Does Parent-Teacher Communication Truly Boost Students' School Performance?

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Abstract

Parent-teacher communication has long been regarded as vital for children's academic success. Our theoretical model indicates that when parents contact teachers, it may have a positive direct effect and a negative spillover effect on students' performance. Using a large panel of junior high school students randomly assigned to classes, we find a substantial negative spillover effect and a far smaller direct effect on both the academic and non-cognitive performances of students, which indicates a significantly negative net effect of parents' contacting teachers. The strong negative spillover effect can be attributed to the decline in teachers' attention to and attitude towards students, and this effect is more pronounced for students with lower performance and whose parents have a lower social status. Our finding suggests that excessive parent-teacher contact should be avoided to safeguard student performance and educational equality.

Keywords: Parent-teacher communication, spillover effect, student performance, educational equality

JEL: I21, I24, D62

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1 Introduction

Parent-teacher communication has long been regarded as crucial in determining children's academic success. Existing studies found that such communication effectively closes the information gap between home and school (Dizon-Ross 2019), enhances children's social and emotional development (Green et al. 2007), and promotes academic performance (Aikens & Barbarin 2008). Motivated by these potential benefits, many schools have adopted strict guidelines that require teachers to ensure parent-teacher contact. Meanwhile, parents are also allocating more resources to initiate and maintain communication with teachers (Guo et al. 2018, Young 2020).

However, emerging anecdotal evidence indicates that numerous parents frequently attempt to obtain extra school resources for their children by contacting teachers, thereby creating a negative spillover effect on other students in the same class (Boonk et al. 2018). Given that teacher resources are limited, an excessive number of parents contacting teachers might reduce the time and energy that teachers can devote to classroom teaching and other teaching-related activities. Moreover, when parents get in touch with teachers, it may compromise the impartiality and objective guidance teachers should provide students. Teachers might be swayed by their relationships with the parents who contact them more often (Young 2020).

We develop a conceptual model to examine the potential impacts of parents contacting teachers on students' performance. The model assumes that each student's school performance is determined by the time the teacher allocates to the individual student and to the overall class instruction. Each mother tries to increase the time the teacher allocates to her child by contacting the teacher. Consequently, a mother's contact with the teacher could have a positive direct effect on her own child and a negative spillover effect on all children in the class (by reducing the time available for whole-class teaching). An optimal contact level for the whole class is chosen when the marginal direct effect equals the marginal spillover effect. However, mothers' competition for the

teacher's time will result in a contact level above the optimal level, and the negative spillover effect will outweigh the positive direct effect, leading to net harm to the average performance of the class.

We examine the model's prediction based on a panel of nationally representative field survey data. This data pertains to 5,322 junior high school students from 134 classes within 70 schools in China over two years. This unique dataset is highly appropriate for our analysis for three reasons. Firstly, all these students are randomly assigned to classes along with randomly assigned teachers, which alleviates the concern regarding endogenously formed classes (Lavy & Sand 2019). Secondly, the panel data structure enables us to include student-fixed effects to account for the potential reverse causality, that is, parents of students with better performance are more or less likely to contact teachers. Thirdly, the survey gathered detailed information regarding the frequency of parents contacting teachers for each student in the class. This study focuses solely on the effect of contact initiated by parents while controlling for teacher-initiated contact to isolate its effects.

We adhere to the conceptual model to jointly estimate both the direct and spillover effects within a single regression model. The direct effect is captured by the frequency of contact that each student's parents have with the teacher, and the spillover effect is captured by the class-average contact frequency of all parents.[1] Thus, the direct effect measures the effect of a one-unit increase in the contact frequency of the student's parents, and the spillover effect measures the effect when the average of the parents in the class increases their contact frequency by one unit. A significant advantage of jointly estimating both effects lies in resolving the reflection problem, which refers to the difficulty in differentiating peer influences on an individual from that individual's influence on peers (Carrell et al. 2013). Our empirical strategy does not require isolating these reciprocal influences. Instead, we are only concerned with the relative magnitudes

[1]The results remain robust when the spillover effect is captured by the average contact frequency of all other parents, excluding the student's own parents.

of the direct and spillover effects estimated conditional on each other.[2]

The estimates indicate substantial negative spillover effects on both academic and non-cognitive performance. If the class-average contact frequency is increased by one unit, the Chinese and English test scores of an average student will be reduced by 4.4% and 7.0% respectively, and the ability to overcome learning difficulties and confidence in the future will be decreased by 0.149 and 0.178 standard deviations respectively. These estimates are robust to adopting different fixed effects, including various control variables, using alternative contact measures, adopting a non-linear model setting, focusing on sub-samples, and excluding potential outliers. In contrast, the estimated direct effects are close to zero and are only statistically significant for the effect on confidence in the future. In robustness checks where the student-fixed effects are replaced by the class-fixed effects, the direct effects are significantly positive for most outcomes but are still far smaller than the spillover effect. Consequently, the net effect of parents contacting teachers is significantly negative.

We confirm that competing for the teacher's time can explain the significant harm to student performance. Our data reveal that 51% of parents contact the teacher more than three times per semester, and 12% of parents contact more than five times. Such intensive contact inevitably reduces the teacher's time and energy for class teaching and other teaching-related activities, especially since teachers usually need to spend a great deal of time undertaking certain tasks in order to meet parents' expectations after the contact. We find that parents' contacting teachers significantly increases the teacher's working time but reduces the time allocated to in-class teaching. We also find significantly negative impacts of the contact on in-class teaching activities. A one-unit increase in the class-average contact would reduce the probability of each student being questioned by the teacher during class by 0.188 standard deviations and increase the probability of being criticized by 0.191 standard deviations. We also discover

[2]Appendix Table A3 shows that the findings remain consistent when the direct and spillover effects are estimated separately in two regressions.

a significantly negative effect of parents' contacting teachers on students' subjective feelings at school, which can be influenced by teachers' attitudes and attention and are crucial determinants of student performance (Lewis & Diamond 2015). The estimates suggest that a one-unit increase in class-average contact would reduce a student's evaluation of class atmosphere, school atmosphere, and school management by 0.132, 0.351, and 0.610 standard deviations, respectively.

We also attempt to answer the interesting question of why parents choose such a high contact frequency when it has only a negative effect. We find that parents' contacting teachers has a large positive direct effect on the "perceived" performance of their children. If parents make contact decisions based on the perceived performance, this decision is rational. We also show that not all students are negatively affected by their parents' contacting teachers. The negative spillover effects are small and statistically insignificant for students with high performance and whose parents have a high social status. Therefore, parents' contacting teachers not only decreases the class-average performance but also increases educational inequality within the class.

Many early studies found that parent-teacher communication improves students' performance (e.g., Hill & Craft 2003, Olivos 2006, Englund et al. 2004), but more recent studies tend to find an insignificant effect (e.g., McNeal Jr 2012, Stright & Yeo 2014, Wang & Sheikh-Khalil 2014).[3] A key difference between our study and the literature is that we follow the peer-effect literature (e.g., Burke & Sass 2013, Lavy & Sand 2019, Grácio & Vicente 2021) to identify the causal effect by utilizing the random assignment of students and teachers. In addition, to the best of our knowledge, our study is the first to simultaneously evaluate the direct and spillover effects of parents contacting teachers. If we only examined the direct effect as was done in the existing studies, we would also conclude that parents contacting teachers has a positive or insignificant effect on the performance of students.

[3]For more comprehensive reviews of the literature, see Fan & Chen (2001) and Boonk et al. (2018).

This study is also connected to the extensive literature on the peer effects of students. Many significant studies have examined the peer effects of students, showing that peer effects can profoundly influence their performances at school and in the job market by altering their behavior (e.g., Zimmerman 2003, Mas & Moretti 2009, Duflo et al. 2011, Bursztyn & Jensen 2015). Although our study focuses on the effect of parents' behavior rather than students' behavior, it can be seen as examining a special type of peer effect through the channel of parents contacting teachers. In a sense, our study is more closely related to the literature on parents' competition for investments in their children's human capital (Guo & Qu 2022, Young 2020). These studies generally found that parents can leverage their social capital and economic capital to enhance their children's performance and shape school education through interactions with schools. Our study shows that parents' interactions with teachers could have a significantly negative effect on the performance of an average student.

The remainder of this paper is structured as follows: Section 2 provides an overview of the Chinese education system. Section 3 develops a conceptual model to analyze the effect of parents contacting teachers. Section 4 describes the data and empirical methodology. Section 5 presents the empirical findings. Section 6 concludes the paper.

2 Background

2.1 Public education in China

Public schools are a fundamental component of China's compulsory education system. According to the 2022 National Education Development Statistics Bulletin, private schools at the compulsory education stage account for only 5.23% of the total in China. The Compulsory Education Law of China mandates that all school-age children (aged 6–15) must receive compulsory education. Schools enroll students based on the principle of proximity to their residence. Schools maintain extensive records of parent information,

which aids in the distribution of student subsidies and other resources. Due to the intricate procedures involved in transferring schools, most students opt to complete their studies in the same school. Notably, students can typically only participate in the national university entrance examination in their local public high schools.

2.2 China's junior high school system

Junior high schools in China generally span three years, with students typically aged between 12 and 15. Most junior high schools consist of three grades (grades 7, 8, and 9), each lasting one academic year with two semesters. During junior high school, students study a variety of subjects, including Chinese, Mathematics, English, Physics, Chemistry, Biology, History, Politics, and Geography. At the start of grade 7, each student is assigned to a class and remains in the same class for the next three years. Subject-specific instruction is delivered by a team of teachers, while a designated head teacher—usually from one of the core subjects—oversees the class. The head teacher is responsible for managing all aspects of class life, such as setting seating arrangements, organizing extracurricular activities, and maintaining student discipline. Importantly, the head teacher is typically responsible for parent-teacher communication.

2.3 Random assignment of students

In China, junior high schools generally use two ways to allocate students to classrooms. The first method is based on test scores. In some schools, students need to take placement examinations prior to their first year in junior high school. Their scores are then utilized to assign them to different classrooms. The second method is random assignment. Schools using this method usually depend on a computer program to guarantee the randomness of student placement. In smaller schools, random assignment might be carried out manually. For example, parents draw lots to decide their child's classroom assignment. After the student assignments are determined, teachers also

draw lots to select which classes they will teach. In recent years, most junior high schools have adopted the random assignment method. This is promoted by the Ministry of Education as a means to ensure equal and fair opportunities for all students during their compulsory education.

2.4 Parent-teacher communication

Junior high school performance is a crucial factor in determining access to a well-regarded high school, which in turn influences the probability of being admitted to prestigious universities. In the context of China's highly competitive college entrance examination system, parents attach great importance to their children's junior high school education. Consequently, parents often communicate with head teachers in order to keep track of their children's academic progress and seek additional attention and support. As shown in the left panel of Figure 1, on average, a head teacher is contacted by parents as many as 95 times per semester (with a standard deviation of 40). The right panel of the figure shows the proportion of each purpose for which parents contact teachers. More than half of the contacts (56.0%) are related to studying issues, while the remaining contacts are for behavior (15.9%), psychological (10.3%), health (5.8%), and other issues (12.0%). After receiving communication from parents, teachers generally need to allocate time to respond to parents and undertake certain tasks in order to meet parents' expectations. Consequently, the resources of teachers occupied by parental contact may far surpass the time consumed by the contact per se.

The effect of occupying teachers' time could be substantial given that junior high school teachers in China are usually extremely busy. In China, many schools require students and teachers to begin morning self-study sessions as early as 7 a.m., with evening study extending until 10 p.m. Consequently, teachers are often on duty throughout the day, managing responsibilities that include classroom teaching, grading, exam supervision, lesson planning, administrative duties, and performance evaluations.

The workload they are expected to manage is already quite heavy. This fact gives rise to the worry that excessive parental contact may take up precious teaching time and cause teachers to be biased towards the children of frequently-contacting parents.

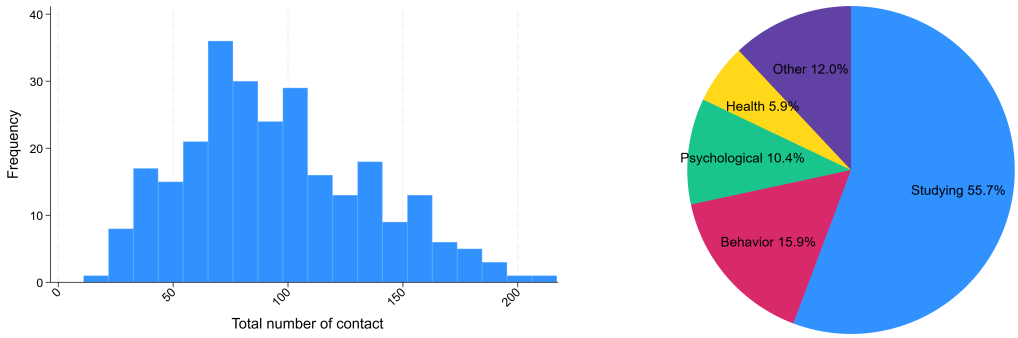

Figure 1: The frequency (left) and purpose (right) of parents contacting teachers
Note: The data used to create these figures are detailed in subsection 4.1.

3 Conceptual Framework

We develop a simple conceptual framework for examining the potential impact of parents contacting teachers on students' performances and for guiding our empirical work. The model assumes a class comprises N identical students and one teacher.[4] The teacher is subject to the following time constraint:

$$T = T_c + \sum_n t_n \tag{1}$$

where T is the total time available, T_c is the time allocated to class teaching and other teaching activities for all students, and t_n is the time allocated only to student n. The teacher's time allocated to a student increases with his mother's effort (e_n) of contacting the teacher (i.e., $\frac{dt_n}{de_n} > 0$). Each mother attempts to maximize her child's performance

[4]We assume all students are identical because our main focus is on the class-average spillover effect. Adopting the more realistic assumption of heterogeneous students would complicate the model but would not influence the prediction regarding the class-average spillover effect.

at school (p_n) by choosing the effort of contact:

$$\max_{e_n} U_n = \max_{e_n} \left[p_n \left(t_n(e_n), T_c \right) \right], \tag{2}$$

where the child's performance is assumed to increase at a decreasing rate with the teacher's time allocated to him ($\frac{dp_n}{dt_n} > 0$ and $\frac{d^2 p_n}{dt_n^2} < 0$) and with the teacher's time allocated to the whole class ($\frac{dp_n}{dT_c} > 0$ and $\frac{d^2 p_n}{dT_c^2} < 0$).[5]

The effort of contacting chosen by a mother depends on her belief about other mothers' responses. An optimal effort level for the whole class will be chosen if each mother believes that other mothers will choose the same effort level at the equilibrium. The optimal effort level can be derived from the first order condition of equation (2) with respect to e_n:

$$\frac{\partial p_n}{\partial e_n} = \underbrace{\frac{\partial p_n}{\partial t_n(e_n)} \cdot \frac{\partial t_n}{\partial e_n}}_{\text{Direct effect}} - \underbrace{\frac{\partial p_n}{\partial \left(T - \sum_n t_n(e_n) \right)} \cdot \frac{\partial t_n}{\partial e_n}}_{\text{Spillover effect}} \tag{3}$$

The first-order condition highlights that an increase in the effort level of a mother could have a positive effect on her own child's performance (the first term on the right-hand side) and a negative effect on the performance of all students in the class (the second term on the right-hand side). These are the positive direct effect and the negative spillover effect of parents contacting teachers that will be empirically examined in this study.

The first-order condition suggests the following equilibrium effort level:

$$\frac{\partial p_n^*}{\partial t_n^*(e_n^*)} = \frac{\partial p_n^*}{\partial (T - \sum_n t_n^*(e_n^*))} = \frac{\partial p_n^*}{\partial T_c^*}, \tag{4}$$

where p_n^*, t_n^*, T_c^* are the optimal performance, time allocated to each child, and time

[5]Here, we assume that the utility cost of the contacting effort is zero. Assuming a positive utility cost of contacting will not alter the qualitative prediction of the model.

allocated to the whole class, respectively, obtained when choosing the equilibrium effort level e_n^*. The equilibrium condition (4) suggests that the optimal performance of students is obtained when the effort level chosen satisfies that the marginal effect of one unit of time allocated to an individual child equals the marginal effect of N units of time allocated to the whole class.

However, if a mother believes that when she increases the effort level, other mothers will not increase their effort level as much, she will choose an effort level above e_n^* to maximize her utility. If all or a substantial share of mothers hold this belief, the competing for the teacher's time will significantly reduce the teacher's time allocated to classroom teaching and, thus, the average performance of students. Specifically, when all mothers choose an effect level of $e_n' > e_n^*$, we will have $T_c' < T_c^*$ and $p_n' < p_n^*$ because e_n^* is the optimal effort level. Even if only a portion of mothers choose an above-optimal effect level, it would still reduce the average performance of students; the performance of students whose mothers increase their effort level hinges on whether the negative spillover effect surpasses the positive direct effect.

Note that the above model predictions pertain to the "perceived" performance of students because mothers are likely to make contact decisions based on what they believe to be their children's performance. The perceived performance may differ from the actual performance, especially regarding the direct effect. A mother is likely to think that more contact with the teacher will have a positive direct effect on her child's school performance. However, this might not necessarily be the case since such contact may not lead to an increase in the teacher's attention towards her child. In contrast, the negative spillover effect is more likely to be true as the contact indeed reduces the teacher's time and energy available for teaching the entire class. Nevertheless, this model still offers a benchmark for us to understand the mechanisms underlying the effect of parents contacting teachers.

4 Data and Empirical Strategy

4.1 The survey data

This study depends on data from the China Education Panel Survey (CEPS), a nationally representative survey of junior high school students and teachers conducted by the National Survey Research Center at Renmin University of China in 2014 and 2015. Funded by the U.S. National Science Foundation, CEPS is recognized for its high quality and has become a key data source for research on China's junior high school education (e.g., Gong et al. 2018, Guo & Qu 2022).

The survey used the average educational level of the population and the proportion of the migrant population as stratifying variables to randomly select 28 county-level units (counties, districts, and cities) nationwide as survey sites. The survey was school-based, with 112 schools and 438 classes randomly selected from these county-level units. All students in the selected classes were included in the sample, resulting in a baseline survey of approximately 20,000 students. The survey used the 2013-2014 academic year as its baseline, beginning with two cohorts: first-year junior high school students (grade 7) and third-year junior high school students (grade 9). The grade 7 cohort was surveyed twice, in 2014 and 2015, while the grade 9 cohort was surveyed only in 2014.

To address endogeneity concerns through student fixed effects, this study primarily employs a balanced panel of students surveyed in both 2014 and 2015 (the grade 7 baseline students). This restriction reduces the study sample to 112 schools, 221 classes, and 10,279 students. Another feature of the survey critical for our identification strategy is that it collected detailed information on the method of assignment of students and teachers to classes (see subsection 2.3 for details of the assignments). Our main analysis centers on classes in which both students and teachers were randomly assigned and in which there was no reclassification between the seventh and eighth grades. Appendix A.2 provides evidence that students and teachers recorded as randomly assigned in the

survey indeed exhibit randomness in the actual data. This further reduces the main study sample to 70 schools, 134 classes, and 5,322 students.

The CEPS data is ideal for examining the effect of parents contacting teachers on student performance. The questionnaire covers detailed information on parent-teacher interactions, academic and non-cognitive performances of students, and other detailed information on teachers and students. The following introduces the key variables. Appendix Table A1 presents summary statistics of the variables.

Key dependent variables. The key dependent variables are test scores of the three core subjects: Chinese, English, and Mathematics. The survey collected midterm test scores of the three subjects in the first semester of 2014 and the second semester of 2015. These scores are provided directly by the schools rather than being self-reported by the students, avoiding recall errors. We focus on these three subjects as they usually have the largest score weight in the college entrance examination and are typically considered core subjects of student learning in China. Another reason is that their assessment methods and grading criteria are relatively standardized, making them more suitable for cross-sectional comparisons. These three subjects are generally scored out of 150 points. To further avoid the effect of differences in scoring criteria across classes and waves, the scores are standardized to the 0-1 range based on the class and wave. Figure 2 presents the mean and upper and lower quartiles of the standardized scores for each subject and class.

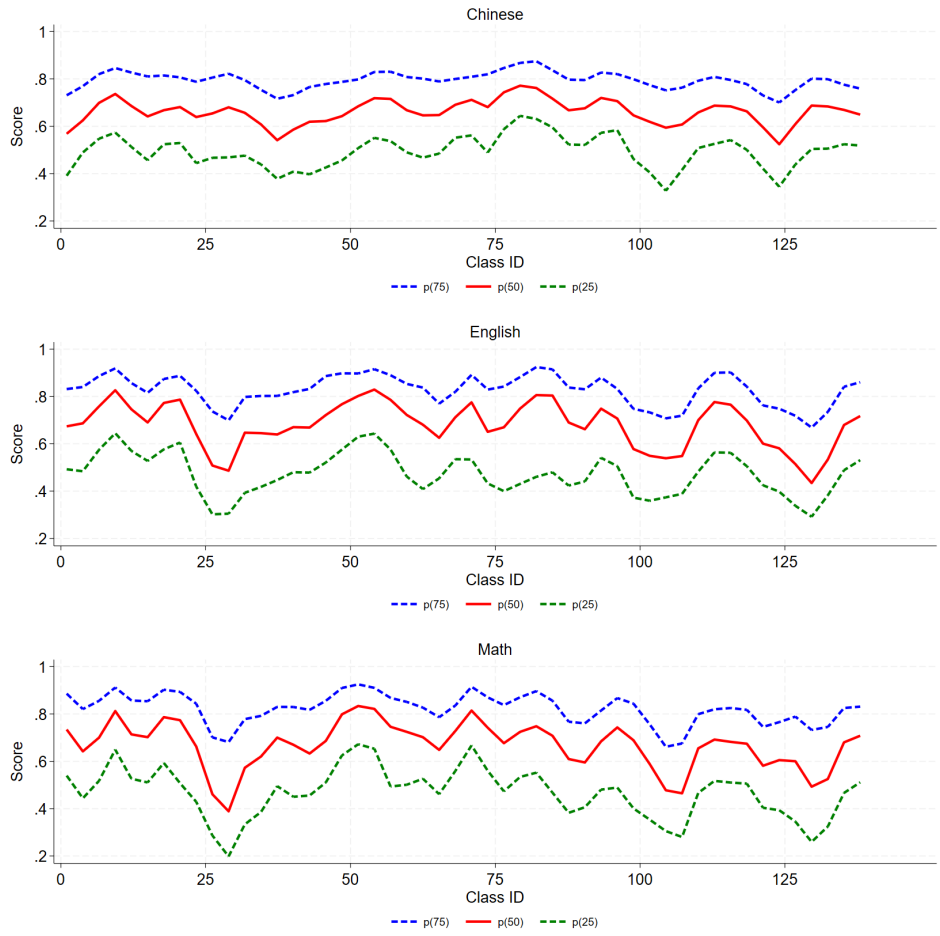

Figure 2: Class-level score distribution

Note: The figure presents the distribution of the mean and the upper and lower quartiles of Chinese, Math, and English scores across classes.

Key independent variable. The key independent variable is the frequency of parents contacting teachers each semester. To reduce the recall bias, the survey did not require parents to recall the exact number of contacts with teachers each semester. Instead, the survey allowed parents to select the frequency of their proactive contact with teachers from the following categories: never, once, two to four times, and five times or more. The contact here pertains solely to the contact with head teachers that is initiated by the parents. As elaborated in subsection 2.4, parents are typically only permitted to contact the head teacher in each class. Our main analysis focuses on the

effect of contacts initiated by teachers, and we show that the main findings are not confounded by the contacts initiated by teachers. We code these four categories from 1 to 4, with 1 corresponding to never contact and 4 corresponding to contact five times or more times.[6] As such, the corresponding regression estimates should be interpreted as the marginal effect of increasing the contact frequency instead of the marginal effect of one additional contact. Figure 3 shows the class-average frequency of parents contacting teachers in each semester.

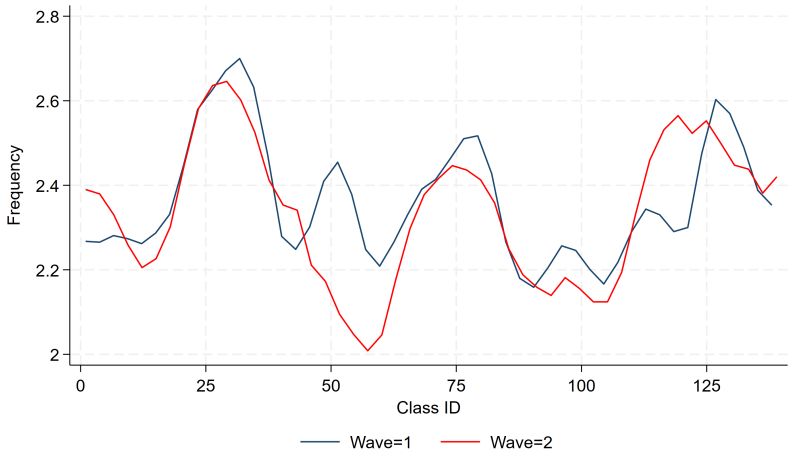

Figure 3: Class-average frequency of parents contacting teachers
Note: The figure presents the distribution of the class-average frequency of parents contacting teachers each semester (i.e., the wave of the survey).

Perceived performance. As a supplementary analysis, we also investigate the effect on a subjective measure of academic outcomes: parents' perceptions of their children's academic performance (perceived performance). The parental self-assessment of their child's academic performance is a valuable supplement to objective scores. This is especially true when considering that parents may base their contact decisions on their perceived performance of their children. The parental self-assessment of their child's academic performance is rated by parents on a scale ranging from 1 (poor) to 5 (excellent). We convert the perceived performance into a standard score by subtracting

[6]We present robustness checks in Table 3 to demonstrate that the findings are not sensitive to the coding methods.

the mean and dividing by the standard deviation.

Non-cognitive outcomes. We also explore the effect on two non-cognitive outcomes: the ability to overcome difficulties and confidence in the future. A student's ability to overcome difficulties (resilience) offers a more comprehensive reflection of the student's overall capabilities (Stoffel & Cain 2018). The survey includes a question that requires students to rate their ability to overcome difficulties in learning on a scale from 1 (strongly disagree) to 4 (strongly agree): even if I feel slightly unwell or have other reasons to stay home, I still do my best to go to school. The resilience is measured by the question. Confidence in the future is measured based on a survey question that asks students to assess the highest degree they are confident in obtaining, from 1 to 4: (1) junior high and secondary vocational/technical school graduate; (2) vocational high school; (3) general high school; (4) college associate degree. These non-cognitive measures are also standardized by subtracting the mean and dividing by the standard deviation.

4.2 Empirical strategy

4.2.1 The regression model

We construct our regression model based on the conceptual framework. The first-order condition (3) suggests that the effect of parents contacting teachers on the performance of a student can be decomposed into the direct effect resulting from his parents' contact and the spillover effect from the contact of all parents in the class. As such, we utilize the following regression model to jointly estimate the direct and spillover effects:

$$Y_{ict} = \alpha_0 + \alpha_1 Contact_{ict} + \alpha_2 AveContact_{ct} + X_{it}\rho + \tau_i + \tau_t + \epsilon_{ict}, \tag{5}$$

where Y_{ict} is the performance of student i in class c and year t, $Contact_{ict}$ is the frequency of the contact of student i's parents with the head teacher, and $AveContact_{ct}$ is the

average frequency of contact with the teacher in class c. The model also controls for the student-fixed effects τ_i, the year-fixed effects τ_t, and a set of time-varying control variables X_{it}. The baseline control variables are the student's health status, whether the student lives with parents, family economic status, parents' occupation, the frequency of teachers contacting the student's parents, and teacher's title. Finally, ϵ_{ict} is an error term clustered at the student level.[7]

According to the conceptual framework, the coefficient α_1 represents the direct effect, while the coefficient α_2 represents the spillover effect. In order to make the direct and spillover effects comparable, we use the class-average contact frequency to capture the spillover effect. Thus, α_1 measures the effect of a one-unit increase in the contact frequency of the student's parents, and α_2 measures the effect when the average of the parents in the class increase their contact frequency by one unit. In a robustness check (presented in Table 3), we use the class-total contact frequency to capture the spillover effect and obtain comparable results.

We expect to find a negative spillover-effect estimate of α_2 if the competition for the teacher's time within a class is substantial. On the other hand, we expect to observe a positive direct-effect estimate of α_1 if the contact truly increases the teacher's time allocated to the student. By comparing the magnitude of α_1 and α_2, we can determine whether the frequency of parental contact with teachers is optimal, excessive, or insufficient. Based on the equilibrium condition (4), $\alpha_1 = -\alpha_2$ suggests an optimal contact frequency, $\alpha_1 > -\alpha_2$ suggests an insufficient contact frequency, and $\alpha_1 < -\alpha_2$ suggests an excessive contact frequency.

[7]As the fixed effects are at the student level, we prefer to cluster the error term at the student level in order to account for potential bias from the autocorrelation of each student's performances. Robustness checks that cluster the error term at the class level find comparable results.

4.2.2 Addressing the endogeneity concerns

Endogenously formed classes. The most crucial endogeneity concern is as follows: if students and teachers are not randomly paired, the relationship between the frequency of parents contacting teachers and students' performance might be influenced by the rules governing student assignments. For instance, assume that students (parents) are assigned to a teacher (class) according to their academic performance. In such a situation, we might observe a significantly positive correlation between the class-average contact frequency and students' performance if the parents of students with better performance tend to contact teachers more often. In this case, the negative spillover effect would be skewed towards being positive. Likewise, if students are assigned based on their parents' social status, the estimated effect could also be distorted; the direction of this bias would depend on how parental social status affects both the contact frequency and children's outcomes.

Fortunately, our data enables us to address this concern by focusing on classes where students and teachers are randomly assigned. As described in subsection 4.1, out of the 221 classes surveyed, 134 classes adopted random student-teacher assignments. By focusing on these randomly assigned classes, we prevent the potential bias that could arise from the pre-existing relationship between students (parents) and teachers. Using data from randomly assigned students is the main approach in the literature for addressing concerns related to endogenously formed classes. For example, Gong et al. (2018) utilized the data on randomly assigned students to investigate the effect of teacher gender on students' performances, and Lavy & Sand (2019) took advantage of conditional random assignment in middle schools in Tel Aviv, Israel, to examine the effect of social networks on students' performances.[8]

The reflection problem. Another significant concern when identifying the effects

[8]More examples of using random assignments of students to identify a causal effect can be found in Carrell et al. (2009), Duflo et al. (2011), Carrell et al. (2013), Feld & Zölitz (2017), Grácio & Vicente (2021).

on students' performance within a class is the reflection problem: it is challenging to distinguish the influence of peers on an individual from the influence of the individual on peers (Sacerdote 2001, Carrell et al. 2013). Nevertheless, this concern is not major in our study since we are primarily interested in comparing the difference between the spillover effect and the direct effect of parents contacting teachers. By adhering to the conceptual framework to estimate both the direct effect and the spillover effect simultaneously within a single model, we do not have to separate the influence of peers on an individual from the influence of the individual on peers. Instead, we are only interested in the relative magnitudes of the direct and spillover effects estimated in relation to one another.

Reverse causality and omitted variable bias. Even though our analysis uses data only from randomly assigned students and teachers, one might still worry that differences among students within a class could lead to biased effect estimates. In particular, one might be concerned that parents of students with better performance tend to contact teachers more often. In this case, the estimated direct effect of parents' contacting on their own children's performance tends to be biased toward positive. This concern mainly applies to the direct effect estimate since the spillover effect is estimated at the class level and the class is randomly formed. We address this concern by using fixed effects and a rich set of control variables. Our baseline model includes student-fixed effects to account for all time-invariant confounding factors and year-fixed effects to account for common shocks. To the extent that the pre-existing correlation between the parents' contact frequency and the students' performance is time-invariant, the reverse causality bias could be addressed. Moreover, the detailed survey data enables us to control for 12 characteristics of students, parents, and teachers. In robustness checks, we show that the results are not sensitive to control variables and alternative fixed effects.

Remaining variation after incorporating student-fixed effects. Although

student-fixed effects are useful for dealing with omitted variable bias, there could be a concern about whether the student-specific variation over the two years is sufficient to identify the effect. Figure 3 alleviates this concern by showing significant variation over the two years. The variation might arise from random inter-annual changes in each parent's contact frequency and the teachers' availability for communication. However, the most crucial variation results from teacher changes over the years. Our data indicates that 48.03% of students had at least one teacher change during the two years. This is mainly because a large proportion of teachers are only responsible for teaching a specific grade, and several new subjects are added to the grade 8 syllabus. It should be noted that in schools with random student-teacher assignments, the new teachers in grade 8 are also randomly assigned.

Potential confounding effects from teachers contacting parents. Although this study focuses solely on the effect of parent-initiated contact with teachers, a concern exists that the estimated effects could be confounded by teacher-initiated contact with parents. For instance, if the parents' contact with teachers is systematically related to the teachers' contact with parents, the estimated effect of the former might reflect the effect of the latter. We deal with this concern by incorporating the frequency of teachers contacting parents as a baseline control variable. Additionally, Appendix Table A4 demonstrates that the estimated effects are robust when controlling for four different measures of teachers contacting parents.

5 Results

5.1 Baseline results

Table 1 shows the estimated direct and spillover effects of parents contacting teachers on students' performance. We estimate the effects on the test scores of three core subjects, namely Chinese, English, and Math. We also estimate the effects on two

non-cognitive outcomes: students' the ability to overcome learning difficulties (resilience) and confidence in the future (confidence). These variables are defined in subsection 4.1. All regressions control for student-fixed effects, year-fixed effects, and six time-varying control variables listed in Appendix Table A1.

The estimates indicate substantial negative spillover effects on both academic and non-cognitive performance. If the class-average contact frequency is increased by one unit, the Chinese and English test scores of an average student will be reduced by 4.4% and 7.0%, respectively. Similarly, a one-unit increase in class-average contact frequency will reduce resilience and confidence by 0.149 and 0.178 standard deviations, respectively. The estimated spillover effect for Math is not statistically significant potentially because teacher feedback and guidance are less crucial in math learning.[9]

In contrast, the estimated direct effects are all very small relative to the spillover effect and are mostly statistically insignificant. We only find a significantly positive direct effect on confidence, but this estimate is still much smaller than the corresponding spillover effect (0.043 versus -0.178). Therefore, the negative spillover effect dominates. We can conclude that parents contacting teachers has substantial net damage on both the academic and non-cognitive performance of students on average.

The finding that parents contacting teachers has no significant direct effect is not in conflict with our theoretical model. As highlighted before, parents may make the contact decision based on their perceived performance of their children, which could be different from the real performance. The last column of Table 1 finds a significantly positive direct effect on parents' perceived performance of their children. The perceived performance is defined in subsection 4.1. The finding of no direct effect is indeed in contrast to previous studies that find a positive effect of parents contacting teachers, potentially because we make more efforts to address the endogeneity bias. Robustness checks presented in Table 2 (columns 1a and 1b) find a significantly positive direct

[9]Math performance depends more on students' conceptual understanding, logical reasoning, and self-directed study outside of the classroom (Singh et al. 2002).

effect when replacing the student-fixed effects with the less reliable class-fixed effects. Nevertheless, we still find that the spillover effect is much larger than the direct effect.

Table 1: Effects of parents contacting teachers on student performances

	Chinese	English	Math	Resilience	Confidence	Perceived performance
	(1)	(2)	(3)	(4)	(5)	(6)
Average contact	-0.044***	-0.070***	0.012	-0.149*	-0.178**	-0.084*
	(0.014)	(0.012)	(0.014)	(0.082)	(0.083)	(0.048)
My contact	-0.002	-0.001	-0.002	0.006	0.043**	0.041***
	(0.003)	(0.003)	(0.003)	(0.018)	(0.019)	(0.011)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,400	9,386	9,398	9,284	9,442	9,494
R-squared	0.823	0.896	0.857	0.594	0.762	0.851

***Notes*:** This table shows the effect of parents contacting teachers on students' performance, estimated based on model (5). "Average contact" represents the average frequency of contact of parents in the class with the head teacher, while "My contact" refers to the frequency at which student i's parents contacts the head teacher. The dependent variables in columns 1-3 are the test scores of student i in Chinese, English, and Math respectively. In columns 4-6, the dependent variables are the child's ability to overcome learning difficulties (Resilience), confidence about the future (Confidence), and parents' perceptions of their child's academic performance (Perceived performance). The dependent variables in columns 1-3 are measured as a percentage, whereas those in the remaining columns are measured in standard deviations. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} for $p < 0.01$, {*}{*} for $p < 0.05$, and {*} for $p < 0.1$.

5.2 Robustness checks

This subsection presents various robustness checks. To save space, all robustness checks focus on the scores of Chinese and English, which are two core subjects graded according to standardized criteria and are significantly affected by parents contacting teachers. All robustness checks have the same model setting as the baseline model, except for the one specified in each check.

Table 2: Robust to omitted variables

	Class fixed effects		Cluster at the school level		Excluding all controls		Including additional controls	
	Chinese	English	Chinese	English	Chinese	English	Chinese	English
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Average contact	-0.033**	-0.065***	-0.044*	-0.071**	-0.036***	-0.084***	-0.051***	-0.064***
	(0.014)	(0.013)	(0.026)	(0.033)	(0.013)	(0.012)	(0.014)	(0.012)
My contact	0.008***	0.013***	-0.001	-0.000	-0.002	-0.003	-0.002	-0.000
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Student FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Class FE	Yes	Yes	No	No	No	No	No	No
Observations	9,998	9,989	9,426	9,410	10,360	10,346	8,550	8,544
R-squared	0.124	0.193	0.824	0.896	0.820	0.885	0.827	0.901

***Notes*:** This table examines the robustness to omitted variables of the baseline estimates presented in columns 1 and 2 of Table 1. Column 1 replaces the student-fixed effects with class-fixed effects. Column 2 clusters the standard error at the school level. Column 3 excludes all control variables. Column 4 includes additional control variables. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

5.2.1 Robust to omitted variables

Table 2 examines the robustness of the estimates with respect to omitted variables. First, we show that replacing the student-fixed effects with the class-fixed effects (columns 1a and 1b) does not change the main finding that parents contacting teachers has a net negative effect; although the direct effects are significantly positive, they are still far smaller than the spillover effects. Second, we cluster the standard errors at the school level to account for potential bias resulting from within-school correlation, and the results remain consistent (columns 2a and 2b). Third, we exclude all the six control variables and find comparable results (columns 3a and 3b). Finally, we additionally control for four class-level time-varying factors and find similar estimates (columns 4a and 4b).[10]

5.2.2 Robust to model specifications

Alternative contact measures. Table 3 examines the robustness of the baseline findings to four alternative measures of parents contacting teachers. To minimize recall bias, the survey asked parents to choose the frequency of their contact with teachers from the following options: never, once, two to four times, and five times or more. In our baseline analysis, we measure the contact frequency by coding these four categories as 1, 2, 3, and 4, where 1 indicates no contact and 4 represents five times or more of contact. As a robustness check, in columns 1a and 1b, we use an alternative coding of 0 (for never), 1 (for once), 3 (for two to four times), and 5 (for five times or more). The estimates still suggest significantly negative spillover effects and no direct effects. Columns 2a and 2b capture the spillover effect using the total contact frequency of the class (calculated based on the 1, 2, 3, and 4 coding) instead of the class-average contact

[10]The additional control variables are the rank of the class in the school, the share of other students living with parents, the average occupation of other parents, and the average economic status of other parents. The occupation is measured by a dummy variable that equals one for occupations of high social status. Similarly, the economic status is also measured by a dummy variable.

frequency. The estimates also suggest a significantly negative spillover effect. Given that the average class size is 47.7 students, the estimates imply a marginal spillover effect of 6.7% on both Chinese and English if the class-average contact increased by one, generally consistent with the baseline estimates. Similarly, columns 3a and 3b capture the spillover effect using the total contact number of the class (calculated based on the 0, 1, 3, and 5 coding) and also find significantly negative spillover effects. In columns 4a and 4b, we exclude student i from the calculation of the class-average contact frequency and find similar results, alleviating concerns regarding the reflection problem.

Table 3: Robust to alternative contact measures.

	Alternative contact measure		Total contact		Alternative total contact		Others contact	
	Chinese	English	Chinese	English	Chinese	English	Chinese	English
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Average contact	-0.020**	-0.043***						
	(0.007)	(0.006)						
Total contact			-0.0014***	-0.0014***	-0.0006***	-0.0007***		
			(0.000)	(0.000)	(0.000)	(0.000)		
Others contact							-0.043***	-0.069***
							(0.013)	(0.012)
My contact	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.003	-0.002
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,400	9,386	9,400	9,386	9,400	9,386	9,400	9,386
R-squared	0.822	0.896	0.823	0.895	0.823	0.895	0.823	0.896

Notes: This table examines the robustness of the baseline findings to four alternative measures of parents contacting teachers. Columns 1a and 1b adopt the alternative coding of 0 (never), 1 (once), 3 (two to four times), and 5 (five times or more). Columns 2a and 2b capture the spillover effect by the total contact number of the class (based on the 1, 2, 3, and 4 coding). Columns 3a and 3b capture the spillover effect by the total contact number of the class (based on the 0, 1, 3, and 5 coding). Columns 4a and 4b exclude student i when calculating the class-average contact frequency. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

Non-linear effects. To investigate the potential non-linearity of the spillover effects, we further include the square and cubic terms of class-average contact ($AveContact_{ct}$) in the regression model (5). As shown in Appendix Figure A1, both the square and cubic estimates suggest no obvious non-linearity in the spillover effects for the Chinese and English scores within the distribution of the contact frequency. However, these estimates should be interpreted carefully because we use a categorical measure of the contact frequency.

Separately estimating the direct and spillover effects. Our baseline analysis adheres to the theoretical model to simultaneously estimate the direct and spillover effects within a single regression model. One significant advantage of this model setting lies in alleviating concerns regarding the reflection problem. Since we are solely interested in the relative magnitudes of the direct and spillover effects, it is rational for us to estimate these effects conditional on one another within a single regression. Appendix Table A3 assesses the severity of the reflection problem by estimating the two effects in separate regressions. The resulting estimates are comparable to the baseline estimates, indicating a limited potential bias arising from the reflection problem.

5.2.3 Robust to sub-samples and outliers

Our baseline analysis is based on a panel of randomly-assigned students. Table 4 investigates the robustness by adopting alternative samples. In columns 1a and 1b, we additionally include students from classes that did not adopt a random student assignment. In columns 2a and 2b, we exclude students from non-public schools. In columns 3a and 3b, we exclude 'left-behind' students, who do not live with their parents. In columns 4a and 4b, we exclude students from wealthy households. In columns 5a and 5b, we exclude high-performing students.[11] All of the resulting estimates suggest a significantly negative spillover effect and no significant direct effect. Appendix Table

[11]Wealthy households and high-performing students are defined based on questions in the survey that ask parents to select from the categories of their household income and children's performance.

A5 demonstrates that winsorizing the sample at the 1st and 99th percentiles or the 5th and 95th percentiles does not significantly affect the estimates.

Table 4: Robust to sub-samples

	Including non-random classes		Excluding non-public schools		Excluding left-behind children		Excluding wealthy households		Excluding high-performing students	
	Chinese (1a)	English (1b)	Chinese (2a)	English (2b)	Chinese (3a)	English (3b)	Chinese (4a)	English (4b)	Chinese (5a)	English (5b)
Average	-0.040***	-0.020*	-0.046***	-0.063***	-0.046***	-0.080***	-0.042***	-0.071***	-0.049***	-0.078***
contact	(0.012)	(0.011)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)	(0.014)	(0.013)
My	0.000	0.002	-0.002	-0.001	-0.003	-0.001	-0.002	0.000	-0.003	0.000
contact	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,778	11,766	9,006	8,996	8,300	8,288	8,428	8,414	8,340	8,326
R-squared	0.816	0.888	0.823	0.897	0.827	0.900	0.821	0.895	0.813	0.889

***Notes*:** This table assesses the robustness of the baseline estimates with respect to sub-samples. Columns 1a and 1b additionally include students from classes that did not adopt a random student assignment. Columns 2a and 2b exclude students from non-public schools. Columns 3a and 3b exclude 'left-behind' students, who do not live with their parents. Columns 4a and 4b exclude students from wealthy households. Columns 5a and 5b exclude high-performing students.The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

5.3 Heterogeneity

We examine the heterogeneity of the spillover effect with respect to the student's performance ranking within the class based on pre-enrollment grades, the student's hukou status,[12] the parents' education levels and occupation, and the head teacher's gender. We estimate the heterogeneity effect based on the following regression model:

$$Y_{ict} = \alpha_0 + \alpha_1 Contact_{ict} + \alpha_2 AveContact_{ct} + \alpha_3 AveContact_{ct} * key_{ict} + X_{it}\rho + \tau_i + \tau_t + \epsilon_{ict}, \quad (6)$$

where key_{ict} is one of the moderator variables, and all other variables are the same as defined in the baseline regression model (5). Here, we are interested in the moderating effect estimate α_3. All of the moderator variables are defined as dummy variables.

As presented in 4, we find that the negative spillover effect applies only to low-ranking students within the class. This finding indicates that parents' contacting teachers increases within-class education inequality. We also find a more substantial negative spillover effect on students with rural hukou than on those with urban hukou. Since rural hukou represents a lower social status, we can conclude that parents' contacting teachers has a more negative impact on students from families of lower social status. Similarly, we find that the negative effect on Chinese scores mainly applies to students whose parents have a lower level of education and are in occupations of lower social status.[13] A potential explanation could be that parents of high social status are able to ensure that the teacher's time is allocated to their children even when excessive parental contact consumes the teacher's time. Finally, we find that the negative spillover effect on Chinese scores disappears when the head teacher is male, potentially because males are more capable of managing the pressure from parents' contact. Unfortunately, only

[12]Hukou is a household registration system in China. Every individual is registered at a specific hukou location, which can be either rural or urban. Traditionally, rural hukou has often been associated with relatively lower levels of social welfare and a lower social status.

[13]We refrain from separately estimating the moderating effect of the mother's and father's occupations because in some families, only one of the parents is employed.

31.5% of head teachers in our sample are male.

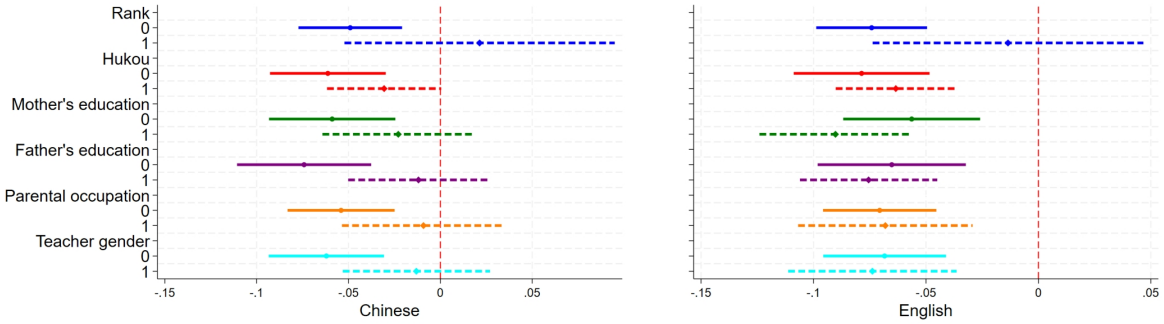

Figure 4: Heterogeneity of the spillover effect

Note: This figure shows the heterogeneity of the spillover effect in relation to the student's performance ranking within the class, the student's hukou status, the parents' education levels, parental occupation, and the head teacher's gender. Horizontal lines represent the 95% confidence intervals. The corresponding point estimates are presented in Appendix Table A6.

5.4 Mechanism

The mechanism of the negative spillover effect depicted in our conceptual framework is that increases in parents contacting teachers occupy the teacher's time and energy available for class teaching and other educational activities. We find strong evidence supporting this mechanism. Columns 1a-1c of Table 5 present the effect of the contact on the teacher's time allocated to work. The survey required the teacher to report the total hours allocated to work, to in-class teaching, and to other school works during the week before the survey. We estimate a version of model (5) that uses the log of the teacher's time allocation as the dependent variable. Column 1a shows that if all parents increase the contact frequency by one, the teacher's total time allocated to work will increase by 0.493 log points. As an average class has about 40 students, this estimate suggests that one contact from parents occupies 1.25% of the teacher's working time. Column 1b shows that the increased time is not allocated to class teaching, which is reduced by 5.80%. Column 1c shows that the increased time is mainly allocated to other works, including communication with parents. The teacher's time occupied could far surpass the time consumed by the contact itself as teachers usually need to

undertake certain tasks in order to meet parents' expectations after the contact.

We find evidence that the contact reduces the quality of class teaching. Columns 2a-2c in the table show that contact reduces a teacher's efforts and attitude in class teaching. We examine the effects on the frequency of the teacher asking my child questions, praising my child, and criticizing my child in class. These measures are reported by parents on a scale from 1 to 4 in the survey and have been standardized by subtracting the mean and dividing by the standard deviation. We find spillover effects of -0.188, -0.103, and 0.191 standard deviations on the chance of the teacher questioning, praising, and criticizing my child, respectively. We only find a direct effect of 0.032 standard deviation on the teacher praising my child. Therefore, more contact from parents reduces the classroom interaction between teachers and students and increases the negative feedback from teachers.

We also show that the contact adversely affects the subjective feelings of students, which could be influenced by teachers' attitudes and attention and are important determinants of students' academic and non-cognitive performances (Lewis & Diamond 2015, Useem 1992, Young 2020). Columns 3a-3c examine the effects on three measures of students' subjective feelings: the perceived overall friendliness of classmates (class atmosphere), the sense of a school atmosphere, and the degree of satisfaction with school management. These variables are also rated on a scale from 1 to 4 in the survey and have been standardized. We find spillover effects of -0.132, -0.351, and -0.610 on the subjective feelings of class atmosphere, school atmosphere, and school management, respectively. We find no significant direct effects on these measures.

Table 5: Channels of the spillover effect of parents contacting teachers

	Teacher's time allocated to work			Objective experience			Subjective feeling		
	Total time	Class teaching	Other works	Question	Praise	Criticism	Class atmosphere	School atmosphere	Student management
	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3c)	(3a)	(3d)
Average	0.493***	-0.058**	0.485***	-0.188***	-0.103	0.191***	-0.132*	-0.351***	-0.610***
contact	(0.027)	(0.026)	(0.024)	(0.069)	(0.069)	(0.074)	(0.073)	(0.042)	(0.049)
My contact	-0.003	0.002	-0.004	0.019	0.032**	-0.023	0.010	-0.003	-0.006
	(0.007)	(0.006)	(0.006)	(0.015)	(0.016)	(0.017)	(0.017)	(0.011)	(0.012)
Control	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,398	9,452	8,974	9,390	9,462	9,428	9,468	9,630	9,630
R-squared	0.604	0.758	0.713	0.716	0.704	0.653	0.674	0.846	0.845

Notes: Columns 1a–1c estimate the percentage effects on the teacher's total time allocated to work, to in-class teaching, and to other school works. Columns 2a–2c estimate the effects on three aspects of in-class teaching activities: the frequency of the teacher asking my child questions (Question), praising my child (Praise), and criticizing my child (Criticize) in the class. Column 3a–3c estimate the effect of class-average contact frequency on students' perceived overall friendliness of classmates (class atmosphere), teahcers' sense of a school atmosphere, and the degree of satisfaction with school management. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

6 Conclusion

Many parents have raised doubts about the long-lasting and intense nature of their involvement in contacting teachers. To a certain extent, the parent-teacher relationship has turned into a display of family strength. While existing research on parent-teacher communication mainly focuses on its direct benefits for their own children, proposing that greater parental involvement in school activities improves their child's outcomes, these studies often neglect the potential negative spillover effect emerging from the competition for the teacher's time. By examining a large panel of randomly assigned students, we discover that when parents contact teachers, there is mainly a negative spillover effect on all students in the same class. We also find that parents contacting teachers widens the within-class education inequality, as the negative impact of parents contacting teachers is more pronounced for students with lower performance and whose parents have a lower social status.

The findings from this study hold significant implications for both parents and policymakers. On one hand, although it has been demonstrated that establishing relationships with teachers can increase teachers' attention towards individual students and have a positive influence on academic results, our findings show that when spillover effects are taken into account and the potential endogenous bias is adjusted, the net effect of parental contact with teachers can be highly negative. Recognizing this fact could help parents make more intelligent investment decisions regarding parent-teacher interactions. On the other hand, and more importantly, in contrast to previous studies that promote more proactive home-school engagement, the finding of this study implies that policymakers might need to restrict the frequency of parents contacting teachers.

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A Appendix for Online Publication

A.1 Data appendix

Table A1: Summary statistics of variables

	Wave 1			Wave 2		
	Obs	Mean	Sd	Obs	Mean	Sd
Key variables:						
My contact	5322	2.366	1.016	5322	2.342	1.011
Average contact	5322	2.375	0.336	5322	2.352	0.33
Chinese Score	5229	0.628	0.236	5260	0.64	0.24
English Score	5228	0.662	0.272	5253	0.598	0.288
Math Score	5228	0.631	0.267	5260	0.615	0.285
Resilience	5134	0.017	0.993	5310	0.023	0.991
Confidence	5268	4.079	1.395	5271	3.843	1.336
Perceived performance	5293	0.025	0.987	5272	0.027	0.995
Control variables:						
Student's health status	5322	4.151	0.875	5314	3.88	0.927
Not living with parents	5322	0.093	0.291	5322	0.077	0.267
Family economic status	5322	3.057	0.527	5322	2.987	0.584
Parents' occupation	5322	0.265	0.441	5322	0.24	0.427
Teacher's contact	5258	0.63	0.483	5266	0.65	0.477
Teacher's title	5322	2.617	1.048	5322	2.761	0.961

***Notes*:** This table presents the summary statistics for key variables and control variables across each wave of the survey. My contact refers to the frequency of individual parental contact with teachers. Average contact refers to the class-average parental contact frequency. Chinese, English, and Math refer to the standardized scores for these three core subjects. Control variables include student health status (coded from 1-5, from poor to good health), whether the student is not living with parents (coded 1 if yes, 0 otherwise), parental occupation (coded 1 if either parent is employed in a state-owned institution, the public sector, as middle-to-senior management in an enterprise, or as a teacher, engineer, or doctor; 0 otherwise), whether teachers contact parents (coded 1 if contact occurs; 0 otherwise), and teacher's title (coded from 1-5, from low to high).

A.2 Random assignments of students

Following the approach of (Antecol et al. 2015), we verify the randomness of class assignments. This is achieved by regressing the class-average frequency of parents contacting teachers on 24 baseline characteristics of students, parents, and teachers while controlling for class and wave-fixed effects. As presented in Table A2, none of the estimated effects of the 24 baseline characteristics are statistically significant. Moreover, these variables are jointly insignificant as well (with an F-statistic of 0.73 and a P-value

of 0.814). These results indicate that all these characteristics are well-balanced across classes with different levels of parent-teacher contact.

The baseline characteristics of students that are examined include hukou,[14] gender, number of siblings, whether attended English classes during elementary school, whether had an illness before junior high school, ranking in the sixth grade, whether skipped grades during elementary school, whether repeated grades during elementary school, whether had a suspension of grades during elementary school, and whether found it difficult to study math, Chinese, and English in the sixth grade. The baseline characteristics of the parents consist of the occupation, education levels, health status, whether involved in the children's education, family income before the child attended junior high school, and current family income. The baseline characteristics of the teacher include the education level, gender, title, and teaching experience of the head teacher.

[14]The hukou system in China, often translated as the "household registration system," is a significant and long-standing policy categorizing Chinese citizens into rural and urban residency statuses.

Table A2: Balancing test

Average contact			
(1)		(2)	
Hukou	0.000	Mother's occupation	0.003
	(0.003)		(0.004)
Gender	-0.000	Father's occupation	0.003
	(0.000)		(0.003)
Number of siblings	0.000	Parent's health status	0.000
	(0.001)		(0.000)
If attended English classes during elementary school	-0.001	Education level of mother	0.000
	(0.001)		(0.000)
Illness before junior high school	0.000	Education level of father	0.000
	(0.000)		(0.000)
Ranking in the sixth grade	0.000	Parental involvement	-0.000
	(0.000)		(0.000)
If attended kindergarten	-0.001	Family income before junior high school	0.001
	(0.000)		(0.002)
Skipped grades	-0.000	Current family income	-0.003
	(0.000)		(0.004)
Suspension of grades	-0.000	Teacher education level	-0.017
	(0.000)		(0.040)
Math difficult	0.000	Teacher's gender	0.065
	(0.000)		(0.114)
Chinese difficult	0.000	Teacher's title	-0.009
	(0.000)		(0.033)
English difficult	0.000	Teacher's experience	0.004
	(0.000)		(0.003)
Observations	9,938	F-statistics	0.73
R-squared	0.868	p-value	0.814

***Notes*:** This table presents the balancing test. The dependent variable is the average frequency of parents contacting teachers. The independent variables are student, parent, and teacher characteristics as detailed in the text. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} $p<0.01$, {*}{*} $p<0.05$, and {*} $p<0.1$.

A.3 Results appendix

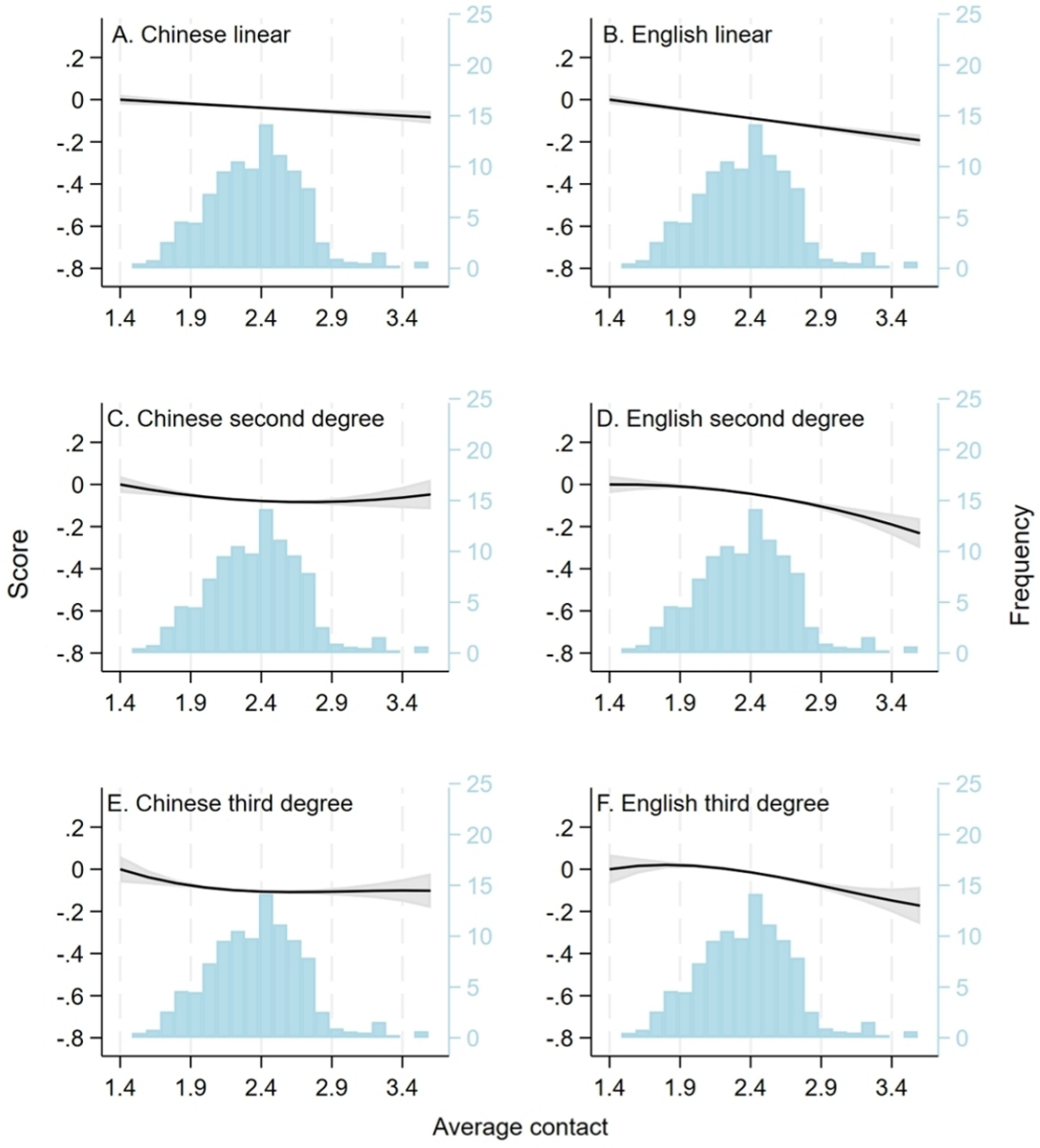

Figure A1: Non-linear effects of class-average frequency of contact on Chinese and English scores

Note: The figure presents the linear (Panels A and B), quadratic (Panels C and D), and cubic (Panels E and F) effects of the class-average frequency of parents contacting teachers on Chinese and English scores. The quadratic and cubic effects are estimated using a modified version of model (5) that additionally includes the squared and cubed terms of the Average contact. The bars represent the distribution of the class-average contact times.

Table A3: Estimating the direct and spillover effects separately

	Both effects		Direct effect only		Spillover effect only	
	Chinese	English	Chinese	English	Chinese	English
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Average contact	-0.044***	-0.070***			-0.045***	-0.071***
	(0.014)	(0.012)			(0.013)	(0.012)
My contact	-0.002	-0.001	-0.003	-0.003		
	(0.003)	(0.003)	(0.003)	(0.003)		
Control	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,400	9,386	9,400	9,386	9,400	9,386
R-squared	0.823	0.896	0.822	0.895	0.823	0.896

***Notes*:** This table examines the robustness of the baseline estimates (replicated in columns 1a and 1b) by separately estimating the direct effect (columns 2a and 2b) and spillover effect (columns 3a and 3b) using modified versions of model (5), which exclude either average contact or my contact. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

Table A4: Robust to different measures of teachers contacting parents

	Teacher contact		Recode_1		Recode_2		Recode_3	
	Chinese	English	Chinese	English	Chinese	English	Chinese	English
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Average contact	-0.044***	-0.069***	-0.045***	-0.070***	-0.044***	-0.069***	-0.044***	-0.070***
	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)
My contact	-0.002	-0.000	-0.003	-0.001	-0.002	-0.000	-0.002	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Teacher	-0.002	-0.007**	-0.000	-0.004*	-0.001	-0.004**	-0.001	-0.003**
contact	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,400	9,386	9,400	9,386	9,400	9,386	9,400	9,386
R-squared	0.823	0.896	0.823	0.896	0.823	0.896	0.823	0.896

***Notes*:** This table examines the robustness of the baseline estimates when controlling for different measures of teachers contacting parents. Columns 1a and 1b adopt the continuous measure of 1 (never contact), 2 (once), 3 (two to four times), and 4 (contact five times or more). Columns 2a and 2b adopt the approximated real measure of 0 (never contact), 1 (once), 2 (two to four times), and 5 (contact five times or more). Columns 3a and 3b adopt the approximated real measure of 0 (never contact), 1 (once), 3 (two to four times), and 5 (contact five times or more). Columns 4a and 4b adopt the approximated real measure of 0 (never contact), 1 (once), 4 (two to four times), and 5 (contact five times or more). The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

Table A5: Robust to potential outliers

	Average 1-99		Average 5-95		Total 1-99		Total 5-95	
	Chinese	English	Chinese	English	Chinese	English	Chinese	English
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Average contact	-0.048***	-0.065***	-0.049***	-0.076***	-0.053***	-0.059***	-0.045***	-0.064***
	(0.014)	(0.012)	(0.015)	(0.012)	(0.014)	(0.012)	(0.014)	(0.013)
My contact	-0.002	-0.001	-0.001	-0.001	-0.001	-0.000	-0.001	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,076	9,062	8,122	8,108	9,028	9,014	8,456	8,440
R-squared	0.824	0.897	0.828	0.896	0.823	0.896	0.823	0.897

***Notes*:** This table examines the robustness of the baseline estimates against potential outliers. Columns 1a and 1b exclude classes where the class-average contact frequency ranked below the bottom 1% or above 99%. Columns 2a and 2b exclude classes with the class-average contact frequency ranked below the bottom 5% or above 95%. Similarly, columns 3a–4b apply winsorization to the sample based on the total contact frequency for each class. The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

Table A6: Heterogeneity of the spillover effect for Chinese scores

	Chinese					
	Rank	Hukou	Mother's education	Father's education	Parents' occupation	Teacher's gender
	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)
Average contact	-0.049***	-0.061***	-0.059***	-0.074***	-0.054***	-0.062***
	(0.014)	(0.016)	(0.018)	(0.019)	(0.015)	(0.016)
Average	0.070*	0.031*	0.036	0.062**	0.045*	0.049**
contact×key	(0.040)	(0.017)	(0.027)	(0.027)	(0.024)	(0.024)
My contact	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,338	9,400	9,400	9,400	9,400	9,400
R-squared	0.822	0.823	0.823	0.823	0.823	0.823

***Notes*:** This table examines the heterogeneity of the spillover effect on Chinese scores in relation to the student's performance ranking within the class, the student's hukou status, the parents' education levels, the parents' occupation, and the head teacher's gender, estimated based on model (6). The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.

Table A7: Heterogeneity of the spillover effect English scores

	English					
	Rank	Hukou	Mother's education	Father's education	Parents' occupation	Teacher's gender
	(1a)	(1b)	(1c)	(1d)	(1e)	(1f)
Average	-0.074***	-0.079***	-0.056***	-0.065***	-0.071***	-0.068***
contact	(0.013)	(0.015)	(0.016)	(0.017)	(0.013)	(0.014)
Average	0.061*	0.015	-0.034	-0.010	0.003	-0.005
contact×key	(0.033)	(0.017)	(0.023)	(0.022)	(0.021)	(0.022)
My contact	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Student FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,324	9,386	9,386	9,386	9,386	9,386
R-squared	0.896	0.896	0.896	0.896	0.896	0.896

***Notes*:** This table examines the heterogeneity of the spillover effect of on English scores in relation to the student's performance ranking within the class, the student's hukou status, the parents' education levels, the parents' occupation, and the head teacher's gender, estimated based on model (6). The clustered standard errors are presented in parentheses. The significance levels are {*}{*}{*} p<0.01, {*}{*} p<0.05, and {*} p<0.1.