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## Last and Furious: Relative Position and School Violence

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# Last and Furious: Relative Position and School Violence

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## ABSTRACT

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# Last and Furious: Relative Position and School Violence\*

This paper examines the effect of a high school student's relative position in the class achievement distribution on school violence. We identify this effect by exploiting idiosyncratic differences in the distribution of earlier academic achievement across classes. Such differences generate quasi-random variation in rank for students with the same initial achievement. We consider distinct types of school violence, namely, verbal, relational and physical violence. We find that rank has a negative effect on both the probability and frequency of perpetrating school violence for all the specific types of violence considered. The effect size is economically significant, especially in the case of physical violence. We find that rank is less or not effective in reducing physical violence for low-background students, migrants, in lower-quality schools and in high-crime areas, consistent with the lower perceived opportunity costs associated with misbehavior for disadvantaged students in low quality schools and located in violent local contexts.

**JEL Classification:** I21, I24, K40

**Keywords:** school rank, school violence

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## 1. Introduction

Violence at school affects a significant proportion of children and adolescents. In the US, in the 2005-2013 period, approximately one-third of students aged 12 to 18 years interviewed in the School Crime Supplement of the National Crime Victimization Survey reported suffering from some form of violence at school during the school year (Robers et al. 2015). On average across OECD countries, in 2015, approximately thirty percent of 15-year-old students reported that they had been victimized at least a few times a year (OECD 2017).

School violence impairs the physical health and emotional well-being of victimized children and adolescents and engenders absenteeism, lack of motivation, and dropout. This, in turn, has a detrimental impact on the academic achievement of affected learners and on their subsequent adult life outcomes, such as labor market performance and antisocial and criminal behavior (Ammermüller 2012; Bowes et al. 2015; Eriksen, Nielsen, and Simonsen 2014; Kim and Leventhal 2008; Ponzo 2013). In addition, violence at school produces negative spillover effects, reducing the quality of education for all students (UNESCO 2017). Overall, school violence imposes substantial costs on society.<sup>1</sup>

Despite its relevance in the process of human capital formation and the potentially damaging effects on subsequent individual and social outcomes, school violence has started to receive attention from the economic literature only recently. Some recent papers have aimed to identify a causal link from victimization to such outcomes (Brown and Taylor 2008; Ammermueller 2012; Ponzo 2013; Eriksen, Nielsen, and Simonsen 2014; Gorman et al. 2019), but convincing empirical evidence on the underlying causes of school violence is still relatively scarce.

In the psychological literature, the likelihood of acting violently is often associated with certain personal characteristics, such as age, physical appearance, gender and ethnicity (Kljakovic and Hunt 2016; OECD 2017). This literature has found that violent behavior is related to contextual factors such as family environment or negative school climate as well (Cook et al. 2010; Guerra, Williams, and Sadek 2011). For instance, several studies show that bullies are more likely to come from abusive, harsh or unsupportive home environments (Barker et al. 2008; Nation et al. 2008; Schwartz et al. 2011). Social

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<sup>1</sup> For instance, the estimated cost of school violence to the US economy is US\$7.9 billion a year (UNESCO, 2017).

interactions play an important role in determining behavioral outcomes as well. In the school setting, as children spend a considerable amount of time in the classroom socializing and interacting with classmates, such interactions likely contribute to shaping students' attitudes towards violence.

In this paper, we investigate whether a specific aspect of the individual school experience affects the probability of perpetrating violence in the school context. Specifically, we investigate how a student's relative position in the achievement distribution within her class affects the likelihood of perpetrating violent behavior towards her own schoolmates. We investigate this issue in the Italian high school setting using administrative and survey data provided by the National Institute for the Evaluation of the Education System (INVALSI) covering the entire population of Italian students enrolled in 10th grade in the school year 2014-15. The age of the students (16 years old) is particularly suitable for our analysis because of the strong influence from peers and comparisons with them during adolescence.

Students' relative position could potentially influence school violence perpetration through different channels. One is that students do not have perfect information regarding their absolute ability (Zafar 2011; Stinebrickner and Stinebrickner 2012). In this case, their easily observable ordinal rank in their peer group may give them incomplete information about their absolute ability. Highly ranked students then have a high perceived ability. If students with a high perceived ability in turn have greater future aspirations, the cost of school violence may be higher for them, for instance, because teachers tend to give worse grades to violent students, but obtaining high marks is important to their future aspirations (e.g., for increasing the likelihood of admission to a specific college/major).

To reach identification, we rely on idiosyncratic differences in the class distribution of prior academic achievement that remain after we control for selection into tracks, schools and classes through class fixed effects. Specifically, through class fixed effects, we hold constant any class variable, and we address concerns related to student sorting that would lead to biased estimates of the rank effect if students with a given propensity towards violence self-select into specific peer environments that determine their rank and behavior at the same time. Moreover, controlling for prior achievement, we compare students with different relative ranks but the same absolute baseline achievement. Hence, our identifying assumption is that when we control for selection into tracks, schools and classes, the relative position of students with the same initial achievement in the class-level achievement distribution is as

good as random. Identification relies on class-to-class variation in the within-class achievement distribution (Elsner and Isphording 2017, 2018; Denning, Murphy and Weinhardt 2018; Murphy and Weinhardt 2018).

Our paper is related to a recently growing body of literature that has studied the effect of relative achievement rank on a variety of outcomes. For example, Elsner and Isphording (2017) study the impact of a student's ordinal rank on educational attainment and find that more highly ranked students are significantly more likely to finish high school and attend college. Murphy and Weinhardt (2018) find that ordinal academic rank during primary school has lasting impacts on test scores and subject choices during secondary school. Denning, Murphy and Weinhardt (2018) show that students with higher academic rank in third grade have higher subsequent test scores; are more likely to take advanced placement courses, graduate from high school, and enroll in college; and have higher earnings 19 years later. There is also evidence that rank is relevant to personality and behavioral outcomes. Pagani, Comi and Origo (2020) study the effect of classroom rank on the Big Five personality traits of high school students and find a positive and sizeable effect of rank on conscientiousness. Elsner and Isphording (2018) consider the effect of rank on subsequent risky behavior. They find a strong negative effect of rank on the likelihood of smoking, drinking, having unprotected sex and engaging in physical fights.

Our paper adds to this literature by analyzing the effect of school rank on violence perpetrated at school. The paper closest to ours is Elsner and Isphording (2018), as it explores the effect of relative rank on the likelihood of having risky behavior, including engaging in physical fights.<sup>2</sup> However, our analysis adds to their findings for different reasons. First, we study the effect of relative school rank on a very specific type of violence, namely, school violence. This is also crucial because by doing so, we relate relative rank to an outcome that is realized in the same environment where rank is evaluated, the school. Second, and most notably, we distinguish among very specific types of violence, namely, verbal, relational and physical. Third, given the richness of our data, we are able to explore the effect of relative

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<sup>2</sup> To obtain information on physical fighting, they use a question asking whether a person engaged in this behavior at least once in the previous 12 months. Then, they observe only the incidence but not the frequency, and they do not observe the context where physical fighting has occurred.

rank not only on the likelihood of perpetrating violent behavior at school (extensive margin) but also on violence frequency (intensive margin). With this paper, we also add to the existing literature on school violence by focusing on one potential determinant of school violence that has never been looked at before.

We find a negative effect of students' relative position within their class on the likelihood of perpetrating violent behavior for any specific type of violence considered. The effect sizes are statistically and economically significant, especially in the case of physical violence, where we find that moving from the bottom to the top of the rank distribution is correlated with a decrease in the probability of perpetrating violence by 20 percent of its average value. We further show a large and negative effect of relative rank on the frequency of perpetrating any type of violent behavior. We explore potential heterogeneity and find that the effect of relative rank on physical violence is not significant for migrants and for low-background students.

Our data do not allow us to test which distinct mechanisms drive the effect of relative rank on school violence. However, in presenting our results, we will provide some suggestive evidence that may be supportive of the mechanism discussed above. Specifically, using data on the school environment and on local juvenile crime, we find that relative rank is less or not effective in reducing physical violence in lower-quality schools or in schools characterized by a bad peer climate or located in high-crime areas. This evidence, together with the non-significant rank effect on physical violence for migrants and low-background students, is consistent with the lower opportunity costs associated with severe (and more punishable) misbehavior for high-achieving disadvantaged students in lower quality schools or in schools located in a violent local context.

The rest of the paper is organized as follows. Section 2 describes the institutional environment. Section 3 presents the data, details the construction of the outcome variables and the rank, and presents descriptive statistics. Section 4 describes the econometric approach and provides empirical evidence in support of the identification strategy. Section 5 presents our main results, investigates relevant heterogeneities in the estimated effects and presents robustness checks. We examine how the relationship between relative rank and violent behavior is affected by the students' context in Section 6. Section 7 discusses potential interpretations of our main results and concludes the paper.



## 2. Institutional environment

Education in Italy starts at 6 years of age and is compulsory until 16. The education system is divided into different stages based upon age: primary education (ages 6–10), middle education (ages 11–14), and secondary education (ages 14–19). Within a specific stage, a student's peers and teachers do not generally vary<sup>3</sup>. When moving on from one stage to the next, students change schools and are reshuffled; then, they have totally new teachers and almost all new classmates.

### 2.1 Before high school

Until middle school (MS), the educational curriculum is the same for all pupils, and the subjects studied are the same. At the end of MS, pupils have to pass a final exam (*Esame di stato*) where they receive a mark that ranges between 6 and 10 with distinction. We will use this achievement measure to compute high school rank because it is determined before students meet and start interacting with their new high school classmates.

The MS final mark can be considered a comprehensive and comparable measure of baseline achievement, assessing three different aspects. First, it evaluates exam-specific student performance. Specifically, the final mark is computed by taking into account the marks that a student receives during the examination, which is composed of four written exams (reading, math and two EU foreign languages), an oral examination covering all MS subjects, and two standardized assessments (math and reading) administered by the National Institute for the Evaluation of the Education System (INVALSI).<sup>4</sup> Second, the final mark depends on a baseline student's evaluation (*voto di ammissione*) established collegially by all of the student's teachers and reflects the student's overall academic performance during the school year. Finally, and crucially for our analysis, the final mark takes into account the student's

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<sup>3</sup> This is not true when students change school, for instance because their family transfers to a different area, or when teachers are assigned to a different school (this may happen for teachers in their first years of teaching if they have not been definitely assigned to a specific school) or when they retire during the school stage.

<sup>4</sup> External examiners supervise both the exam's administration and the grading process.

behavior, which is explicitly evaluated through a specific mark (*voto di condotta*). This mark enters the computation of the MS final mark. Overall, our measure of baseline achievement reflects both students' baseline academic achievement and their behavior at school quite well. In Section 4, we will provide evidence of the correlation between baseline violent attitudes (in grade 5) and MS final mark.

## 2.2 High school

After MS, students move on to high school, where there are three main tracks: *liceo*, technical and vocational. Students' enrollment in high school tracks is not selective and is based on family choice. Any track permits access to a university.

The *liceo* track is specifically designed to prepare students for tertiary education, and the education provided is advanced and mainly theoretical. There are different *liceo* subtracks offering specialization in a certain field of study (humanities, science, languages, art, human sciences and music). The technical track gives students the opportunity to continue either with an occupation or with additional education; it provides both a theoretical education and a specialization that depends on the subtrack (economic or technological). The vocational track prepares students for an occupation upon graduation; it offers education oriented towards practical subjects, and each subtrack focuses on a specific subject in either the services or industry/craft sector (e.g., catering and hospitality or industrial and craft production). Within tracks and subtracks, the pool of subjects is established centrally by the Ministry of Education, and it is the same throughout the country (Comi et al. 2017).

After choosing the track and subtrack, families choose a school among those available, and this choice depends on different factors, such as the school standing or nearness to the place of residence. Once a track and a school have been chosen, students are assigned to a specific class (*sezione*), generally identified by a letter, where the same group of students expect to be together for the entire duration of high school. Importantly, classes are formed by the school staff (generally the school manager aided by a team of teachers), and this process does not take into consideration family preferences for specific

teachers or classmates.<sup>5</sup> Because there are no electives in Italian high schools, class interactions are very strong: classmates take the same courses and spend the entire school day together.

Within the high school tracks, parental background and learning levels are quite homogeneous, but on average, they are higher in the *liceo* track and lower in the vocational track (Schizzerotto and Barone 2006). Our empirical strategy will take into account students' sorting within tracks, subtracks and classes.

### **3. Data and descriptive statistics**

#### *3.1 Data source*

Since the 2009-10 school year, INVALSI has conducted yearly evaluations of the entire student population in grades 2, 5, 8 and 10 based on standardized tests in math and reading.<sup>6</sup> Our empirical analysis uses administrative-level data provided by INVALSI for the cohort of Italian students enrolled in their second year of high school (grade 10) in the 2014-15 school year. These data contain information on student scores obtained on the national standardized test administered by INVALSI itself in the same grade (both math and reading), in addition to information on students' sociodemographic characteristics, such as gender, age, citizenship and parents' education and occupation, which are drawn from school administrative records. The sample includes 281,535 students completing both the math and reading tests.

After the conclusion of the INVALSI tests, students have to fill out a questionnaire, which we are able to merge with the administrative dataset thanks to a student identifier. The questionnaire is based on students' self-reports, and it elicits several information, including retrospective information on their MS

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<sup>5</sup> To provide corroborating evidence on this, we check whether the average observable student characteristics significantly differ between classes of the same track in the same school. The results in Table A1 in the appendix confirm that there are no statistically significant differences in a number of observable student characteristics (MS final marks, share of girls, share of migrants, parental background and age) across classes once we control for school and track fixed effects.

<sup>6</sup> From the 2017-18 school year onwards, English is tested as well, and from the 2018-19 school year, grade 13 students (last year of high school) are also assessed by INVALSI.

final mark and information on their schooling experience and attitudes. The questionnaire content changes yearly. For the 2014-15 school year, the questionnaire contained exceptionally detailed questions that can be used to measure violent behavior at school. After merging the questionnaire with the administrative dataset, we are left with a sample of 275,653 student observations.<sup>7</sup> Table A2 in the appendix reports summary statistics on student characteristics.

To provide indirect evidence that the MS final mark actually captures baseline attitudes towards violence quite well, we use additional data on a different student cohort. Specifically, we use data on students enrolled in grade 10 in the 2018-19 school year that we are able to link to the same students' administrative data and questionnaires in grade 5 (2013-14 school year) and grade 8 (2016-17 school year). Notably, for this student cohort, the grade 5 questionnaire contains information on violent behavior at school, while the grade 10 questionnaire contains information on the MS final mark.<sup>8</sup>

### *3.2 Outcome variables: violence at school*

School violence can take many forms. It includes verbal abuse, in the form of mocking, insulting or name calling; relational and emotional abuse, such as isolating, rejecting, humiliating or ignoring; and physical violence, which is any form of physical aggression, such as hitting, punching or kicking with the intention to hurt (OECD 2017). Although school violence may be perpetrated and experienced by students, teachers and other school staff, in this paper, we focus on violence perpetrated by students towards other students.

Verbal and relational violence occur frequently at school. For instance, on average, across OECD countries, 14.4 percent of students reported that their peers isolated them on purpose a few times during

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<sup>7</sup> However, our empirical analysis is based on the sample restricted to individuals without missing values in the questions on violent behavior at school, corresponding to 220,030 observations.

<sup>8</sup> Starting in the 2012-13 school year, INVALSI makes it possible to link students' data across grades through an encoded student number (to ensure anonymity). Unfortunately, we cannot use the cohort of students attending grade 10 in 2018-2019 for our main analysis because the grade 10 questionnaire does not contain information on violent behavior.

the school year, and almost 20 percent (approximately four students in a typical class) reported that their peers had made fun of them. Physical violence is less common but still an important problem in many schools and classes. Approximately 12 percent of students (at least two students per class) reported that they have been hit or pushed around at least a few times a year (OECD, 2017). Physical violence is possibly the most obvious type of school violence, and it is often deemed more critical than verbal and relational violence. However, nonphysical forms of violence produce severe consequences as well, such as lack of motivation, absenteeism and dropout (UNESCO, 2017).

Our data contain unique information on both the type and frequency of violent behavior. Specifically, we are able to distinguish among verbal, relational, and physical violence perpetration, and we observe the frequency by which each type of violence is perpetrated. We measure students' violent behavior using responses to the following questionnaire items: "During the current school year, how often did you i) mock, ii) insult, iii) isolate or exclude, or iv) beat up other students?" The possible answers are "Never", "Sometimes", "Every week", and "Every day". The first two questions refer to verbal violence, which we distinguish as mocking and insulting, which is the most worrisome type of verbal violence. The third question is related to relational violence and the last to physical violence.<sup>9</sup>

Table 1 reports the responses to the four questionnaire items. Verbal violence is the most widespread type of school violence, especially mocking, with more than 55 percent of students reporting being a perpetrator at least once in the school year. Approximately 30 percent of students perpetrated relational violence in the form of excluding or isolating their schoolmates, while most students (approximately 90 percent) did not report perpetrating physical violence. Overall, almost 70 percent of students perpetrated at least one form of violence at least once in the school year.

Table 1

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<sup>9</sup> The questions we use describe violent behavior but do not allow us to identify bullying specifically. Bullying intrinsically involves a continuous relationship between two actors, the bully and the victim, with the victim usually in a weaker position. Our questions, however, do not ask who the recipients of students' violence are. Clearly, our measures of violence do include bullying.

We use the previous questions to generate four different outcome variables. We create dummies for the four specific types of violence. They equal one if the respondent reported perpetrating the specific type of violence at least once during the school year and zero otherwise.

Table 2 reports the mean values of the four specific types of violence for different student subgroups. Violent behavior is generally more widespread among boys. The largest difference between girls and boys is for physical violence, while the lowest is for relational violence. Migrants report that they insult and perpetrate physical violence more often than natives. Students with an MS final mark lower than eight are more violent than higher-achieving students, and older students (i.e., those born in the first half of the year) are more likely to perpetrate violent behavior than younger students are.<sup>10</sup> Violent students are more likely to be in vocational and technical high schools than in *liceo* high school. The difference is less striking when considering relational violence, whereas it is the largest for physical violence. Students from low socioeconomic backgrounds are on average more violent, with the exclusion of mocking.

Table 2

### 3.3 *Relative rank*

Our variable of interest is relative classroom rank. We compute it by using the MS final exam mark that students receive before entering high school. An important feature of our setting is that when moving on to high school, students have an almost entirely new set of peers. This is partly because MS classmates choose different tracks, subtracks and schools and partly because, even when choosing the same high school, students from the same MS class are generally reshuffled and assigned to different

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<sup>10</sup> Students' age is related to the probability of being victimized as well. Ballatore et al. (2020) find that the probability of being victimized is decreasing in students' age.

high school classes.<sup>11</sup> Thus, students have no interaction with their high school classmates before the beginning of high school, which mitigates concerns about reflection and unobserved common shocks affecting the current measures of achievement and violent behavior at the same time. We compute the rank at the class level because in the Italian school environment, this is where most interactions among students take place.

To compute rank, we convert the absolute ordinal rank of each student in the classroom into the percentile rank in order to obtain a comparable measure referring to classes of different sizes (Brown et al., 2008). We assign a value of one to the lowest-ranked students (i.e., those with the lowest MS final mark in the high school class) and a number equal to the class size to the highest-ranked students (i.e., those with the highest MS final mark in the high school class), and then we compute the percentile rank of student  $i$  as follows:

$$\text{Percentile rank}_{i,c} = \frac{\text{Rank}_{i,c} - 1}{\text{class } i \text{ size} - 1}$$

where  $\text{Rank}_{i,c}$  is the rank of student  $i$  within class  $c$ . The percentile rank ranges from 0 (for the lowest-ranked students) to 1 (for the highest-ranked students).

The rank variable that we use can be considered a measure of students' relative baseline achievement. Notably, students are aware of their own mark. Moreover, it is very common for them to share this information among their new schoolmates and for high school teachers to ask students their MS final mark at the beginning of high school. This implies that students have a clear perception of how they rank in the new high school environment.

In Figure 1 (panel a), we plot the main characteristics of the classroom rank distribution (the minimum, the maximum, the 25<sup>th</sup> and 75<sup>th</sup> percentiles and the median) against all the different possible values of the MS final mark. Clearly, the two variables are positively correlated, but students with the

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<sup>11</sup> Using INVALSI longitudinal data on students enrolled in grade 8 in the 2013-14 school year and in grade 10 in the 2015-16 school year, we observe that 56 percent of students have no peers who went to the same MS and, on average, 95 percent of high school peers are new to them.

same MS mark can also be at very different ranks due to differences in the shape of the class distributions of MS final mark.

Figure 1

To exclude the possibility that such variation is driven by students sorting into different tracks, we plot the same distribution netted out of track fixed effects (Figure 1, panel b). The figure shows that even after we control for selection into tracks, the data display substantial within-track variability in the rank measure. We will provide additional evidence on this point in Section 4.3.

## 4. Empirical strategy

### 4.1 Baseline equation

To investigate how the achievement rank affects the probability of engaging in violent behavior at school, we start from the following baseline equation:

$$[1] \quad V_{istc} = \alpha + \beta \text{rank}_{istc} + \gamma X_{istc} + \varepsilon_{istc}$$

where  $V_{istc}$  is a dummy variable indicating whether student  $i$  in school  $s$ , track  $t$ , and class  $c$  reports having engaged in a specific type of violent behavior.  $\text{Rank}$  is the percentile achievement rank as defined in the previous section.  $X_{istc}$  is a vector of student-level characteristics including dummies for gender, migrant status, parental educational background and age.  $\varepsilon_{istc}$  is the error term, which we allow to be correlated within each track and school.

Importantly, the vector  $X$  includes a set of dummies for each student's MS final mark to capture any cardinal effect of prior achievement on violent behavior. This is crucial to our identification strategy, as we want to compare students who have the *same* prior achievement and who differ only in their ordinal position in the high school class distribution of MS final marks (Elsner and Isphording 2017; Murphy and Weinhardt 2018; Comi et al. 2020). As the final MS mark also encompasses an evaluation of student behavior at school, the inclusion of this set of dummies also helps to control for baseline differences in student violence at school because having a lower MS final mark is correlated with being less well



behaved, less dutiful, and more troublesome. We will return to discuss evidence on this aspect in a later section.

In an ideal setting, the causal effect of the achievement rank on student violent behavior would be estimated by randomly allocating students to different peer groups. Conditional on each student's MS mark, this would mechanically generate exogenous variation in the measure of students' achievement rank, which would indeed depend only on the characteristics of the MS final mark distribution in the designated random group. For example, two students with the same MS final mark would rank differently in their high school classes because their classes might differ in terms of average MS final mark or because of a different dispersion in the MS final marks.

Nevertheless, the assumption of random assignment is difficult to defend in our setting, as parents and students choose their high school track and school at the end of the MS path. In what follows, we thus explain the ways in which our strategy deals with the sorting of students into tracks, schools, and classes so that we could identify the parameter of interest.

#### *4.2 Sorting into tracks, schools, and classes*

In the Italian institutional context, we expect the endogenous sorting of students to happen mainly at the track and school level. Indeed, as detailed in Section 2, at the end of MS, students and their families first choose the track (academic, technical or professional) and then, within each track, select the specific high school to attend, generally among those located at a convenient distance. Hence, unobserved track or school factors, such as track quality or school prestige, may be correlated with students' rank. To account for this selection process, we include in Equation 1 both school and track fixed effects ( $\varphi_s, \varphi_t$ ):

$$[2] \quad V_{istc} = \alpha + \beta \text{rank}_{istc} + \gamma X_{istc} + \varphi_s + \varphi_t + \varepsilon_{istc}$$

Sorting into classes is a less serious problem in our context. Once families have chosen the track and school for their children, students are assigned to a certain class regardless of families' or students'

preferences for specific teachers or schoolmates, as the Italian law prohibits it (see Section 2).<sup>12</sup> Moreover, classes within a track in each school often share teachers for most subjects.

Observed and unobserved class-level characteristics could still be somehow correlated with achievement rank if, for example, the school staff tend to form classes as heterogeneously as possible in terms of gender and immigrant status (as also prescribed by the law) or in terms of prior school behavior (as, for instance, communicated by the MS of origin). In this sense, class fixed effects ( $\varphi_c$ ) are crucial to identification, as they net away all these observed and unobserved factors:<sup>13</sup>

$$[3] \quad V_{istc} = \alpha + \beta \text{rank}_{istc} + \gamma X_{istc} + \varphi_s + \varphi_t + \varphi_c + \varepsilon_{istc}$$

Identification would thus exploit within-class variation in the rank measure, depending on higher moments of the achievement distribution because with the inclusion of class fixed effects, we already control for the mean achievement rank. In other words, we compare students in different classes who have the same MS final mark but a different ordinal position in the achievement rank measure due to differences in peer composition across classes in terms of MS final marks. Identification is thus ensured

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<sup>12</sup> In any case, sorting within track, school or class would threaten identification only in cases where it is based on ranking, for instance, because some parents try to select the track/school/class for their children depending on how they will be ranked within them. These parents would thus need to have ex ante information on the distribution of peer characteristics in the different classes within a given track and school (which is basically impossible). Moreover, in general, parents are more likely to try to choose classes with better-quality peers, where their children will rank worse on average (Murphy and Weinhardt 2018). This would produce, if any, a downward bias in our estimates if parents trying to choose better peers for their children are more likely to have well-behaved children.

<sup>13</sup> Given that the class identifier is unique in our data, once we control for class fixed effects, we also implicitly control for school and track fixed effects.

as long as there is sufficient variation in the rank measure, once purged by class fixed effects and by MS final mark. In all estimates, we cluster standard errors at the track and school levels.<sup>14</sup>

#### *4.3 Evidence corroborating the identification strategy*

In this section, we provide evidence in support of our identification strategy with regard to three points.

First, our identification relies on the presence of sufficient variation in relative rank after controlling for class fixed effects and for baseline ability measured through MS final mark. Table 3 shows the raw variation in rank (column 1) and its residual variation net of class fixed effects conditional on the MS final mark (column 2), which is the identifying variation in our preferred specification of equation (3). The table also reports the variation in the outcome variables. As shown in the first column, the raw standard deviation of rank is 0.31 (column 1). When class fixed effects are removed and MS final mark is controlled for, the residual variation decreases to 0.10 (column 2). Regarding the outcome variables (row 2 to 5), looking across columns, we see that their variation is slightly reduced by the removal of class fixed effects and MS final mark. Overall, the figures in Table 3 show that even with our preferred specification in Equation 3, we have enough variation in both the variable of interest and the dependent variables.

Table 3

Second, our identification assumption is that the observed variation in rank is as good as random once we control for student characteristics, including MS final mark, and for different sets of fixed effects. To investigate the validity of this assumption, we test whether the variation in rank is related to the variation in some predetermined individual characteristics, namely, gender, citizenship, parental background and age. We perform balancing tests regressing dummy variables for each of these characteristics on rank and on class fixed effects. As shown in Table 4, rank is not correlated with any

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<sup>14</sup>In most Italian high schools, there is only one track; then, clustering at the school and track level is the same as clustering at the school level. However, we estimated the previous equations by clustering at the more conservative school level as well. Results are available upon request.

dependent variable. This evidence suggests that rank does not systematically differ across classes relative to the observed individual characteristics.

Table 4

A final concern is related to our assumption that the MS final mark captures baseline violent behavior (see Section 2). To obtain evidence for the validity of this assumption, we use longitudinal data on the cohort of students enrolled in grade 5 in the 2013-14 school year, which we can follow through their grade 8 (2016-17 school year) and up to grade 10 (2018-19 school year). Notably, in the grade 5 questionnaire, these students were asked the same set of questions on violent behavior at school that we used to build our grade 10 outcome variables (see Table 1). To summarize the available information, we conduct principal component analysis of the four questions, and only one factor is retained (eigenvalue = 2.1), loading all four components. We obtain information on students' MS final marks from the grade 10 questionnaire, while we obtain information on students' academic achievement from the grade 8 administrative data. Specifically, we observe the student scores on the national standardized test administered by INVALSI in grade 8 in math and reading, which are directly entered in the computation of MS final mark (see Section 2).

Using these data, we can test whether violent behavior measured in grade 5 is related to MS final marks. Table 5 displays the results. In column 1, we regress the MS final mark on grade 5 violence and on grade 8 class fixed effects. In column 2, we add a set of individual controls (gender, migrant status, age and parental education), and in column 3, we include the standardized math and reading INVALSI scores as well. As shown in the table, pupils perpetrating violence at school in grade 5 achieve lower MS final marks. In all specifications, the coefficients of the violence variable are both statistically and economically significant, also when controlling for math and reading achievement in column 3. Overall, we interpret these results as evidence that the MS final mark captures the baseline violent behavior quite well.

Table 5

## 5. Results

### 5.1 Baseline results

Table 6 reports the estimation results of the model in Equation 3, with the specific types of violent behavior as dependent variables. We include controls for gender, migrant status, age and parental education. All specifications include class fixed effects that absorb track, subtrack and school fixed effects. Standard errors are clustered at the school and track levels.

Looking across columns, we note that rank has a negative effect on the probability of perpetrating any of the specific types of violence considered. The effect sizes are economically significant. Regarding verbal violence, moving from the bottom to the top of the rank distribution is correlated with a decrease in the probability of mocking and insulting by 0.04 and 0.05 points, respectively, corresponding to 7.8 and 13.5 percent of their average values. The likelihood of perpetrating relational violence decreases by 0.03 points (10 percent of its average value) when moving from the last to the first position in the class. The largest effect of rank is on physical violence. Moving from the bottom to the top is associated with a 0.02-point decrease in the likelihood that a student perpetrates physical violence, corresponding to approximately 20 percent of its average value (0.10).

Table 6

When looking at the other control variables, we see that girls are less likely to perpetrate any type of violent behavior, although there are remarkable differences in the effect size by type of violence. Specifically, we find a very large gender difference in the case of physical violence, where being a boy is associated with a 7.6 percentage point increase in the probability of acting violently, corresponding to approximately 70 percent of its average value. By contrast, the smallest gender difference is found for relational violence. Migrant students are less likely to be violent at school, with the exception of physical violence, for which an individual's migrant status has a positive association with the probability of perpetrating this type of violence. Older students are more likely to be violent at school, excluding relational violence. Our results also show that students with low parental education, for given baseline achievement, rank and other student characteristics, are less likely to perpetrate verbal violence, but parental background is not related to the likelihood of committing relational and physical violence.

## 5.2 Violence frequency

The results above show that students with higher class rankings are less likely to perpetrate violence at school, where violence is defined as perpetration of a violent behavior at least once in the school year. The next point that we investigate is whether rank also affects the frequency of violence. The continuing repetition of violence is a crucial aspect to consider, as even less intense types of violence, such as mocking, may have relevant detrimental effects when they occur regularly.

We use as outcome variables a series of dummies taking the value of one for students perpetrating specific types of violence at least once a week, then comparing them with students who either did not perpetrate violence at all or who acted violently sometimes during the school year.<sup>15</sup> The results are shown in Table 7. We find that relative rank is negatively associated with the probability of frequently perpetrating any type of violence. Considering the lower frequency by which students adopt violent behavior at least weekly (see Table 1), such effects are both economically and statistically significant. For instance, in the case of physical violence, a 0.5 change in rank, corresponding to a student moving from the middle to the bottom of the rank distribution, is associated with a 35 percent increase in the probability of perpetrating violence.

Table 7

## 5.3. Robustness and heterogeneous effects

Our results show a negative and significant effect of relative rank on students' propensity to behave violently at school. In this section, we test whether our results are robust to alternative sample definitions and whether they hold for specific student subgroups.

The first 4 columns of Table 8 show estimates of equation (3) excluding classes with a very low number of students (fewer than 10), while in columns 5 to 8, we exclude schools in the upper and lower tails of the violence distribution (i.e., schools above the 90<sup>th</sup> and below the 10<sup>th</sup> percentile of the school violence distribution) to test whether our main results are driven by particularly violent/nonviolent

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<sup>15</sup> We do not use the daily perpetration of violence as the outcome because the share of students who report acting violently every day is very low (see Table 1).

schools. As the table clearly shows, the negative effect of rank on the probability of perpetrating violent behavior is robust to both of the alternative sample definitions.

Table 8

We next examine heterogeneity in our main result with respect to individual characteristics, namely, gender, migrant status and parental background. We consider the four specific types of violent behavior as outcomes. Figure 2 displays the results. As shown in the figure, the rank effect is negative and statistically significant for the majority of subgroups and types of violence. There is no heterogeneity along the gender dimension with the exclusion of physical violence, for which the preventive effect of relative position is lower for girls than for boys. The rank effect is lower (in absolute terms) for migrant students than for natives when considering insulting and physical violence. Finally, the estimates show that the preventive effect of rank is the same for students with high and low parental education, excluding physical violence, for which rank is significant only for students whose parents have higher education levels.

The lower rank effect for migrants and for students with low parental education on physical violence—the form of violence more likely to be observed and punished—may reflect that the cost of committing violence is lower for these students due to their lower expected benefit of education and lower future aspirations. We will provide additional evidence for this interpretation of the rank effect in the next section.

Figure 2

## **6. Rank, school environment and local crime**

In this section, we investigate whether the effect of rank on school violence depends on the school environment or on the local context of the school. Schools may actually differ along many dimensions, which can in turn influence the social acceptance of violence at school or the social recognition of being at the top of the achievement distribution. In this respect, academic quality and school climate are crucial school characteristics to be considered.

Schools with higher academic quality are usually more competitive and place more weight on the relative rank of students within the class. In the Italian institutional setting, the school tracks described in Section 2 may be used as a first proxy for school academic quality: compared to technical and vocational schools, on average, *liceo* track schools attract higher-achieving students and feature a more competitive environment. Our data provides detailed information about students' aspirations relative to both education attainment and future careers. Regarding educational objectives, students are asked in the questionnaire to indicate the highest level of education they plan to achieve. Descriptive evidence confirms that students from the *liceo* track are significantly more likely than other students to declare that they will pursue a bachelor's or master's degree (see columns 1 and 2 of Table A3 in the appendix). As to job career expectations, students express their opinions on a list of items related to the reasons they go to school, and a number of these items refer to job-related aspirations.<sup>16</sup> Using these items, we carried out a principal component analysis and retained the first component (with an eigenvalue equal to 2.6 and loading with similar weights all the components), which we named job-related aspirations. We find that students from the *liceo* track have higher expectations of their future jobs and professional growth (see Table A3, column 3).

Given the higher expectations for the future, especially in terms of college admission, the cost of committing violence at school should be higher for highly ranked students in the *liceo* track than for those in the technical or vocational tracks, especially for types of violence that are more easily seen and punished, such as physical fighting. Hence, the negative effect of rank on the probability of committing school violence should be larger for students in the *liceo* track than for other students.

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<sup>16</sup> The question is as follows: Here are a number of reasons for which it may be important to go to school. To what extent does each of them correspond to the reasons why you go to school? Possible answers are not at all; a little; enough; and a lot. The items considered are "I study to find a valuable job in the future"; "I study to be prepared for what I would like to do in the future"; "I study to find a job I like in the future"; "I study to work in a field I like in the future"; "I study because this will help me to choose my future job"; and "I study to get the necessary skills for my future professional growth".



Table 9 reports our main estimates when we allow differential rank effects for students in the *liceo* track compared to the other students. We find heterogeneous results depending on the type of violence considered: the preventive effect of relative rank on the probability of mocking is significantly smaller for students in the *liceo* track, while the effect is considerably larger in the case of physical violence. Quite interestingly, the differential effect of rank for students in the *liceo* track seems to increase with the severity of the form of violence considered, but the result is not statistically significant for insulting and relational violence. Overall, these results are consistent with our interpretation based on the relevance of future higher costs associated with misbehavior for high-ranked students in high-quality schools. Specifically, rank gives students imperfect information about their ability and it could be that higher perceived ability is more related to future educational and professional aspirations for *liceo* students than for other students. Such higher aspirations in turn increase the expected benefit of good behavior.

Table 9

Another school-level factor that may significantly influence student behavior is school climate, a complex and multidimensional phenomenon that has a strong influence on social norms, values and rules prevailing at school (Cohen et al. 2009; Gage, Larson, and Prykanowski 2014). In some schools, students feel safe and supported by their teachers and cooperate with their peers; in other schools, students feel neglected or misunderstood by either their teachers or their peers.

There is evidence showing that a positive school climate is associated with reduced bullying reports (Kasen et al. 2004; Orpinas, Horne, and Staniszewski 2003; Waasdorp, Bradshaw, and Leaf 2012). Furthermore, students' feelings of belonging and connectedness to their schools influence their actual engagement in school activities, which in turn affect their academic achievement (Laurito et al. 2019; Wang and Holcombe 2010) and wellbeing (Varela et al. 2019). In light of this evidence, we test whether school climate may also influence the effect of relative rank on the probability of committing any of the forms of violence considered.

Our dataset contains several items that may proxy for school climate in terms of the cooperative behavior of both teachers and peers. More specifically, the questionnaire asks how much the student agrees with the following statements: a) In my class, teachers pay attention to what students say during

lectures; b) In my class, everyone respects students' opinions; c) In my class, teachers care about students' problems; and d) In my class, students feel understood. Possible answers are as follows: I completely disagree; I disagree; I agree; and I completely agree. We carried out a principal component analysis of these items and retained the first component, with an eigenvalue equal to 2.5, explaining more than 62 percent of the total variance. We named this component *teacher climate*.

In another question, students have to indicate a) how many classmates they get along with; b) how many classmates they would help if they were in need; and c) how many classmates they consider to be friends. Possible answers are none, very few, a few, many, and all. A principal component analysis based on these items provides a first component with an eigenvalue equal to 2, explaining more than two-thirds of the total variance. We named this component *peer climate*.

We then computed the school means of these two components and used them to identify schools with a relatively bad climate, that is, schools with either a teacher climate or peer climate lower than the 10<sup>th</sup> percentile of the corresponding school-level variable. Estimates of the interaction of these dummies with the rank variable show a statistically significant negative relationship between relative rank and most of the four types of violence, regardless of the quality of the school climate. In the case of both types of verbal violence and relational violence, the estimated rank coefficient for schools with a bad climate is similar to that estimated for the remaining schools. A major exception is related to physical violence, for which we find a nonsignificant effect of rank for schools with a bad climate, especially when the latter is measured through the quality of peer relationships (see Figure 3).<sup>17</sup>

Overall, our results show that a bad school climate and a sense of estrangement, especially with respect to peers, completely offset the protective role of relative rank against committing physical violence. This result may be explained by the lower (perceived) opportunity cost faced by high-

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<sup>17</sup> The F test allows us to reject the null hypothesis that the rank effect for students in schools with a bad peer climate is equal to that of students in schools with a better peer climate ( $F=13.98$ ,  $p\text{-value}=0.0002$ ). We find that the rank effect is smaller and not statistically significant in schools with a bad climate also when we classify schools on the basis of teacher climate, but in this case, the F test does not allow us to conclude that the two rank effects are different between the two groups of schools. The results are available upon request.

achieving students in uncooperative contexts, where misbehavior, especially towards peers, as captured by our indicators of violence, may be socially condemned less than it is in more cooperative contexts.

### Figure 3

Finally, we move from the school to the neighborhood level and investigate whether the rank effect is also influenced by the level of local crime. A few studies report a positive and direct association between neighborhood violence and school violence (Khoury-Kassabri et al. 2004; Espelage 2014), while a growing body of research emphasizes the detrimental effect of exposure to neighborhood violence on students' attainment and achievement (among others, Koppensteiner and Menezes, 2019; Burdick-Will, 2013; Monteiro and Rocha, 2017; Sharkey et al 2014).<sup>18</sup>

We expect that the rank effect on the probability of committing violence at school may also be influenced by the level of neighborhood crime, but the sign of this effect is *ex ante* unclear. On the one hand, living in high-crime areas could make good behavior for highly ranked students less important because those students may have lower aspiration than similar students located in more privileged areas due to higher perceived socioeconomic barriers to social mobility; on the other hand, succeeding at school in high-crime areas may be the only effective way to pursue social mobility and escape a negative environment. Thus, the opportunity cost of committing violence at school may be even larger in high-crime areas than in low-crime ones.

As a measure of local crime, we use an indicator of the juvenile crime rate (i.e., crime rate of young people aged 14-17) at the provincial level (which is the most disaggregated regional background variable available in INVALSI data).<sup>19</sup> We construct a measure of involvement in criminal activity based on the Italian National Institute of Statistics (ISTAT) official data on adolescent offenders aged 14 to 17

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<sup>18</sup> A number of mechanisms may explain this effect, such as psychological stress, fear, lack of concentration and mental health disorders caused by being a victim or a witness of crime; lower school resources or bereavement effects caused by violent crimes (such as civil wars or drug battles); individual or household behavioral adaptation intended to provide protection in a dangerous neighborhood; and spillover effects from victimized classmates.

<sup>19</sup> As a robustness check, we restrict the crime rate to young people aged 14-15, corresponding to the same age group of our sample. The results are unchanged and are available upon request.

reported to the judicial authority for any type of crime. We take the average (over the years 2004-2008) of the ratios between the number of adolescent offenders in each province over the corresponding age group population (the so-called offending rate).

On the basis of the distribution of this indicator, we identify students living in provinces with relatively high juvenile crime rates (i.e., higher than the 90<sup>th</sup> percentile) separately from the remaining students. Figure 4 reports the main estimates of the rank effect for these two groups of students. Similar to what we found in the case of school climate, our estimates show a negative effect of the relative rank on all types of school violence and all groups of students, except for students in high-crime areas in the case of physical violence. For the latter, the estimated coefficient is not significantly different from zero for students in schools located in provinces with a high juvenile crime rate.

Figure 4

Overall, our analysis emphasizes that local contextual factors significantly influence the rank effect on the probability of committing violence at school, especially forms that are more visible and punishable, as in the case of physical violence. All the contextual indicators considered (that is, type of school, school climate or local juvenile crime rate) show that relative rank is less or not effective in reducing physical fighting in lower-quality schools, schools characterized by a bad peer climate or schools located in high-crime areas. This evidence is consistent with the lower opportunity costs associated with severe (and more punishable) misbehavior for high-achieving students in low quality schools and in schools placed in a disadvantaged context.

## **7. Conclusions**

This paper focuses on one potential determinant of violent behavior at school and finds that being in the upper part of the achievement rank distribution, for a given absolute achievement, decreases the probability of engaging in such behavior and reduces its frequency. These results hold for any type of violence considered, namely, verbal, relational and physical. The effect sizes are economically significant, especially for physical violence. Our paper highlights that school quality and climate and local crime significantly influence the rank effect on the probability of committing violence at school, especially physical violence.

Although our data do not allow us to identify the precise mechanisms driving the effect of relative rank on school violence, our results are consistent with the assumption that rank, which gives students imperfect information about their absolute ability, affects their perceived ability and future aspirations. This may in turn influence their expected benefit of good behavior at school, thus increasing the opportunity costs associated with misbehavior.

We believe that this paper provides clear evidence of an important determinant of violence at school. This issue is important to study because increasing evidence suggests that school violence is very costly and has both short- and long-term negative effects on cognitive and noncognitive outcomes as well as on labor market performance and health. By learning more about the factors that shape adolescents' violent behavior, teachers and school staff can identify more at-risk students and design appropriate, targeted interventions. In this respect, violence reduction policies that target low-ranked students could have positive effects.

Our estimates clearly show that the rank effect is less pronounced for migrants, for students with low parental education and for students located in more disadvantaged schools or areas, especially in the case of more disruptive forms of violence. Our main interpretation of these results relies on the role of the perceived opportunity cost of violence and aspirations. Specifically, those students, even when they believe to have high-ability because they rank high, may have low future expectations because of high perceived socioeconomic barriers to ambitious educational and working careers. Indeed, recent literature show that students from disadvantaged backgrounds often lack ambition, also independently from their ability (Hoxby and Avery, 2013, Guyon and Huillery, 2016).

In order to make those students more aware of the opportunity cost of misbehaving, policies targeted to disadvantaged students that strengthen their awareness of the link between perceived ability and future prospects and that contribute to align ability with aspirations are needed. This calls for programs such as targeted mentoring and coaching that reduce the perceived socioeconomic barriers that induce low-background/high-ability students to yearn less demanding careers (Dalton et al., 2016; Genicot and Ray, 2017; Mookherjee et al., 2010). In addition to their direct effect, such policies can reduce school violence also through the mechanism we investigated in this paper.

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## **Appendix**

Table A1

Table A2

Table A3

**Table 1: Prevalence of school violence**

	Mocking	Insulting	Relational Violence	Physical violence	At least one type of violence
Never	44.81	59.7	70.18	89.76	30.88
Sometimes	47.8	33.41	26.24	7.54	56.93
Every week	3.65	3.76	2.01	1.25	5.97
Every day	3.74	3.13	1.58	1.45	6.23
Observations	220,030	220,030	220,030	220,030	220,030

Note: This table reports responses to the questionnaire items: “During the current school year, how often did you i) mock ii) insult iii) isolate or exclude iv) beat up other students?”.

**Table 2: Violent behavior by students' subgroups**

	Mocking	Insulting	Relational violence	Physical violence
All students	0.55	0.40	0.30	0.10
Gender				
Girl	0.45	0.29	0.28	0.05
Boy	0.66	0.52	0.32	0.16
Citizenship				
Migrant	<b>0.56</b>	0.44	<b>0.30</b>	0.15
Native	<b>0.55</b>	0.40	<b>0.30</b>	0.10
Age				
Born first half of the year	0.57	0.43	0.31	0.11
Born second half of the year	0.53	0.38	0.29	0.09
Academic achievement				
MS final mark $\geq 8$	0.52	0.35	0.29	0.08
MS final mark $< 8$	0.59	0.48	0.32	0.14
Parental background				
Low background	<b>0.55</b>	0.43	0.31	0.13
Medium/high background	<b>0.55</b>	0.40	0.30	0.10
School track				
Academic track	0.50	0.33	0.27	0.06
Technical track	0.61	0.48	0.32	0.13
Vocational track	0.61	0.52	0.36	0.17

Note: This table reports averages of the four school violence dummies for different students' subgroups; the violence variables takes the value of 1 if the specific violent behavior has been perpetrated at least once in the school year. t tests on the equality of means between subgroups show that means are different with a significance level of 1% for all subgroups and violence variables with the exception of groups and variables whose figures are in bold in the table.

**Table 3: Variation in main variables**

	Raw variables	Net of class fixed effect and MS final mark
Rank	0.306	0.101
Mocking	0.497	0.465
Insulting	0.490	0.451
Relational violence	0.457	0.431
Physical violence	0.303	0.277

This table reports the raw and the residual (net of class fixed effects and MS final mark) standard deviation in rank and in the outcome variables.

**Table 4: Balance test for rank**

	Gender	Citizenship	Parental education	Age
Rank	0.012 (0.001)	0.003 (0.006)	-0.015 (0.010)	0.011 (0.011)
Observations	220,030	220,030	220,030	220,030
R-squared	0.345	0.147	0.199	0.114

This table reports estimates from separate regressions of the individual characteristics in the columns on rank conditional on class fixed effects and on MS final mark. Gender is a dummy equal to one for girls; citizenship is a dummy equal to one for students with both parents born abroad; parental background is a dummy equal to one for students who has at least one parent with tertiary education; age is a dummy for students born in the first half of the year. Robust standard errors are in parentheses. They are clustered at the track and school level.

**Table 5: Baseline violence and MS final mark**

	(1)	(2)	(3)
Violence	-0.147*** (0.003)	-0.113*** (0.003)	-0.056*** (0.002)
Student characteristics	No	Yes	Yes
Math/reading achievement	No	No	Yes
CLASS FE	Yes	Yes	Yes
Observations	319,328	256,109	255,670
R-squared	0.143	0.197	0.562

This table reports estimates from separate regressions of the MS final mark on grade 5 violence conditioning on class fixed effects and progressively controlling for individual characteristics and for reading/math scores obtained in the standardised assessments administered by INVALSI during the grade 8 MS final exam. The violence variable is obtained after performing principal component analysis on the four specific-violence variables reported in Table 1 in grade 5. Individual controls include dummies for migrant, girl, parental background and age. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\*  $p < 0.01$



**Table 6: Rank and violent behavior**

	Mocking	Insulting	Relational violence	Physical violence
Rank	-0.043*** (0.011)	-0.054*** (0.011)	-0.030*** (0.010)	-0.021*** (0.007)
Boy	0.188*** (0.003)	0.181*** (0.003)	0.028*** (0.003)	0.076*** (0.002)
Migrant	-0.024*** (0.004)	-0.005 (0.004)	-0.016*** (0.004)	0.037*** (0.003)
Born first half of the year	0.018*** (0.002)	0.017*** (0.002)	0.001 (0.002)	0.009*** (0.001)
Low background	-0.015*** (0.003)	-0.010*** (0.003)	-0.003 (0.003)	-0.001 (0.002)
MS final mark	Yes	Yes	Yes	Yes
Class FE	Yes	Yes	Yes	Yes
Observations	220,030	220,030	220,030	220,030
R-squared	0.150	0.177	0.115	0.175

This table reports estimates for separate regressions of the variables in column on individual characteristics conditioning on class fixed effects and controlling for MS final mark. The dependent variables are equal to 1 if the individual reported perpetrating the specific type of violence at least once in the current school year. Migrant is a dummy equal to one for students with both parents born abroad; low background is a dummy equal to one for students with parents holding no more than compulsory education. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\* p<0.01

**Table 7: Rank and intensity of violence**

	Mocking	Insulting	Relational violence	Physical violence
Rank	-0.022*** (0.006)	-0.029*** (0.006)	-0.018*** (0.005)	-0.019*** (0.004)
Student characteristics	Yes	Yes	Yes	Yes
MS final mark	Yes	Yes	Yes	Yes
Class FE	Yes	Yes	Yes	Yes
Observations	220,030	220,030	220,030	220,030
R-squared	0.133	0.137	0.121	0.139

This table reports estimates for separate regressions of the variables in column on individual characteristics conditioning on class fixed effects and controlling for MS final mark. The dependent variables are equal to 1 if the individual reported perpetrating the specific type of violence at least weekly. Individual controls include dummies for migrant, girl, parental background and age. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 8: Rank and violent behavior: Robustness**

	Exclude very small classes				Exclude highly and weakly violent school			
	Mocking	Insulting	Relational violence	Physical violence	Mocking	Insulting	Relational violence	Physical violence
Rank	-0.040*** (0.011)	-0.056*** (0.011)	-0.033*** (0.011)	-0.022*** (0.007)	-0.044*** (0.011)	-0.056*** (0.011)	-0.032*** (0.011)	-0.025*** (0.007)
Student characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MS final mark	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Class FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210,249	210,249	210,249	210,249	207,087	207,087	207,087	207,087
R-squared	0.142	0.170	0.108	0.164	0.138	0.167	0.110	0.172

This table reports estimates for separate regressions of the variables in column conditioning on class fixed effects and controlling for MS final mark and for individual characteristics. The dependent variables are equal to 1 if the individual reported perpetrating the specific type of violence at least once in the current school year. Individual controls include dummies for migrant, girl, parental background and age. Estimates in columns 1 to 4 are obtained excluding students belonging to classes with less than 10 students. Estimates in columns 5 to 8 are obtained excluding students belonging to schools in the first and last deciles of the school violence distribution. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\* p<0.01

**Table 9: Rank and violence: School track heterogeneity**

	(1)	(2)	(3)	(4)
	Mocking	Insulting	Relational violence	Physical violence
Rank	-0.049*** (0.011)	-0.051*** (0.011)	-0.025** (0.011)	-0.014* (0.008)
Rank x liceo track	0.017** (0.009)	-0.011 (0.009)	-0.013 (0.009)	-0.021*** (0.006)
Student characteristics	Yes	Yes	Yes	Yes
MS final mark	Yes	Yes	Yes	Yes
Class FE	Yes	Yes	Yes	Yes
Observations	220,030	220,030	220,030	220,030
R-squared	0.150	0.177	0.115	0.177

This table reports estimates for separate regressions of the variables in column conditioning on class fixed effects and controlling for MS final mark and for individual characteristics. The dependent variables are equal to 1 if the individual reported perpetrating the specific type of violence at least once in the current school year. Individual controls include dummies for migrant, girl, parental background and age. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\* p<0.01

**Table A1: Test on differences in observable characteristics between classes within track and school**

	MS final mark	Gender	Citizenship	Parental background	Age
F test	1.044	0.562	1.165	0.725	0.472
p-value	0.405	0.914	0.288	0.771	0.961
Average difference	0.015	0.004	0.006	0.005	0.006

Notes: This table reports the F test and the corresponding p-value on the set of class dummies coefficients obtained from regressions based on data collapsed at the class level of each observable characteristic on class dummies controlling for track and school fixed effects. The third line reports the average difference between class coefficients within track and school weighted by the sample size on which the respective coefficients have been estimated.

**Table A2: Summary statistics**

	Mean	Std. dev.	Min	Max
Girl	0.51	0.50	0.00	1.00
Migrant	0.09	0.29	0.00	1.00
Born first half of the year	0.52	0.50	0.00	1.00
MS final mark	7.85	1.26	6.00	11.00
Low background	0.16	0.36	0.00	1.00
Academic track	0.53	0.50	0.00	1.00
Technical track	0.32	0.47	0.00	1.00
Vocational track	0.15	0.36	0.00	1.00
Observation	220,030			

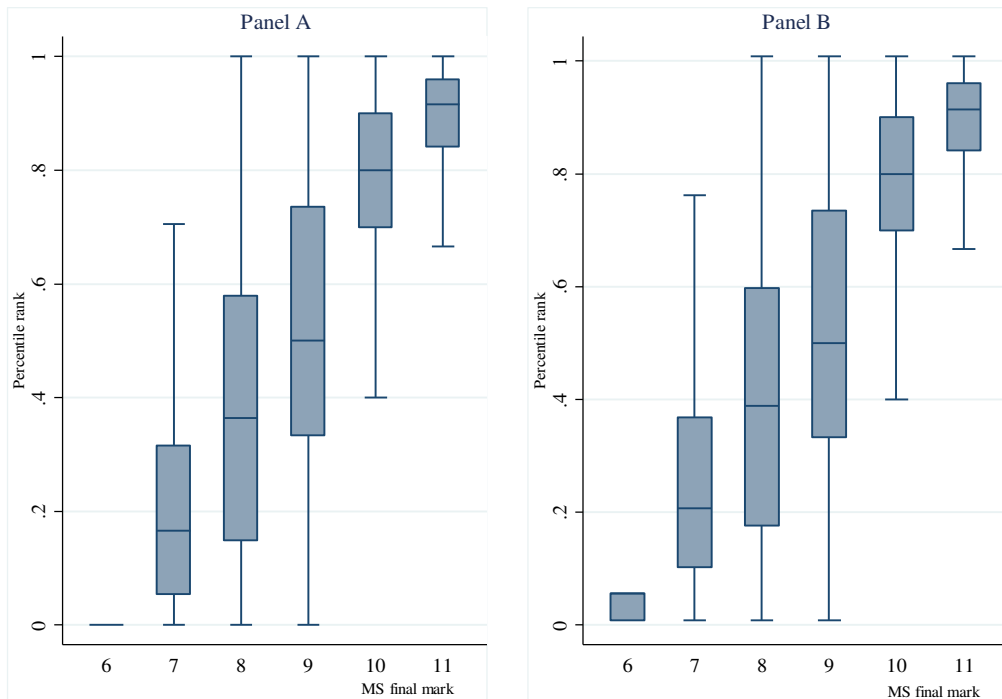
Note: This table reports summary statistics for the estimation sample, which is restricted to individuals without missing values in the questions on violent behavior at school.

**Table A3: Future aspirations by school track**

VARIABLES	(1) Pursue bachelor degree	(2) Pursue master degree	(3) Aspirations on future job
Liceo track	0.329*** (0.006)	0.216*** (0.005)	0.055*** (0.009)
Student characteristics	Yes	Yes	Yes
Class FE	Yes	Yes	Yes
Observations	220,030	220,030	216,075
R-squared	0.322	0.223	0.048

This table reports estimates for separate regressions of the variables in column on liceo-track fixed effect conditioning on class fixed effects and controlling for MS final mark and for individual characteristics. The dependent variables in columns 1 and 2 are equal to 1 for students reporting they aim to get a bachelor degree (column 1) and a master degree (column 2). The dependent variable in column 3 is obtained carrying out a principal component analysis on a set of questions related to job aspirations (see footnote 15). Individual controls include dummies for migrant, girl, parental background and age. Robust standard errors are in parentheses. They are clustered at the track and school level. \*\*\* p<0.01

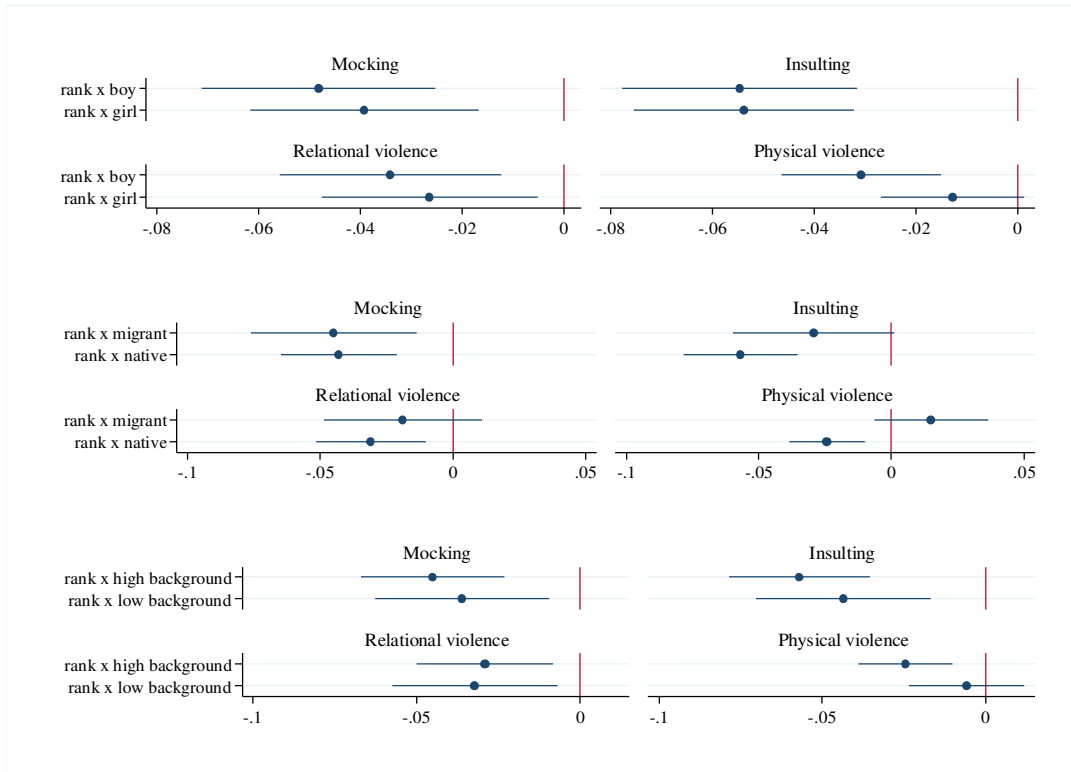
**Figure 1: MS final mark and rank distribution**



This figure shows the the minimum, the maximum, the 25th and 75th percentiles, and the median (indicated with the horizontal line) of rank by MS final mark. In panel b, rank are residuals from OLS regressions of rank on school track fixed effects adding the regression constant and excluding observations above the 99th and below the 1st percentile.

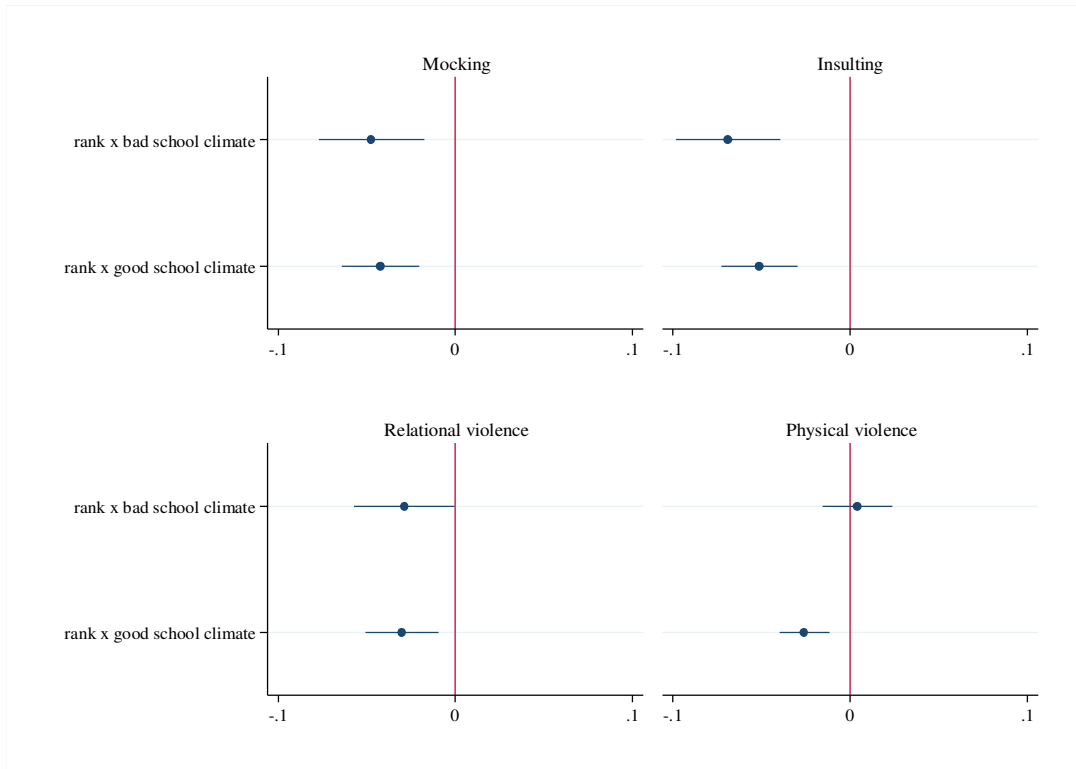


**Figure 2: Rank and school violence: Heterogeneity**



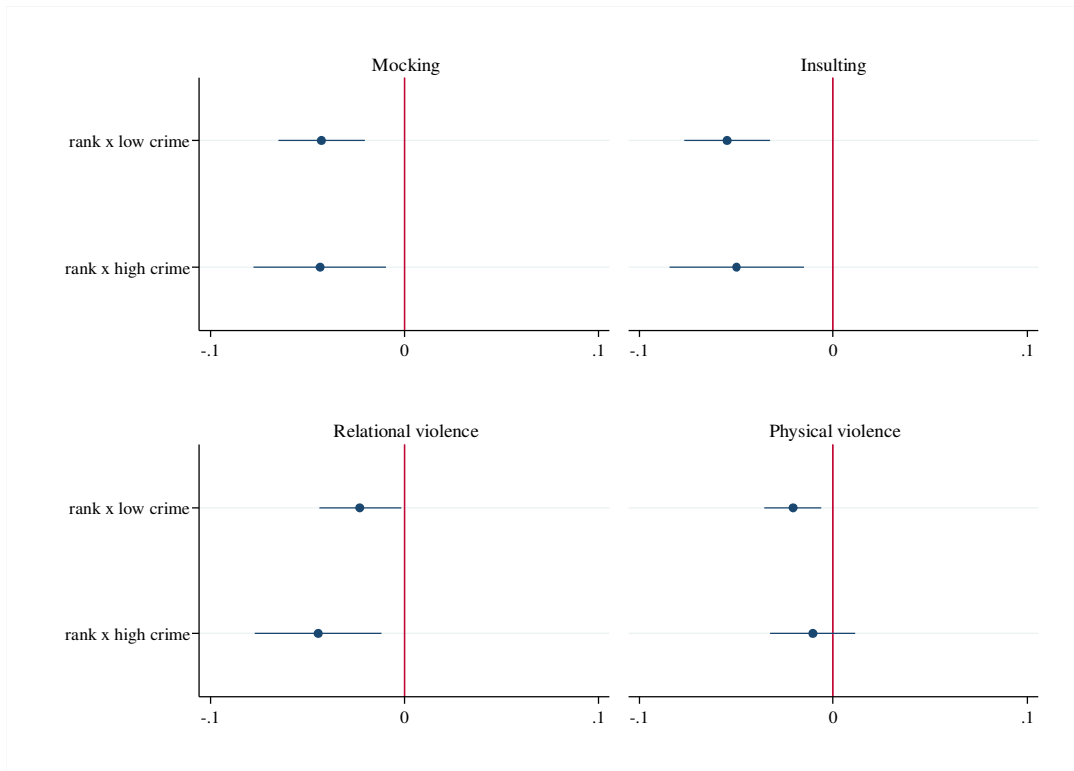
This figure shows estimates and their confidence interval of the interaction coefficient between rank and the respective dummy. Estimates refer to separate regressions of the variables in each panel on the interaction terms conditioning on class fixed effects and controlling for MS final mark and for individual characteristics (dummies for migrant, girl, parental background and age)

**Figure 3: Relative rank and school climate**



This figure shows estimates and their confidence interval of the interaction coefficient between rank and two dummies for, respectively, students in schools with bad peer climate (<10th percentile of the distribution of school peer climate) and the remaining students (>10th percentile of the distribution of school peer climate). Estimates refer to separate regressions of the variables in each panel on the interaction terms conditioning on class fixed effects and controlling for MS final mark and for individual characteristics (dummies for migrant, girl, parental background and age)

**Figure 4: Relative rank and local juvenile crime**



This figure shows estimates and their confidence interval of the interaction coefficient between rank and two dummies for, respectively, students in provinces with high juvenile crime rates (>90th percentile of the distribution of juvenile crime rate) and the remaining students (<90th percentile of the distribution of juvenile crime rates). Estimates refer to separate regressions of the variables in each panel on the interaction terms conditioning on class fixed effects and controlling for MS final mark and for individual characteristics (dummies for migrant, girl, parental background and age)