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DISCUSSION PAPER SERIES

IZA DP No. 16975

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ISSN: 2365-9793

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ABSTRACT

The Rank of Socioeconomic Status within a Class and the Incidence of School Bullying and School Absence*

In this study, we examine the impact of a student's household socioeconomic status (SES) rank within a class on two critical factors affecting the accumulation of human capital: school bullying victimization and school absence. We identify the effect from the variation of a within-class SES rank of students assigned to different schools and classes, controlling the absolute level of SES and class fixed effects. Using the data from middle-school students in the Trends in International Mathematics and Science Study (TIMSS), we find that, although the absolute level of SES is negatively associated with these incidences, students with a high SES rank within a class are more likely to be the victims of school bullying and to be absent from school. We confirm that these results are robust when the sample is restricted to schools where students' assignment to classes is as good as random.

JEL Classification: I21

Keywords: rank, socioeconomic status, school bullying, school absence

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* This study is conducted as a part of the Project "Microeconometric Analysis of Education Policy with Large Administrative Data" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). The authors are grateful for valuable comments from the editor, anonymous referees, Katsuya Takii and the participants of the research meeting of the project and Discussion Paper seminar participants at RIETI. The authors acknowledge financial support for this project from the Japan Society for the Promotion of Science (Grant Numbers 20H05629 for Ryuichi Tanaka). The usual disclaimer applies. Any errors are our own. Data Availability Statement: The data used in this article can be obtained from the website of the IEA (https://www.iea.nl/data-tools/repository/timss). Additional replication materials are provided in the Online Appendix. Disclosure Statement: Inoue declares that he has no relevant or material financial interests that relate to the research described in this paper. Tanaka declares that his research is supported by the Grant-in-Aid for Scientific Research of the Japan Society for the Promotion of Science (grant number 20H00069). There is no other conflict of interest to be disclosed for all the authors.

1. Introduction

In the majority of advanced nations, primary and lower secondary education is mandatory. These educational stages play a pivotal role in shaping human capital as they equip students with fundamental skills in subjects like mathematics and languages, prerequisites for advanced learning in higher education and essential competencies for success in the labor market. Given that the quality of education during these compulsory schooling years significantly influences individuals' later lives, governments in advanced countries bear substantial responsibility for delivering top-tier compulsory education.

To ensure the effectiveness of compulsory education, it is crucial to create and maintain a conducive learning environment that addresses globally observed problematic student behaviors, such as school bullying and absenteeism. Data from the Organisation for Economic Co-operation and Development (OECD) in 2019 underscores the scale of the issue, with 23% of students reporting monthly experiences of bullying and 21% admitting to skipping a full day of school at least once every two weeks across OECD countries.[1] Numerous studies have consistently highlighted the adverse impact of both bullying and school absenteeism on the accumulation of human capital. Research by scholars such as Le et al. (2005), Brown and Taylor (2008), Ammermueller (2012), Eriksen et al. (2014), and Gorman et al. (2019) has delved into the negative consequences of bullying, while works by Goodman (2014), Aucejo and Romano (2016), Gershenson et al. (2017), Liu and Gershenson (2021), and Cattan et al. (2023) have shed light on the detrimental effects of school absenteeism.[2] Consequently, gaining a deeper understanding of the determinants behind bullying victimization and school absenteeism in educational settings is essential for mitigating these detrimental impacts on the formation of human capital.

The influence of parental socioeconomic status (SES) on school bullying victimization and absenteeism has been a subject of extensive research. In a comprehensive meta-analysis, Tippett and Wolke (2014) revealed a consistent negative association between a student's household SES and their likelihood of experiencing bullying. Further corroborating these

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[1] Regarding the frequency of bullying victimizations, there was a discernible upward trend prior to the Covid-19 pandemic. OECD (2019) report reveals a concerning pattern, with the percentage of students reporting frequent bullying incidents (several times a month) increasing by four percentage points on average across OECD countries between 2015 and 2018. However, a contrasting narrative emerges during the Covid-19 pandemic, as some studies indicate a reduction in both school bullying and cyberbullying due to the disruption of face-to-face interactions. For instance, Werner and Woessmann (2023) study highlights that nearly half of German parents reported a decrease in their children's experiences of bullying victimization after schools closed. Additionally, an analysis of U.S. data from Google Internet searches by Bacher-Hicks, Goodman, and Mulhern (2022) suggests a significant decrease in both in-person and online bullying incidents.

In terms of absenteeism, OECD (2019) indicates a stability in the percentage of students who skipped a full day of school and those who missed some classes, with no notable change from 2015 to 2018. However, there was a three-percentage-point increase in the percentage of students who arrived late during this period.

[2] Pereznieto et al. (2010) report an estimated cost associated with school violence to the U.S. economy to be $7.9 billion annually.

findings, a study by Knaappila et al. (2018) using data from Finnish youth spanning 2000 to 2015 identified a link between bullying victimization and perpetration and parental socioeconomic adversity. Moreover, numerous investigations have demonstrated a strong connection between low SES and a heightened risk of absenteeism among students. Noteworthy among these studies are the works of Ready (2010), Morrissey et al. (2014), Gottfried and Gee (2017), Gennetian et al. (2018), and Gubbels et al. (2019). Collectively, this body of research underscores that household SES not only impacts educational investments made by families but also plays a significant role in shaping students' behavioral patterns within educational institutions.

While extensive research has explored the connection between the socioeconomic status (SES) of students' households and problematic behaviors like bullying victimization and absenteeism, there remains a notable gap in understanding how the relative SES of students' households influences these behaviors. The relative SES, or the position of SES within the school or class hierarchy, may significantly impact student behavior for several reasons. First, the relative SES, often synonymous with the rank of SES within the school or class, encapsulates the 'quality' of a student's peers concerning their own SES. Numerous studies have delved into the effects of peer characteristics such as gender, race, social and economic backgrounds, and classmates' academic abilities on various educational outcomes (e.g., Epple and Romano, 2011; Sacerdote, 2014). These investigations have consistently highlighted the pivotal role of peer quality in shaping students' educational experiences. Furthermore, research has also demonstrated the relevance of peer relationships in understanding school bullying victimization and absenteeism (e.g., Hong and Espelage, 2012; Wolke and Lereya, 2015). Given the significance of peer quality in educational contexts, it is plausible to expect that SES rank, serving as a proxy for peer quality relative to one's own, could be closely linked to the incidence of school bullying victimization and absenteeism.

Secondly, relative SES encompasses the concept of relative deprivation, a condition arising from an unequal distribution of resources within a particular group, leading to feelings of inequity, stress, and social inferiority due to disparities in social standing (Wilkinson and Pickett, 2009). Examining how individual behavior and well-being are influenced by relative deprivation, Mangyo and Park (2011) explore the impact of SES relative to a reference group, such as one's former classmates in school. Furthermore, Balsa et al. (2014) delve into whether a student's relative SES directly correlates with risky behaviors, revealing a positive association between relatively low SES and the consumption of alcohol and cigarettes among males. In a different context, Napoletano et al. (2016) identify that relative affluence is inversely related to bullying victimization among Canadian adolescents. Additionally, Paffenholz (2023) uncovers that a higher SES rank in high school positively affects students' depression scores,

cognitive abilities, self-esteem, and popularity. Consequently, it becomes evident that SES rank may exert influence on the incidence of school bullying and absenteeism through the intricate mechanism of relative deprivation.[3]

Thirdly, SES rank within a class or a school matters for students' behaviors through self-selection induced by social-status concerns of students. Cicala et al. (2018) present a Roy model in which students self-select into peer subgroups within a class based on their position in the ability distribution, aligning with their comparative advantages. According to their model, students with lower ranks find their comparative advantage in becoming "troublemakers," whereas those with higher ranks have a comparative advantage in being "nerds." The same students might choose to be troublemakers in one group where they rank lower, and nerds in another group where they rank higher. Thus, the SES rank correlated with ability could potentially influence behavior and the selection of peer groups in schools.[4] Similarly, social pressure may be a source of the importance of relative SES for students' behaviors.[5] It has been shown that students are concerned about how they are perceived by their peers, affecting their behaviors (e.g., Bursztyn & Jensen, 2015, 2019). Bursztyn & Jensen (2019) have revealed that the reluctance to engage in study efforts stems from the desire to conceal effort in schools where diligence is mocked among students, and the desire to hide a lack of ability in environments where high academic performance is valued among peers. In our context, if a student with a high SES ranking finds themselves in a classroom environment where a high SES is not regarded favorably, they may experience intense social pressure, potentially leading to bullying from peers or absences from school.

In this study, we investigate the influence of the socioeconomic status (SES) rank of students' households within a class on two critical factors that hinder the accumulation of human capital: school bullying victimization and school absenteeism. To the best of our knowledge, this is the first study examining the effect of SES rank on students' absenteeism behavior. One common challenge in identifying the effects of peer characteristics is the non-random assignment of students to classes. If class assignment is not random, and unobservable student traits are associated with both SES rank and the outcomes under examination, there's a risk of biased estimates. To address this potential endogeneity issue, researchers have typically

[3] The impact of relative status extends into adult populations as well. As evidenced by Luttmer (2005), individuals residing in neighborhoods where their neighbors earn more than they do often report lower levels of happiness compared to those living among peers with similar earnings. Similarly, Clark and Oswald (1996) establish a link between job satisfaction and salary relative to one's coworkers, highlighting that it is the relative salary within the workplace that influences job satisfaction rather than the absolute salary level.

[4] The empirical findings of Cicala et al. (2018) supportive for their theory are similar to our findings. In the experiment of maze-solving tasks by public middle school students in Houston, Texas, the low-ranked students chose the problematic behavior to interrupt the higher-ranked students who were working hard and earnestly. With a high correlation between SES and ability, our findings can be considered consistent with their social status theory.

[5] For recent literature on the effects of social pressure and its mechanisms, see Bursztyn and Jensen (2017).

employed methods such as random student group assignment (e.g., Sacerdote, 2001) or the introduction of class characteristic variations across cohorts (e.g., Lavy and Schlosser, 2011). In our study, we derive the effect of SES rank by analyzing the variation in the within-class rank of students who are placed in different schools and classes. We accomplish this while flexibly controlling for the absolute level of SES and incorporating class fixed effects, following a methodology similar to Murphy and Weinhardt (2020) and Elsner and Isphording (2018) with student ability instead of households' SES. Controlling for the absolute level of SES, we compare students with identical absolute SES levels but differing within-class SES ranks. Therefore, our central assumption is that, when accounting for absolute SES level and class fixed effects, the SES ranks of students with the same absolute SES level are determined almost randomly. To validate this assumption, we conduct the same analyses with a restricted sample of schools with multiple classes, where the average class SES is balanced across classes and the null hypothesis that class assignment is independent of household SES is not rejected employing Monte Carlo simulations.

Utilizing data from the 2015 Trends in International Mathematics and Science Study (TIMSS), we have constructed an SES index based on the methodology of Hanushek et al. (2022). Our objective is to estimate the effects of SES rank on two critical factors: students' experiences of school bullying victimization and their school absenteeism patterns. We find that while the absolute level of SES is negatively associated with the incidence of school bullying and school absence, controlling for SES, eighth-grade students with a *high* SES rank within a class are *more* likely to be victims of school bullying and to be absent from school. These SES rank effects remain robust when analyzed within a restricted sample characterized by nearly random student class assignments. Furthermore, our study delves into the heterogeneity of these SES rank effects, uncovering that they are notably more pronounced among female students, those with higher SES ranks, in classes with lower SES, and in classes with greater SES inequality. In our pursuit of understanding the mechanisms underlying these SES rank effects, we investigate their potential influence on students' attitudes toward schools and classes. Our research reveals that students with higher SES ranks tend to express less favorable sentiments, including a reluctance to engage with their classmates, perceptions of unfair treatment by their teachers, and a belief that their learning experiences in school are suboptimal. These shifts in students' attitudes and behaviors associated with SES rank provide insight into potential reasons for absentee behavior.

Our study contributes to the literature on the effects of ranks within schools and classes on various educational outcomes, in addition to the literature discussed above.[6] Murphy and Weinhardt (2020) shed light on how primary school test score rankings influence subsequent

[6] For a review of this literature, see Delaney and Devereux (2022).

test scores, student confidence levels, and subject choices during secondary schooling. Similarly, Elsner and Isphording (2017) uncover the positive influence of a student's ordinal academic rank within a high school cohort on high school graduation rates and college attendance. Using data from randomly assigning college students to tutoring, Elsner et al. (2021) find that higher academic ranks improve academic performance in colleges and increase the probability of choosing relevant follow-up courses and majors. The study by Goulas et al. (2022), which examines data from randomly assigned high school classes, highlights how females with a higher comparative advantage (class rank) in STEM fields are more inclined to pursue STEM degrees. Denning et al. (2023) utilize administrative data from Texas and show that students with high academic rankings in the third grade tend to achieve higher test scores later, are more likely to attend college, and earn higher incomes 19 years later.

In addition to academic achievements, Elsner and Isphording (2018) uncover a moderating effect of ordinal ability rank in high school on risky behaviors such as smoking and alcohol consumption. These studies collectively emphasize the manifold benefits of higher academic rankings, including increased student confidence, opportunities to interact with similarly high-achieving peers, and greater support from teachers and parents. Relevant to our study, Comi et al. (2021) explore the impact of high school students' academic rankings within their classes on school violence, revealing a negative association between academic rank and the likelihood and frequency of school violence incidents. Ballatore et al. (2020) investigate the effects of age rank within schools on school bullying rates, finding that a higher rank in the age distribution reduces the likelihood of being bullied. Furthermore, Pagani et al. (2021) delve into the influence of academic rank within the classroom on the Big Five personality traits of high school students, noting its effect on conscientiousness. Our study expands on this body of research by examining the impact of SES rank, presenting a novel perspective on the sources that drive rank effects and their influence on non-academic outcomes within educational settings.

The remainder of this paper is organized as follows. In the next section, we explain our empirical framework. Section 3 explains the study's data. We report the estimation results and their robustness in section 4. Section 5 discusses the effects on other related outcomes and the heterogeneity of the effects. Section 6 concludes the study.

2. Econometric Framework

To estimate the effect of SES rank within a class on school bullying and school absence, we estimate the following regression model:

$$Y_{ics} = \beta_0 + \beta_1 SESRank_{ics} + f(SES_{ics}) + \beta_2 X_{ics} + \lambda_c + \varepsilon_{ics} \qquad (1)$$

where Y_{ics} denotes school bullying and school absence for student i in class c of school s;

$SESRank_{ics}$ is the percentile SES rank of student i in class c; $f(SES_{ics})$ is a fifth-order polynomial of the SES of student i; X_{ics} contains the gender, age, and dummy variables for missing values of student i; λ_c is the class fixed effects; and ε_{ics} is the error term. The coefficient of interest is β_1, which captures the effect of SES rank within a class on school bullying and school absence. We use cluster-robust standard errors at the school level, accounting for the correlation in the level of school bullying and school absence within the same school.

We identify the SES rank effect by incorporating SES in a flexible manner alongside class fixed effects. This approach allows us to draw comparisons among students who possess identical absolute SES levels but find themselves in distinct ordinal positions within their peer groups due to variations in the distribution of SES within each class-cohort.

The class fixed effects serve to absorb any average disparities in characteristics across classes. This encompasses peer group attributes that exert a collective influence on all students within a class, such as mean SES levels, their variability, and the characteristics assigned to classmates. This identification strategy, characterized by the inclusion of class fixed effects, has previously been employed in the estimation of academic rank effects, as demonstrated in studies by Murphy and Weinhardt (2020), Comi et al. (2021),Elsner et al. (2021), and Denning et al. (2023). Hence, our foundational assumption is that, when we employ a flexible SES control method and factor in class fixed effects, the assignment of SES rank to students becomes nearly random.[7]

Furthermore, we confirm the robustness of our results through various checks. Most importantly, we perform the same analysis on a sample of students from schools where multiple classes have been sampled and where the average SES across classes is evenly distributed. In this restricted sample, we use Monte Carlo simulations to verify that the null hypothesis of class assignment being independent of household SES is not rejected. Additionally, considering the potential correlation between SES and other variables such as academic performance and IQ, we conduct analyses that control for academic rank and age rank to mitigate omitted variable bias related to SES rank. Additionally, considering the potential heterogeneity in class characteristics, we control for SES using ventiles and conduct an analysis that includes interaction terms between the SES ventiles and both the average SES of the class and the standard deviation of SES.

The interpretation of our coefficient of interest, β_1, deserves discussion. In our setting for the analysis of bullying victimization, a student's rank affects how the peers behave towards the student. Thus β_1 can be interpreted as the effect of the SES rank of the student perceived by the peers. In the case that students do not observe their peers' precise ranks, the actual rank

[7] The robustness of the results is maintained within a specification where the absolute SES level is nonparametrically controlled for, utilizing the decile and ventile dummies rather than continuous variables.

of the student can be considered as the instrument for the perceived rank by the peers. Consequently, the estimate of β_1 based on a reduced form regressing outcomes on a student's actual rank can be interpreted as a weighted average over different types of compliers among peers whose perceived rank is affected by the actual one.[8] Accordingly, the estimated effect could be heterogeneous depending on how peers are responsive to a student's actual rank.[9]

3. Data

Our primary data source is TIMSS 2015, an international survey that assesses the performance of eighth-grade students in mathematics and science. It also compiles comprehensive data on students, households, teachers, schools, and curricula from participating countries worldwide.[10]

Samples were extracted by employing the two-stage random sample design, where schools are selected as the first stage and classes are selected as the second stage in each country. In principle, all students in the selected classes are sampled. However, the number of students in the sample may be smaller than the actual number because of student non-participation in the survey. In all estimations, we use a rescaled student sampling weight to assign the same weight to each country because we use student samples from many countries.

The raw data included a total of 285,190 students. We implemented the following sample restrictions: First, we excluded students who did not respond to questions related to bullying victimization and absenteeism, which are the dependent variables in our study, resulting in a reduction of the sample size by 35,397 students. Second, we omitted students in classes with fewer than ten students, as interactions among students in smaller class sizes may differ from those in larger classes. This led to a further reduction of 4,799 students. Ultimately, our final sample size amounted to 244,994 students, representing a 14% decrease from the initial total sample. If sample selection due to missing outcome variables is correlated with SES rank, it may lead to biased estimation results. To address this concern, we report the results of robustness checks later, wherein no systematic relationship between SES rank and missing samples is observed. For missing information, we impute any missing values of independent variables by the median of the smallest unit available among the class, school, and country

[8] Measurement error of the perceived rank attenuates the estimate of the coefficient of the interest. In this case, our estimates can be interpreted as the lower bound (in absolute value) of the true effect.
[9] Using the same data from TIMSS, Inoue & Tanaka (2023) estimate the influence of SES rank on school bullying and absence for fourth-grade elementary school students. They find that the effect is less pronounced and lacks statistical significance compared to its impact on eighth-grade students. This observation is consistent with the interpretation of the coefficient estimate if, compared to middle school students, elementary school students are less aware of their peers' SES ranks reducing the likelihood of peers reacting to a student's actual SES rank.
[10] The most recent TIMSS 2019 survey has slightly less information on school belonging used for other outcomes in this study than the 2015 survey. Therefore, we chose to use the 2015 data.

units.[11] The imputed sample proportions are negligible, accounting for less than 1%, for variables such as gender, age, the number of books at home, and six other common household possessions (such as computers, study desks, private rooms, Internet access, etc.) across all countries. However, for parents' highest level of education, the imputed sample proportion stands at 21%.[12] Our regression model incorporates dummy variables to account for missing values among students for each respective variable.[13]

To construct the SES index, we leverage data related to parental education and household possessions. This information not only serves as a practical proxy for long-term assets but also helps mitigate the potential for reverse causation. In particular, we adopt the approach outlined by Hanushek et al. (2022), who employ a comprehensive SES measure as the first principal component of a vector that includes dummy variables representing all available household resources, along with another vector of dummies representing parental education levels.[14] More specifically, our data encompasses six key home resources, including the quantity of books (classified into five categories), as well as parental educational attainment (categorized into five levels). These variables represent common questions posed in the TIMSS survey, and they are consistent across participating countries.[15]

Next, we calculate the percentile rank of SES within each class using the following formula:

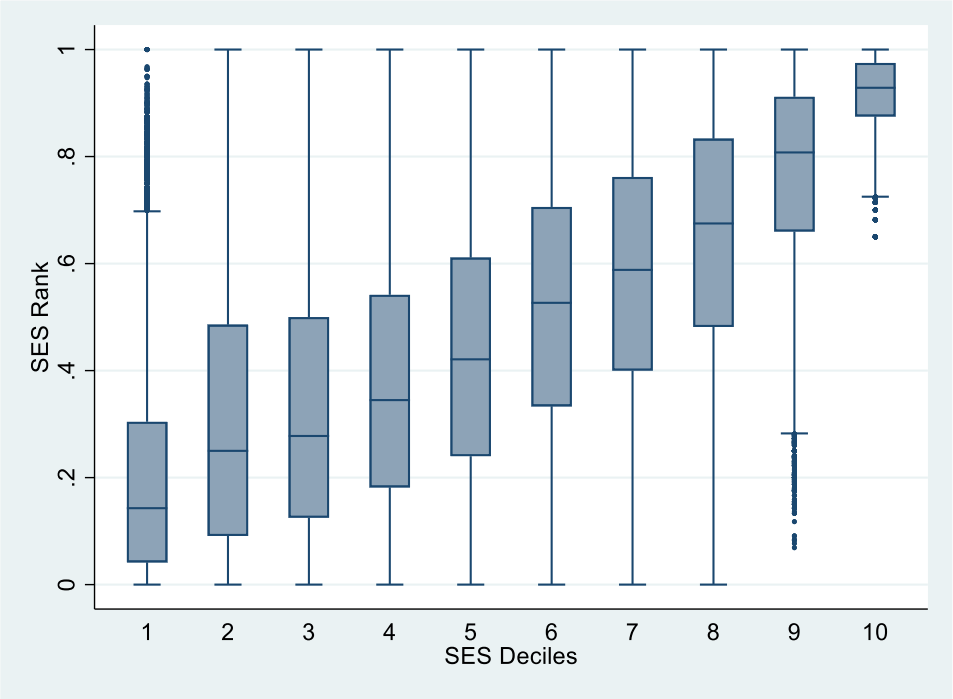
$$SES\text{-}Rank_{ics} = \frac{n_{ics}-1}{N_{cs}-1}$$

where $SES\text{-}Rank_{ics}$ is the percentile SES rank of student i in class c of school s; N_{cs} is the number of students in class c of school s; n_{ics} is the ordinal rank of the SES of student i in class c of school s, which increases SES to a maximum of N_{cs}.[16] Figure 1 illustrates the distribution of SES percentile ranks within classes across different SES deciles. This graphical representation reveals the substantial variation in SES percentile ranks observed among

[11] Wößmann (2003) and Fuchs and Wößmann (2007) impute for missing fundamental attribution such as gender, age, grade, parental education level, and the number of books at home by using the mean or median of the smallest available group (class, school, country).
[12] If a respondent answered 'I don't know' when asked about their parent's highest level of education, we treat this response as a missing value and proceed with imputation.
[13] We have verified the robustness of our results, even when excluding the sample with missing values from our analysis. Detailed results are available upon request.
[14] Hanushek et al. (2022) have devised four distinct alternative SES metrics based on data pertaining to home environments and parental education levels. In our analysis, we compute these alternative SES indices and observe that our findings remain consistent and robust across all of these SES measures.
[15] More precisely, our analysis relies on responses to six specific items regarding household possessions, which encompass: (1) Personal ownership of a computer or tablet; (2) Shared usage of a computer or tablet within the household; (3) Availability of a study desk or table for personal use; (4) Possession of a private room; (5) Access to an Internet connection; and (6) Personal ownership of a mobile phone."
[16] When generating the SES rank variable, we assume that the class size corresponds to the number of students who participated in the TIMSS survey.

students within the same SES deciles.[17]

Figure 1. Box plot of SES rank



To validate the nearly random assignment of SES ranks to each student, we conducted a balancing test among students with varying SES ranks. If SES ranks are indeed assigned randomly while accounting for class fixed effects and absolute SES levels, students with different SES ranks should exhibit similar characteristics. To assess this, we regressed predetermined characteristics, such as gender and age, on students' SES ranks. Table 1 presents the results of the balancing test. Column (1) displays unconditional estimates (controlling solely for missing value dummies), while column (2) provides conditional estimates (accounting for class fixed effects, the absolute level represented as a fifth-degree polynomial of SES, and missing value dummies). In the unconditional estimation in column (1), there are statistically significant differences in gender and age among SES ranks. However, when we additionally control for class fixed effects and the absolute SES level in column (2), these differences become markedly smaller and are no longer statistically significant at the 5% significance level. The results of the balancing test indicate that, when controlling for class fixed effects and the absolute SES level represented as a fifth-order polynomial, student characteristics are well-balanced across various SES ranks. Additionally, Table A1 presents the results of balance tests across various specifications, incorporating linear to sixth-degree

[17] As a robustness check, in instances of tied rankings, we adopted a conservative approach by assigning a lower ranking to all affected students, a method consistent with Murphy and Weinhardt (2020). Notably, our findings remained consistent in these analyses, and detailed results are available upon request.

polynomial terms of SES, as well as non-parametric controls for SES deciles and ventiles using dummy variables. It is confirmed that no statistically significant coefficients are observed at the 5% level or below when controlling for SES using polynomial terms of the fifth degree or higher, and dummy variables for SES ventilation.

Table 1. Balancing Test for Predetermined Characteristics

	(1) Unconditional test			(2) Conditional test		
Variables	Coefficient	S.E.	Obs.	Coefficient	S.E.	Obs.
Girl	-0.0240***	(0.0038)	244,994	-0.0073	(0.0121)	244,994
Age	-0.0889***	(0.0048)	244,994	0.0278*	(0.0151)	244,994

Notes: Each cell represents a separate regression which regress the demographic characteristics above on SES rank. All specifications control for dummy variables for missing values and give the same weight to each country. Conditional estimates additionally control for a fifth-degree polynomial of students' SES and class fixed effects. Standard errors are clustered-robust at the class level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

To capture the incidence of victimization caused by school bullying, we utilize student responses to a comprehensive set of questions related to bullying within the framework of TIMSS. This includes nine specific questions probing bullying victimization experiences: (1) Made fun of me or called me names, (2) Left me out of their games or activities, (3) Spread lies about me, (4) Stole something from me, (5) Hit or hurt me, (6) Made me do things I didn't want to do, (7) Shared embarrassing information about me, (8) Posted embarrassing things about me online, and (9) Threatened me. For each of these items, students are presented with four response options: 1 "Never," 2 "A few times a year," 3 "Once or twice a month," and 4 "At least once a week." The student bullying scale is standardized using Item Response Theory scaling methods, specifically the Rasch partial credit model (Martin et al., 2016), to ensure a mean of 10 and a standard deviation of two across all countries. [18] Note that the student bullying scale is given in the TIMSS data set, and that as bullying victimization becomes more frequent, the value of the student bullying scale decreases. To gather data on school absence, we rely on students' responses to a four-level ordinal scale, which spans from 'more than once a week' to 'never or rarely.' We then create a binary dummy variable that signifies absence occurring at least once every two weeks as our dependent variable.

[18] In interpreting the magnitude of the student bullying scale within the context of TIMSS 2015, it's important to note that a score of 9.3 or higher indicates that students are seldom subjected to bullying, whereas a score of 7.3 or lower suggests that students experience such behaviors on an almost weekly basis. Scores falling between 7.3 and 9.3 imply that students encounter bullying roughly on a monthly basis. Consequently, an increase of one standard deviation, equivalent to a two-point rise on the student bullying scale, signifies that students who were previously enduring bullying nearly every week are now likely to experience it very infrequently, if at all. For more detailed information, please refer to Martin et al. (2016).

Table 2 presents the summary statistics for our dataset. In terms of bullying victimization, the average scores for each item fall within the range of 1 ('Never') to 2 ('A few times a year'). Notably, 'Made fun of me or called me names' and 'Spread lies about me' exhibit higher average scores, indicating a higher incidence of verbal bullying victimization compared to physical bullying. Regarding student absences, approximately 15% of students reported being absent more than once every two weeks. Furthermore, there exists a correlation between these two measures of risky behaviors. Table A2 provides the correlation coefficients among SES, the Bullying Scale, and the absence dummy variable. Notably, the Bullying Scale and the absence dummy variable display a negative correlation, suggesting that students who frequently experience bullying victimization are also more likely to be frequently absent from school.

To explore potential pathways through which rank effects may impact school bullying and absenteeism, we turn to students' subjective responses regarding their sense of school belonging as additional outcome variables. This set of inquiries encompasses seven items: (1) I like being in school, (2) I feel safe when I am at school, (3) I feel like I belong at this school, (4) I like to see my classmates at school, (5) Teachers at my school are fair to me, (6) I am proud to go to this school, and (7) I learn a lot in school. Each of these questions allows students to select from four response options: 1 “Disagree a lot,” 2 “Disagree a little,” 3 “Agree a little,” and 4 “Agree a lot.” For all these questions, the average response is between 3 (“Agree a little”) and 4 (“Agree a lot “). We estimate the regression model (1) with the responses to these questions as the dependent variable in the equation.

Table 2. Summary statistics.

	Mean	S.D.	Obs.
Dependent variable:			
Bullying Scale	10.13	1.98	244,994
Made fun of me or called me names	1.97	1.13	244,994
Left me out of their games or activities	1.55	0.94	244,994
Spread lies about me	1.67	0.95	244,994
Stole something from me	1.49	0.88	244,994
Hit or hurt me	1.44	0.85	244,994
Made me do things I didn't want to do	1.31	0.73	244,994
Shared embarrassing information about me	1.44	0.82	244,994
Posted embarrassing things about me online	1.18	0.58	244,994
Threatened me	1.24	0.67	244,994
Absence_Once every two weeks or more	0.15	0.36	244,994
Like being in school	3.13	0.85	244,068
Safe at school	3.28	0.82	243,603
Belong at school	3.23	0.87	241,560
Like to see classmates	3.62	0.67	243,005
Fair teachers	3.22	0.85	242,835
Proud to go to this school	3.23	0.89	243,341
Learn a lot in school	3.44	0.73	243,938
Independent variable of interest:			
SES Rank	0.50	0.30	244,994
Independent variable of others:			
SES	0.01	1.60	244,994
Girl	0.50	0.50	244,994
Age	14.2	0.73	244,994

Notes: SES rank is percentile rank of SES within the class. All tabulations give the same weight to each country.

4. Results

This section presents the estimation results obtained using Eq. (1). First, we explain the main results of the effects of SES rank on bullying victimization and school absence. We then discuss the robustness of the main findings.

4.1 The correlation between SES and the incidence of school bullying and school absence

First, we estimate the correlation between SES and the incidence of school bullying and school absence. Table A3 reports the results. In column (1) of Table A3, the coefficient of SES on the bullying scale is positive and statistically significant at the 1% level. This finding suggests that students with higher SES backgrounds are less susceptible to bullying victimization. Furthermore, as indicated in column (2), the coefficient of SES on school absence is observed to be negative and statistically significant at the 1% level. This implies that students with higher SES backgrounds tend to exhibit lower rates of absenteeism from school.

4.2 The SES rank effect on school bullying and school absence

Next, we proceed to estimate regression model (1) to assess the influence of SES rank within the class on bullying victimization and absenteeism. Our results for three different specifications are detailed in Table 3. Columns (1) and (4) present the findings with control for SES and school fixed effects; Columns (2) and (5) include control for SES and class fixed effects; and Columns (3) and (6) further incorporate control for student characteristics.

Table 3. The SES rank effect on school bullying and school absence.

	Bullying Scale			Absence_Once every two weeks or		
	(1)	(2)	(3)	(4)	(5)	(6)
SES Rank	-0.2597***	-0.2199***	-0.2186***	0.0631***	0.0339***	0.0327***
	(0.0463)	(0.0503)	(0.0503)	(0.0087)	(0.0097)	(0.0097)
SES	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	No	No	Yes	No	No	Yes
School fixed effects	Yes	Abs.	Abs.	Yes	Abs.	Abs.
Class fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.207	0.220	0.221	0.147	0.158	0.162

Note: The Bullying Scale indicates that lower values mean more bullying victimization. SES controls a fifth-degree polynomial of students' SES, Student controls include students' gender, age and dummy variables for missing values. All specifications give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

In column (1), the coefficient of SES rank on the bullying scale is notably negative and statistically significant at the 1% level. This result suggests that students with a higher SES rank within the class are *more* likely to be victims of school bullying. This relationship is stable after

controlling for class fixed effects (Column (2)) and student characteristics (Column (3)). Furthermore, the coefficient of SES rank on school absence is found to be positive and statistically significant at the 1% level in columns (4), (5), and (6). These results imply that students with higher ranks within the class exhibit an increased likelihood of being absent from school.

It's worth noting that the magnitude of the estimated coefficients in columns (2) and (5) is slightly lower than those in columns (1) and (4), suggesting that estimates in the specifications controlling for school fixed effects, instead of class fixed effects, may exhibit a slight upward bias. This phenomenon could be attributed to non-random student assignments to classes within schools in the full sample. If classes with varying SES levels coexist within the same school, students may be assigned to classes based on their own SES, thereby changing their SES rank and influencing their likelihood of experiencing bullying. This aspect will be further explored in the analysis of restricted samples, where students' class assignments are close to random.

To delve deeper into the impact of SES rank, we examine its effects on each individual bullying victimization variable used to construct the bullying scale. As detailed in Table A4, SES rank exhibits an adverse effect on all nine bullying victimization items, with all of them attaining statistical significance at the 1% level. These results corroborate our earlier findings in Table 3.

Additionally, Table A5 provides the estimated effects of SES rank with respect to the frequency of absences. The results reveal that SES rank has an adverse impact on school absence, specifically occurring more than once a week (Column (1)), more than once every two weeks (Column (2), consistent with Table 3), and more than once a month (Column (3)).

In summary, our analysis indicates that middle school students with higher SES ranks within their classes are more prone to experiencing school bullying and exhibiting school absenteeism.

4.3. Robustness

In order to validate the robustness of our primary findings, this section offers the results of a series of robustness checks. These include analyses that additionally control for academic and age ranks, conducted with restricted samples exhibiting balanced SES means across classes within schools. Furthermore, we explore alternative definitions of the SES indicator, focus on analyses specific to rural schools where the likelihood of school choice is reduced—and conduct sensitivity analyses with various functional forms of SES to adequately control for potential non-linear effects.

4.3.1. Analysis Controlled for Academic Rank and Age Rank

The SES of students may be associated with variables such as academic performance and ability. Therefore, SES rankings could correlate with these variables' rankings, potentially leading to omitted variable bias if not adequately controlled. To mitigate this concern and strengthen the robustness of our findings, our analysis not only incorporates the absolute levels of academic achievement (with a focus on math scores) but also includes these scores up to the fifth-order polynomial terms and their respective within-class academic achievement rankings. Additionally, we consider both the absolute age of students, also up to the fifth-order polynomial terms, and their within-class age rankings in Model (1). This comprehensive approach allows us to concurrently estimate the parameters for SES rank, academic achievement rank, and age rank.

The results are shown in Table 4. Columns (1) and (4) reiterate Columns (3) and (6) from Table 3 as benchmarks. Columns (2) and (5) present the estimation results of the model that controls for the absolute level of academic achievement and the in-class academic rank. Meanwhile, Columns (3) and (6) display the outcomes of the model that additionally controls for the absolute level of age and the in-class age rank. The findings indicate that the relationship between SES rank and outcomes such as bullying victimization and absenteeism remains robust even after controlling for academic and age ranks. These results suggest that the impact of SES rank is not solely explained by social dynamics related to academic performance, such as the likelihood of facing bullying due to academic achievement rather than SES, or by treatment differences stemming from age discrepancies. The stable relationship between the SES ranking and the outcomes underscores a clear and independent role of SES, beyond the influences of academic performance and age.

Table 4. Robustness check: Controlled for Academic Rank and Age

	Bullying Scale			Absence_Once every two weeks or more		
	(1)	(2)	(3)	(4)	(5)	(6)
SES Rank	-0.2186***	-0.2015***	-0.2023***	0.0327***	0.0260***	0.0258***
	(0.0503)	(0.0504)	(0.0503)	(0.0097)	(0.0096)	(0.0096)
Academic Rank		-0.0193	-0.0215		0.0119	0.0118
		(0.0439)	(0.0438)		(0.0083)	(0.0083)
Age Rank			0.0216			-0.0226***
			(0.0379)			(0.0073)
SES	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.221	0.224	0.224	0.162	0.183	0.183

Note: All specifications control a fifth-degree polynomial of students' SES, gender, age, dummy variables for missing values, and class fixed effects. Columns (2) and (5) additionally control for within-class ranks of mathematics test scores and a fifth-degree polynomial of the mathematics test scores. Moreover, Columns (3) and (6) build upon the specifications in Columns (2) and (5) by further controlling for within-class ranks of age and a fifth-degree polynomial of age. All specifications give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

4.3.2. Sensitivity check

One potential concern in identifying causal effects is the possibility of misspecification in the regression model. In our baseline estimation, we control for the absolute level of SES using a fifth-order polynomial function. To ensure the robustness of our findings, we conduct a sensitivity analysis that extends the controls for SES from a linear model up to a sixth-order polynomial function. Additionally, we include nonparametric controls through the use of SES ventile dummy variables.

Table A6 provides an overview of the results, affirming their consistency with the baseline model estimation outcomes presented in Table 3.

4.3.3. Analysis restricted to samples with average SES levels balanced across classes within schools

Our identification strategy relies on the premise that through meticulous control for SES in a flexible manner and inclusion of class-fixed effects, the assignment of SES ranks to students with identical SES levels within a class closely approximates random allocation. The outcomes of our balancing tests, focusing on students' characteristics, support this strategy.

In order to further solidify our identification strategy, we conduct additional robustness checks with samples where schools are considered to organize their classes independently of SES. Specifically, we restrict our samples exhibiting no statistically significant differences in mean SES across classes. To ensure the validity of our restricted samples, we employ Monte

Carlo simulations to affirm that class assignments are effectively independent of household SES and closely resemble random assignments. Initially, we restrict our samples to instances where multiple classes are drawn from a single school, yielding a total of 110,768 observations. Interestingly, we discover that approximately 20% of the sample belongs to schools where the average SES across classes is not balanced, prompting us to exclude this portion of the sample.

Subsequently, we utilize Monte Carlo simulations to verify that students in the restricted sample are assigned almost randomly to the class. Our simulation process involves the random assignment of each student to classes within their school, followed by the calculation of the percentile rank of SES within their assigned class. This procedure is repeated 1,000 times, enabling us to construct a 95% confidence interval under the null hypothesis that class assignments are random within the school. We then assess whether the observed SES rank falls outside this confidence interval. Table 5 presents the results of these Monte Carlo simulations. In the sample where SES means are balanced across classes (Panel A), a mere 3.8% of the student sample rejects the null hypothesis. However, in samples where the mean SES across classes is unbalanced (Panel B), a significantly larger proportion, 37.7% of the sample, rejects this null hypothesis. Since the rejection rates are meager in samples where the SES means are balanced across classes, we conclude that student class placement is almost random in our restricted sample.

Table 5. Verification of the randomness of student class placement using Monte Carlo simulation.

	Mean	S.D.	Obs.
Panel A (Samples where the observed SES is balanced across classes)			
Reject	0.038	0.191	89,042
Panel B (Samples where the observed SES is not balanced across classes)			
Reject	0.377	0.485	21,726

Note: This table shows the results of examining whether students are randomly assigned to classes. First, using Monte Carlo simulation, each student is randomly assigned to a class within a school, and the percentile rank of SES within that class is calculated. This process is repeated 1,000 times. Then, a 95% confidence interval is constructed under the null hypothesis that the class assignment of students is random. Next, we check whether the observed SES ranks lie outside the confidence interval. The variable "Reject" is a dummy variable that takes one if the null hypothesis is rejected. Panel A shows the results for samples where the observed SES is balanced across classes at the 5% significance level, while Panel B shows the results for samples where it is not.

Columns (1) and (3) in Table 6 mirror the results from columns (3) and (6) of Table 3, acting as a reference point. Columns (2) and (4) of Table 6 display the outcomes when our analysis is

limited to samples belonging to schools where the mean SES is balanced across classes. The results presented in columns (2) and (4) of Table 6 indicate that the adverse effects of SES rank are moderated when examining samples from schools where mean SES levels are balanced across classes. This suggests that in schools where classes are organized by SES, students assigned to classes with lower average SES levels experience a more pronounced adverse effect from their SES rank. Conversely, students assigned to classes with higher average SES levels, where the incidence of bullying victimization is lower, exhibit a lesser adverse effect from their SES rank. Essentially, in schools where class organization is influenced by SES, relatively high-SES students placed in classes with low SES averages are the most strongly affected by the adverse consequences of SES rank.

Table 6. Robustness check: Analysis restricted to samples with average SES levels balanced across classes within schools.

	Bullying Scale		Absence_Once every two weeks or more	
	(1)	(2)	(3)	(4)
SES Rank	-0.2186***	-0.1988**	0.0327***	0.0289*
	(0.0503)	(0.0854)	(0.0097)	(0.0149)
Keep schools where SES is balanced across classes.	No	Yes	No	Yes
SES	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes
Observations	244,994	89,042	244,994	89,042
R-squared	0.221	0.189	0.162	0.146

Notes: The Bullying Scale indicates that lower values mean more bullying victimization. SES controls a fifth-degree polynomial of students' SES, Student controls include students' gender, age and dummy variables for missing values. All specifications give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

In summary, although results exhibit some variations with respect to sample selection, particularly in cases where the mean SES is not balanced across classes, our main findings remain robust and substantiated.

4.3.4 Comparing Classrooms with Similar SES Distributions.

In addition to limiting our analysis to students belonging to schools with a balanced average SES, as previously confirmed, we contemplate a method to examine the effects of SES rank among classrooms with similar SES distributions. This method involves a model that further

controls for interaction terms between SES and the classroom's average SES and SES standard deviation. Herein, we estimate a model that controls for the absolute level of SES using ventile dummy variables, as well as interaction terms between these ventile dummy variables and the classroom's average SES and SES standard deviation. Table A7 presents the results of this analysis, showing that the findings are consistent with the baseline results displayed in Table 3. This consistency suggests that our findings are robust against potential biases related to classroom SES distribution variations, such as the sorting of students among classes.

4.3.5. Analysis restricted to schools in small municipalities, where school choice is less likely to be available.

It bears repeating that while class fixed effects effectively control for the average impact of student assignment both across and within schools, it's crucial to acknowledge the potential for heterogeneity in this influence, which could introduce bias in the estimated coefficients of the SES Rank effect. To address this concern, we undertake a specific sample restriction by focusing on schools in smaller municipalities where the likelihood of school choice is notably reduced.

More precisely, we narrow our sample to encompass students residing in municipalities with populations of less than 15,000 and 3,000, respectively. The outcomes of this analysis are presented in Table A8. Remarkably, these results align with the baseline estimates showcased in Table 3, providing reassurance that our baseline model is not significantly compromised by potential bias arising from school choice considerations.

4.3.6. Analyses with different ways of defining the SES indicator.

The definition and measurement of SES can vary significantly based on contextual factors and data availability (Hanushek et al., 2022). In a broad sense, SES encompasses one's access to financial, social, cultural, and human capital resources. A student's SES typically includes parental education, parental occupation, and household or family income (Cowan et al., 2012). In our analysis, we take steps to ensure the robustness of our findings by examining alternative SES measures.

To construct these alternative SES measures, following the approach of Hanushek et al. (2022), we transform categorical data on parental education into a straightforward linear measure of years of schooling, categorical data on books in the home into a linear measure representing the total number of books present, and binary data on possessions in the home into a unified linear measure (Alternative SES1 and Alternative SES2). Furthermore, to discern whether the effects of SES rank arise from intangible social statuses, such as parental education,

or from tangible economic environmental differences within households, such as the number of books or possessions, we also perform analyses using SES indices constructed solely from variables representing the former (Alternative SES3) and solely from variables representing the latter (Alternative SES4). Specifically, the alternative SES indices are constructed as follows:

Alternative SES1: This index is derived from the first principal component analysis of a vector that includes a continuous measure of parental education levels, a categorical variable representing the number of books in the home, and a composite index of six home-related variables. This composite index is itself calculated from the first principal component of these variables.

Alternative SES2: This index is derived from the first principal component of a vector incorporating categorical variables for parental education levels and the number of books in the home, excluding the six home-related variables.

Alternative SES3: This index is constructed solely from a categorical variable representing levels of parental education.

Alternative SES4: This index is derived from the first principal component of a vector that includes dummy variables representing the number of books in the home and six other home-related items.

Table A9 provides a summary of the results, clearly demonstrating the robustness of our findings across these alternative SES1 and SES2 measures. Furthermore, the SES rank effect appears to be attenuated in the alternative SES3 compared to alternative SES4. A possible explanation for this could be that constructing SES indicators solely based on educational attainment information might significantly reduce variation and increase measurement error. Additionally, the SES rank effect manifests only when the relative SES positions are perceived. This suggests that visible economic environments, such as the number of books owned or other tangible possessions, are more readily perceived indicators of SES rank than less visible indicators of social status, like parental education. In other words, these findings imply that differences in the physical economic environments among middle school students are more likely to influence their perception of relative SES differences among classmates during interactions.

4.3.7. Impact of Sample Selection

In our main analysis, we exclude samples with missing data on outcomes such as bullying victimization or absences, as well as samples from classes with fewer than ten students. If these omissions are not random, they could potentially bias the effects of SES rank. Therefore, we assess whether the sample omission is systematic and whether there is a systematic relationship between SES rank and the samples observed.

To understand the characteristics of the excluded samples, we regress the "Observation Dummy"—a variable assigned a value of 1 for included samples and 0 for excluded ones—on predetermined variables such as gender, age, and SES in a linear regression. Table A10 presents these results, indicating that the observed samples tend to be female, younger, and of higher SES, thus not missing at random. This suggests that controlling for these attributes is appropriate in estimating the effects of SES rank.

Next, to determine if there is a systematic relationship between the "Observation Dummy" variable and SES rank, we estimate it using the "Observation Dummy" variable as an outcome in Model (1). The results, presented in Table A11, show no systematic relationship between the "Observation Dummy" variable and SES rank. This implies that sample selection does not significantly bias the effects of SES in the model that controls for SES, student attributes, and class fixed effects.

Furthermore, to conduct analysis that accounts for the probability of observation, we calculate the observation probability from the analysis in Table A10 and perform a weighted analysis using inverse probability weighting. We also perform estimations without using sampling weights to assess the impact of sampling weights. Columns (1) and (4) in Table A12 reiterate columns (3) and (6) from Table 3 as benchmarks. Columns (2) and (5) present the analysis results using inverse probability weighting, and columns (3) and (6) show the results without using weights, all of which are consistent with the main findings. These results confirm that the main results are not significantly biased due to the impacts of sample selection and sampling weights.

4.3.8. Measurement error in SES

Measurement error in SES ranks is another potential issue that could bias the effects attributed to SES ranks. Denning et al. (2023) addressed the non-standard measurement errors in the variables determining ranks by "percentilizing" them, thereby calculating class-specific ranks based on these percentilized variables.

Following this methodology, we also compute the percentiles of students' SES instead of using their "raw" SES scores. Subsequently, we estimate the effects of SES rank using variables

that determine class-specific SES ranks based on these percentilized SES scores. Table A13 presents these results, with columns (1) and (4) serving as benchmarks by reiterating columns (3) and (6) from Table 3. The findings demonstrate robustness, both when using variables that generate SES ranks after global percentilization (columns (2) and (5)) and when using variables that generate SES ranks after percentilization within each country (columns (3) and (6)).

5. Discussions

5.1. Investigating Other Relevant Outcomes

The preceding sections have shed light on the adverse effects of SES rank within the class on bullying victimization and school absence. To deepen our understanding of why SES rank exerts these detrimental effects, we explore its impact on other pertinent outcomes, such as students' attitudes toward school and their experiences related to bullying victimization and absenteeism. A favorable academic performance and positive relationships with peers and teachers are recognized as pivotal factors contributing to students' attachment to school and their willingness to attend regularly (OECD, 2019).

As previously mentioned in the data section, the TIMSS 2015 survey included questions pertaining to students' sense of school belonging. This set of questions comprises seven items, including inquiries about liking school, feeling safe at school, having a sense of belonging, enjoying the company of classmates, perceiving teachers as fair, feeling proud of the school, and believing in the value of learning at school.

The findings of our analysis are reported in Table 7, spanning columns (1) through (7). Within this table, three out of the seven items exhibit an adverse SES rank effect at the 5% significance level. Specifically, students with higher SES ranks tend to express a lesser liking for seeing their classmates, harbor doubts regarding the fairness of their teachers, and perceive a reduced level of learning at school. These results align with the SES rank effect outlined in Table 3, and it is reasonable to attribute these changes related to SES rank to absenteeism. One potential interpretation is that the allocation of teacher resources may be biased toward students with lower SES ranks. Given the correlation between SES and ability ranks, teachers might need to spend more effort on lower-ranked SES students to tailor instruction or mitigate disruptive behaviors. If this is the case, students with higher SES ranks might feel that the teaching lacks fairness. Additionally, higher SES rank students may feel that they learn less at

school or might be less inclined to associate with lower SES rank students.[19]

Table 7. The SES rank effect on related outcomes.

	Like being in school	Safe at school	Belong at school	Like to see classmates	Fair teachers	Proud to go to this school	Learn a lot in school
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SES Rank	-0.0021	0.0059	0.0254	-0.0408**	-0.0492**	-0.0165	-0.0423**
	(0.0215)	(0.0213)	(0.0232)	(0.0177)	(0.0219)	(0.0225)	(0.0184)
SES	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	244,068	243,603	241,560	243,005	242,835	243,341	243,938
R-squared	0.240	0.191	0.162	0.185	0.172	0.230	0.219

Notes: All specifications control a fifth-degree polynomial of students' SES, students' gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

These additional insights serve to deepen our comprehension of the multifaceted impact of SES rank within the classroom, shedding light on how it influences students' perceptions and attitudes toward school-related factors.

5.2. Exploring Heterogeneity in SES Rank Effects

In our quest to gain a more nuanced understanding of the effects of SES rank, we delve into the issue of heterogeneity, seeking to ascertain how these effects may vary across different student and class characteristics. This exploration aims to identify and provide support for students at higher risk of experiencing risky behaviors due to their SES rank. To uncover these potential differences, we extend our regression model (Eq. 1) by introducing interaction terms between SES rank and the corresponding variables of interest.

The results of our analysis, including these interaction terms, are presented In Table 8. Notably, we observe that the adverse effect of SES rank on bullying victimization is more pronounced for female students and reaches statistical significance (Column (1)). However, when it comes to absences, the effect of SES rank does not exhibit significant variation by gender (Column (5)).

To further dissect these effects, we create a dummy variable that takes on a value of 1

[19] Additionally, when altering the method of constructing SES and employing the previously mentioned Alternative SES1, 2, and 4, the coefficients for SES rank do not substantially differ from those presented in Table 7. While 'Like to see classmate' may occasionally lose statistical significance, 'Fair teacher' and 'Learn a lot in school' consistently remain statistically significant at the 5% level. On the other hand, when employing the Alternative SES3, which is constructed solely from categorical parental education data, there exists a statistically significant positive association between SES rank and perceptions of "liking being in school" and feeling "safe at school." Conversely, the negative associations with "liking to see classmates," "fairness of teachers," and "learning a lot in school" that are statistically significant in other SES measures, vanish when using Alternative SES3. These differences might be attributed to a reduction in variability and an increase in measurement errors inherent in using only educational information to construct the SES. Additionally, children of highly educated parents may have a heightened awareness of the importance of schooling, potentially influencing these perceptions.

when the SES rank exceeds 0.5. By interacting this dummy variable with the SES rank variable and incorporating it into Eq. (1), we discern that the SES rank effect is present for students both above and below the 0.5 threshold but is more pronounced for those with SES ranks above 0.5 (Column (2)). Notably, this heterogeneity in SES rank effects is not observed for absenteeism (Column (6)).

To further explore the potential non-linearity of the effects of SES rank, we replace the ordinal rank variable with dummy variables representing rank positions and estimated a more detailed nonparametric model. Table A14 shows the estimated results when replacing the SES rank variable with ventile dummy variables, using the 10th ventile as the reference group. The results in column (1) of Table A14 reveal that the incidence of bullying significantly increases for students in the 16th ventile and above, compared to the 10th ventile, and significantly decreases for students between the 2nd and 6th ventiles. This indicates that students with higher SES ranks are more likely to be targeted for bullying, while those with lower ranks are less likely to be bullied. Furthermore, the analysis in column (2) of Table A14 indicates that absenteeism is significantly higher for the 15th ventile compared to the 10th, and there is a notable trend of lower absenteeism for ranks below the 9th ventile. This suggests a tendency for students with lower SES ranks to have fewer absences.

Our investigation also extends to the impact of absolute SES levels and SES disparities within class cohorts. We gauge absolute SES levels using means and SES disparities through standard deviations. Incorporating interaction terms between SES rank and these class characteristic variables into Eq. (1), we find that the adverse effects of SES rank on bullying victimization are mitigated in classes with higher absolute levels of SES (Column (3)). This observation may be attributed to classes with elevated absolute SES levels being less conducive environments for bullying. Conversely, no significant heterogeneity is identified for absenteeism in relation to these class SES characteristics (Column (7)).

In considering the heterogeneity of SES rank effects by class SES inequality, we discern that no significant variation is evident for bullying victimization (Column (4)). However, for absenteeism, classes characterized by greater SES inequality appear to be more adversely affected (Column (8)).This exploration into the heterogeneity of SES rank effects unveils important nuances, helping us better understand the differential impact of SES rank across various student and class contexts[20].

[20] We conduct a joint hypothesis test on the coefficients of the SES rank and its interaction term in Table 8. The results are statistically significant at a 1% significance level or lower.

Table 8. Heterogeneous effects.

	Bullying Scale				Absence_Once every two weeks or more			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SES Rank * Girl	-0.1302***				-0.0058			
	(0.0316)				(0.0061)			
SES Rank * SES Rank (>0.5) dummy		-0.0627**				0.0078		
		(0.0315)				(0.0060)		
SES Rank * Average of class level SES			0.1231***				-0.0039	
			(0.0223)				(0.0044)	
SES Rank * Standard deviation of class level SES				-0.0919				0.0237*
				(0.0630)				(0.0123)
SES Rank	-0.1500***	-0.1288*	-0.2398***	-0.1628**	0.0358***	0.0216*	0.0334***	0.0183
	(0.0536)	(0.0675)	(0.0506)	(0.0650)	(0.0102)	(0.0131)	(0.0098)	(0.0122)
SES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.221	0.221	0.221	0.221	0.162	0.162	0.162	0.162

Notes: All specifications control a fifth-degree polynomial of students' SES, students' gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

6. Conclusion

In this study, we have delved into the impact of SES rank on bullying victimization and absenteeism among middle school students, leveraging data from TIMSS. Our approach to identifying the SES rank effect involved flexibly controlling SES and introducing class fixed effects. The findings are that students with a higher SES rank within their class are more prone to experiencing school bullying and absenteeism. Importantly, these results hold robust even when the analysis is confined to schools where SES averages are balanced across classes. This finding underscores the significance of considering not just absolute SES but also the relative SES of students' households within the class when examining determinants of bullying victimization and absenteeism. Curiously, our results deviate from those of Napoletano et al. (2016), who observed a negative correlation between the relative affluence of Canadian youth and bullying victimization. The divergence may be attributed, in part, to the utilization of different datasets.

Furthermore, our investigation into the effects of SES rank on students' sense of school belonging provides insight into a potential mechanism underlying the adverse impacts on bullying victimization and absenteeism. Our analysis reveals that as SES rank ascends, students are less inclined to desire the company of their friends. Additionally, students with higher SES ranks perceive unfair treatment from their teachers and express dissatisfaction with their learning experience at school. These results suggest that students with higher SES ranks may feel a sense of discomfort within the school environment. While our study does not establish causality, the sense of school belonging is negatively correlated with the incidence of school bullying. In addition, we confirmed that students who are more likely to be victims of bullying are more likely to be absent from school. Similar to previous studies that have reported that bullying victimization can be a factor in avoiding school (e.g., Hutzell and Payne, 2012, 2018), our results indicate that school bullying is a determinant of school absence.

The implications of our findings resonate across educational policy. Firstly, while prior literature exploring the link between SES and student risky behaviors often centers on the absolute level of SES, our study underscores the importance of SES rank. Secondly, our research unveils nuanced patterns of heterogeneity in the effects of SES rank, varying by student gender and class characteristics. These nuanced findings beckon educational policymakers and interventionists to adopt a multifaceted approach, addressing the diverse needs of different student subgroups. While students with lower absolute SES levels have traditionally been the focus of support, our results advocate for tailored policies and interventions aimed at a broader spectrum of students.

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Table A1. Balancing Test for Predetermined Characteristics

	Girl	Age
	(1) Unconditional	
SES Rank	-0.0240***	-0.0889***
	(0.0038)	(0.0049)
	(2) Class fixed effects and the linear term in the SES	
SES Rank	0.0159*	0.0500***
	(0.0086)	(0.0102)
	(3) Class fixed effects and the quadratic terms in the SES	
SES Rank	-0.0084	0.0324**
	(0.0111)	(0.0138)
	(4) Class fixed effects and the third-order terms in the SES	
SES Rank	-0.0058	0.0303**
	(0.0120)	(0.0151)
	(5) Class fixed effects and fourth-order terms in SES	
SES Rank	-0.0071	0.0293*
	(0.0120)	(0.0151)
	(6) Class fixed effects and fifth-order terms in SES	
SES Rank	-0.0073	0.0278*
	(0.0120)	(0.0151)
	(7) Class fixed effects and sixth-order terms in SES	
SES Rank	-0.0071	0.0280*
	(0.0120)	(0.0151)
	(8) Class fixed effects and deciles of SES	
SES Rank	-0.0218**	-0.0183
	(0.0106)	(0.0138)
	(9) Class fixed effects and ventiles of SES	
SES Rank	-0.0073	0.0093
	(0.0114)	(0.0146)
N	244,994	

Notes: Each cell represents a separate regression analysis where demographic characteristics are regressed on SES rank. All models account for dummy variables representing missing values and give the same weight to each country. Column (1) presents the estimates without any additional control, while Columns (2) to (7) present estimates controlling for class fixed effects and SES ranging from linear to sixth-degree polynomial. Columns (8) to (9) present estimates controlling for class fixed effects and SES, divided into deciles and ventiles, respectively. Standard errors are clustered at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A2. Correlation coefficients among SES, Bullying Scale, and the dummy variable for absence.

	SES	Bullying Scale	Absence_Once every two weeks or more
SES	1.00		
Bullying Scale	0.11	1.00	
Absence_Once every two weeks or more	-0.08	-0.08	1.00

Note: The number of observations is 244,994.

Table A3. Relationship between SES and bullying victimization and absences.

	Bullying Scale	Absence_Once every two weeks or more
	(1)	(2)
SES	0.0232***	-0.0062***
	(0.0044)	(0.0009)
Student controls	Yes	Yes
Class fixed effects	Yes	Yes
Observations	244,994	244,994
R-squared	0.221	0.162

Note: The Bullying Scale indicates that lower values mean more bullying victimization. All specifications control students' gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A4. The SES rank effect on individual bullying victimization items.

	Made fun of me or called me names	Left me out of their games or activities	Spread lies about me	Stole something from me	Hit or hurt me	Made me do things I didn't want to do	Shared embarrassing information about me	Posted embarrassing things about me online	Threatened me
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SES Rank	0.0862***	0.0858***	0.0921***	0.0576***	0.0688***	0.0580***	0.0626***	0.0550***	0.0586***
	(0.0292)	(0.0244)	(0.0246)	(0.0214)	(0.0218)	(0.0188)	(0.0224)	(0.0160)	(0.0169)
SES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.179	0.142	0.135	0.244	0.150	0.132	0.125	0.120	0.138

Note: All specifications control a fifth-degree polynomial of students' SES, gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A5. The SES rank effect on school absence.

	Absence_More than one in a week	Absence_Once every two weeks or more	Absence_More than once a month
	(1)	(2)	(3)
SES Rank	0.0252***	0.0327***	0.0312**
	(0.0067)	(0.0097)	(0.0123)
SES	Yes	Yes	Yes
Student controls	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes
Observations	244,994	244,994	244,994
R-squared	0.134	0.162	0.179

Notes: All specifications control a fifth-degree polynomial of students' SES, gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A6. Robustness check: Sensitivity check.

	Bullying Scale	Absence_Once every two weeks or more
	(1) Students' gender, age and dummy variables for missing values	
SES Rank	0.0520***	-0.0208***
	(0.0155)	(0.0030)
	(2) (1) + Class fixed effects and the linear term in the SES	
SES Rank	-0.0725**	0.0102
	(0.0345)	(0.0066)
	(3) (1) + Class fixed effects and the quadratic terms in the SES	
SES Rank	-0.2634***	0.0291***
	(0.0448)	(0.0086)
	(4) (1) + Class fixed effects and the third-order terms in the SES	
SES Rank	-0.2247***	0.0327***
	(0.0502)	(0.0097)
	(5) (1) + Class fixed effects and fourth-order terms in the SES	
SES Rank	-0.2166***	0.0331***
	(0.0503)	(0.0097)
	(6) (1) + Class fixed effects and fifth-order terms in the SES	
SES Rank	-0.2186***	0.0327***
	(0.0503)	(0.0097)
	(7) (1) + Class fixed effects and sixth-order terms in the SES	
SES Rank	-0.2181***	0.0326***
	(0.0504)	(0.0097)
	(8) (1) + Class fixed effects and deciles of SES	
SES Rank	-0.1661***	0.0165**
	(0.0427)	(0.0083)
	(9) (1) + Class fixed effects and ventiles of SES	
SES Rank	-0.2097***	0.0291***
	(0.0476)	(0.0092)
N	244,994	

Note: Each cell represents a separate regression analysis where Bullying Scale and the absence indicator are regressed on SES rank. Column (1) presents the estimates contorlling for students' gender, age and dummy variables for missing values. Columns (2) to (7) present estimates additionally controlling for class fixed effects and SES ranging from linear to sixth-degree polynomial. Columns (8) to (9) present estimates additionally controlling for class fixed effects and SES, divided into deciles and ventiles, respectively. Standard errors are clustered at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A7. Robustness check: Comparing Classrooms with Similar SES Distributions.

	Bullying Scale			Absence_Once every two weeks or more		
	(1)	(2)	(3)	(4)	(5)	(6)
SES Rank	-0.1800***	-0.2303***	-0.1867***	0.0308***	0.0319***	0.0319***
	(0.0562)	(0.0543)	(0.0539)	(0.0111)	(0.0108)	(0.0115)
Ventiles of SES	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Ventiles of SES × class's average SES	Yes	No	Yes	Yes	No	Yes
Ventiles of SES × class's SES standard	No	Yes	Yes	No	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.221	0.221	0.221	0.162	0.162	0.163

Note: The Bullying Scale indicates that lower values mean more bullying victimization. SES controls ventiles of students' SES, Student controls include students' gender, age and dummy variables for missing values.Columns (1) and (4) display the estimation results when including interaction terms between the SES ventiles and the class's average SES. Columns (2) and (5) report estimates that control for interaction terms between SES ventiles and the class's SES standard deviation. Columns (3) and (6) provide the estimates when controlling for both sets of the interaction terms. All specifications give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

Table A8. Robustness check: Analysis restricted to schools where school choice is less likely to be available.

	Bullying Scale		Absence_Once every two weeks or more	
	Rural area (15,000 people or fewer in the area)	Rural area (3,000 people or fewer in the area)	Rural area (15,000 people or fewer in the area)	Rural area (3,000 people or fewer in the area)
	(1)	(2)	(3)	(4)
SES Rank	-0.1895**	-0.3528**	0.0344*	0.0768**
	(0.0948)	(0.1592)	(0.0187)	(0.0336)
SES	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes
Observations	59,184	19,553	59,184	19,553
R-squared	0.234	0.250	0.143	0.138

Notes: The Bullying Scale indicates that lower values mean more bullying victimization. All specifications control a fifth-degree polynomial of students' SES, gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

Table A9. Robustness check: Analyses with alternative definition of the SES indicator.

	Bullying Scale	Absence_Once every two weeks or more
(1) SES Rank	-0.2186***	0.0327***
	(0.0500)	(0.0097)
(2) SES Rank from Alternate SES1	-0.2219***	0.0292***
	(0.0506)	(0.0098)
(3) SES Rank from Alternate SES2	-0.2324***	0.0624***
	(0.0489)	(0.0095)
(4) SES Rank from Alternate SES3	-0.1484**	-0.0210
	(0.0662)	(0.0131)
(5) SES Rank from Alternate SES4	-0.2549***	0.0181*
	(0.0545)	(0.0103)
Observations	244,994	

Notes: The Bullying Scale indicates that lower values mean more bullying victimization. Specifications in columns (1)-(3) and (5) control a fifth-degree polynomial of students' SES, students' gender, age, dummy variables for missing values, and class fixed effects. The specification in column (4) controls for the level of parental education level instead of the fifth-order polynomial of student SES, since SES Rank from Alternate SES3 is created only for parental education level. All specifications give the same weight to each country Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A10. Robustness Check: Characteristics of the Observational Sample.

	Observation Dummy
Girl	0.0083***
	(0.0014)
Age	-0.0159***
	(0.0013)
SES	0.0057***
	(0.0006)
Class fixed effects	Yes
Observations	279,678
R-squared	0.470

Note: The "Observation Dummy" refers to a variable where a value of "1" is assigned to samples included in the analysis (those without missing data on bullying victimization or absences, and with class sizes of more than 10 students) and a value of "0" is assigned to samples not included in the analysis. The table shows the results of a linear regression of the "Observation Dummy" on predetermined variables. The same weight is given to each country. Standard errors are clustered at the school level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A11. Robustness Check: Relationship Between Observational Sample and SES Rank.

	Observation Dummy
SES Rank	-0.0005
	(0.0004)
SES	Yes
Student controls	Yes
Class fixed effects	Yes
Observations	279,678
R-squared	0.497

Note: The "Observation Dummy" refers to a variable where a value of "1" is assigned to samples included in the analysis (those without missing data on bullying victimization or absences, and with class sizes of more than 10 students) and a value of "0" is assigned to samples not included in the analysis. SES controls a fifth-degree polynomial of students' SES, Student controls include students' gender, age and dummy variables for missing values. The specification gives the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

Table A12. Robustness Check: Analysis Considering Sample Selection.

	Bullying Scale			Absence_Once every two weeks or more		
	(1)	(2)	(3)	(4)	(5)	(6)
SES Rank	-0.2186***	-0.2217***	-0.2186***	0.0327***	0.0330***	0.0327***
	(0.0503)	(0.0417)	(0.0416)	(0.0097)	(0.0079)	(0.0079)
SES	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Inverse probability weight	No	Yes	No	No	Yes	No
Sampling weight	Yes	No	No	Yes	No	No
Observations	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.221	0.220	0.219	0.162	0.154	0.154

Note: The Bullying Scale indicates that lower values mean more bullying victimization. SES controls a fifth-degree polynomial of students' SES, Student controls include students' gender, age and dummy variables for missing values. Standard errors are clustered-robust at the school level and reported in parentheses. * p < 0.10. ** p < 0.05. *** p < 0.01.

Table A13. Robustness Check: Analysis with SES rank indicators based on percentile SES.

	Bullying Scale			Absence_Once every two weeks or more		
	(1)	(2)	(3)	(4)	(5)	(6)
SES Rank (based on raw SES score)	-0.2186***			0.0327***		
	(0.0503)			(0.0097)		
SES Rank (based on the post-percentile		-0.2196***			0.0329***	
SES across the entire sample)		(0.0503)			(0.0097)	
SES Rank (based on the post-percentile			-0.2192***			0.0328***
SES within each country)			(0.0503)			(0.0097)
SES	Yes	Yes	Yes	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	244,994	244,994	244,994	244,994	244,994	244,994
R-squared	0.221	0.221	0.221	0.162	0.162	0.162

Notes: The Bullying Scale indicates that lower values mean more bullying victimization. All specifications control a fifth-degree polynomial of students' SES, students' gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the class level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table A14. The Nonlinearity of SES Rank Effects.

	Bullying Scale	Absence_Once every two weeks or more
	(1)	(2)
SES Rank		
Q1 (1-5)	0.0225	-0.0108
	(0.0416)	(0.0081)
Q2	0.0648*	-0.0185***
	(0.0360)	(0.0069)
Q3	0.0663**	-0.0096
	(0.0332)	(0.0065)
Q4	0.0624**	-0.0109*
	(0.0316)	(0.0059)
Q5	0.0841***	-0.0144**
	(0.0301)	(0.0058)
Q6	0.0569*	-0.0127**
	(0.0291)	(0.0055)
Q7	0.0372	-0.0093*
	(0.0289)	(0.0055)
Q8	0.0250	-0.0078
	(0.0280)	(0.0054)
Q9	0.0304	-0.0126**
	(0.0278)	(0.0052)
Q11	-0.0127	0.0004
	(0.0290)	(0.0056)
Q12	-0.0317	0.0016
	(0.0292)	(0.0057)
Q13	-0.0306	-0.0036
	(0.0289)	(0.0053)
Q14	-0.0381	0.0039
	(0.0294)	(0.0057)
Q15	-0.0157	0.0127**
	(0.0319)	(0.0060)
Q16	-0.0817**	0.0043
	(0.0322)	(0.0062)
Q17	-0.0824**	0.0039
	(0.0332)	(0.0066)
Q18	-0.1251***	0.0063
	(0.0357)	(0.0070)
Q19	-0.1571***	0.0110
	(0.0393)	(0.0077)
Q20 (95-100)	-0.1792***	0.0086
	(0.0472)	(0.0091)
SES	Yes	Yes
Student controls	Yes	Yes
Class fixed effects	Yes	Yes
Observations	244,994	244,994
R-squared	0.221	0.162

Note: The Bullying Scale indicates that lower values mean more bullying victimization. All specifications control a fifth-degree polynomial of students' SES, students' gender, age, dummy variables for missing values, and class fixed effects and give the same weight to each country. Standard errors are clustered-robust at the school level and reported in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.