that I could transfer to another school.". Each of these statements has four categories: strongly disagree (1), somewhat disagree (2), somewhat agree (3), and strongly agree (4). With an average number of about 3 for the first four questions with positive description and an average number of about 1.5 for the last two questions with negative description, indicating most students feel positive about school.

Panel C of Table 12 shows that being popular with the opposite gender does not necessarily impact how a student feels about the class and school. In contrast, being popular with

the same gender significantly impacts how a student feels about the class and school in all six aspects, which provides evidence why the negative impacts from same-sex friends are smaller than opposite-sex friends. Although building and maintaining friendships with both gender crowd out time that would be spent on coursework-related activities, being popular with the same gender improves students' feelings about school, which in turn positively impacts academic performance.

9   Conclusion

Gender peer effects on adolescents' academic outcomes have been extensively studied, mostly in the context of class, grade or school groups. Instead of measuring gender peer effects based on the gender proportion in a reference group, we use a nationally representative survey in China to evaluate the impacts of a student's same-gender and opposite-gender friends on his/her academic outcomes. The academic outcomes under exploration include the standardized scores of three core subjects that all middle school students are required to take in China as well as the total score based on them.

The nonrandom formation of friendship networks makes it difficult to fully assess the influence, as it is difficult to distinguish whether friends influence the academic outcomes, or whether students select friends who are similar to them in respect to grades. In order to deal with the endogeneity of friendship networks formation, we rely on the plausibly exogenous variations from the combination of parents' strictness on students' friendship networks, school-level numbers of same-gender and opposite-gender friends, and the share of opposite-gender schoolmates. Our IV estimates consistently show that being popular with the same gender and the opposite gender adversely influences students' academic performance, while the OLS estimates have the opposite signs in all specifications. The coefficients of being popular with the opposite gender are larger than those of being popular with the same gender. Having one more friend of the opposite gender does not impact math scores significantly. In

particular, the results indicate that having one more friend of the same gender decreases each subject (Chinese, math and English) by 1-1.5 points and the total score by 3.6113 points, while having one more friend of the opposite gender lowers Chinese and English scores, each by about 2 points and the total score by 5.2456 points. The results are robust against alternative model specifications. The heterogeneity effect analysis reveals that the students are less hurt by being popular as growing up. The effects are also insignificant for males.

The main avenue of the negative effects can be explained by the "crowding out effect of time". Given the fixed time students have, students who are more popular spend more time with friends on after-school activities, such as surfing the Internet, playing video games, etc. Popular students also have high frequencies to hang out with friends and are more active in class and school activities. Time spent on studying is crowded out by social interactions. Our heterogeneous results also suggest that building friendships is more time-consuming than maintaining friendships. Further research could be performed to investigate whether social interactions benefit a broader group of students academically in the following academic year as more follow-up data become available. Another important reason for the negative effects of being popular with the opposite gender could be the increased probability of being in a romantic relationship, which adversely influences academic performance. On the other hand, we find that being popular with the same gender improves the class and school environment and helps students develop good feelings about schools, which partially offsets the negative "crowding out effect". The identified mechanisms could be the underlying reason why the negative effects of opposite-gender friends are significantly larger than that generated by same-gender friends.

Our findings are of significant practical relevance, especially for parents, teachers and policymakers who seek to efficiently allocate the related resources to improve the academic performance of the students. It is worth noting that although the negative effects of making friend, especially with the opposite gender on academic achievement are identified in our sample of middle school students in China, it does not rule out the possibility that friends may

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generate positive effects for improving physical and/or mental health, boosting happiness, reducing stress, improving self-confidence and self-worth, helping cope with traumas, and the like. And the negative effects identified in this study may not carry over to other age groups and/or other samples.

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Table 1: Who will be the first one for you to turn to in the following situations?

	Schoolmates or friends	Parents	Relatives	Teachers	No one
Have a talk	16,130	2,158	212	81	813
	(83.17)	(11.13)	(1.09)	(0.42)	(4.19)
In trouble	8,106	9,013	277	1,103	846
	(41.90)	(46.59)	(1.43)	(5.70)	(4.37)
Need help	10,822	6,660	236	999	636
	(55.92)	(34.41)	(1.22)	(5.16)	(3.29)

Note: The data used is all students in the survey, not limited to the final sample. Percentage in parentheses.

Table 2: Frequency Distribution of Friends and School Friends

		Number of friends						
		0	1	2	3	4	5	
Number of school friends	0	522 (100.00)	129 (22.32)	112 (11.17)	88 (5.52)	46 (3.35)	492 (3.41)	1,389 (7.13)
	1		449 (77.68)	217 (21.64)	180 (11.29)	96 (6.99)	483 (3.35)	1,425 (7.31)
	2			674 (67.20)	335 (21.02)	177 (12.88)	983 (6.82)	2,169 (11.13)
	3				991 (62.17)	284 (20.67)	1,728 (11.99)	3,003 (15.41)
	4					771 (56.11)	2,595 (18.00)	3,366 (17.27)
	5						8,135 (56.43)	8,135 (41.75)
		522 (2.68)	578 (2.97)	1,003 (5.15)	1,594 (8.18)	1,374 (7.05)	14,416 (73.98)	19,487 (100.00)

Note: Students have no friends are excluded in the sample. Percentage in parentheses.

Table 3: Descriptive Statistics of Variables

	N	Mean	St. Dev.	Min	Max
School FSS	18,457	3.3868	1.5402	0	5
School FOS	18,457	0.2593	0.6506	0	5
Outcomes:					
Chinese	18,441	70.2265	9.7054	6.1645	98.4746
Mathematics	18,427	70.1514	9.8401	8.4217	145.1149
English	18,426	70.1941	9.8343	11.3495	107.8161
Total	18,386	210.6265	25.5760	55.4928	293.9303
Covariates:					
Grade 9	18,457	0.4683	0.4990	0	1
Male	18,457	0.5072	0.5000	0	1
Han	18,415	0.9157	0.2779	0	1
Rural Hukou	18,457	0.5488	0.4976	0	1
Local Hukou	18,457	0.8234	0.3814	0	1
Only child in the family	18,457	0.4351	0.4958	0	1
Family SES: poor	18,413	0.0370	0.1889	0	1
Family SES: somewhat poor	18,413	0.1723	0.3777	0	1
Family SES: moderate	18,413	0.7305	0.4437	0	1
Family SES: somewhat rich	18,413	0.0570	0.2318	0	1
Family SES: rich	18,413	0.0031	0.0560	0	1
Parental education	18,429	10.8478	3.0655	0	19
Parental strictness with grades: no	18,437	0.0280	0.1651	0	1
Parental strictness with grades: moderate	18,437	0.4725	0.4993	0	1
Parental strictness with grades: serious	18,437	0.4995	0.5000	0	1
Baseline cognitive ability	18,457	0.0196	0.8567	-2.0290	2.7099
Attended preschool	18,354	0.7991	0.4007	0	1
Covariates (class-level):					
Class size	18,457	48.4938	12.7627	9	88
Male (Head teacher)	18,457	0.3660	0.4817	0	1
Age (Head teacher)	18,292	37.2229	6.8115	19	60
Teaching experience (Head teacher)	17,968	15.6415	7.4784	0	38
% of girls	18,457	0.4851	0.0795	0.1111	0.7500
% of local Hukou	18,457	0.8226	0.2038	0	1
% of rural Hukou	18,457	0.5491	0.2901	0	1
Class rankings: among the worst	18,457	0.0333	0.1793	0	1
Class rankings: below average	18,457	0.1333	0.3399	0	1
Class rankings: average	18,457	0.3484	0.4765	0	1
Class rankings: above average	18,457	0.3758	0.4843	0	1
Class rankings: among the best	18,457	0.1092	0.3119	0	1

Table 3: Descriptive Statistics of Variables (cont'd)

Covariates (school-level):					
Private school	18,458	0.0729	0.2600	0	1
School rankings: among the worst	18,457	0.0090	0.0947	0	1
School rankings: below average	18,457	0.0677	0.2512	0	1
School rankings: average	18,457	0.1152	0.3193	0	1
School rankings: above average	18,457	0.5814	0.4933	0	1
School rankings: among the best	18,457	0.2266	0.4187	0	1
Instruments:					
School-level average school FSS	18,457	3.3755	0.3234	2.3125	4.0920
School-level average school FOS	18,457	0.2588	0.0889	0	0.5625
% of opposite gender schoolmates	18,457	0.4943	0.0540	0.2455	0.7545
Parents' strictness with friends: no	18,457	0.1898	0.3922	0	1
Parents' strictness with friends: moderate	18,457	0.4966	0.5000	0	1
Parents' strictness with friends: serious	18,457	0.3135	0.4639	0	1

Table 4: OLS Estimates of Friends on Grades

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	0.0678	0.0089	0.1596***	0.2339*
	(0.0525)	(0.0535)	(0.0512)	(0.1375)
School FOS	0.3400***	0.2171*	0.3593***	0.8944***
	(0.1131)	(0.1143)	(0.1141)	(0.2953)
Grade 9	−0.3015	−0.1971	−0.3895	−0.8805
	(0.2300)	(0.2501)	(0.2600)	(0.6493)
Male	−5.7654***	−1.1530***	−5.6508***	−12.5205***
	(0.1589)	(0.1627)	(0.1599)	(0.3945)
Han	−0.1991	−0.2439	−0.4671	−0.9209
	(0.4001)	(0.4189)	(0.3564)	(0.9969)
Rural hukou	0.3383*	0.5247***	0.0040	0.8493*
	(0.1735)	(0.1785)	(0.1692)	(0.4428)
Local hukou	−1.3075***	−0.9308***	−0.4671**	−2.6556***
	(0.2316)	(0.2184)	(0.2154)	(0.5672)
Only child in the family	0.2082	0.3701**	0.4866***	1.0487**
	(0.1819)	(0.1856)	(0.1686)	(0.4579)
Family SES: somewhat poor	1.0499**	0.7399*	0.3013	1.9550*
	(0.4112)	(0.4459)	(0.3938)	(1.0761)
Family SES: moderate	0.7880*	0.7012	0.3780	1.7380
	(0.4171)	(0.4546)	(0.4013)	(1.0977)
Family SES: somewhat rich	0.7978	0.1381	0.0157	0.8134
	(0.5057)	(0.5532)	(0.4863)	(1.3360)
Family SES: rich	−6.5557***	−5.4735***	−3.4499**	−15.0284***
	(2.0923)	(1.8350)	(1.7183)	(5.1706)
Parental education	0.2616***	0.2472***	0.2978***	0.8107***
	(0.0321)	(0.0321)	(0.0336)	(0.0854)
Parental strictness with grades: moderate	0.3302	−0.0460	−0.2460	−0.1000
	(0.5121)	(0.4564)	(0.4402)	(1.2188)
Parental strictness with grades: serious	1.0118**	0.5124	0.7208	2.0692*
	(0.5146)	(0.4677)	(0.4582)	(1.2485)
Baseline cognitive ability	3.8400***	5.0684***	4.0522***	12.9463***
	(0.1191)	(0.1348)	(0.1149)	(0.3352)
Attend preschool	0.5656***	0.7224***	0.3526*	1.6917***
	(0.1839)	(0.2028)	(0.1870)	(0.4926)
Observations	17,609	17,596	17,593	17,556
R^2	0.2062	0.1891	0.2123	0.2466
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 5: IV Estimates of Friends on Grades

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−1.0782***	−1.2194***	−1.3629***	−3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	−1.9793*	−0.8215	−2.4147**	−5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
Grade 9	−0.2805	0.0090	−0.3765*	−0.6628
	(0.2057)	(0.2121)	(0.2098)	(0.5369)
Male	−5.8353***	−1.1796***	−5.7387***	−12.7041***
	(0.1421)	(0.1458)	(0.1447)	(0.3695)
Han	−0.3381	−0.3809	−0.6313*	−1.3524
	(0.3464)	(0.3558)	(0.3528)	(0.9003)
Rural hukou	0.3256*	0.5178***	−0.0131	0.8145*
	(0.1731)	(0.1776)	(0.1760)	(0.4490)
Local hukou	−1.5414***	−1.1359***	−0.7506***	−3.3710***
	(0.2272)	(0.2329)	(0.2312)	(0.5891)
Only child in the family	0.3138*	0.4725***	0.6132***	1.3814***
	(0.1714)	(0.1759)	(0.1744)	(0.4449)
Family SES: somewhat poor	1.1000***	0.7664*	0.3736	2.1024**
	(0.3872)	(0.3972)	(0.3939)	(1.0080)
Family SES: moderate	0.8464**	0.7480**	0.4579	1.9167**
	(0.3691)	(0.3787)	(0.3755)	(0.9608)
Family SES: somewhat rich	0.7156	0.0841	−0.0753	0.5854
	(0.4627)	(0.4746)	(0.4707)	(1.2023)
Family SES: rich	−6.9001***	−5.5220***	−3.8480***	−15.8288***
	(1.2644)	(1.2852)	(1.2975)	(3.3070)
Parental education	0.2581***	0.2495***	0.2930***	0.8037***
	(0.0290)	(0.0298)	(0.0295)	(0.0754)
Parental strictness with grades: moderate	0.2083	−0.2468	−0.3699	−0.5480
	(0.4149)	(0.4241)	(0.4204)	(1.0758)
Parental strictness with grades: serious	0.7861*	0.1932	0.4701	1.2764
	(0.4225)	(0.4316)	(0.4278)	(1.0952)
Baseline cognitive ability	3.7998***	5.0433***	4.0038***	12.8312***
	(0.0903)	(0.0927)	(0.0918)	(0.2343)
Attend preschool	0.5237***	0.6653***	0.3044*	1.5503***
	(0.1749)	(0.1795)	(0.1779)	(0.4539)
Observations	17,609	17,596	17,593	17,556
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓
Diagnostics				
First-stage F statistic	57.984	57.984	57.984	57.984
	36.909	36.909	36.909	36.909
Sargan test	2.582	3.544	0.238	0.809

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 6: Robustness Checks: IV Estimates of Friends on Grades using Random Assignment Schools

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−1.3255**	−0.4720	−1.4828**	−3.1712**
	(0.6351)	(0.5713)	(0.6105)	(1.4894)
School FOS	-4.1998**	0.3980	-2.9107*	-6.9505*
	(1.7636)	(1.5761)	(1.7225)	(4.2039)
Grade 9	−0.9280*	0.4112	−0.5482	−1.0540
	(0.4908)	(0.4411)	(0.4753)	(1.1677)
Male	−5.9100***	−1.0137***	−5.7324***	−12.5983***
	(0.2724)	(0.2436)	(0.2637)	(0.6438)
Han	−0.8868*	−0.4754	−1.0602**	−2.3302**
	(0.4862)	(0.4356)	(0.4667)	(1.1383)
Rural hukou	0.1962	0.4648**	−0.1712	0.5150
	(0.2529)	(0.2260)	(0.2427)	(0.5915)
Local hukou	−2.0266***	−0.7876**	−1.2530***	−3.9421***
	(0.4353)	(0.3885)	(0.4187)	(1.0188)
Only child in the family	0.5270*	0.4334*	1.0024***	1.9651***
	(0.2719)	(0.2421)	(0.2592)	(0.6333)
Family SES: somewhat poor	0.8236	0.0917	−0.3146	0.5694
	(0.6157)	(0.5484)	(0.5893)	(1.4364)
Family SES: moderate	0.9420	0.3242	0.0333	1.2484
	(0.5817)	(0.5182)	(0.5575)	(1.3593)
Family SES: somewhat rich	0.7142	0.0251	−0.3819	0.3206
	(0.7317)	(0.6518)	(0.7011)	(1.7090)
Family SES: rich	−8.4533***	−6.8651***	−4.1546**	−18.3230***
	(1.9812)	(1.7667)	(1.9187)	(4.6735)
Parental education	0.2280***	0.3057***	0.3083***	0.8481***
	(0.0479)	(0.0427)	(0.0462)	(0.1125)
Parental strictness with grades: moderate	0.0225	−0.7957	−0.3645	−1.1852
	(0.6090)	(0.5404)	(0.5823)	(1.4274)
Parental strictness with grades: serious	0.1554	−0.4580	0.0615	−0.2764
	(0.6495)	(0.5759)	(0.6185)	(1.5219)
Baseline cognitive ability	3.5716***	4.9346***	3.9300***	12.4335***
	(0.1507)	(0.1345)	(0.1456)	(0.3559)
Attend preschool	0.4861*	0.8103***	0.2683	1.6095***
	(0.2626)	(0.2339)	(0.2515)	(0.6128)
Observations	11,700	11,696	11,697	11,676
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 7: Robustness Checks: IV Estimates of All Friends on Grades

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
FSS	−2.0401***	−1.7599***	−2.5320***	−6.2869***
	(0.6811)	(0.6824)	(0.7227)	(1.8222)
FOS	−2.3336***	−1.5608*	−2.8984***	−6.7976***
	(0.8454)	(0.8533)	(0.9061)	(2.2826)
Grade 9	0.0745	0.3017	0.0621	0.4140
	(0.2823)	(0.2836)	(0.3005)	(0.7597)
Male	−5.7015***	−1.0863***	−5.5727***	−12.3043***
	(0.1484)	(0.1484)	(0.1575)	(0.3979)
Han	−0.1593	−0.2104	−0.3879	−0.7569
	(0.3715)	(0.3719)	(0.3952)	(0.9969)
Rural hukou	0.2841	0.4869***	−0.0597	0.7139
	(0.1879)	(0.1878)	(0.1993)	(0.5024)
Local hukou	−1.3588***	−0.9640***	−0.5172**	−2.7695***
	(0.2305)	(0.2303)	(0.2445)	(0.6160)
Only child in the family	0.2777	0.4276**	0.5726***	1.2855***
	(0.1834)	(0.1837)	(0.1949)	(0.4927)
Family SES: somewhat poor	0.6504	0.4047	−0.1878	0.7235
	(0.4375)	(0.4359)	(0.4637)	(1.1739)
Family SES: moderate	0.3563	0.3449	−0.1532	0.4021
	(0.4228)	(0.4202)	(0.4479)	(1.1345)
Family SES: somewhat rich	−0.1414	−0.5793	−1.1387*	−1.9993
	(0.5892)	(0.5854)	(0.6246)	(1.5770)
Family SES: rich	−7.6752***	−6.1080***	−4.8165***	−18.1762***
	(1.4185)	(1.4004)	(1.5169)	(3.8241)
Parental education	0.2267***	0.2247***	0.2520***	0.7082***
	(0.0340)	(0.0342)	(0.0363)	(0.0913)
Parental strictness with grades: moderate	−0.1616	−0.5545	−0.7798	−1.6203
	(0.4942)	(0.4875)	(0.5165)	(1.3137)
Parental strictness with grades: serious	0.2081	−0.2542	−0.1922	−0.3896
	(0.5400)	(0.5305)	(0.5621)	(1.4306)
Baseline cognitive ability	3.6813***	4.9500***	3.8556***	12.4777***
	(0.1104)	(0.1103)	(0.1173)	(0.2951)
Attend preschool	0.2691	0.4649**	−0.0114	0.7887
	(0.2133)	(0.2126)	(0.2263)	(0.5693)
Observations	17,609	17,596	17,593	17,556
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 8: Robustness Checks: Additional Controls

	(1)	(2)	(3)
	Panel A: Chinese		
School FSS	−1.0782***	-1.1266***	-1.0925***
	(0.3556)	(0.3544)	(0.3587)
School FOS	−1.9793*	-2.0074*	-2.0974**
	(1.0335)	(1.0284)	(1.0526)
	Panel B: Mathematics		
School FSS	−1.2194***	-1.2725***	-1.2599***
	(0.3661)	(0.3649)	(0.3690)
School FOS	−0.8215	-0.9090	-1.2222
	(1.0637)	(1.0580)	(1.0823)
	Panel C: English		
School FSS	−1.3629***	-1.4093***	-1.3377***
	(0.3613)	(0.3605)	(0.3643)
School FOS	−2.4147**	-2.3926**	-2.6003**
	(1.0586)	(1.0549)	(1.0772)
	Panel D: Total		
School FSS	−3.6113***	-3.7557***	-3.6363***
	(0.9218)	(0.9182)	(0.9296)
School FOS	−5.2456*	-5.3622**	-5.9344**
	(2.7056)	(2.6909)	(2.7550)
	Other controls		
Individual controls	✓	✓	✓
Class and school controls	✓	✓	✓
County FE	✓	✓	✓
Friends' academic performance		✓	
Other parents' strictness measurements			✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 9: IV Estimates of Friends on Grades by Grade Level

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
	Main results			
School FSS	−1.0782***	−1.2194***	−1.3629***	−3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	−1.9793*	−0.8215	−2.4147**	−5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
	Panel A: 7th grade 2013−2014			
School FSS	−1.4051***	−1.6849***	−1.8462***	−4.9435***
	(0.5003)	(0.5115)	(0.5178)	(1.2974)
School FOS	−4.4722**	−0.8602	−5.5711***	−10.8607**
	(1.8412)	(1.8898)	(1.9266)	(4.8671)
Observations	9,318	9,314	9,316	9,298
	Panel B: 7th grade 2014−2015			
School FSS	2.1406	2.0985	1.0564	5.4404
	(1.3252)	(1.6703)	(1.4309)	(3.3909)
School FOS	−5.0320***	2.7513	−3.5014*	−8.0410*
	(1.7195)	(2.1665)	(1.8469)	(4.3745)
Observations	8,702	8,704	8,694	8,693
	Panel C: 9th grade 2013−2014			
School FSS	−0.5776	−0.6023	−0.4521	−1.5435
	(0.5735)	(0.5849)	(0.5787)	(1.4772)
School FOS	−0.2232	0.6422	0.4234	0.6450
	(1.3729)	(1.3867)	(1.3859)	(3.5270)
Observations	8,291	8,282	8,277	8,258
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 10: IV Estimates of Friends on Grades by Gender

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
	Main results			
School FSS	−1.0782***	−1.2194***	−1.3629***	−3.6113***
	(0.3556)	(0.3661)	(0.3613)	(0.9218)
School FOS	−1.9793*	−0.8215	−2.4147**	−5.2456*
	(1.0335)	(1.0637)	(1.0586)	(2.7056)
	Panel A: Females			
School FSS	−0.8606**	−1.9118***	−1.3908***	−4.1185***
	(0.4369)	(0.4991)	(0.4510)	(1.1749)
School FOS	−2.3369**	-1.3217	−2.7144**	−6.6234**
	(1.1771)	(1.3431)	(1.2228)	(3.1847)
Observations	8,707	8,703	8,702	8,692
	Panel B: Males			
School FSS	−0.9334	−0.2798	−0.7889	−1.8571
	(0.5756)	(0.5543)	(0.5742)	(1.4485)
School FOS	-1.1992	-0.0068	-1.6545	-3.0099
	(2.0050)	(1.9299)	(2.0197)	(5.1129)
Observations	8,902	8,893	8,891	8,864
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 11: Descriptive Statistics of How Time is Used

	N	Mean	St. Dev.	Min	Max
Time allocation:					
School assignments	16,472	16.4237	9.1297	0	51.0000
Extra assignments	15,015	2.9421	4.3559	0	19.8333
Cram schools	13,767	0.4529	1.2751	0	8.6667
Sports	15,459	4.2886	4.1226	0	19.8333
Reading (not textbooks)	16,260	5.9795	4.7364	0	23.8333
Watching TV	15,602	5.4000	4.8031	0	25.2333
Internet and video games	16,198	3.6361	4.4778	0	26.2500
Housework	15,792	5.2040	4.5413	0	24.8167
Activities and behaviors:					
Number of hobbies	18,415	1.6096	1.1279	0	7
Museums and zoos (friends)	17,908	1.9293	1.0242	1	5
Movies, games and shows (friends)	17,863	2.2887	1.2686	1	5
Join in class/school activities	18,338	2.7546	1.0126	1	4
Late for classes	18,414	1.2489	0.6136	1	4
Absence from Class	18,408	1.0878	0.4211	1	4
Romantic relationship	18,306	1.2375	0.4909	1	3
Sleeping time	18,031	7.9817	1.2376	4	12.9333
Class and school environment:					
Nice classmates	18,350	3.2747	0.7969	1	4
Easy to get along with classmates	18,355	3.1748	0.8340	1	4
Good class atmosphere	18,330	3.1404	0.8717	1	4
Close to people in school	18,216	2.9406	0.9211	1	4
Bored of school	18,267	1.6668	0.8644	1	4
Desire to transfer	18,376	1.5058	0.8662	1	4

Table 12: Mechanisms

Panel A: Time allocation

	SCH ASGMT (1)	Extra ASGMT (2)	Crams (3)	Sports (4)	Reading (5)	TV (6)	INET & Games (7)	Housework (8)
School FSS	−0.3463	−0.3069	0.0208	−0.1675	0.0966	0.7370***	0.3675*	−1.1379***
	(0.3659)	(0.1899)	(0.0566)	(0.1786)	(0.1970)	(0.2081)	(0.1916)	(0.2078)
School FOS	−3.1983***	−0.0389	−0.0215	−1.3362**	1.0323*	0.6670	1.2510**	−2.3730***
	(1.1309)	(0.5454)	(0.1656)	(0.5719)	(0.5885)	(0.6280)	(0.5565)	(0.6119)
Observations	15,761	14,337	13,107	14,782	15,553	14,920	15,491	15,122

Panel B: Activities and behaviors

	Hobbies (9)	Mus & Zoo (10)	Shows (11)	CLS AV (12)	Late (13)	Absence (14)	RR (15)	Sleeping (16)
School FSS	0.0562	0.1171***	0.1816***	0.0276	−0.0390	0.0273	−0.0325	−0.2415***
	(0.0442)	(0.0394)	(0.0496)	(0.0391)	(0.0243)	(0.0168)	(0.0200)	(0.0457)
School FOS	−0.1794	0.5171***	0.6210***	0.2965***	0.0503	0.0120	0.1648***	−0.0020
	(0.1290)	(0.1212)	(0.1512)	(0.1125)	(0.0705)	(0.0485)	(0.0571)	(0.1352)
Observations	17,589	17,119	17,074	17,516	17,588	17,582	17,481	17,238

Panel C: Class and school environment

	Classmates (17)	Easy to get to (18)	Atmosphere (19)	Close (20)	Bored (21)	Transfer (22)
School FSS	0.0751**	0.0975***	0.1835***	0.1866***	−0.1325***	−0.1159***
	(0.0313)	(0.0330)	(0.0348)	(0.0363)	(0.0344)	(0.0343)
School FOS	−0.0826	0.0431	−0.0917	0.1180	0.1500	0.1608
	(0.0913)	(0.0954)	(0.1007)	(0.1029)	(0.0987)	(0.0991)
Observations	17,528	17,532	17,511	17,400	17,446	17,551

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.
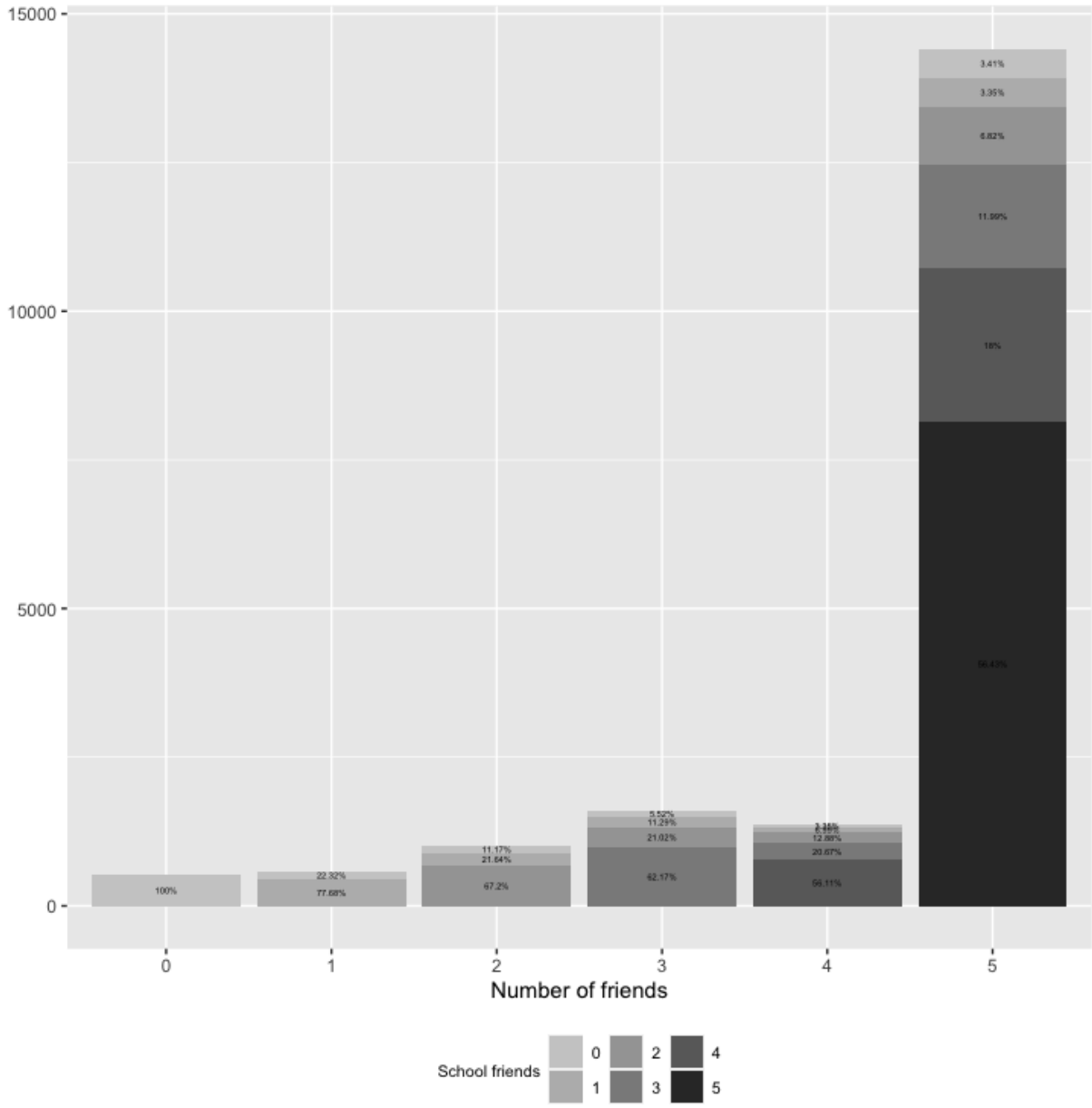
Figure 1: How Many Friends are from the Same School
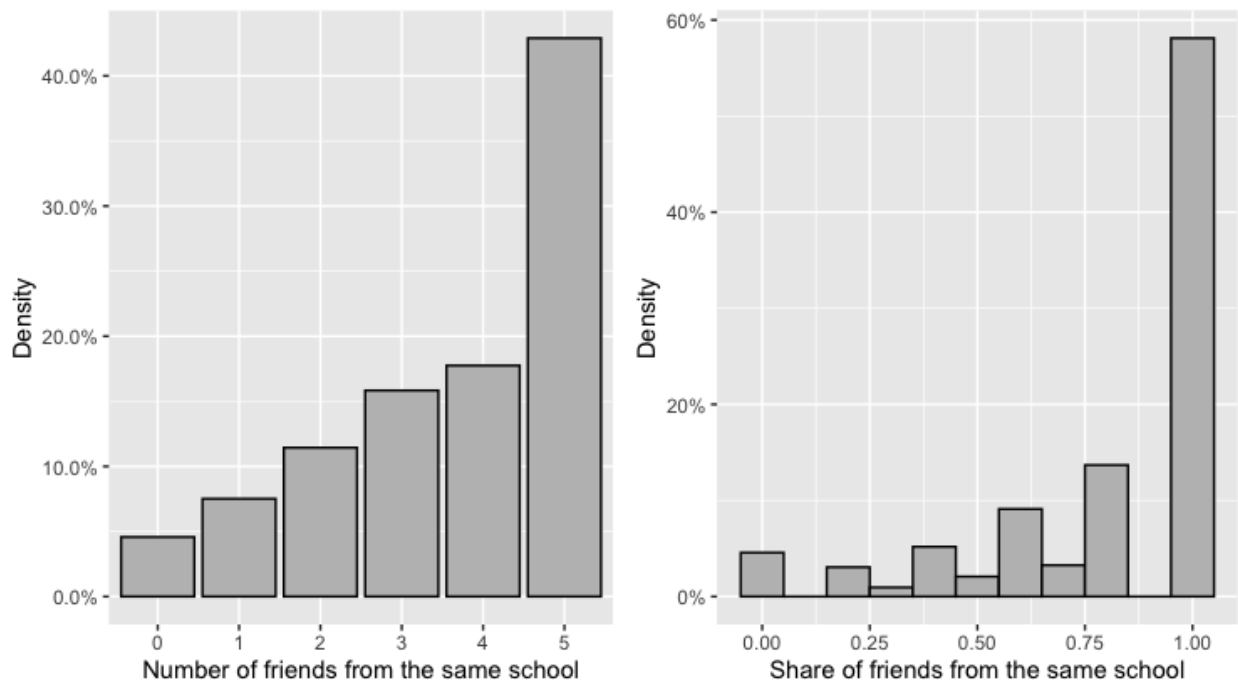
Figure 2: Distribution by School Friends
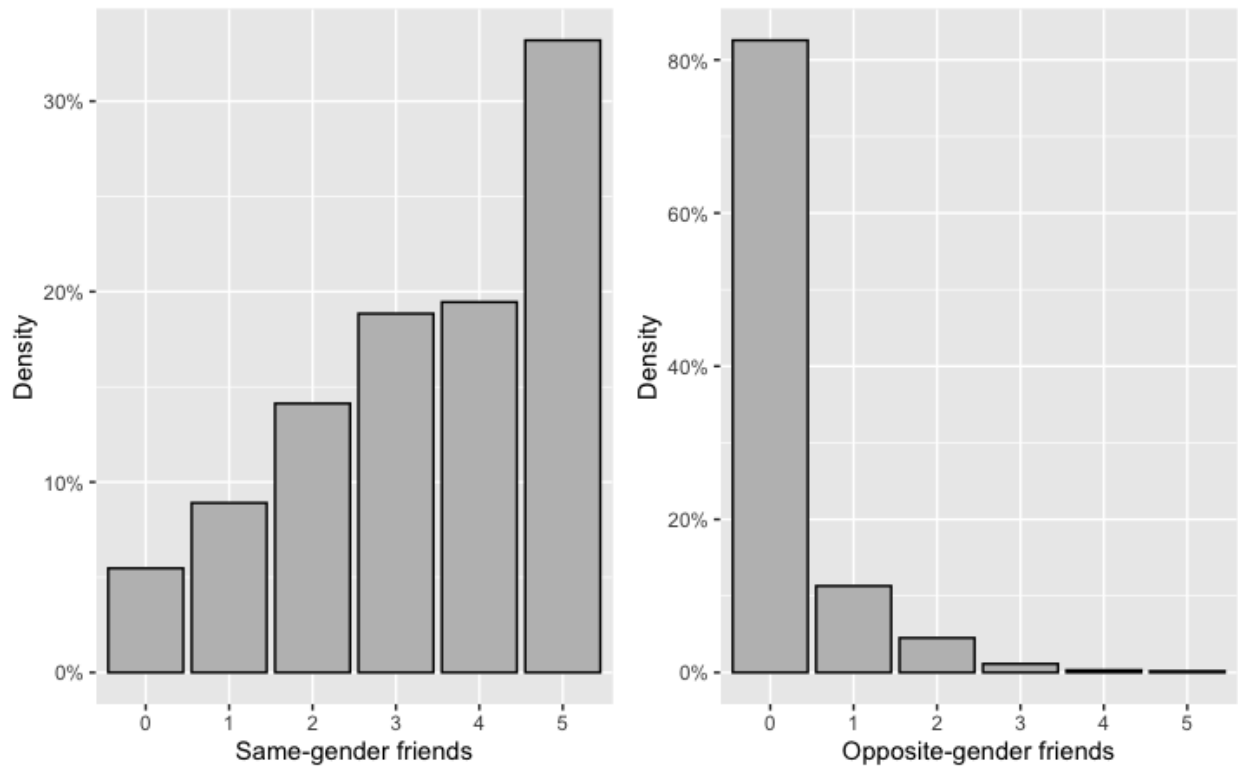
Figure 3: Distribution of the Same Gender and the Opposite Gender School Friends
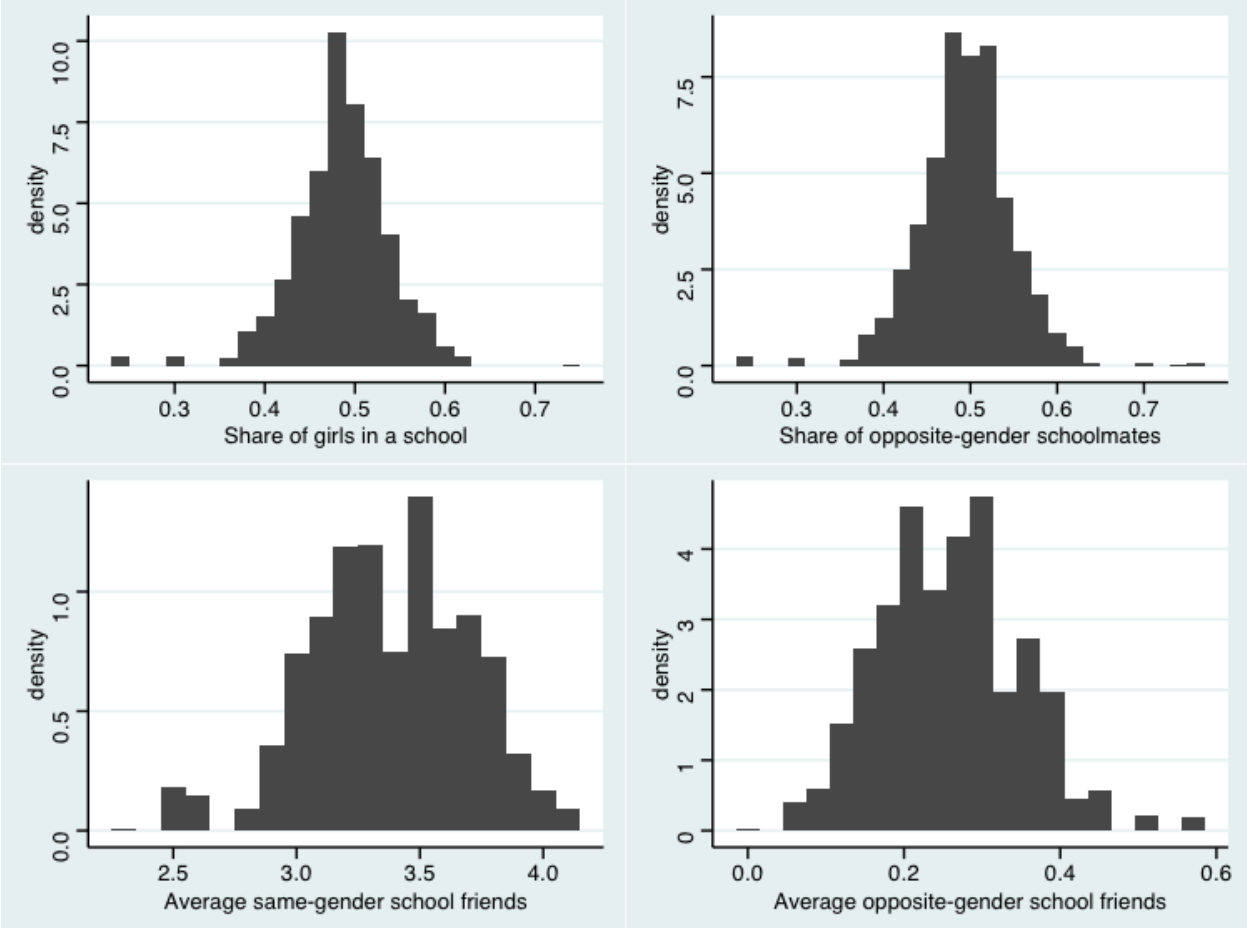
Figure 4: Distribution of Variables used as Instruments
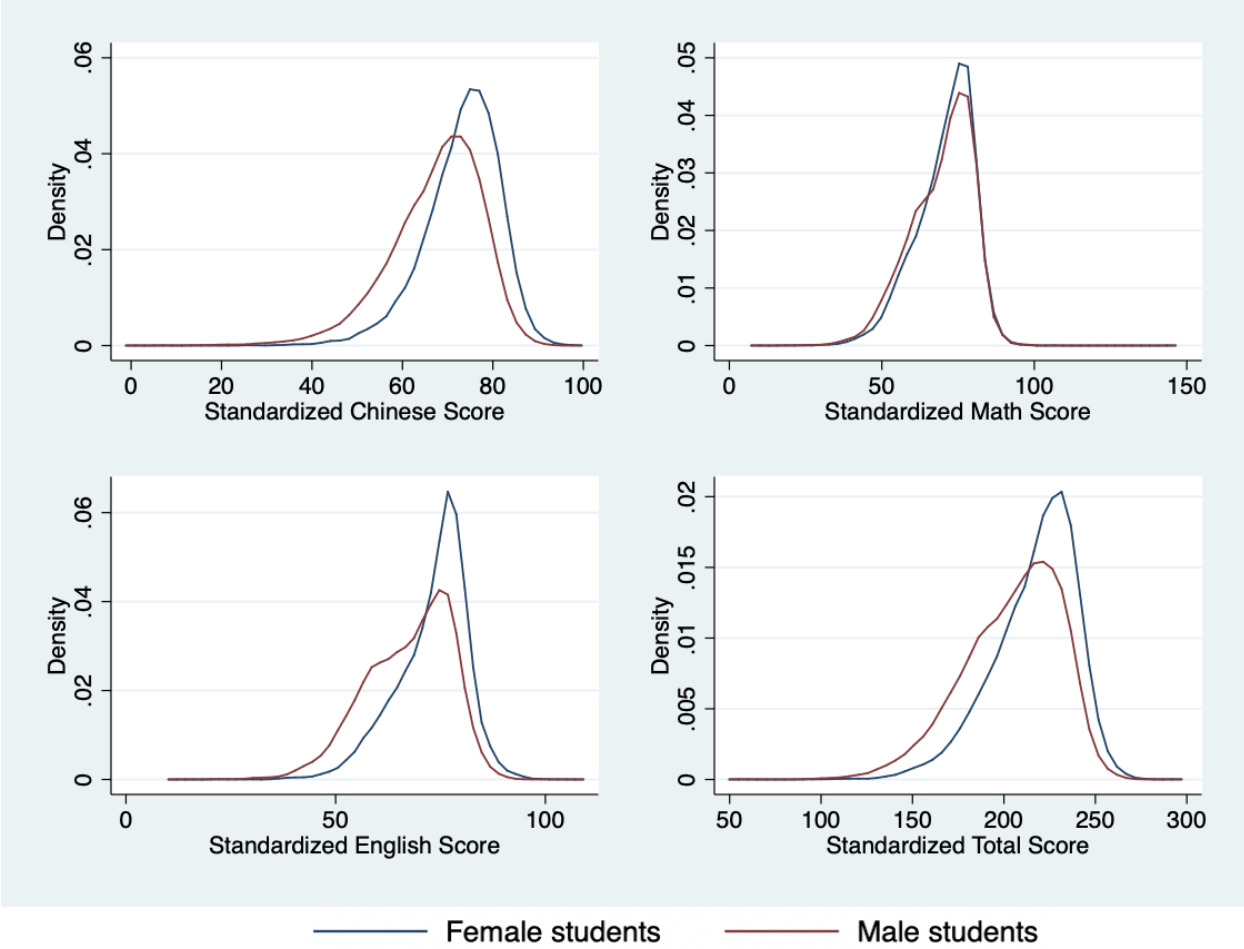
Figure 5: Distribution of Standardized Scores by Gender

Appendix

Table A.1: Correlations Between Parents' Strictness

	Grades	Behaviors	Attendances	Go home	Friends	Clothing	Internet	TV
Grades	1							
Behaviors	0.456	1						
Attendances	0.298	0.381	1					
Go home	0.260	0.307	0.450	1				
Friends	**0.226**	0.284	0.253	0.378	1			
Clothing	0.216	0.264	0.260	0.300	0.403	1		
Internet	0.291	0.258	0.217	0.234	0.223	0.277	1	
TV	0.301	0.245	0.203	0.228	0.234	0.281	0.538	1

Table A.2: Descriptive Statistics of Variables using Random Assignment Schools

	N	Mean	St. Dev.	Min	Max
School FSS	12,286	3.3599	1.5357	0	5
School FOS	12,286	0.2744	0.6640	0	5
Outcomes:					
Chinese	12,276	70.2524	9.7087	6.1645	98.4746
Mathematics	12,271	70.1664	9.8341	17.5113	145.1149
English	12,273	70.2163	9.8379	18.0814	107.8161
Total	12,251	210.6701	25.5583	68.6015	293.9303
Covariates:					
Grade 9	12,286	0.4607	0.4985	0	1
Male	12,286	0.5090	0.4999	0	1
Han	12,255	0.8873	0.3162	0	1
Rural Hukou	12,286	0.4974	0.5000	0	1
Local Hukou	12,286	0.8056	0.3957	0	1
Only child in the family	12,286	0.4581	0.4983	0	1
Family SES: poor	12,252	0.0316	0.1749	0	1
Family SES: somewhat poor	12,252	0.1513	0.3584	0	1
Family SES: moderate	12,252	0.7529	0.4313	0	1
Family SES: somewhat rich	12,252	0.0611	0.2396	0	1
Family SES: rich	12,252	0.0030	0.0549	0	1
Parental education	12,262	11.0025	3.1878	0	19
Parental strictness with grades: no	12,271	0.0301	0.1708	0	1
Parental strictness with grades: moderate	12,271	0.4643	0.4987	0	1
Parental strictness with grades: serious	12,271	0.5057	0.5000	0	1
Baseline cognitive ability	12,286	0.0426	0.8792	-2.0290	2.7099
Attended preschool	12,203	0.8109	0.3916	0	1
Covariates (class-level):					
Class size	12,286	47.6837	13.7730	9	88
Male (Head teacher)	12,286	0.3637	0.4811	0	1
Age (Head teacher)	12,170	37.3448	7.0234	19	60
Teaching experience (Head teacher)	11,958	15.6320	7.6383	1	38
% of girls	12,286	0.4830	0.0832	0.1111	0.7500
% of local Hukou	12,286	0.8034	0.2088	0.0400	1
% of rural Hukou	12,286	0.4990	0.2925	0	1
Class rankings: among the worst	12,286	0.0406	0.1974	0	1
Class rankings: below average	12,286	0.1561	0.3630	0	1
Class rankings: average	12,286	0.3240	0.4680	0	1
Class rankings: above average	12,286	0.3684	0.4824	0	1
Class rankings: among the best	12,286	0.1109	0.3140	0	1

Table A.2: Descriptive Statistics of Variables using Random Assignment Schools (cont'd)

Covariates (school-level):					
Private school	12,286	0.0739	0.2616	0	1
School rankings: below average[19]	12,286	0.0575	0.2327	0	1
School rankings: average	12,286	0.1192	0.3241	0	1
School rankings: above average	12,286	0.5555	0.4969	0	1
School rankings: among the best	12,286	0.2678	0.4428	0	1
Instruments:					
School-level average school FSS	12,286	3.3508	0.3173	2.3125	4.0920
School-level average school FOS	12,286	0.2737	0.0862	0	0.5625
% of opposite gender schoolmates	12,286	0.4933	0.0585	0.2455	0.7545
Parents' strictness with friends: no	12,286	0.1772	0.3818	0	1
Parents' strictness with friends: moderate	12,286	0.5029	0.5000	0	1
Parents' strictness with friends: serious	12,286	0.3199	0.4664	0	1

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[19]Schools with the worst rankings are dropped in the sample.

Table A.3: Falsification Tests

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
Parental strictness with friends: moderate	2.6344	0.7204	1.1991	4.8979
	(1.6908)	(1.4630)	(1.2575)	(4.0305)
Parental strictness with friends:	1.1870	0.1505	0.6570	2.2237
	(1.7417)	(1.6073)	(1.4178)	(4.2442)
Class % of girls	16.0249	12.4665	11.2655	40.1467
	(11.1014)	(9.4784)	(9.4806)	(28.3174)
Class % of local Hukou	18.6462**	15.7995**	4.8539	37.8488*
	(9.2043)	(7.4209)	(6.8217)	(21.0985)
Class % of rural Hukou	−2.1263	2.0605	−6.0331	−5.8029
	(8.6464)	(7.7702)	(6.5093)	(21.3662)
School % of girls	−16.0479	−8.3235	3.9445	−21.7842
	(22.5676)	(16.7072)	(16.1319)	(49.9822)
School % of local Hukou	−18.2737	−16.2551*	−6.8816	−38.6757
	(11.8499)	(9.7755)	(8.5499)	(27.5748)
School % of rural Hukou	1.9142	−0.5291	6.4681	8.3285
	(9.5865)	(8.8919)	(7.0518)	(23.6205)
Observations	459	462	463	458
R^2	0.0864	0.0915	0.0984	0.0951
Individual controls:	no	no	no	no
Class and school controls	no	no	no	no
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.4: First-Stage Estimation

	Number of FSS (1)	Number of FOS (2)
School-level average school FSS	1.0156***	0.0143
	(0.0707)	(0.0330)
School-level average school FOS	-0.0244	1.0353***
	(0.2387)	(0.1-36)
% of opposite gender schoolmates	-0.8211***	0.4181***
	(0.2264)	(0.0983)
Parents' strictness with friends: moderate	0.0588*	0.0034
	(0.0331)	(0.0135)
Parents' strictness with friends: serious	0.0297	-0.0379***
	(0.0354)	(0.0147)
Grade 9	-0.2093***	0.1278***
	(0.0285)	(0.0123)
Male	-0.0225	0.0563***
	(0.0272)	(0.0108)
Han	0.1117*	0.0257
	(0.0621)	(0.0244)
Rural Hukou	0.0071	0.0056
	(0.0283)	(0.0118)
Local Hukou	0.1416***	0.0536***
	(0.0381)	(0.0156)
Only child in the family	-0.0705**	-0.0147
	(0.0289)	(0.0121)
Family SES: somewhat poor	0.0056	-0.0285
	(0.0675)	(0.0293)
Family SES: moderate	-0.0064	-0.0161
	(0.0662)	(0.0288)
Family SES: somewhat rich	0.0542	0.0362
	(0.0809)	(0.0384)
Family SES: rich	-0.0849	0.2280**
	(0.2074)	(0.1155)
Parental education	-0.0038	0.0041 *
	(0.0055)	(0.0022)
Parental strictness with grades: moderate	0.1890**	-0.0547*
	(0.0755)	(0.0317)
Parental strictness with grades: serious	0.2843***	-0.0539*
	(0.0761)	(0.0318)
Baseline cognitive ability	0.0299*	0.0188***
	(0.0164)	(0.0069)
Attend preschool	0.0675**	-0.0032
	(0.0298)	(0.0137)
Observations	17,624	17,624
F statistic	57.984	36.909
	(0.000)	(0.000)

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.5: IV Estimates of Friends on Grades (7th Grade)

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−1.4051***	−1.6849***	−1.8462***	−4.9435***
	(0.5003)	(0.5115)	(0.5178)	(1.2974)
School FOS	−4.4722**	−0.8602	−5.5711***	−10.8607**
	(1.8412)	(1.8898)	(1.9266)	(4.8671)
Male	−5.9245***	−1.2599***	−5.8277***	−12.9464***
	(0.1951)	(0.1993)	(0.2026)	(0.5087)
Han	−0.6534	−0.7267	−0.6858	−2.0747*
	(0.4724)	(0.4831)	(0.4902)	(1.2298)
Rural hukou	0.1362	0.4513*	−0.2091	0.3445
	(0.2380)	(0.2432)	(0.2465)	(0.6186)
Local hukou	−1.6061***	−1.2240***	−0.8828***	−3.6519***
	(0.3102)	(0.3165)	(0.3214)	(0.8052)
Only child in the family	0.5432**	0.6005**	0.8151***	1.9283***
	(0.2359)	(0.2411)	(0.2446)	(0.6130)
Family SES: somewhat poor	1.5966***	1.0960**	1.0305*	3.6173***
	(0.5332)	(0.5454)	(0.5513)	(1.3920)
Family SES: moderate	1.1200**	1.1275**	1.2618**	3.3926**
	(0.5098)	(0.5214)	(0.5263)	(1.3297)
Family SES: somewhat rich	0.7624	−0.0224	0.3092	0.9085
	(0.6466)	(0.6605)	(0.6685)	(1.6820)
Family SES: rich	−5.9175***	−5.1001***	−2.7805	−12.9518***
	(1.6161)	(1.6279)	(1.6969)	(4.2532)
Parental education	0.1961***	0.2177***	0.2131***	0.6314***
	(0.0418)	(0.0428)	(0.0434)	(0.1089)
Parental strictness with grades: moderate	1.7014***	0.3213	0.3999	2.0461
	(0.6377)	(0.6459)	(0.6552)	(1.6586)
Parental strictness with grades: serious	1.9362***	0.4317	1.1523*	3.1020*
	(0.6476)	(0.6549)	(0.6644)	(1.6828)
Baseline cognitive ability	3.6894***	4.7707***	3.7786***	12.2149***
	(0.1243)	(0.1270)	(0.1290)	(0.3235)
Attend preschool	0.8289***	0.8538***	0.3688	2.1234***
	(0.2564)	(0.2620)	(0.2656)	(0.6659)
Observations	9,318	9,314	9,316	9,298
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.6: IV Estimates of Friends on Grades in the Following Year (7th Grade)

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	2.1406	2.0985	1.0564	5.4404
	(1.3252)	(1.6703)	(1.4309)	(3.3909)
School FOS	−5.0320***	2.7513	−3.5014*	−8.0410*
	(1.7195)	(2.1665)	(1.8469)	(4.3745)
Male	−14.7681***	−4.2071***	−16.3118***	−35.2194***
	(0.5406)	(0.6820)	(0.5812)	(1.3767)
Han	0.8989	−1.3913	−0.1528	−0.6633
	(1.2832)	(1.6164)	(1.3775)	(3.2646)
Rural hukou	−0.7259	1.8292**	0.1826	1.2301
	(0.6483)	(0.8179)	(0.6968)	(1.6500)
Local hukou	−2.1303**	0.2378	−0.7057	−2.8038
	(0.8507)	(1.0732)	(0.9132)	(2.1624)
Only child in the family	0.4910	0.6842	1.7810**	2.8724*
	(0.6439)	(0.8119)	(0.6923)	(1.6392)
Family SES: somewhat poor	2.8778**	1.6197	2.7585*	7.3159**
	(1.4603)	(1.8415)	(1.5686)	(3.7142)
Family SES: moderate	1.3151	2.1727	3.5235**	7.0087**
	(1.4000)	(1.7652)	(1.5038)	(3.5607)
Family SES: somewhat rich	−0.9191	0.0233	1.5540	0.6531
	(1.7854)	(2.2516)	(1.9177)	(4.5408)
Family SES: rich	−5.8442	−6.4157	−8.7816*	−21.0553*
	(4.5193)	(5.6994)	(4.8541)	(11.4939)
Parental education	0.3665***	0.7559***	0.7516***	1.8531***
	(0.1156)	(0.1458)	(0.1243)	(0.2942)
Parental strictness with grades: moderate	2.2829	1.7376	1.0854	5.2228
	(1.7735)	(2.2363)	(1.9053)	(4.5112)
Parental strictness with grades: serious	2.4926	2.9965	2.8327	8.4054*
	(1.7912)	(2.2582)	(1.9247)	(4.5573)
Baseline cognitive ability	7.9813***	13.2384***	10.8354***	32.0885***
	(0.3381)	(0.4265)	(0.3633)	(0.8603)
Attend preschool	2.0467***	2.9736***	2.6801***	7.7603***
	(0.7044)	(0.8879)	(0.7575)	(1.7935)
Observations	8,702	8,704	8,692	8,693
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.7: IV Estimates of Friends on Grades (9th Grade)

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−0.5776	−0.6023	−0.4521	−1.5435
	(0.5735)	(0.5849)	(0.5787)	(1.4772)
School FOS	−0.2232	0.6422	0.4234	0.6450
	(1.3729)	(1.3867)	(1.3859)	(3.5270)
Male	-−5.7223***	−1.0358***	−5.5880***	−12.3257***
	(0.2132)	(0.2161)	(0.2145)	(0.5492)
Han	0.0892	0.1812	−0.4802	−0.2012
	(0.5237)	(0.5309)	(0.5275)	(1.3507)
Rural hukou	0.5295**	0.6173**	0.1996	1.3592**
	(0.2606)	(0.2639)	(0.2622)	(0.6710)
Local hukou	−1.5689***	−0.9557***	−0.6638*	−3.1489***
	(0.3439)	(0.3481)	(0.3463)	(0.8856)
Only child in the family	−0.0977	0.1771	0.1714	0.2458
	(0.2638)	(0.2667)	(0.2652)	(0.6802)
Family SES: somewhat poor	0.4926	0.1622	−0.4774	0.0431
	(0.5850)	(0.5916)	(0.5905)	(1.5116)
Family SES: moderate	0.5114	0.0980	−0.5319	−0.0386
	(0.5568)	(0.5630)	(0.5620)	(1.4385)
Family SES: somewhat rich	0.5618	−0.0192	−0.6713	−0.2424
	(0.6847)	(0.6925)	(0.6904)	(1.7668)
Family SES: rich	−8.3278***	−5.8601***	−5.1635**	−19.5905***
	(2.1183)	(2.1436)	(2.1291)	(5.4438)
Parental education	0.3220***	0.2962***	0.3884***	1.0076***
	(0.0428)	(0.0434)	(0.0431)	(0.1103)
Parental strictness with grades: moderate	−1.0497*	−0.7945	−1.0191*	−2.7854*
	(0.5565)	(0.5634)	(0.5595)	(1.4306)
Parental strictness with grades: serious	−0.0925	0.0173	−0.0744	−0.1020
	(0.5736)	(0.5810)	(0.5768)	(1.4749)
Baseline cognitive ability	4.0707***	5.5777***	4.4396***	14.0748***
	(0.1381)	(0.1399)	(0.1388)	(0.3552)
Attend preschool	0.1229	0.3337	0.0830	0.5810
	(0.2475)	(0.2508)	(0.2491)	(0.6374)
Observations	8,291	8,282	8,277	8,258
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.8: IV Estimates of Friends on Grades (Female)

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−0.8606**	−1.9118***	−1.3908***	−4.1185***
	(0.4369)	(0.4991)	(0.4510)	(1.1749)
School FOS	−2.3369**	-1.3217	−2.7144**	−6.6234**
	(1.1771)	(1.3431)	(1.2228)	(3.1847)
Grade 9	−0.2247	0.3093	−0.2875	−0.2018
	(0.2453)	(0.2795)	(0.2533)	(0.6596)
Han	−0.3932	−0.0294	−0.8974**	−1.4358
	(0.4269)	(0.4852)	(0.4412)	(1.1473)
Rural hukou	0.4066*	0.4145	0.1484	0.9294
	(0.2219)	(0.2524)	(0.2290)	(0.5958)
Local hukou	−1.2739***	−0.9629***	−0.5290*	−2.6836***
	(0.2791)	(0.3173)	(0.2882)	(0.7496)
Only child in the family	0.0350	0.2568	0.4317*	0.7075
	(0.2239)	(0.2545)	(0.2310)	(0.6011)
Family SES: somewhat poor	1.1730**	0.9475*	0.5212	2.6339**
	(0.4872)	(0.5540)	(0.5025)	(1.3066)
Family SES: moderate	0.5632	0.5606	0.2547	1.3761
	(0.4647)	(0.5283)	(0.4793)	(1.2462)
Family SES: somewhat rich	0.7934	0.2392	0.2683	1.2833
	(0.5951)	(0.6765)	(0.6137)	(1.5959)
Family SES: rich	−11.7389***	−9.1603***	−9.1391***	−30.0973***
	(1.8389)	(2.0906)	(1.8967)	(4.9323)
Parental education	0.2546***	0.2903***	0.2978***	0.8492***
	(0.0371)	(0.0422)	(0.0383)	(0.0996)
Parental strictness with grades: moderate	−0.8080	−2.0757***	−1.3290**	−4.3725***
	(0.5463)	(0.6210)	(0.5631)	(1.4650)
Parental strictness with grades: serious	−0.4411	−1.8814***	−0.7450	−3.2121**
	(0.5644)	(0.6416)	(0.5816)	(1.5128)
Baseline cognitive ability	3.5852***	4.8350***	3.5872***	11.9912***
	(0.1160)	(0.1319)	(0.1197)	(0.3115)
Attend preschool	0.8030***	0.9718***	0.4387*	2.2537***
	(0.2250)	(0.2558)	(0.2320)	(0.6036)
Observations	8,707	8,703	7,702	8,692
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.9: IV Estimates of Friends on Grades (Male)

	Chinese (1)	Mathematics (2)	English (3)	Total (4)
School FSS	−0.9334	−0.2798	−0.7889	−1.8571
	(0.5756)	(0.5543)	(0.5742)	(1.4485)
School FOS	-1.1992	-0.0068	-1.6545	-3.0099
	(2.0050)	(1.9299)	(2.0197)	(5.1129)
Grade 9	−0.3964	−0.3113	−0.5798	−1.3812
	(0.3835)	(0.3710)	(0.3851)	(0.9781)
Han	−0.2290	−0.6200	−0.2628	−1.0038
	(0.5463)	(0.5268)	(0.5475)	(1.3839)
Rural hukou	0.2108	0.5211**	−0.2218	0.5215
	(0.2660)	(0.2559)	(0.2665)	(0.6733)
Local hukou	−1.7393***	−1.1680***	−0.8701**	−3.7437***
	(0.3635)	(0.3488)	(0.3640)	(0.9167)
Only child in the family	0.5695**	0.6126**	0.8074***	1.9563***
	(0.2596)	(0.2493)	(0.2597)	(0.6557)
Family SES: somewhat poor	1.0296*	0.4940	0.2166	1.5279
	(0.6010)	(0.5774)	(0.6022)	(1.5328)
Family SES: moderate	1.0834*	0.7407	0.6086	2.2242
	(0.5715)	(0.5492)	(0.5729)	(1.4585)
Family SES: somewhat rich	0.6744	−0.2017	−0.3242	−0.0747
	(0.7006)	(0.6730)	(0.7018)	(1.7777)
Family SES: rich	−4.2598**	−3.3918**	−0.6908	−7.5158*
	(1.7578)	(1.6642)	(1.7856)	(4.5019)
Parental education	0.2614***	0.2096***	0.2932***	0.7632***
	(0.0458)	(0.0442)	(0.0461)	(0.1165)
Parental strictness with grades: moderate	1.2571**	1.2399**	0.6244	3.0842*
	(0.6395)	(0.6105)	(0.6360)	(1.6147)
Parental strictness with grades: serious	2.0699***	1.9181***	1.7392***	5.6173***
	(0.6473)	(0.6170)	(0.6428)	(1.6338)
Baseline cognitive ability	3.9896***	5.1652***	4.3606***	13.5021***
	(0.1386)	(0.1335)	(0.1388)	(0.3505)
Attend preschool	0.2921	0.4316*	0.1933	0.9980
	(0.2665)	(0.2565)	(0.2670)	(0.6749)
Observations	8,902	8,893	8,891	8,864
Class and school controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.10: Effect of Friends on Time Allocation

	SCH ASGMT (1)	Extra ASGMT (2)	Crams (3)	Sports (4)	Reading (5)	TV (6)	INET & Games (7)	Housework (8)
School FSS	−0.3463	−0.3069	0.0208	−0.1675	0.0966	0.7370***	0.3675*	−1.1379***
	(0.3659)	(0.1899)	(0.0566)	(0.1786)	(0.1970)	(0.2081)	(0.1916)	(0.2078)
School FOS	−3.1983***	−0.0389	−0.0215	−1.3362**	1.0323*	0.6670	1.2510**	−2.3730***
	(1.1309)	(0.5454)	(0.1656)	(0.5719)	(0.5885)	(0.6280)	(0.5565)	(0.6119)
Grade 9	2.5599***	0.5266***	−0.0128	−0.0303	−1.1246***	−0.5819***	0.2623**	−0.5578***
	(0.2213)	(0.1083)	(0.0322)	(0.1066)	(0.1181)	(0.1222)	(0.1130)	(0.1224)
Male	−1.6902***	−0.3997***	−0.0801***	0.4559***	−0.9940***	0.2271***	0.9542***	−0.6659***
	(0.1483)	(0.0767)	(0.0221)	(0.0725)	(0.0796)	(0.0845)	(0.0757)	(0.0833)
Han	−0.0937	−0.2236	0.0452	−0.0658	0.1948	−0.0083	−0.0596	−0.3416*
	(0.3595)	(0.1893)	(0.0569)	(0.1779)	(0.1974)	(0.2030)	(0.1874)	(0.2025)
Rural hukou	0.4588**	−0.0679	−0.0232	0.1603*	0.1974**	0.0120	−0.0906	0.4119***
	(0.1789)	(0.0915)	(0.0268)	(0.0887)	(0.0971)	(0.1016)	(0.0931)	(0.0999)
Local hukou	−0.2577	0.0333	0.0707*	−0.2254*	−0.2732**	−0.2123	0.1498	−0.4043***
	(0.2358)	(0.1196)	(0.0364)	(0.1177)	(0.1275)	(0.1330)	(0.1237)	(0.1313)
Only child in the family	0.3682**	−0.0050	0.0966***	−0.1531*	−0.2040**	−0.1094	−0.0880	−0.3776***
	(0.1754)	(0.0917)	(0.0271)	(0.0892)	(0.0969)	(0.1002)	(0.0923)	(0.0983)
Baseline cognitive ability	−0.0548	−0.0890*	0.0381***	0.1322***	0.2157***	−0.3749***	−0.1818***	−0.4155***
	(0.0936)	(0.0475)	(0.0141)	(0.0466)	(0.0503)	(0.0522)	(0.0481)	(0.0518)
Attend preschool	0.1274	0.1143	0.0215	0.0899	0.1271	−0.1224	0.1593*	−0.2776***
	(0.1823)	(0.0928)	(0.0268)	(0.0896)	(0.0982)	(0.1037)	(0.0940)	(0.1019)
Observations	15,761	14,337	13,107	14,782	15,553	14,920	15,491	15,122
Parents and family control	✓	✓	✓	✓	✓	✓	✓	✓
Class and school controls	✓	✓	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.11: Effect of Friends on Activities and Behaviors

	Hobbies (1)	Mus & Zoo (2)	Shows (3)	CLS AV (4)	Late (5)	Absence (6)	RR (7)	Sleeping (8)
School FSS	0.0562	0.1171***	0.1816***	0.0276	−0.0390	0.0273	−0.0325	−0.2415***
	(0.0442)	(0.0394)	(0.0496)	(0.0391)	(0.0243)	(0.0168)	(0.0200)	(0.0457)
School FOS	−0.1794	0.5171***	0.6210***	0.2965***	0.0503	0.0120	0.1648***	−0.0020
	(0.1290)	(0.1212)	(0.1512)	(0.1125)	(0.0705)	(0.0485)	(0.0571)	(0.1352)
Grade 9	−0.1537***	−0.0889***	0.0714**	−0.0926***	0.0789***	0.0135	0.1033***	−0.7211***
	(0.0256)	(0.0238)	(0.0296)	(0.0225)	(0.0141)	(0.0097)	(0.0114)	(0.0267)
Male	−0.1918***	0.0147	0.0399**	−0.0858***	0.0451***	0.0247***	0.0512***	0.1372***
	(0.0177)	(0.0161)	(0.0203)	(0.0155)	(0.0097)	(0.0067)	(0.0079)	(0.0183)
Han	−0.1005**	0.1072***	0.0902*	0.0068	0.0379	0.0093	−0.0557***	0.0607
	(0.0431)	(0.0389)	(0.0486)	(0.0380)	(0.0237)	(0.0163)	(0.0192)	(0.0447)
Rural hukou	−0.0772***	−0.0270	−0.0921***	−0.0352*	−0.0244**	−0.0065	−0.0001	0.0146
	(0.0216)	(0.0194)	(0.0243)	(0.0190)	(0.0118)	(0.0081)	(0.0096)	(0.0224)
Local hukou	−0.0837***	−0.0616**	0.0478	−0.0654***	−0.0050	0.0131	−0.0146	−0.0430
	(0.0283)	(0.0255)	(0.0319)	(0.0249)	(0.0155)	(0.0107)	(0.0126)	(0.0293)
Only child in the family	−0.0309	0.0480**	0.0317	−0.0207	−0.0222*	−0.0153*	−0.0061	−0.0324
	(0.0213)	(0.0192)	(0.0241)	(0.0188)	(0.0117)	(0.0081)	(0.0095)	(0.0221)
Baseline cognitive ability	0.0339***	0.0475***	0.0495***	0.0629***	−0.0388***	−0.0325***	−0.0205***	−0.0429***
	(0.0112)	(0.0101)	(0.0127)	(0.0099)	(0.0062)	(0.0042)	(0.0050)	(0.0116)
Attend preschool	0.0611***	0.0875***	0.0840***	0.0686***	0.0043	−0.0158*	−0.0054	−0.0378*
	(0.0218)	(0.0196)	(0.0246)	(0.0192)	(0.0120)	(0.0082)	(0.0097)	(0.0227)
Observations	17,589	17,119	17,074	17,516	17,588	17,582	17,481	17,238
Parents and family control	✓	✓	✓	✓	✓	✓	✓	✓
Class and school controls	✓	✓	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table A.12: Effect of Friends on Class and School Environment

	Nice classmates (1)	Easy to get along with (2)	Class atmosphere (3)	Feel close (4)	Bored of school (5)	Desire to transfer (6)
School FSS	0.0751**	0.0975***	0.1835***	0.1866***	−0.1325***	−0.1159***
	(0.0313)	(0.0330)	(0.0348)	(0.0363)	(0.0344)	(0.0343)
School FOS	−0.0826	0.0431	−0.0917	0.1180	0.1500	0.1608
	(0.0913)	(0.0954)	(0.1007)	(0.1029)	(0.0987)	(0.0991)
Grade 9	0.0254	0.0372*	0.0275	−0.0236	0.0991***	0.0595***
	(0.0182)	(0.0192)	(0.0202)	(0.0208)	(0.0198)	(0.0199)
Male	−0.0961***	−0.0639***	−0.1101***	−0.0963***	0.0580***	−0.0135
	(0.0126)	(0.0132)	(0.0139)	(0.0144)	(0.0138)	(0.0137)
Han	0.0041	0.0699**	0.0719**	0.0247	−0.0299	−0.0374
	(0.0307)	(0.0321)	(0.0338)	(0.0353)	(0.0336)	(0.0334)
Rural hukou	−0.0298*	−0.0448***	−0.0089	0.0013	−0.0388**	−0.0293*
	(0.0153)	(0.0160)	(0.0169)	(0.0176)	(0.0168)	(0.0167)
Local hukou	−0.0287	−0.0669***	−0.0255	−0.0233	−0.0048	−0.0115
	(0.0201)	(0.0210)	(0.0221)	(0.0231)	(0.0220)	(0.0219)
Only child in the family	−0.0163	0.0021	0.0101	0.0297*	−0.0106	−0.0217
	(0.0152)	(0.0159)	(0.0168)	(0.0174)	(0.0166)	(0.0165)
Baseline cognitive ability	0.0829***	0.0544***	0.0522***	0.0700***	−0.0674***	−0.0521***
	(0.0080)	(0.0084)	(0.0088)	(0.0092)	(0.0087)	(0.0087)
Attend preschool	0.0351**	0.0421***	0.0124	0.0280	−0.0177	0.0122
	(0.0155)	(0.0162)	(0.0171)	(0.0179)	(0.0170)	(0.0169)
Observations	17,528	17,532	17,511	17,400	17,446	17,551
Parents and family control	✓	✓	✓	✓	✓	✓
Class and school controls	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓

Note: Standard errors are reported in brackets. Standard errors are clustered at class level.
* significant at 10% level, ** significant at 5% level, *** significant at 1% level.