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Discussion Paper No. 07-004

**Violence in European Schools:
Victimization and Consequences**

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Zentrum für Europäische
Wirtschaftsforschung GmbH

Centre for European
Economic Research

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Nontechnical summary

Violence at schools is a phenomenon that is apparent in most countries. Despite the public attention devoted to outbursts of violence nowadays, little is known about the dimension and consequences of small-scale violence which students face at school each day. Common forms of everyday violence at schools are students being excluded from social groups, being verbally and physically harassed, being bullied and being stolen from by classmates. The motivation, concentration and self-confidence of students are likely to suffer when students are affected by violence.

This paper uses representative data from the Trends in International Mathematics and Science Study (TIMSS) for eleven European countries and the British National Child Development Study (NCDS) to examine the degree to which students experience violence at schools and the consequences on student performance and further outcomes. The main questions being addressed are: What is the dimension of school violence? Who are the victims? What is the effect of being a victim on student performance, educational achievement and earnings? The analysis of the TIMSS data refers to both students in grade four and in grade eight since a child's personality develops fast and students in primary and secondary schools may be affected differently by school violence. The indicators for violence are whether students have been stolen from or been hurt by other students in the preceding month. In addition to the cross-country TIMSS data, the longitudinal NCDS data for Britain is analyzed. This data provides the opportunity to study the impact of being bullied as a child not only on contemporary outcomes like student performance but as well on later outcomes like educational degrees and earnings. Moreover, the NCDS includes information on the physical appearance of children that are strongly linked to being bullied.

The self reported degree of student violence is high, both for students being hurt and stolen from by other students and for children that are bullied. Students in grade four report a higher level of school violence than students in grade eight. Looking at surveys from different years reveals no clear time-trend. The determinants of being a victim show that female students and students in villages or small towns are less likely to be hurt or stolen from by other students while students with an immigration background are more likely to be victims. Besides the student characteristics typically observed in student performance studies, also the appearance of students such as their looks and their height play an important role in the process of victimization. Moreover, having older siblings reduces the probability of being bullied while it increases when having younger siblings, in particular when siblings have the same gender.

The effect of being a victim of school violence on student achievement is significant both for the TIMSS and the NCDS data. The longitudinal NCDS data allow for a more credible identification of the effect, providing controls for prior achievement, prior victimization and additional student characteristics. The analysis shows that the behavior of peers in form of school violence is an important determinant of both contemporary and later student achievement. The effect size of 0.04 on contemporary reading achievement is small but significant. Moreover, being bullied as a child has a significant impact on the level of educational attainment and labor market earnings, but only through the effect on student performance. The results show that school violence is a widespread problem which has short and long term consequences for victims, be it boys or girls. Reducing violence at schools not only eases life for many students who suffer from it but should also lead to more investment in human capital.

Violence in European Schools: Victimization and Consequences

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Abstract: Violence at schools is a well-known problem in many societies. This paper assesses the degree of school violence in 11 European countries and analyzes the determinants of being a victim and its effect on student performance. The study draws on the international TIMSS 2003 and the British longitudinal NCDS data. The level of school violence is high in most countries but seems not to increase over time. Besides gender, social and migration background and the appearance of students determine being bullied, hurt or stolen from by fellow students. Being a victim has a small but significantly negative impact on contemporary and later student performance and the level of educational attainment and thereby affects earnings. It is hence an important peer effect that should not be omitted in the estimation of educational production functions.

Key words: School violence, bullying, human capital, TIMSS, NCDS

JEL classification: I21, J24, Z13

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1 Introduction

Violence at schools is a phenomenon that is apparent in most countries. Public attention is mostly drawn to the most extreme forms of student violence, the torture and killings of students like in Columbine and Erfurt. More common forms of everyday violence at schools are students being excluded from social groups, being verbally and physically harassed and being stolen from by classmates. Despite the public attention devoted to outbursts of violence nowadays, little is known quantitatively about the dimension and consequences of small-scale violence which students face at school each day. The motivation, concentration and self-confidence of students are likely to suffer when students are affected by violence. Hence, school violence may be an important determinant in the process of educational production that is neglected in most research on student performance.

The economics of education literature has recently devoted much attention to the impact of peers' performance, social background, race or gender on student achievement (e.g. Ammermueller and Pischke, 2006; Hanushek et al., 2003; Hoxby, 2000). Violent behavior of peers, however, that might give rise to negative peer effects has been rarely addressed. A notable exception is the study by Brown and Taylor (2005), which follows a similar approach as this study and examines the impact of bullying on educational achievement and wages in Britain. Using NCDS data, they find significant and sizeable negative effects of being bullied in school on student performance, educational attainment and wages. A related study by Le et al. (2005) shows that childhood disorder problems such as bullying activity and starting physical fights has a negative impact on higher educational attainment and labor market earnings, even when controlling for family fixed effects in their sample of Australian twins.

Most studies in the field are from educational researchers and sociologists and aim at explaining the causes of violent behavior.¹ They rarely provide a representative view over the dimension of different forms of violence and do not address the consequences for the performance of students. Woods and Wolke (2004) conduct a study on the causes of violent behavior in primary schools in two areas in the UK and find no evidence on a significant link between bullying behavior and student performance. Although recent student performance

¹ For an overview on sociological and psychological research on violence in schools see the website of the „Violence in schools initiative“ of the European Commission and its member states <http://www.gold.ac.uk/connect/index.html>.

studies provide detailed information on attitudes and experiences of students at school, the literature on violent behavior is scarce. One study uses data from a previous TIMSS survey and explains the degree of school violence across countries by the level of crime in general and the educational system (Akiba et al., 2002). The inequality in student performance within a country is found to be the only significant determinant of the level of school violence. However, the authors do not control for country effects.

Besides links to the sociological and psychological literature, the analysis of being bullied as a child on the later outcomes educational achievement and labor market earnings relates to the literature on labor market returns to specific characteristics.² Examples are returns to beauty and height on the labor market (e.g. Hamermesh and Biddle, 1994; Harper, 2000; Mobius and Rosenblat, 2006). Some of these studies also rely on longitudinal data and find positive returns to an attractive physical appearance for the US and the UK. The channels for the labor market premium for beauty are identified as sorting into occupations, correlations between attractiveness, confidence and earnings and discrimination by employers. It can be expected that the long run effects of bullying on earnings rather act through the impact on skill accumulation and confidence than through discrimination on the labor market because being bullied as a child is not observable for the employer.

This paper uses representative data from the Trends in International Mathematics and Science Study (TIMSS) for eleven European countries and the British National Child Development Study (NCDS) to examine the degree to which students experience violence at schools and the consequences on student performance and further outcomes. The main questions being addressed are: What is the dimension of school violence? Who are the victims? What is the effect of being a victim on student performance, educational achievement and earnings? The analysis of the TIMSS data refers to both students in grade four and in grade eight since a child's personality develops fast and students in primary and secondary schools may be affected differently by school violence. The indicators for violence are whether students have been stolen from or been hurt by other students in the preceding month. The countries of interest are Belgium, Cyprus, England, Hungary, Italy, Latvia, Lithuania, The Netherlands, Norway, Scotland and Slovenia. In addition to the cross-country TIMSS data, the longitudinal NCDS data for Britain is analyzed. This data provides the opportunity to study the impact of being bullied as a child not only on contemporary outcomes like student performance but as

well on later outcomes like educational degrees and earnings. Moreover, the NCDS includes information on the physical appearance of children that are strongly linked to being bullied.

The main findings of this study are that being hurt, stolen from or bullied as a child has a negative impact on contemporary student performance. The results from the NCDS data show that the effect is persistent even when controlling for prior performance and physical appearance, which is a strong determinant of being bullied. While being bullied at age 11 significantly decreases student performance at age 11 and 16 and the highest level of educational attainment, it only has indirect effects on earnings at age 33.

The following section introduces the data and provides descriptive evidence on the dimension of violence at schools. Section three discusses the underlying mechanisms and the empirical framework. In section four, the results are presented and discussed in reference to the literature. Section five concludes.

2 Data and descriptive statistics

2.1 The TIMSS data

The Trends in International Mathematics and Science Study (TIMSS) was conducted by the International Association for the Evaluation of Educational Achievement (IEA) in about 50 countries worldwide in 2003. The publicly available data combines student-level performance data in mathematics and science and extensive background information. Both students in grade four and grade eight were tested. Schools were sampled randomly in each country and then entire classes of these schools were chosen to participate. The students took standardized achievement tests in both mathematics and science. The results were scaled according to an international test score with a mean of 500 and an international standard deviation of 100. In addition, each student, his teacher and principal had to complete a questionnaire giving background information on students, the community, resources of the school including teacher characteristics and the institutional setting. All available data for an individual student were merged together with his sampling weight. Table A1 provides data on the participation at student, class and school level and the ratio of sampled students. Schools in geographically

² A further strain of literature that is loosely related is the economics of crime (e.g. Glaeser and Sacerdote, 1999; Levitt, 1997). However, the focus here is on the behavior of children and its effects on educational achievement.

remote regions, extremely small schools and schools for students with special needs were excluded from the study, as were disabled students in regular schools. These restrictions are necessary to facilitate the sampling of students and to sample only students that could participate in the tests but might have led to a bias of the sampled students, especially when many disordered but not disabled students have been placed into special schools. However, all other students could be sampled and the exclusion rate was not to exceed 10 percent.³ Students with missing values have been excluded from the data.

To determine the degree of violence at schools, two questions of the student questionnaires are used. Students were asked: “In school, did any of these things happen during the last month?” in reference to the two points “Something of mine was stolen” and “I was hit or hurt by other student(s)”. They could answer by yes or no. The indicators thus reflect two kinds of small-scale violence that are not observed by other statistics but may well have an impact on students. The time of one month should be long enough to include all students who are affected by violence regularly and short enough that students can remember the situation and that it may still have an impact on their behavior.

2.2 The NCDS data

The National Child Development Study (NCDS) is a longitudinal study that follows all children born in the UK between March 3 and 9 in 1958. Further sweeps were carried out when the children were aged 7, 11, 16, 23, and 33. The information used here is from the sweeps in 1965, 1969, 1974 and 1991 when the persons were aged 7, 11, 16 and 33. Information on student violence is available for children aged 7 and 11, test scores are used for children aged 7, 11 and 16 and the highest educational level and earnings are asked when persons are aged 33. Information is taken from student’s tests, individual, teacher and parent questionnaires. For more detailed information on the NCDS see Ferri et al. (2005). Sample attrition is a problem when we consider outcomes like earnings at age 33 but not for the outcomes at younger ages where attrition is still low.

The variable of interest is from the mother’s questionnaire and is a categorical variable whether the child has been bullied not at all, sometimes or often. The question differs from the question in TIMSS in several respects. The question is asked to the mother and not to the

³ For more information on TIMSS, see Ammermueller et al. (2005) and the TIMSS internet homepage <http://timss.bc.edu>.

child and does not explicitly refer to violence in schools. The main difference to the TIMSS data is obviously the time difference in the observation period of over 30 years. Students in the NCDS are interviewed in 1965 and 1969 and in TIMSS in 2003. Therefore it is doubtful in how far the results from the two studies are actually comparable.

2.3 Descriptive statistics

Tables A2 and A3 show the descriptive statistics for TIMSS of the math score, the indicators for violence and the student background, class and school variables for grade four and eight, respectively. The average math test scores are highest in the Flemish part of Belgium and in The Netherlands, both for grade four and grade eight. In grade four, only Norway, Slovenia and Scotland score below the international mean of 500 while at grade eight, several countries have below-average mean performance. Norway and Cyprus are the two lowest performing countries at grade eight.

The average value of the two indicators of school violence for the two grade levels are presented graphically in Figures 1 to 4. The first two figures compare the two indicators of violence at school at grades four and eight, respectively. Between 24 and 47 percent of all students have been hit or hurt by other students in the last month in grade four. Although the figures for being a victim of theft are lower, they still range from 12 to 32 percent. Small-scale violence at school is hence not a negligible phenomenon but affects a large share of students. The correlation coefficient between the two indicators on a national level is 0.70 for grade four and 0.54 for grade eight. The level of violence is highest in Belgium (Flemish part) and Cyprus at grade four and in Cyprus and Slovenia at grade eight. The Netherlands, Norway and Hungary show low levels of violence at both grades. At grade eight, theft is almost as common as being hurt. Overall, the level of violence is lower at grade eight than at grade four. This is shown in Figures 3 and 4. The difference between the two grade levels is much higher for being hurt than for being stolen from. Being hurt by 10 year-old students in primary school may be quite different from being hurt by 14 year-olds. Therefore, the level of violence may be even higher in secondary education, when the incidents that are included in the indicator are much more severe. Moreover, the development of the children's personality may partly explain the reported difference between the grade levels. Younger children may feel being victimized much easier than older children or physical contact among children may be more common at a lower age. However, these arguments should apply much less to the indicator for being the victim of theft.

Previous TIMSS studies have asked similar questions to students about violence at schools. TIMSS 1995 and the Progress in International Reading Literacy Study (PIRLS) from 2001 provide information on violence in grade four; TIMSS 1995 and TIMSS 1999 include information on students in grade eight. While the questions on being stolen from and hurt are identical for TIMSS 2003 and PIRLS, they differ slightly for TIMSS 1995 and 1999. Students are asked how often they have been stolen from and how often they think they might be hurt by another student within the last month in school. The percentage shown in Figures 5 and 6 include all students that have been affected by violence once or more often in the last month. For the TIMS studies, the information refers to the student population in the Math achievement files. In PIRLS students have been tested only in reading literacy.

For grade four, the percentages for all three studies are closely together. Figure 5 shows that there is no coherent time trend across countries, given that the information is truly comparable across studies. When the indicator of being hurt is used instead (Figure 6), there is a slight positive time trend in many countries. Figure 7 presents the results for grade eight for being stolen from. The difference between the studies and years are much larger than for grade four. The share of students that have been stolen from is highest for TIMSS 1999 and lowest for TIMSS 2003 for most countries. This evidence suggests a slight increase followed by a decrease in violence over time. For being hurt the time trend looks similar.

Table A4 displays the summary statistics for the NCDS data and a description of the variables. The test scores are reading test scores, which provide the greatest variation of all test scores. The highest educational degree is a categorical variable comprising seven educational degrees. Earnings are gross weekly earnings.⁴ The share of students that have been bullied at least sometimes is 34 percent for students of age 7 and 23 percent for students of age 11. This is a similar magnitude as in the TIMSS data and supports the evidence that younger students are more likely to be bullied.

The levels of violence are striking and should make aware how many children are actually suffering from other student's behavior. The determinants and consequences of school violence on student performance are analyzed in section four.

⁴ Observations have been dropped for which the ratio between gross and net earnings is unreasonably high or low.

3 Empirical framework

This section lays down the framework that is used to estimate the determinants of being a victim of violence and the effects thereof on student performance, educational attainment and earnings.

The process of victimization is a complex interaction between perpetrators and potential victims, which are non-exclusive groups. Modeling this process goes beyond the scope of this paper and demands profound knowledge of behavioral mechanisms and is hence a task for psychologists (cf. Smith et al., 2004). This analysis focuses on characteristics of students that determine the probability of being affected by school violence. The determinants of being a victim of school violence can be manifold. They can comprise characteristics of students such as their gender and age, their appearance such as height and weight, their personal traits, their relative position compared to peers, their family background, home environment and school characteristics. Sociologists identify negative school, personal and family factors as potential causes of violent behavior (cf. Footnote 1). Attending the same school and living in the same neighborhood as potential perpetrators clearly raises the probability of being a victim. Therefore both estimated with and without school-fixed effects are presented.

In order to estimate the determinants of being a victim of school violence, the following equation is being estimated:

$$V_{ics} = \delta_0 + B_{ics}\delta_1 + v_s + \eta_{cs} + \varepsilon_{ics}, \quad (1)$$

where V_{ics} is an indicator of being the victim of violence or theft for student i in class c in school s . The vector B_{ics} includes student background variables. The error terms v_s , η_{cs} and ε_{ics} are at the school, class and individual level, respectively. The definitions of both V_{ics} and B_{ics} differ between TIMSS and NCDS. Moreover, different specifications are estimated that add further covariates and control for differences between schools. The various specifications are discussed in the section on results.

The consequences for students of being bullied or a victim of violence can be very diverse as well. First of all, the psyche of victims is likely to suffer. Children may be less self-confident, dislike attending school or have bad dreams. This will be tested in a first step. However, the focus of the study lies on significant economic outcomes, such as cognitive abilities,

educational achievement and earnings. In order to estimate the effect of school violence in the TIMSS data, the following standard educational production function is used:

$$T_{ics} = \alpha_0 + B_{ics}\alpha_1 + C_{cs}\alpha_2 + S_s\alpha_3 + V_{ics}\alpha_4 + v_s + \eta_{cs} + \varepsilon_{ics} \quad (2)$$

where T_{ics} is the test score of a student. The class variables teacher's experience and teacher's sex are represented by C_{cs} while the school variables average daily instruction hours, having a shortage of teachers, materials, buildings or computers, the absolute number of students in school and the community size where the school is located are included in S_s . V_{ics} indicates whether students are victims of violence, measured by being stolen from or being hurt by other students within the prior month. The descriptive statistics for all variables for TIMSS are shown in Tables A2 and A3. The parameters α_0 to α_4 are to be estimated. The error terms v_s , η_{cs} and ε_{ics} are at the school, class and individual level, respectively.

The production function resembles models for the estimation of peer effects. Only when peers behave violently and hurt or steal from their classmates, it is possible that students are victims of violence. The problems in estimating equation (2) are hence similar to those in peer effect models. In the latter, the reflection problem (Manski, 1993) complicates the estimation because a student's performance depends on the performance of its peers and vice versa. Moreover, class and school level shock included in η_{cs} and v_s , such as having a very able teacher or attending a very poorly endowed school, can bias the estimated peer effects. In equation (2), all three error terms might be correlated with V_{ics} and lead to biased estimates of α_4 . When students attend schools with very incompetent teachers or the school's neighborhood is plagued by crime, which is not observed by the variables included in S_s , students are both more likely to achieve low test scores and to be a victim of violence. It is also possible that victimization depends on the performance in schools or that both performance and being a victim are determined by student characteristics other than those included in B_{ics} . Then ε_{ics} and V_{ics} would be correlated.

In order to control for any school level shocks, the following school-fixed effects model is estimated:

$$T_{ics} = \beta_{0s} + B_{ics}\beta_1 + C_{cs}\beta_2 + V_{ics}\beta_3 + \eta_{cs} + \varepsilon_{ics} \quad (3)$$

Any neighborhood effects are then included in the school dummies β_{0s} . However, V_{ics} might still be endogenous in equation (3) because it is correlated with either η_{cs} or ε_{ics} . This is the

case when unobserved characteristics of students such as their appearance are correlated with both student performance and being bullied. One estimation approach would be to look for a suitable instrument for V_{ics} . A possible instrument is $\bar{V}_{(-i)cs}$, which is the average value of V_{ics} at the class level, excluding a student's own value of V_{ics} . It is likely to determine V_{ics} because students in classes with a higher level of violence are more likely to be victimized themselves. It should not affect the performance of students as measured by T_{ics} directly, though.

Although the instrument is suitable from a theoretical point of view, the first step regressions show that it is rather weak and does not have the expected impact. Therefore, the results for the IV strategy are not presented nor discussed in this paper. An alternative estimation approach would be to control for prior performance and further characteristics of students. When students are victims of violence because of their performance in school or their appearance, this should be grasped by the prior level of performance and further student characteristics. To follow this estimation strategy, longitudinal data is needed that provide information on student achievement at different points in time. The British NCDS cohort study from 1958 has information on students at age 7, 11 and 16 including information on student's appearance. The appearance of students may be an important determinant of being a victim and may be correlated with student achievement as well. The following equation is estimated:

$$T_{11is} = \gamma_0 + B_{is}\gamma_1 + S_s\gamma_2 + V_{11is}\gamma_3 + T_{7is}\gamma_4 + L_{is}\gamma_5 + V_{7is}\gamma_6 + \eta_s + \varepsilon_{is} \quad (4)$$

where T_{11is} is the reading test score of student i in school s at age 11. Student background is captured by B_{is} and includes variables on student's gender, parents' origin, the social class of the father, parents' interest in their child's education and whether the student receives free meals at school. S_s is a vector on the school characteristics student teacher ratio, the type of school and school local authority and controls for the school environment. The variable V_{11is} indicates whether students are victims of violence, i.e. whether they are being bullied according to their mother. T_{7is} is the reading test score at age 7 and L_{is} includes variables on the attractiveness of the students as judged by the teacher and his height and whether he is obese. All vectors that are not indexed by age are for students at age 11. When all factors that are correlated with both being bullied and student performance are included as explanatory variables in equation (4), the parameter γ_3 can be estimated consistently. This should be the case in particular when we include V_{7is} as an additional covariate.

A similar equation is also estimated using reading test scores at age 16, the categorical variable highest educational achievement and gross weekly earnings at age 33 as dependent variables. In different specifications, the controls student background, student appearance, prior test scores and dummies for the highest educational level are added successively to the regressions, as shown in the regression tables. The estimations for the TIMSS data use Cluster Robust Linear Regressions (CRLR) to account for the stratified sampling design and are weighted by a student's sampling probability. The regressions for the NCDS data use OLS. Using probit or ordered probit regressions for the estimation with discrete dependent variables leads to very similar results.

4 Results

4.1 Determinants of being a victim

This section analyzes which students are affected by violence in schools, using both the TIMSS and NCDS data. For TIMSS, the indicator for being stolen from or hurt in the last month is regressed on student characteristics and family background variables. The regressions include once two dummies for city size and once school-fixed effects. The latter regressions show which type of students are affected by violence once all differences in the level of violence between schools are controlled for.

TIMSS results

Table 1 presents the estimates pooling all countries for the dependent variable being stolen from for grades four and eight. Tables A5 and A6 present the estimates for all countries separately. Female students are significantly less affected by violence than male students in most countries. The age of students is no significant determinant while students with at least one immigrated parent are more often stolen from. This also holds for students who speak a different language at home, although the effect is significant in fewer countries. It is surprising to see that the number of books at home, the main indicator of social background, hardly affects the probability of being a victim. In Lithuania the effect is significantly negative and in Slovenia it is positive. In the other countries the estimated effect is around zero. The size of the household in which students live that might indicate the family situation is no significant determinant of being stolen from, as well. The dummies for town size indicate that students in the countryside are less affected by violence than students in small

towns. There is no significant difference between students living in towns and larger cities, except for Lithuania.

When the regressions include school-fixed effects and hence control for the selection into schools, the estimated effects change only slightly. Most notably, the coefficients for having an immigrant background or speaking another language at home decline and are significant in fewer countries. This implies that immigrant students are attending schools with higher levels of violence in general. Within schools, the difference between immigrant and native students are much smaller but are still significant in several countries. The opposite can be observed for the number of books at home. Although the coefficient is still small, it is now positive in all but two countries and twice significant. Students from a higher social background hence attend schools with a lower level of violence in general, within schools they are stronger affected than less affluent students, though. These results also hold for being hurt, which can be seen in Tables 2, A7 and A8. Therefore, the findings do not only reflect that students from a higher social background are more likely to own subjects that are worth being stolen but show that these students are more likely to be victims in general.

The most important changes between grades four and eight occur for the age of students, their migration background and household size. Older students are more likely to be stolen from. Age is only an important determinant of being victimized at secondary and not at primary school because class repetition increases the variation of student age over the years. This can be seen in the summary statistics in Tables A2 and A3. Once school-fixed effects are included, age is no more significant in most countries. This implies that older students in grade eight, who are also performing below average, are rather attending secondary schools with higher levels of violence. Having a migration background is of lower importance for explaining victimization at grade eight than at grade four. As before, the number of books at home has only a slight positive effect on being stolen from when school-fixed effects are included. Household size is a significant determinant in several countries, in particular in the model with no school effects. Students living with several siblings seem more likely to be stolen from.

The results for the pooled data including country dummies reinforce the country results. Controlling for school-fixed effects, students from a higher social background, measured by the number of books at home, are more likely to be stolen from in grade eight but not in grade

four. The same holds for household size. Schools that are situated in villages have fewer problems with violence than schools located in towns.

NCDS results

The evidence for the NCDS data, which is more suited to identify the effects, confirms the results. Moreover, the NCDS provides further information on students that are potential determinants. The additional variables describe the appearance of students, their siblings and two school characteristics. Table 3 includes three specifications that are estimated for all students and separately for boys and girls to look at gender differences in victimization. The first specification includes only family background variables. As shown before, boys are more likely to be bullied than girls. Having a parent born in India raises the probability of being bullied only for boys but has no effect for girls. The social class of the father has no impact, while parents' interest in the child's education reduces being bullied, in particular for girls. Being eligible for free meals at school is positively associated with being bullied. Older brothers seem to protect their little brothers from being bullied, while having a younger sister makes girls more prone to being bullied. The effects for older sisters and younger brothers point in the same direction but are not significant. Apparently older siblings support their younger sibling, which makes them a target of perpetrators. The link seems to be stronger for same sex siblings.

Specification (2) includes variables on student appearance. Being taller, looking attractive as judged by the teacher and having no twitches reduces the probability of being bullied for both boys and girls. Wearing glasses only has negative consequences for boys while there is some evidence that corpulent girls are bullied more often. Adding school level variables and school controls in column (3) shows that the pupil-teacher ratio has no impact. When principals state that the child's teacher takes the initiative to discuss problems of the child, boys are more likely to be bullied. The psychological literature states that teacher's inability to deal with disorder and violence in class is an important determinant of violence. The estimated effect does not support this hypothesis or might be biased.

4.2 Effects on student performance and further outcomes

Before presenting the estimates of the consequences of being a victim for cognitive achievement, the rich information on students in the NCDS data is exploited to give an insight in how far the psyche of students might be affected by being bullied. Students of age 11 who are bullied are more likely to be destructive and to have bad dreams as judged by their

mothers. This relationship is significant even when all covariates from specification (3) in Table 3 are included in the regressions and when controlling for destructive behavior / bad dreams at age 7. However, being bullied is not related to being engaged in fights. This indicates that the psyche of bullied students suffers and they remain passive instead of engaging in fights. The results also hint in the direction that bullied students are less likely to be perpetrators themselves.

TIMSS results

First the evidence from the international TIMSS data is presented, followed by the results for the British NCDS data. The TIMSS math test scores are regressed on the indicator of being stolen from and being hurt. Student, class, school level variables and finally school-fixed effects are included as controls successively leading to equation (2). Table 4 present the regression estimates for the individual countries and the pooled data for grade four. Without controls, students that have been stolen from score between 16 and 40 test score points lower than other students. This difference is significant in all countries and is of a high magnitude. The more control variables are added, the lower is the coefficient on violence in absolute terms. It decreases most strongly when school-fixed effects are included (column 4), but is still highly significant and ranges from ten to 31 points. For grade eight, the results are presented in Table 5. The magnitude of the coefficients of being stolen from is on average slightly lower than at grade four. When school-fixed effects are included, the coefficient turns insignificant in two countries. The significant effects in the other countries cannot be interpreted as causal effects of violence on student performance, though. It remains unclear so far whether students are performing lower because they are the victims of violence or whether low performing students are more likely to be victimized.

The impact of the indicator being hurt for the pooled data is shown in Table 6. The coefficient is significantly negative for all specifications and for both grades. The negative impact of being hurt is smaller than for being stolen from. As opposed to the previous results, the impact is stronger in absolute terms for grade eight than for grade four.

NCDS results on contemporary performance

Since an IV estimation strategy using TIMSS data is not promising, the effect of being a victim on student achievement is estimated using equation (3) and the British NCDS data in order to identify the causal effect of bullying. Table 7 presents the coefficient of the categorical variable being bullied from a regression of the reading score at age 11 on this

variable, student background and school variables and prior achievement. The more covariates are added to the model, the smaller is the coefficient in absolute size. The strongest decrease occurs when the control for prior achievement is included in the regressions in column (2). The impact of bullying on contemporary achievement is always significantly negative for boys while it turns insignificant for girls when school controls are added. The effect is slightly larger for boys than for girls. This effect should be causal because we control for prior achievement, prior bullying and also further student characteristics like student appearance, which are correlated with both being bullied and student achievement. Noteworthy is that the estimated effect hardly changes between specification (4) and specification (5) when the additional control of being bullied at age 7 is added. It even increases slightly. This indicates that the previous controls capture any confounding factors. The results imply that the estimates for the TIMSS data, where no controls for student appearance and prior performance are included, are likely to be downward biased.

To investigate this issue further and compare the results from the two data sets, Table 8 presents effect sizes of the impact of being a victim on student performance. For TIMSS, the data from England and Scotland are pooled to be comparable to the NCDS data. Two specifications for the different classes / age groups are estimated. The first one includes only a basic set of student background variables, the second specification adds controls for each school in TIMSS and school type and school authority controls for the NCDS. The results show that the effect sizes are similar across both studies, are always highly significant and vary around 0.10. This implies that a change in one standard deviation in the indicator for being a victim leads to a change of a tenth of a standard deviation in the outcome measure, i.e. the math or reading test scores. In both studies, the effects are slightly larger for the specification including only student background controls compared to the model with school controls, indicating a selection of students to schools that has been shown in the previous tables as well. In TIMSS, effects tend to be larger for fourth than for eighth graders while effects are larger for students of age 11 than of age 7 for the NCDS data. The last rows present effects sizes for students of age 11, including additional controls on student appearance and previous performance and bullying experience at age 7. The absolute effect decreases by about half when these controls are included in the model to around 0.04 and is hence lower than most estimates of peer effects, for example (compare Ammermueller und Pischke, 2006). The results indicate that the effects estimated on the limited information available in the TIMSS data are downward biased by about hundred percent. When these

results are comparable over time and hold as well for other countries, the results from the NCDS data can be used to make inferences on the unbiased effect by correcting the estimated effects of the TIMSS data.

A question that remains is whether bullying only affects student performance or if student performance affects being bullied as well. This question of reverse causality can be addressed by regressing bullying at age 11 on performance at age 7, controlling for being bullied at age 7 and performance at age 11 and the further covariates of specification (3) in Table 3. The results indicate that previous performance affect being bullied significantly for girls but not for boys.

NCDS results on later outcomes

The NCDS data are used as well to estimate the impact of being bullied as a child at age 11 on later outcomes, which helps to understand long term consequences of school violence. Table 7 presents estimates for the impact on test scores at age 16. Similar to the previous estimates, the coefficients decrease in absolute size when further controls are included but are always significantly negative. The effects are of comparable size to the effects on contemporary achievement for boys but are relatively larger for girls and are significant. Table 9 displays the coefficients for the impact of being bullied at age 11 on the highest educational degree at age 33. The effect on educational attainment is significantly negative for girls but not for boys, once controls for previous test scores are added. Using ordered probit instead of linear regressions leads to comparable results.

When we consider the outcome earnings at age 33, being bullied has no direct effect, using the standard Mincer controls and a sample of employees in the private sector. Once we distinguish between the effect for males and females, we get slightly significant negative effects for males. However, this effect disappears once we control for previous student performance. This implies that being bullied has long term consequences for labor market outcomes earnings only through its effect on educational attainment and student performance but no further direct effects. The results are roughly comparable to those of Brown and Taylor (2005). The only difference is that they still find direct effects of bullying on earnings at age 33 but not at age 42. This could be explained by the use of different covariates.

5 Conclusion

School violence is an eminent problem in all eleven European countries analyzed here. Using both the international TIMSS and the British NCDS data, determinants and consequences of school violence are assessed. The self reported degree of student violence is astonishingly high, both for students being hurt and stolen from by other students and for children that are bullied. Students in grade four report a higher level of school violence than students in grade eight, which is likely to depend on the different perception of students of different age. The level of violence is highest in Belgium and Cyprus at grade four and in Cyprus and Slovenia at grade eight. The Netherlands, Norway and Hungary show low levels of violence at both grades. Looking at surveys from different years reveals no clear time-trend.

The determinants of being a victim show that female students and students in villages or small town are less likely to be hurt or stolen from by other students. At grade four, students with an immigration background are more likely and students from a high social background are less likely to be victims. Once we control for school effects, having at least one parent born abroad has only a slight positive impact on being a victim, while the effect of social origin disappears. At grade eight, the determinants are similar. Here we observe an impact of immigration background only across schools, while students from a higher social background are more likely to be victims within schools. The background of students hence plays a role in the selection to certain schools with a higher level of violence and for being a victim in a given school. Besides the student characteristics typically observed in student performance studies, also the appearance of students such as their looks and their height play an important role in victimization. Moreover, having older siblings reduces the probability of being bullied while it increases when having younger siblings, in particular when siblings have the same gender.

The effect of being a victim of school violence on student achievement is significant both for the TIMSS and the NCDS data. In the cross-sectional TIMSS data identification of the effect is troublesome. The longitudinal NCDS data allow for a more credible identification of the effect, providing controls for prior achievement, prior victimization and additional student characteristics. The analysis shows that the behavior of peers in form of school violence is an important determinant of both contemporary and later student achievement. The effect size of 0.04 on contemporary reading achievement is small but significant. Omitting the additional controls like student appearance and prior performance that are not available in the TIMSS

data leads to a downward bias of the estimate of around 100 percent. Moreover, being bullied as a child has a significant impact on the level of educational attainment and labor market earnings, but only through the effect on student performance.

The results show that school violence is a widespread problem which has short and long term consequences for victims, be it boys or girls. The selection of students into schools explains an important part of becoming a victim and adds to the problem of negative peer effects for students from a lower social background. Reducing violence at schools not only eases life for many students who suffer from it but should also lead to more investment in human capital. When estimating educational production functions, this kind of peer effect should not be omitted.

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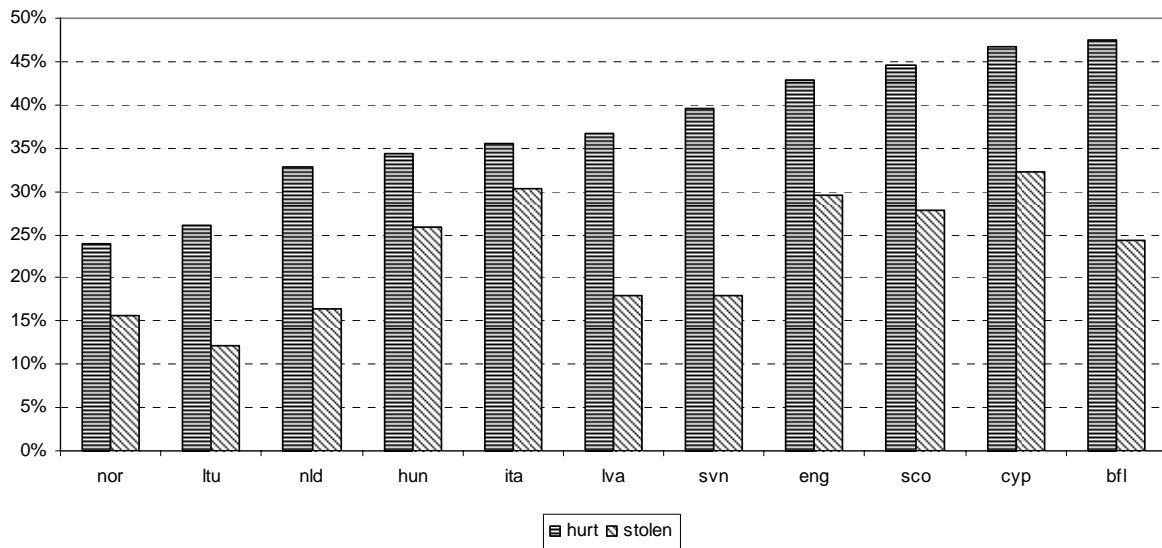


Figure 1: Percentage of students being victim in the last month in grade four

Note: nor=Norway, ltu=Lithuania, nld=Netherlands, hun=Hungary, ita=Italy, lva=Latvia, svn=Slovenia, eng=England, sco=Scotland, cyp=Cyprus, bfl=Flemish part of Belgium

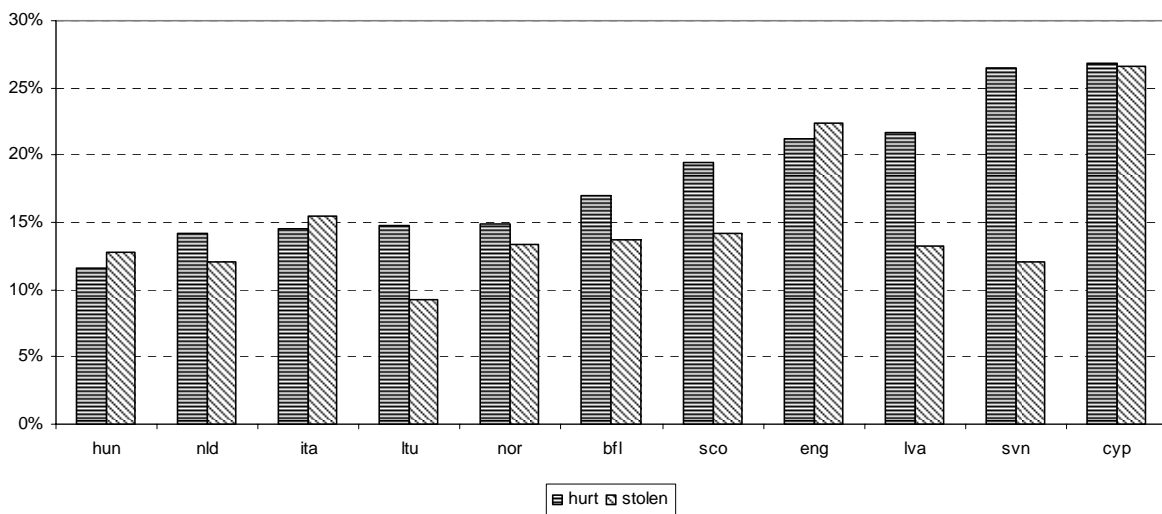


Figure 2: Percentage of students being victim in the last month in grade eight

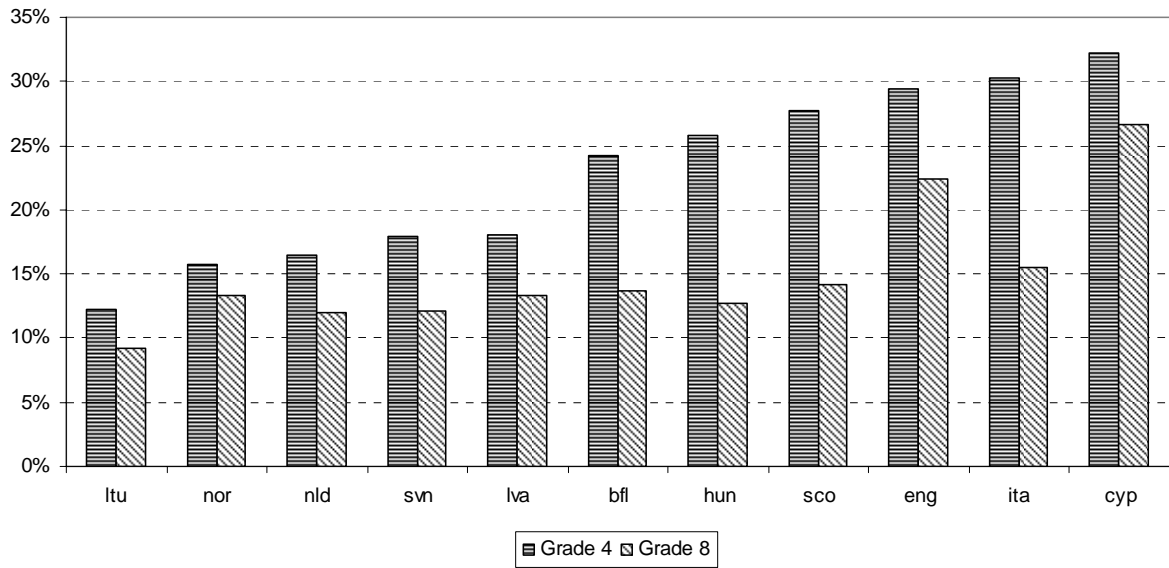


Figure 3: Percentage of students who got stolen from in the last month

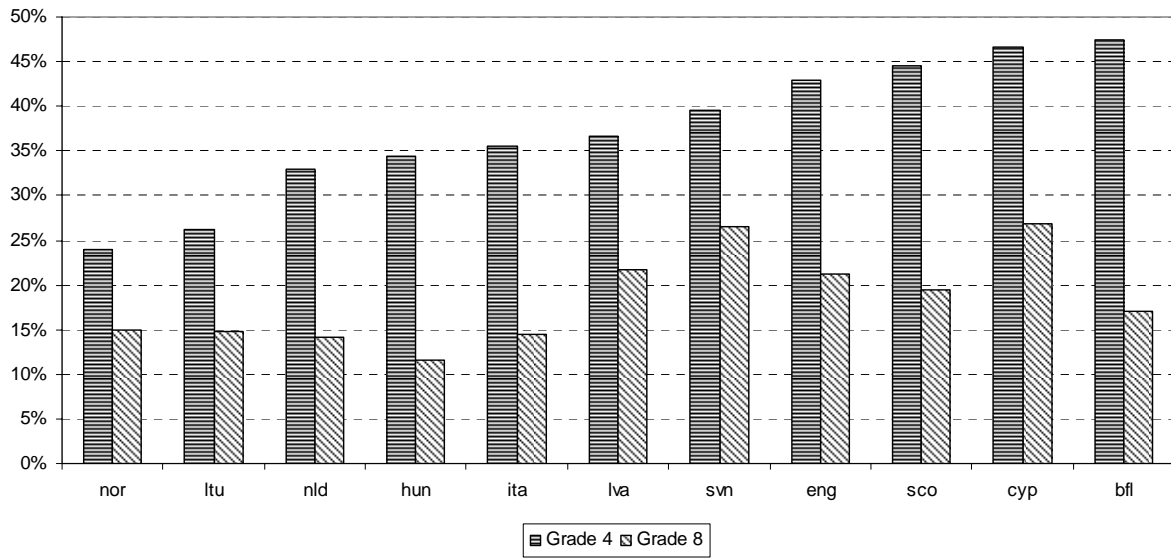


Figure 4: Percentage of students who got hurt in the last month

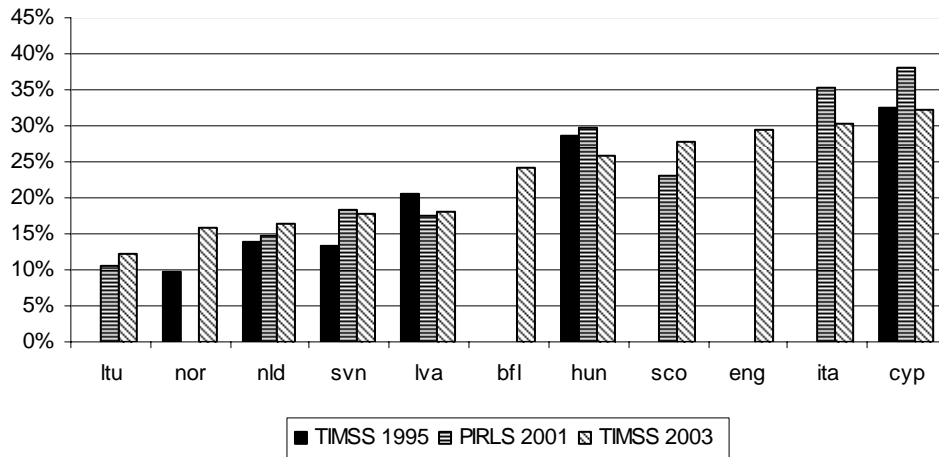


Figure 5: Time trend in being stolen from in grade four

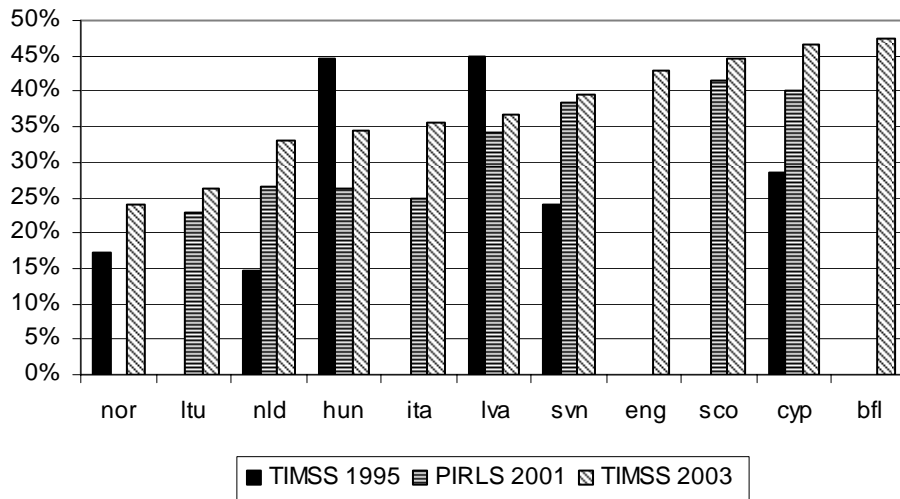


Figure 6: Time trend in being hurt in grade four

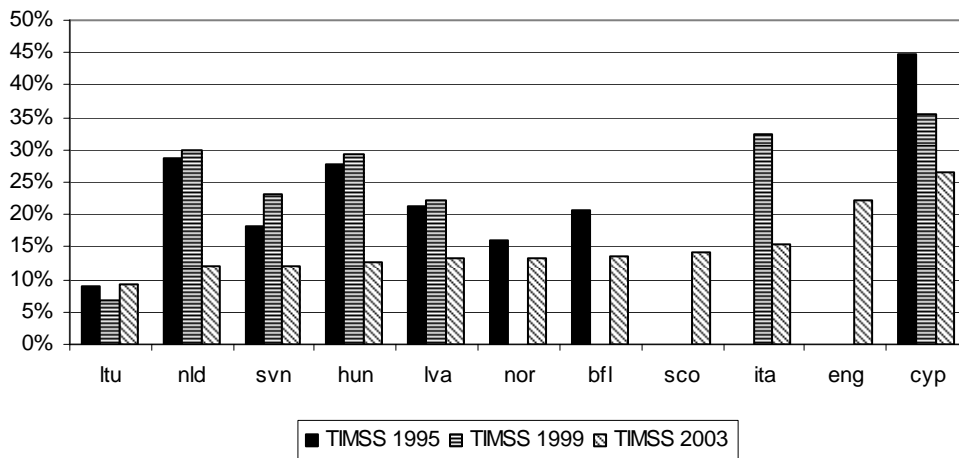


Figure 7: Time trend in being stolen from in grade eight

Table 1: Determinants of being stolen from for all countries, TIMSS

	Grade 4			Grade 8		
Female	-.058*** (.013)	-.057*** (.013)	-.056*** (.013)	-.054*** (.016)	-.043** (.015)	-.043** (.015)
Age	-.009 (.013)	-.014 (.011)	-.013 (.012)	.031*** (.005)	.016*** (.003)	.016*** (.003)
Immigrant	.039** (.016)	.022* (.010)	.026** (.011)	.019** (.006)	.003 (.004)	.003 (.003)
Language	.046* (.025)	.026 (.018)	.027 (.020)	.016 (.011)	.009 (.008)	.009 (.007)
Books	-.003** (.001)	.003 (.004)	.004 (.003)	.001 (.002)	.004** (.002)	.004* (.002)
Household size	.004*** (.001)	.001 (.001)	.001 (.001)	.009** (.003)	.005** (.001)	.005** (.002)
City	.001 (.018)			-.007 (.011)		
Village	-.043** (.015)			-.012* (.006)		
Peer class measure of books			.01 (.017)			-.028 (.021)
Country dummies	✓	✓	✓	✓	✓	✓
SFE		✓	✓		✓	✓
R ²	.0274	.1536	.1523	.0196	.1134	.1135
Observations	30,580	30,580	30,773	31,031	31,031	31,031

Coefficients from CRLR, robust standard errors in parentheses.
Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 2: Determinants of being hurt for all countries, TIMSS

	Grade 4			Grade 8		
Female	-.090*** (.007)	-.088*** (.006)	-.088*** (.006)	-.078*** (.024)	-.065*** (.019)	-.065*** (.019)
Age	-.056*** (.017)	-.061*** (.012)	-.061*** (.012)	-.005 (.006)	-.013 (.007)	-.013 (.008)
Immigrant	.013* (.007)	.017*** (.004)	.017*** (.004)	.007 (.013)	.000 (.019)	.000 (.018)
Language	.041 (.026)	.037** (.015)	.037** (.015)	.070** (.027)	.067** (.026)	.066** (.026)
Books	.011* (.006)	.007* (.004)	.008 (.004)	.007* (.004)	.009* (.005)	.008 (.004)
Household size	-.004** (.002)	-.002 (.002)	-.002 (.002)	.000 (.001)	-.000 (.001)	-.000 (.002)
City	.029 (.017)			.002 (.012)		
Village	.002 (.009)			-.002 (.015)		
Peer class measure of books			.004 (.032)			-.043 (.029)
Country dummies	✓	✓	✓	✓	✓	✓
SFE		✓	✓		✓	✓
R ²	.0270	.1170	.1170	.0242	.0910	.0914
Observations	30,773	30,773	30,773	31,031	31,031	31,031

Coefficients from CRLR, robust standard errors in parentheses.
Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 3: Determinants of being bullied at age 11, NCDS

	All			Boys			Girls		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female	-.07*** (.02)	-.05*** (.02)	-.05*** (.02)						
Parents born in India	.08 (.06)	.09 (.06)	.12** (.06)	.17** (.08)	.17** (.08)	.22*** (.08)	-.02 (.08)	-.00 (.08)	.05 (.08)
Parents born abroad	.05 (.06)	.06 (.06)	.08 (.06)	.05 (.09)	.08 (.09)	.09 (.09)	.06 (.08)	.06 (.08)	.08 (.08)
Social class of father	-.01* (.01)	-.00 (.01)	-.00 (.01)	-.01 (.01)	-.00 (.01)	.00 (.01)	-.01 (.01)	-.01 (.01)	-.00 (.01)
Parents' interest	-.04*** (.01)	-.02** (.01)	-.02* (.01)	-.03* (.02)	-.01 (.02)	-.01 (.02)	-.05*** (.01)	-.04*** (.01)	-.03*** (.02)
Free meal	.12*** (.03)	.09*** (.03)	.08** (.03)	.14*** (.05)	.11** (.04)	.10** (.05)	.09** (.04)	.07* (.04)	.06 (.04)
Has older brother	-.03* (.02)	-.03* (.02)	-.04** (.02)	-.04* (.02)	-.05* (.02)	-.05** (.03)	-.01 (.02)	-.02 (.02)	-.03 (.02)
Has younger sister	.04*** (.02)	.04** (.02)	.03** (.02)	.02 (.02)	.01 (.02)	.00 (.02)	.06*** (.02)	.06*** (.02)	.05** (.02)
Wears glasses		.05** (.03)	.05* (.03)		.10*** (.04)	.09** (.04)		.00 (.03)	.01 (.04)
Height		-.01*** (.00)	-.01*** (.00)		-.01*** (.00)	-.01* (.00)		-.01** (.00)	-.01 (.00)
Attractive looks		-.14*** (.02)	-.13*** (.02)		-.16*** (.03)	-.15*** (.03)		-.12*** (.03)	-.12*** (.03)
Twitches		.13*** (.03)	.13*** (.03)		.18*** (.04)	.15*** (.04)		.09** (.04)	.09** (.04)
BMI 90 percent		.01 (.03)	.00 (.03)		-.06 (.05)	-.06 (.05)		.06* (.03)	.05 (.03)
Teacher's initiative to discuss child			.04** (.02)			.05* (.03)			.03 (.02)
Pupil-teacher ratio			-.00 (.00)			-.00 (.00)			-.00 (.00)
School controls			✓			✓			✓
R ²	.0186	.0386	.0882	.0135	.0461	.142	.0175	.0303	.122
Observations	4555	4555	4555	2132	2132	2132	2423	2423	2423

Linear regression of categorical variable being bullied in 1969 on student background variables in 1969. Standard errors in parentheses. School controls include 8 dummies for school types, 3 dummies for streaming of school and 192 dummies for local school authorities. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 4: Effect of being stolen from on math scores at grade four, TIMSS

	(1)	(2)	(3)	(4)
<i>Belgium</i>	-13.69*** (2.51)	-13.21*** (2.52)	-12.98*** (2.50)	-10.42*** (-7.42)
<i>Cyprus</i>	-23.91*** (3.64)	-23.82*** (3.62)	-24.17*** (3.63)	-23.87*** (3.70)
<i>England</i>	-23.92*** (5.19)	-25.26*** (.05)	-23.33*** (5.13)	-16.96*** (4.82)
<i>Hungary</i>	-20.79*** (3.55)	-19.81*** (3.51)	-18.55*** (3.60)	-15.03*** (2.79)
<i>Italy</i>	-16.71*** (4.31)	-16.45*** (4.27)	-16.43*** (4.01)	-11.60*** (2.48)
<i>Lithuania</i>	-36.64*** (4.09)	-36.81*** (4.09)	-35.66*** (3.88)	-30.21*** (3.70)
<i>Latvia</i>	-21.87*** (4.76)	-21.35*** (4.80)	-21.01*** (4.64)	-20.38*** (4.17)
<i>The Netherlands</i>	-17.26*** (3.52)	-16.69*** (3.45)	-16.43*** (3.22)	-15.52*** (3.82)
<i>Norway</i>	-34.52*** (3.79)	-34.56*** (3.74)	-32.21*** (3.48)	-30.74*** (3.61)
<i>Scotland</i>	-24.87*** (4.11)	-25.06*** (3.99)	-24.19*** (3.76)	-18.19*** (3.50)
<i>Slovenia</i>	-27.31*** (4.19)	-26.41*** (4.37)	-26.41*** (4.23)	-26.90*** (4.30)
<i>All countries</i>	-20.43*** (2.15)	-20.46*** (2.28)	-20.39*** (2.03)	-14.39*** (1.76)
Student level variables	✓	✓	✓	✓
Class level variables		✓	✓	
School level variables			✓	
School-fixed effects				✓

CRLR of math scores on dummy for being stolen from and covariates, robust standard errors in parentheses. Student level variables include gender, age in months, having one parent born abroad, speaking another language at home, three categories of the number of books at home and number of persons living in household. Class level variables are teacher's experience, experience squared and gender. School level variables are average hours taught per day, shortage of teachers, material buildings or computers, grade size and two dummies on school location. Regressions for all countries include country dummies, except for specification (4). Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 5: Effects of being stolen from on math scores at grade eight, TIMSS

	(1)	(2)	(3)	(4)
<i>Belgium</i>	-20.24*** (3.96)	-19.38*** (3.87)	-16.30*** (3.25)	-7.85*** (1.91)
<i>Cyprus</i>	-19.13*** (3.30)	-18.95*** (3.33)	-19.63*** (3.38)	-18.89*** (3.40)
<i>England</i>	-13.59** (6.14)	-13.40** (6.25)	-13.47** (6.42)	-5.48 (3.51)
<i>Hungary</i>	-19.70*** (4.50)	-19.63*** (4.51)	-17.83*** (4.41)	-9.23** (3.82)
<i>Italy</i>	-19.53*** (3.71)	-19.86*** (3.59)	-19.81*** (3.64)	-13.18*** (3.21)
<i>Lithuania</i>	-26.04*** (5.19)	-27.02*** (5.08)	-26.74*** (4.96)	-21.49*** (4.46)
<i>Latvia</i>	-17.08*** (4.16)	-17.51*** (4.15)	-15.67*** (4.17)	-13.29*** (3.91)
<i>The Netherlands</i>	-13.09*** (4.33)	-13.38*** (4.07)	-13.12*** (4.07)	2.75 (2.28)
<i>Norway</i>	-23.44*** (3.39)	-23.31*** (3.39)	-22.82*** (3.32)	-21.12*** (33.22)
<i>Scotland</i>	-13.33** (5.37)	-13.04*** (5.39)	-14.23*** (5.29)	-7.72** (2.98)
<i>Slovenia</i>	-15.28*** (4.24)	-15.39*** (4.08)	-16.51*** (3.96)	-13.18*** (3.71)
All countries	-17.97*** (1.49)	-18.05*** (1.59)	-17.89*** (1.45)	-9.26*** (2.60)
Student level variables	✓	✓	✓	✓
Class level variables		✓	✓	
School level variables			✓	
School-fixed effects				✓

CRLR of math scores on dummy for being stolen from and covariates, robust standard errors in parentheses. Student level variables include gender, age in months, having one parent born abroad, speaking another language at home, three categories of the number of books at home and number of persons living in household. Class level variables are teacher's experience, experience squared and gender. School level variables are average hours taught per day, shortage of teachers, material buildings or computers, grade size and two dummies on school location. Regressions for all countries include country dummies, except for specification (4). Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 6: Effect of being hurt on math scores for all countries, TIMSS

	(1)	(2)	(3)	(4)
<i>Grade four</i>	-8.72*** (1.69)	-8.52*** (1.73)	-8.14*** (1.55)	-6.60*** (1.41)
<i>Grade eight</i>	-13.95*** (.89)	-13.92*** (.92)	-14.19*** (.99)	-8.52*** (1.70)
Student level variables	✓	✓	✓	✓
Class level variables		✓	✓	
School level variables			✓	
School-fixed effects				✓

CRLR of math scores on dummy for being hurt and covariates, robust standard errors in parentheses. Student level variables include gender, age in months, having one parent born abroad, speaking another language at home, three categories of the number of books at home and number of persons living in household. Class level variables are teacher's experience, experience squared and gender. School level variables are average hours taught per day, shortage of teachers, material buildings or computers, grade size and two dummies on school location. Regressions for all countries include country dummies, except for specification (4). Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 7: Effects of being bullied on reading scores at age 11 and 16, NCDS

	(1)	(2)	(3)	(4)	(5)
Test score age 11					
All	-1.10*** (.17)	-.49*** (.14)	-.44*** (.14)	-.31** (.14)	-.33** (.15)
Boys	-1.20*** (.25)	-.57*** (.21)	-.51** (.21)	-.37* (.22)	-.50** (.23)
Girls	-.99*** (.22)	-.40** (.20)	-.35* (.20)	-.23 (.20)	-.17 (.21)
Test score age 16					
All	-1.25*** (.19)	-.67*** (.16)	-.54*** (.16)	-.38** (.16)	-.38** (.17)
Boys	-1.28*** (.28)	-.69*** (.24)	-.50** (.24)	-.39 (.24)	-.42* (.25)
Girls	-1.19*** (.25)	-.61*** (.22)	-.52** (.22)	-.45** (.23)	-.43* (.23)
Student background	✓	✓	✓	✓	✓
Prior test score		✓	✓	✓	✓
Student appearance			✓	✓	✓
School controls				✓	✓
Bullied at age 7					✓

Linear regressions of reading test scores at age 11 and 16 on categorical variable being bullied and controls. Standard errors in parentheses. Controls are the same as in Table 3. Prior test score is from age 7 and age 11 for dependent variable test score age 11 and age 16, respectively. Number of observations is 4,031 for dependent variable score age 11 and 3,382 for score age 16 for all. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 8: Effect sizes of violence on test scores in TIMSS and NCDS

	Age 7		Grade 4 / Age 11		Grade 8	
TIMSS						
stolen			-.146 ^{***}	-.107 ^{***}	-.092 ^{***}	-.062 ^{***}
hurt			-.104 ^{***}	-.065 ^{***}	-.075 ^{***}	-.046
NCDS						
further controls	-.075 ^{***}	-.045 ^{***}	-.117 ^{***}	-.072 ^{***}		
further controls			-.044 ^{***}	-.033 ^{***}		
Student background	✓	✓	✓	✓	✓	✓
School controls / SFE		✓		✓		✓

Linear regressions of math test scores (TIMSS) for England and Scotland including country dummies, reading test scores (NCDS) on dummy variable (TIMSS), categorical variable (NCDS) of violence indicator and controls. Student background variables include age, female, books, origin (TIMSS) and female, origin, social class (NCDS). School-fixed effects model (TIMSS) and school type and school authority controls (NCDS). Further controls (NCDS) include test score and being bullied at age 7, attractive looks and height. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 9: Effects of being bullied on highest educational degree age 33, NCDS

	(1)	(2)	(3)	(4)
All	-.22 ^{***} (.05)	-.13 ^{***} (.05)	-.11 ^{**} (.05)	-.13 ^{**} (.05)
Boys	-.20 ^{***} (.08)	-.11 (.07)	-.08 (.08)	-.13 (.08)
Girls	-.22 ^{***} (.07)	-.14 ^{**} (.06)	-.12 [*] (.06)	-.15 ^{**} (.07)
Student background	✓	✓	✓	✓
Prior test scores		✓	✓	✓
Student appearance			✓	✓
School controls				✓

Linear regressions of categorical variable highest educational degree on categorical variable being bullied and controls, standard errors in parentheses. Controls are the same as in Table 3. Number of observations is 3,641. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table 10: Effects of being bullied on earnings age 33, NCDS

	(1)	(2)	(3)	(4)
All	-.09*** (.03)	-.04 (.03)	-.02 (.03)	-.01 (.03)
Boys	-.10*** (.04)	-.07* (.04)	-.05 (.04)	-.03 (.04)
Girls	-.07 (.05)	-.01 (.05)	.02 (.05)	.02 (.05)
Participation	✓	✓	✓	✓
Mincer controls		✓	✓	✓
Prior test scores			✓	✓
Student appearance				✓

Linear regressions of gross weekly earnings on categorical variable being bullied and controls, standard errors in parentheses. Participation controls are married and working part-time. Mincer controls add six dummies for highest educational attainment. Prior test score is reading test score at age 16. Student appearance variables same as in Table 3. Number of observations is 1,944 for all.

Significance levels: *** 1 percent, ** five percent, * ten percent.

Table A1: Number of students, classes and schools in TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Grade 4											
Students	3,979	3,407	1,654	2,612	3,919	3,188	2,534	1,887	3,214	2,060	2,126
Classes	233	181	74	138	237	207	138	105	200	103	133
Schools	136	131	66	137	171	124	113	96	128	80	129
≥ 2 classes:											
Classes	190	76	16	2	132	166	50	18	144	45	8
Schools	93	26	8	1	66	83	25	9	72	22	4
Grade 8											
Students	3,913	3,068	13,04	2,771	3,730	3,425	2,674	2,213	3,452	1,703	2,778
Classes	222	138	64	138	194	211	138	104	163	81	144
Schools	120	50	44	138	157	121	109	104	127	72	144
≥ 2 classes:											
Classes	138	138	39	0	74	180	58	0	72	18	0
Schools	50	50	19	0	37	90	29	0	36	9	0

Table A2: Summary statistics for grade four, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Math score	553.13 (55.03)	517.90 (78.25)	535.08 (82.90)	534.93 (71.58)	506.82 (76.40)	537.41 (69.67)	538.12 (68.41)	545.15 (49.40)	463.00 (70.03)	496.86 (73.06)	483.65 (71.86)
Stolen	.23 (.42)	.30 (.46)	.30 (.46)	.26 (.44)	.30 (.46)	.12 (.33)	.17 (.38)	.15 (.36)	.15 (.36)	.27 (.44)	.18 (.38)
Hurt	.46 (.50)	.46 (.50)	.43 (.50)	.34 (.47)	.35 (.48)	.25 (.43)	.37 (.48)	.32 (.47)	.24 (.43)	.46 (.50)	.38 (.49)
Student variables											
Female	.51 (.50)	.50 (.50)	.51 (.50)	.51 (.50)	.49 (.50)	.50 (.50)	.50 (.50)	.48 (.50)	.51 (.50)	.52 (.50)	.50 (.50)
Age	-.01 (.49)	.00 (.33)	.00 (.30)	-.01 (.45)	.01 (.34)	.00 (.40)	-.01 (.46)	.01 (.50)	.01 (.30)	.33 (-1.52)	-.01 (.33)
Immigrant	.20 (.40)	.19 (.39)	.22 (.41)	.10 (.30)	.13 (.33)	.09 (.29)	.26 (.44)	.21 (.41)	.15 (.36)	.16 (.36)	.17 (.37)
Language	.15 (.36)	.13 (.34)	.06 (.24)	.01 (.10)	.07 (.26)	.03 (.16)	.09 (.28)	.08 (.27)	.06 (.24)	.12 (.33)	.10 (.30)
Books	3.01 (1.06)	2.84 (1.09)	3.24 (1.20)	3.18 (1.19)	2.64 (1.20)	2.66 (1.06)	3.21 (1.12)	3.09 (1.13)	3.26 (1.14)	3.26 (1.25)	3.01 (1.09)
Household size	3.47 (1.16)	3.75 (1.32)	3.51 (1.33)	3.38 (1.21)	3.30 (1.17)	3.46 (1.32)	3.50 (1.43)	3.67 (1.16)	3.54 (1.17)	3.34 (1.24)	3.84 (1.40)
Class variables											
Teacher's exp.	16.30 (9.84)	10.93 (8.04)	13.54 (10.66)	19.58 (9.20)	21.18 (9.65)	18.15 (10.11)	20.06 (9.37)	16.54 (12.06)	15.52 (1.44)	15.92 (10.00)	18.94 (.90)
Teacher femal.	.79 (.41)	.80 (.40)	.75 (.43)	.95 (.22)	.97 (.18)	.99 (.08)	.99 (.09)	.65 (.48)	.83 (.38)	.92 (.26)	.96 (.19)
School variables											
Daily instr. hours	5.89 (.21)	4.60 (.39)	4.86 (.42)	4.87 (.45)	5.21 (.80)	4.59 (.46)	4.43 (.56)	5.50 (.00)	4.50 (.00)	5.03 (.26)	4.33 (.32)
Shortage teachers	.07 (.25)	.45 (.50)	.10 (.30)	.09 (.29)	.17 (.37)	.04 (.19)	.15 (.36)	.12 (.32)	.19 (.39)	.11 (.31)	.03 (.18)
Shortage materials	.05 (.21)	.34 (.47)	.23 (.42)	.11 (.31)	.12 (.33)	.34 (.47)	.28 (.45)	.09 (.29)	.18 (.38)	.07 (.25)	.03 (.16)
Shortage Buildings	.28 (.45)	.38 (.49)	.27 (.45)	.32 (.47)	.49 (.50)	.37 (.48)	.18 (.39)	.41 (.49)	.33 (.47)	.21 (.41)	.35 (.48)
Shortage computers	.25 (.43)	.43 (.49)	.25 (.43)	.39 (.49)	.37 (.48)	.61 (.49)	.42 (.49)	.23 (.42)	.54 (.50)	.20 (.40)	.23 (.42)
School size	41.44 (21.13)	57.04 (28.02)	55.12 (31.90)	64.34 (84.24)	100.65 (44.90)	72.44 (55.36)	60.13 (45.34)	32.34 (17.07)	39.92 (22.27)	45.73 (25.27)	57.25 (29.50)
City	.12 (.32)	.09 (.29)	.27 (.45)	.27 (.44)	.17 (.37)	.31 (.46)	.25 (.44)	.18 (.39)	.20 (.40)	.28 (.45)	.11 (.31)
Village	.40 (.49)	.62 (.48)	.20 (.40)	.47 (.50)	.46 (.50)	.43 (.49)	.61 (.49)	.21 (.41)	.48 (.50)	.37 (.48)	.72 (.45)

Weighted average, standard deviation in parentheses.

Table A3: Summary statistics for grade eight, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Math score	542.34 (68.68)	467.01 (74.80)	515.41 (78.84)	531.61 (75.64)	486.54 (72.37)	503.01 (76.04)	510.14 (70.22)	538.79 (67.01)	465.17 (65.42)	504.43 (68.44)	495.52 (67.49)
Stolen	.14 (.34)	.27 (.44)	.22 (.41)	.12 (.33)	.15 (.35)	.09 (.29)	.13 (.33)	.12 (.33)	.13 (.34)	.15 (.35)	.11 (.32)
Hurt	.16 (.37)	.26 (.44)	.22 (.42)	.11 (.32)	.14 (.35)	.15 (.36)	.22 (.41)	.14 (.35)	.14 (.35)	.19 (.40)	.25 (.44)
Student variables											
Female	.54 (.50)	.50 (.50)	.48 (.50)	.51 (.50)	.50 (.50)	.51 (.50)	.50 (.50)	.50 (.50)	.50 (.5)	.53 (.50)	.51 (.50)
Age	.00 (.55)	-.02 (.41)	.00 (.34)	-.01 (.49)	-.01 (.44)	.01 (.48)	.04 (.52)	.00 (.50)	.00 (.31)	.01 (.33)	-.03 (.40)
Immigrant	.16 (.37)	.16 (.36)	.14 (.34)	.03 (.18)	.09 (.29)	.11 (.31)	.28 (.45)	.18 (.39)	.13 (.34)	.08 (.28)	.19 (.39)
Language	.11 (.31)	.08 (.27)	.02 (.15)	.01 (.08)	.03 (.18)	.03 (.16)	.09 (.29)	.04 (.21)	.04 (.20)	.03 (.18)	.09 (.28)
Books	2.89 (1.18)	2.88 (1.12)	3.41 (1.32)	3.63 (1.18)	3.00 (1.31)	2.87 (1.14)	3.61 (1.12)	3.22 (1.23)	3.54 (1.19)	3.05 (1.30)	2.99 (1.12)
Household size	3.44 (1.21)	3.74 (1.16)	3.37 (1.17)	3.26 (1.15)	3.28 (1.07)	3.29 (1.24)	3.31 (1.30)	3.59 (1.12)	3.41 (1.24)	3.28 (1.16)	3.43 (1.31)
Class variables											
Teacher's exp.	18.56 (11.15)	11.36 (9.49)	14.99 (11.83)	22.03 (9.84)	22.58 (8.32)	20.61 (10.36)	21.22 (9.90)	16.58 (10.44)	17.84 (11.66)	15.79 (9.87)	20.24 (8.45)
Teacher femal.	.74 (.44)	.68 (.47)	.59 (.49)	.85 (.35)	.80 (.40)	.88 (.32)	.93 (.26)	.31 (.46)	.36 (.48)	.48 (.50)	.89 (.32)
School variables											
Daily instr. hours	6.01 (.39)	5.18 (.50)	5.05 (.27)	5.78 (.39)	5.25 (.60)	5.53 (.63)	5.42 (.75)	6.00 (.00)	4.50 (.00)	5.48 (.26)	5.65 (.36)
Shortage teachers	.04 (.19)	.43 (.50)	.22 (.41)	.12 (.32)	.12 (.32)	.14 (.35)	.24 (.43)	.23 (.42)	.07 (.26)	.11 (.32)	.05 (.21)
Shortage materials	.02 (.14)	.34 (.47)	.36 (.48)	.10 (.30)	.11 (.31)	.58 (.49)	.38 (.49)	.10 (.30)	.12 (.32)	.12 (.32)	.03 (.16)
Shortage buildings	.22 (.41)	.56 (.50)	.54 (.50)	.34 (.48)	.29 (.45)	.26 (.44)	.19 (.39)	.33 (.47)	.53 (.50)	.45 (.50)	.33 (.47)
Shortage computers	.28 (.45)	.59 (.49)	.48 (.50)	.44 (.50)	.27 (.44)	.64 (.48)	.51 (.50)	.36 (.48)	.59 (.49)	.37 (.48)	.27 (.44)
School size	153.68 (78.94)	181.36 (53.13)	219.25 (57.89)	69.74 (116.84)	149.17 (78.76)	87.59 (51.18)	73.18 (48.59)	224.70 (126.04)	94.49 (45.58)	175.29 (69.13)	65.48 (29.61)
City	.11 (.31)	.26 (.44)	.44 (.50)	.26 (.44)	.22 (.42)	.28 (.45)	.27 (.45)	.29 (.46)	.20 (.40)	.25 (.43)	.13 (.34)
Village	.19 (.39)	.42 (.49)	.18 (.38)	.45 (.50)	.40 (.49)	.51 (.50)	.55 (.50)	.05 (.22)	.40 (.49)	.40 (.49)	.69 (.46)

Weighted average, standard deviation in parentheses.

Table A4: Summary statistics NCDS

Variable name		Description
Reading score age 7	24.43 (6.57)	Southgate Group Reading Test score
Reading score age 11	16.80 (6.20)	Reading comprehension test score
Reading score age 16	26.48 (6.48)	Test 1-reading comprehension
Highest educational degree (reported age 33)	3.91 (1.59)	Categorical variable 1-no degree 2-CSE grade 2-5, GCSE grades D-G 3-CSE grade 1, O-Level, GCSE-grades A-C 4-A-Level, AS-Level 5-postgradual qualification 6-University degree
Ln (Gross weekly earnings)	5.24 (.92)	Ln (Gross weekly earnings age 33) in pounds
Bullied age 7	1.39 (.58)	bullied by other kids at age 7 (categorical variable) 0-child never bullied (65.89%) 1-child sometimes bullied (29.25%) 2-child frequently bullied (4.86%)
Bullied age 11	1.27 (.52)	bullied by other kids at age 11 (categorical variable) 0-child never bullied (76.66 %) 1-child sometimes bullied (19.49%) 2-child frequently bullied (3.85%)
Female	.54 (.50)	Dummy variable 0-male, 1-female
Parents born in India	.02 (.15)	Dummy variable 1-father or mother born in India
Parents born abroad other	.02 (.13)	Dummy variable 1-father or mother born abroad (other than India)
Social class of father	4.24 (1.58)	Categorical variable at age 11 1- unclassified 2- social class V 3- social class IV manual 4- social class IV non-manual 5- social class III manual 6- social class III non-manual 7- social class II 8- social class I
Parents' interest	2.44 (.78)	Categorical variable on parents' interest in child at age 11 (1-4)
Free meal	.08 (.27)	Dummy-variable 1-child receives free school meals at age 11
Has older brother	.40 (.49)	Has at least one older brother
Has younger sister	.41 (.49)	Has at least one younger sister
Wears glasses	.10 (.30)	Wears glasses at age 11
Height	56.63 (2.82)	Height in inches at age 11
Attractive looks	.82 (.38)	Dummy variable Looks assessed by teacher at age 11
Twitches	.07 (.26)	Dummy variable Has twitches etc. of face, eye at age 11
BMI 90 percent	.10	Dummy-variable

	(.29)	Highest ten percent at age 11
Teacher's initiative to discuss	.47 (.50)	Teacher's initiative to discuss child's problem judged by principal
Pupil teacher ratio	23.39 (9.76)	Pupil teacher at school at age 11

Average, standard deviation in parentheses. Same sample as used for regressions in Table 3.

Table A5: Determinants of being a victim at grade four, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Female	-.093*** (.015)	-.078*** (.016)	-.024 (.022)	-.073*** (.019)	-.076*** (.017)	-.019 (.01)	-.009 (.015)	-.064*** (.018)	-.047*** (.017)	-.019 (.020)	-.047** (.018)
Age	.001 (.02)	.003 (.027)	-.061* (.035)	.001 (.021)	-.023 (.022)	.031** (.022)	.050 (.022)	.025 (.021)	.018 (.022)	.007 (.046)	.007 (.023)
Immigrant	.031 (.023)	.045** (.022)	.050** (.024)	.067** (.030)	.008 (.028)	.012 (.024)	.009 (.019)	.127*** (.029)	.038** (.019)	.051* (.028)	.045* (.023)
Language	.119*** (.023)	.027 (.023)	.100** (.047)	.038 (.076)	.013 (.042)	.059* (.035)	.047 (.032)	-.048 (.058)	.055 (.034)	.035 (.031)	.088*** (.030)
Books	.007 (.007)	.007 (.009)	.000 (.010)	-.002 (.007)	-.003 (.007)	-.012** (.005)	.010 (.008)	.003 (.008)	.003 (.007)	-.001 (.010)	.027*** (.008)
Household size	.014* (.007)	-.011 (.007)	-.001 (.010)	.013* (.007)	.001 (.007)	.002 (.006)	-.009 (.006)	.010 (.007)	-.002 (.006)	.004 (.008)	.004 (.006)
City	-.008 (.026)	-.007 (.050)	.058 (.043)	.025 (.030)	-.033 (.037)	-.027** (.015)	.033 (.034)	.005 (.027)	.005 (.019)	.006 (.043)	-.005 (.038)
Village	-.037 (.024)	-.013 (.030)	-.071* (.038)	.038 (.032)	-.069** (.031)	-.001 (.018)	.038 (.030)	-.006 (.026)	.034 (.021)	-.086** (.034)	-.048 (.031)
R ²	.0327	.0108	.0223	.0122	.0124	.0081	.0077	.0280	.0099	.0137	.0208
Observations	4,204	3,757	2,290	2,798	3,919	3,580	3,044	2,275	3,543	2,939	2,459

CRLR of being stolen from on student background variables, robust standard errors in parentheses. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table A6: Determinants of being a victim at grade four with school-fixed effects, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Female	-.082*** (.015)	-.086*** (.016)	-.023 (.021)	-.066*** (.020)	-.077*** (.016)	-.015 (.014)	-.007 (.015)	-.063*** (.019)	-.045** (.017)	-.005 (.020)	-.056*** (.018)
Age	-.002 (.018)	.009 (.027)	-.066* (.034)	-.010 (.021)	-.023** (.022)	.030 (.021)	.025 (.020)	.023 (.018)	.013 (.022)	.020 (.041)	.003 (.024)
Immigrant	.022 (.023)	.038* (.022)	.011 (.028)	.035 (.028)	.009 (.026)	.014 (.024)	.004 (.016)	.105*** (.033)	.038* (.020)	.059** (.025)	.032 (.023)
Language	.080*** (.022)	.019 (.023)	.079 (.050)	.048 (.085)	-.003 (.039)	.041 (.046)	.045 (.032)	-.053 (.051)	.065* (.035)	.031 (.031)	.087** (.035)
Books	.007 (.007)	.011 (.008)	.013 (.009)	.004 (.008)	-.003 (.007)	-.005 (.006)	.014* (.008)	.009 (.009)	.008 (.007)	.006 (.009)	.018** (.008)
Household size	.009 (.007)	-.009 (.007)	-.002 (.011)	.001 (.007)	.000 (.007)	.001 (.006)	-.006 (.006)	.014** (.007)	-.003 (.007)	.004 (.008)	.007 (.006)
SFE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R ²	.1266	.1130	.1315	.1435	.1562	.0753	.1237	.1207	.0844	.1247	.1432
Observations	4,204	3,757	2,290	2,798	3,919	3,580	3,044	2,275	3,543	2,939	2,459

CRLR of being stolen from on student background variables and school dummies, robust standard errors in parentheses. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table A7: Determinants of being a victim at grade eight, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Female	-.010 (.014)	-.117*** (.020)	-.102*** (.026)	-.039*** (.013)	-.026** (.012)	-.035*** (.013)	-.020 (.017)	-.047*** (.014)	-.024** (.012)	-.077*** (.018)	-.068*** (.014)
Age	.035*** (.013)	.006 (.017)	.012 (.029)	.038*** (.015)	.025* (.015)	.029** (.013)	.010 (.014)	.037** (.016)	-.004 (.021)	-.077 (.018)	-.001 (.016)
Immigrant	.038* (.020)	-.022 (.023)	.055 (.039)	-.005 (.036)	-.001 (.026)	.016 (.019)	-.029** (.014)	.006 (.019)	.014 (.023)	-.077 (.018)	.022 (.017)
Language	-.019 (.019)	.029 (.028)	.005 (.091)	.209* (.117)	-.006 (.046)	.056** (.034)	.056 (.035)	.026 (.044)	.114** (.045)	.060 (.057)	.019 (.022)
Books	-.006 (.005)	.009 (.005)	.003 (.008)	-.009 (.006)	.005 (.005)	-.013 (.005)	.000 (.007)	.003 (.006)	-.008 (.006)	-.001 (.006)	.017** (.007)
Household size	.002 (.006)	.015** (.007)	.015* (.009)	-.001 (.006)	.015*** (.006)	.004 (.005)	.011* (.006)	-.008 (.006)	.006 (.005)	.012* (.006)	.009* (.005)
City	.072* (.038)	.062* (.037)	-.005 (.033)	.014 (.020)	-.039* (.023)	-.004 (.013)	.006 (.022)	.010 (.018)	.016 (.020)	.010 (.024)	-.057* (.029)
Village	-.013 (.022)	-.010 (.023)	-.060* (.034)	.017 (.019)	-.009 (.022)	-.015 (.014)	.022 (.023)	.020 (.060)	-.013 (.017)	.048* (.025)	-.046* (.025)
R ²	.0138	.0237	.0255	.0138	.0062	.0118	.0093	.0110	.0104	.0186	.0196
Observations	4,496	3,522	1,726	2,961	4,097	3,727	3,182	2,578	3,685	2,192	3,043

CRLR of being stolen from on student background variables, robust standard errors in parentheses. Significance levels: *** 1 percent, ** five percent, * ten percent.

Table A8: Determinants of being a victim at grade eight with school-fixed effects, TIMSS

	BFL	CYP	ENG	HUN	ITA	LTU	LVA	NLD	NOR	SCO	SVN
Female	-.006 (.014)	-.117*** (.020)	-.108*** (.027)	-.032** (.013)	-.017 (.012)	-.033** (.013)	-.015 (.020)	-.035** (.014)	-.026** (.012)	-.067*** (.018)	-.068*** (.014)
Age	.016 (.013)	.008 (.018)	.011 (.029)	.034** (.016)	.007 (.015)	.017 (.014)	-.003 (.014)	.008 (.015)	-.002 (.021)	-.014 (.024)	.004 (.017)
Immigrant	.041** (.019)	-.023 (.024)	.026 (.040)	-.030 (.035)	-.002 (.025)	.014 (.019)	-.016 (.014)	-.002 (.019)	.021 (.023)	.014 (.034)	-.001 (.017)
Language	-.027 (.020)	.031 (.028)	.003 (.087)	.146 (.116)	.006 (.045)	-.036 (.042)	.008 (.027)	.007 (.046)	.106*** (.040)	.040 (.056)	.028 (.023)
Books	.002 (.005)	.011* (.006)	.007 (.008)	-.002 (.007)	.006 (.005)	-.009* (.006)	-.003 (.006)	.014** (.007)	-.008 (.006)	.003 (.007)	.015** (.007)
Household size	.000 (.005)	.013* (.007)	.013 (.009)	-.004 (.006)	.006 (.005)	.000 (.006)	.004 (.006)	-.002 (.007)	.009 (.006)	.012** (.006)	.010** (.005)
SFE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R ²	.1021	.0605	.0846	.1114	.1225	.0652	.1152	.1046	.0744	.0926	.0964
Observations	4,496	3,522	1,726	2,961	4,097	3,727	3,182	2,578	3,685	2,192	3,043

CRLR of being stolen from on student background variables and school dummies, robust standard errors in parentheses. Significance levels: *** 1 percent, ** five percent, * ten percent.