Bullying in Elementary School*

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Abstract: Bullying is a widespread social phenomenon which is thought to have detrimental effects on life outcomes. This paper investigates the link between bullying and later school performance. We rely on rich survey and register-based data for children born in a region of Denmark during 1990-1992, which allows us to carefully consider possible confounders including psychological factors. We implement an IV strategy inspired by Carrell and Hoekstra (2010) where we instrument victim status with the proportion of peers from troubled

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homes in one's classroom. We show that bullied children suffer in terms of GPA and effects tend to increase with severity.

"IF there's one goal of this conference, it's to dispel the myth that bullying is just a harmless rite of passage or an inevitable part of growing up. It's not. Bullying can have destructive consequences for our young people. And it's not something we have to accept."

- President, Barack Obama at the Anti-Bullying Conference in the White House, March 10, 2011.

I. Introduction

A student is characterized as being bullied or victimized when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students (Olweus, 1993). This paper investigates the determinants and potential effects of bullying in elementary school on academic achievement.

Bullying is a serious and widespread phenomenon: 27 % of the Danish children that we analyze are reported by their parents and/or teacher to be victims of bullying (similar numbers are reported by e.g. Brown and Taylor (2008) for Britain, Nordhagen et al. (2005) for Denmark, and Saufler and Gagne (2000) and Centers for Disease Control (2010) for the US). From an economic point of view, such common negative actions may be extremely costly, not only in terms of immediate individual welfare but also in terms of longer run consequences. Despite this, very little research documents the impact of bullying on economic outcomes. An exception is the paper by Brown and Taylor (2008) that uses regression based techniques to show that bullying is associated with reduced educational attainment and wages. We know of no other papers studying the link between bullying and long term economic outcomes.

Our paper contributes to this very small literature by using survey and register-based data on children born in a region of Denmark during 1990-1992 to investigate the determinants and potential effects of bullying at age 10-12 on 9th grade GPA.

Our data include exceptionally rich register- and survey-based information on physical and mental health as well as socio-emotional and psychological issues measured prior to exposure to bullying. The survey data also present a unique opportunity to define bullying status as both the teacher and parents answered whether the child was a bully or a victim of bullying. Because we are interested in school bullying, the teacher's perception is crucial in order to obtain a truthful picture of the interactions among peers. At the same time it would not be sufficient to restrict ourselves to the teachers' responses as they do not observe the child for the entire school day, and they do not to the same extent as the child's parents have the confidence of the child.

We implement an instrumental variables strategy inspired by Carrell and Hoekstra (2010) who find that domestic violence affects not only children in the family but also their peers in the classroom. Here we exploit administrative data on parents' criminal history including convictions for violent crime, property crime or any other non-traffic related crime. We document that criminal behavior of the parents of one child increases the likelihood that other children in the classroom are bullied. As such, we shed light on a channel through which the results of Carrell and Hoekstra (2010) may operate. We show that our findings are robust to using more standard sibling comparisons. We acknowledge that the problem of non-random selection of victims is particularly difficult to control and stress that caution should be made when interpreting our results.

We see that the quality of the family environment as well as individual child characteristics is predictive of bullying status. We find that individual characteristics such as poor early mental

health, indicators of hyperactive behavior, and physical appearance are important drivers of victimization.

Our results suggest that being bullied significantly lowers 9th grade GPA. The effects tend to increase with the severity of bullying. Robustness analyses suggest that signs are robust, though prevalence and magnitudes are sensitive to which informant is used to report on victimization. Our results suggest that teacher reported victimization is, on average, more severe than parent reported victimization.

The remainder of the paper unfolds as follows: Section II surveys the literature on bullying and its determinants and consequences. Section III discusses the institutional context and the available data while Section IV presents baseline OLS regressions and Section V our main empirical strategy and associated results. Section VI shows robustness analyses and investigates heterogeneity, while Section VII concludes.

II. Background

As discussed above, bullying is the exposure to repeated negative actions over time on the part of one or more students; Olweus (1993, 1997). Negative actions are intentional attempts to injure or cause discomfort in others. Examples are physical contact, verbal insults, rumors, and intentional exclusion. For the actions to qualify as bullying, an asymmetric power relationship between the bully and the victim should also exist such that the bullied child has difficulties defending him or herself against the perpetrator. The seminal works by Olweus (1993, 1997) describe two victim types: passive and provocative. The typical passive victim is cautious, sensitive and quiet and reacts by crying. Boys in this category are generally physically weaker than other boys. The provocative victim, on the other hand, has problems with concentration, causes irritation and tension and is often hyperactive.

A. Why Would Bullying Affect Future Outcomes?

Psychological explanations of why bullying affects future outcomes distinguish between the effects of being a victim and being a perpetrator of bullying. Victimization is closely related to harassment and violence (Patchin and Hinduja, 2011), which are known to have unfortunate long-run consequences, although causal relationships are inherently difficult to establish (Currie and Tekin, 2012). The negative long-run consequences may be interpreted in the framework of general strain theory (Agnew, 1992) that argues that individuals who experience a strain (e.g. bullying) may produce negative emotions such as anger, frustration, depression or anxiety, which may lead to a corrective action in terms of wrongdoing, self-harm, suicide etc. Ouellet-Morin et al. (2011) show that bullied children had lower and longer lasting cortisol response to stress than the comparison group, suggesting that bullying invokes biological changes in victims with potential long-lasting impacts.

Some theories would predict that also perpetrators may be affected by bullying. However, we make no attempt to identify the potential effect of being a perpetrator because the case for this analysis is plausibly weaker.

The mentioned theories may be reconciled with the economic theories of life-cycle skill formation (e.g. Heckman, 2008). In economics, it has been shown that early investments not only have a large potential pay-off, they are also efficient in the sense that an equity-efficiency trade-off does not exist, which is the case for later investments. The reasons are that skills acquired in one period persist into future periods and that skills produced at one stage raise the productivity of investment at subsequent stages. Importantly, skills are multidimensional and are likely to complement each other. In this context, coping with victimization of bullying early in life directs resources away from investment in other skills.

In addition, to the extent that bullying exerts a direct negative impact on self-esteem and other non-cognitive skills as suggested above, educational and labor market success are also affected through this channel (Heckman (2008) and Waddell (2006)). The loss in terms of education, health and lifetime earnings potential may be enormous if bullying is interpreted in this framework.

B. Prior Evidence about Childhood Bullying

In this section we review the literature on predictors of being bullied in order to obtain a guideline for defining the conditioning set in our study of the potential effect of victimization on scholastic achievement.

Brown and Taylor (2008) is one of the few existing studies that actually investigate the link between bullying and educational attainment. They find that strong predictors of being bullied at age 11 are being a boy, having disabilities, unattractive physical appearance, personality traits, and number of schools attended.

Henningsen (2009) identifies the two main determinants of victimization as low family income and not feeling safe with one's parents. However, also parental education and divorce as well as more rare instances such as serious illness in the family, accidents, foster care, drug abuse and sexual assault correlates with victimization. Wolke et al. (2001) confirm that low socio-economic status correlates positively with victimization, and moreover find that ethnic background/skin color is an important predictor.

A plausible hypothesis is that not only individual characteristics but also the institutional framework matters for the prevalence of bullying. However, Persson and Svensson (2010) find no effects of class size on victimization. Obviously, school-based anti-bullying programs might also influence the prevalence of bullying. Farrington and Ttofi (2009) systematically review evaluations of such programs and find that long, high-intensity interventions that,

among other things, emphasize teacher and parent training effectively reduce bullying and victimization.

Based on the literature reviewed, the conditioning set in our study of the potential effect of victimization on educational achievement should preferably include socio-economic variables such as gender, age, ethnic origin, family resources and strains, as well as individual characteristics such as personality traits, psychological factors, disabilities, physical appearance, and physical weakness/strength. Among institutional characteristics, the previous literature indicates that class size is of less importance, while school and teacher characteristics or fixed effects should be included to account for anti-bullying prevention and related policies.

III. Institutional Context and Data

This section presents the institutional context within which we perform our analyses and gives a detailed discussion of data sources along with measures of bullying, the outcome, and the conditioning set.

A. Elementary School in Denmark

The vast majority of Danish children attend public elementary school (87 %)[1] and subsequently publicly subsidized after-school care (83 %).[2] After-school care most often takes place at an after-school club set up at schools with the idea that children have an integrated day (93 %). The personnel may to a minor extent overlap with the personnel during the school

[1] This number includes the pupils attending the voluntary 10th grade. For details, see Ministry of Education (2009).

[2] The figures for after-school care apply for 6-9 year-olds. See Statistics Denmark (2010).

day. However, after-school care may also take place at a recreation centre detached from schools (7 %).[3] Thus school and after-school care is by far the most important scene for social interactions between children.

In grade 0, pupils are taught by a form teacher who is a trained pedagogue. From grade 1 to grade 9, pupils are taught by subject-specific teachers rather than form teachers, among which one or two teachers take on the responsibility as a class teacher. Concern for the social climate in class is the responsibility of the class teacher(s), while introduction of anti bullying programs are most often school-based policies.

B. Data

The main data used in the analyses below stem from The Aarhus Birth Cohort (ABC). The data consist of initially 10,907 children born by 10,375 mothers in Aarhus, Denmark during 1990-1992. Of these, 525 women gave birth to more than one child during the period of observation, which we exploit in our robustness analysis. All pregnant women were eligible to participate in the survey and were recruited via tax-paid antenatal health services in their 14th gestational week,[4] and 98% chose to participate. In 2001 (when the children were 9-11 years old) and again in 2002, the parents of the children were surveyed, and in 2002 also the teachers of the children were interviewed and asked to evaluate the children's behavior. What is crucial for our purposes is that information about teacher and parent assessed incidents of

[3] The reported figures apply for 6-9 year-olds. Among 10-13 year-olds, 32% attend after-school care, and for this age group it most often takes place in a recreation centre or in a youth club. See Statistics Denmark (2010).

[4] 99.8% of all pregnant women received this type of care. See Delvaux, Buekens, Godin and Boutsen (2001).

bullying were provided. In addition, measures of socio-emotional and psychological issues are available which is of major importance in our analysis of bullying.

We drop observations where we observe no information about victimization from either the parents or the teacher as well as observations with no classmates in our dataset. This results in 4,490 observations. Finally we do not observe 9th Grade GPA for another 235 children who drop out or skip the exam. Our final sample thus consists of 4,255 children. Appendix A contains more information about attrition.

The survey data are augmented with a rich set of register-based information on 1) parents' socio-economic background, crime and health status (level of education, labor market history, settlement patterns, income, prescription drug usage, somatic and psychiatric diagnoses from general hospitals, crime records)[5] and 2) children's early health outcomes including information about circumstances pertaining to the birth of the child, daily information on prescription drug usage, yearly information about hospital use and related diagnoses, type of child care, the classroom they attended, and 9th grade test scores and yearly marks. We use the register data to strengthen our conditioning set and to construct the outcome measure as detailed below.

[5] The psychiatric diagnoses are obtained from the Danish Psychiatric Central Register; see Munk-Jorgensen and Mortensen (1997) for details.

Bullying

In identifying bullying, we exploit the parent and teacher questionnaires conducted in 2001 (only parents) and 2002. Each supplies a rating of the extent to which the child is a victim of bullying and whether the child bullies other children.[6]

According to Olweus (1997), negative acts only qualify as bullying if they take place *repeatedly*, *over time*, and if the negative acts are *intentional* and the victim cannot defend him or herself (*asymmetric power relationship*). In the past decade bullying has received increasing attention in the Danish society. Bullying policies have been introduced in school, the media has drawn attention to the problem at several occasions and politicians have also increased focus on the matter. We therefore assume that the respondents have an appropriate understanding of the concept.[7] Of course, we cannot be absolutely certain that the respondents employ the exact same definition as suggested by Olweus.

In our main analysis, we identify a child as a victim of bullying if *either* the teacher *or* the parents replied that the child is being bullied "to a small extent", "to some extent" or "to a large extent" in the 2001 questionnaire or "somewhat true" or "certainly true" in the 2002 questionnaires. Table 1A displays the bullying status of the children in our sample. Among the 4,255 children, 1,151 (27 %) are identified as victims of bullying. This largely resembles

[6] In 2001 parents are asked whether their child engage in bullying and whether the child is being bullied (No, To a small extent, To some extent, To a large extent). In 2002 parents and teachers are asked to what extent during the past 6 months are the following statements descriptive of the child: is being bullied or teased by other children in school, often gets into fights or bullies other children (Not true, Somewhat true , Certainly true).

[7] See the discussion by Wolke et al. (2001) about the problems of defining an internationally comparable measure of the prevalence of bullying when the languages differ.

the prevalence rates obtained in other studies based on self-reporting or parental reporting (see the introduction). We also see that 20% of the victimization is reported to be severe (at least one of the informants state that the child is "bullied to a large extent/certainly true"), while 80% is reported as minor victimization (child is "bullied to a small/to some extent/somewhat true").

Of course, one might worry about measurement errors in this context, and Bertrand and Mullainathan (2001) discuss possible pitfalls associated with the use of subjective measures such as bullying.[8] Individuals may, for example, answer on different scales; they may misreport due to social desirability; and they may report to have attitudes, which are consistent with past behavior. One might also worry that an informant who has observed a change in the child's behavior during a period of time (truancy, low scholastic performance or nightmares), which indicates that something troubling is going on in the child's life, may be more likely to report victimization. In a similar line of reasoning "victim mentality" may vary across children; what may be considered bullying by one child may be blown off by another child. All these mechanisms may create a spurious correlation between victimization and our outcome.

To address such measurement concerns we exploit that we have bullying information from two sources (teachers and parents) and explore to what extent our results are robust towards changing the definition of bullying to rely on one or the other source or both. We also investigate the consequences of distinguishing between the severities of the bullying experience.

Presumably, teachers and parents possess different sets of information about the child and the child's behavior. Thus, we expect that exploiting both reporting sources will provide a more

[8] These issues turn out to be particularly severe when the subjective measure is used as an outcome.

truthful picture of the extent of bullying. Although Oliver and Candappa (2003) find that the majority of pupils would tell their mothers about the bullying episodes, we cannot rule out that some pupils would choose not to inform their parents because they are afraid that this would lead the parents to take action, which might increase victimization. If victimized children are negatively selected, we expect misclassification due to underreporting to cause a downwards bias in our formal analysis of consequences of being bullied and this will likely be reduced when we rely also on teacher's report.

The correlation between the teacher's and parent's responses to whether the child is being bullied is 0.29. The parents in our sample are more likely to report their child a victim of bullying compared to the teachers (23 % are reported to be bullied by parents and 12 % are reported to be bullied by teachers). These numbers emphasize the importance of having two informants as well as the importance of careful robustness checks.

The peer relations and the social interactions leading to victimization experiences may vary across gender as well as victim mentality (e.g. Espelage et al. (2000)). Therefore, we study boys and girls separately in part of the robustness analyses.

Characteristics of Children and Parents

Means of selected characteristics of children and their parents by bullying status are shown in Tables 1A, 1B and 1C. These variables also enter into our conditioning set in the formal analyses below. Except for psychosocial well-being, height and minor physical handicaps at ages 9-11, all the child and parental characteristics shown here stem from administrative registers and are measured before the child starts school. Classroom fixed effects are based on the earliest possible classroom identifier (most often grade 1) in order to avoid potential class and school mobility induced by early initiated victimization.

As suggested by the literature, measures of the quality of family environment such as number of older siblings and parental divorce are predictive of victimization as is immigrant status. Similarly, poor early mental health (as indicated by prescription of anti-depressives and a mental or behavioral diagnosis established before the age of seven) predicts bullying status at ages 10-12[9] as does a higher than average number of early emergency ward visits that may be indicative of hyperactive behavior; see Dalsgaard, Nielsen and Simonsen (2013). Physical appearance has also been suggested as a driver of victimization. In line with this hypothesis, we see that minor physical handicaps such as impaired hearing, the wearing of glasses, and cross-eyedness are associated with victimization. The type of child care before starting school also correlates with exposure to bullying.

Among the conditioning variables, we include four variables computed from a factor analysis based on items reflecting socio-emotional and psychological well-being. We obtain four factors (zero mean and unit standard deviation); *hyperactive*, *absent minded*, *empathic* and *anxious*, using explorative principal component analysis. Appendix B presents a detailed description of the items used and the factor analyses including validity measures. From Table 1A, it is clear that the psychosocial factors vary tremendously across bullying status. The gap in means between victims and controls ranges from 36% (for *anxious*) to 52% (for *empathic*) of a standard deviation. We expect these psychosocial factors to be strongly associated with victimization because they are closely related to the two prototypical victims: the passive and the provocative victim. Psychosocial factors might also very well influence school achievement and thus our outcome measure.[10] Although it is clear that these variables stand

[9] See Currie and Stabile (2006) and Fletcher and Wolfe (2008) who argue that children with ADHD suffer in terms of academic outcomes.

[10] We denote these variables psychosocial factors, but they are closely related to personality traits and socio-emotional capabilities and the underlying questions are widely used in child

out as potentially very important for our analysis, we also exert some caution, because they are measured in 2001, the same year as the first parent survey on victimization, and therefore they may be affected by long-lasting victimization or common source bias. Partly for this reason we include control variables step by step below.

As is evident in Tables 1B and 1C, parents of victimized children are negatively selected in terms of observable characteristics: they are younger when they give birth, they have lower levels of education, lower income, are more likely to be unemployed, more likely to be part-time employed and are less likely to be higher level employees. Similarly, they are more likely to be treated for cardiovascular diseases, receive anti-depressives and to have a mental health diagnosis. Finally, they are significantly more likely to have a criminal history and this is especially true for fathers.

The characteristics of children and parents described above are employed in a rich conditioning set used in the subsequent empirical analysis.

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psychology/psychiatry to describe children's well-being and to screen for and diagnose mental and behavioral disorders. In addition, they may also be related to victim mentality as discussed earlier.

TABLE 1A *Means of Selected Child Characteristics by Bullying Status*[a]

	# obs	Victims Mean[a]	Victims Std. Dev.	Controls Mean	Controls Std. Dev.
Intensity of victimization:					
Severe bullying (0/1)	1,151	0.198	0.399		
Outcomes:					
9th grade GPA	4,255	**-0.019**	0.788	0.340	0.730
Instrument:					
Proportion of peer's parents convicted of crime	4,255	**0.252**	0.189	0.220	0.160
Register-based control variables :					
Boy (0/1)	4,255	0.518	0.500	0.503	0.500
Born prematurely (before week 37)	4,223	0.092	0.289	0.085	0.279
Birth weight (kg)	4,247	3.492	0.574	3.505	0.551
Complications at birth (0/1)	4,219	0.010	0.098	0.007	0.084
# younger siblings	4,236	*0.573*	0.642	0.614	0.660
# older siblings	4,236	**0.955**	1.072	0.870	1.000
Ethnicity (0/1)	4,255	**0.059**	0.236	0.026	0.158
Divorce (0/1)	4,255	**0.107**	0.309	0.065	0.247
# moves	4,255	0.125	0.404	0.108	0.371
Antidepressant medicine (0/1)	4,255	0.012	0.110	0.011	0.103
Diagnosis of mental or behavioral disorder (0/1)	4,255	0.006	0.078	0.003	0.054
Emergency Ward visits from 4-6 yrs. (0/1)	4,255	**0.403**	0.491	0.366	0.482
Private care (0/1)	4,255	**0.052**	0.222	0.035	0.185
Centerbased care (0/1)	4,255	**0.917**	0.277	0.944	0.229
Home care (0/1)	4,255	*0.030*	0.169	0.020	0.139
Psychosocial factors :					
Factor 1: Hyperactive	4,194	**0.257**	1.169	-0.200	0.744
Factor 2: Absent-minded	4,170	**0.294**	1.151	-0.204	0.811
Factor 3: Empathic	4,192	**-0.368**	1.149	0.228	0.742
Factor 4: Anxious	4,191	**0.240**	1.162	-0.179	0.768
Other controls measured in 2001 :					
Height (cm)	3,738	140.99	8.60	140.89	8.02
Impaired Hearing (0/1)	4,217	**0.078**	0.269	0.045	0.207
Wears glasses (0/1)	4,233	**0.092**	0.289	0.060	0.237
Cross-eyed (0/1)	4,204	**0.051**	0.221	0.036	0.187
Share bullied	4,255		0.271		

Psychosocial factors, height, impaired hearing, wears glasses and cross-eyedness are measured in 2001. The rest of the control variables are measured before age 7.

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold:** 5%-level; *italic* : 10%-level.

TABLE 1B *Means of Selected Characteristics of the Mother by Bullying Status*[a]

	# obs	Victims Mean[a]	Victims Std. Dev.	Controls Mean	Controls Std. Dev.
Age at birth of child	4,255	**29.6**	4.7	30.0	4.3
Smoked (0/1)	2,374	**0.318**	0.466	0.247	0.432
Elementary school (0/1)	4,211	**0.215**	0.411	0.131	0.337
High school (0/1)	4,211	0.083	0.276	0.079	0.269
Vocational degree (0/1)	4,211	**0.348**	0.477	0.316	0.465
Short further education (0/1)	4,211	0.040	0.195	0.045	0.208
Medium further education (0/1)	4,211	**0.241**	0.428	0.323	0.468
Long further education (0/1)	4,211	**0.073**	0.260	0.106	0.308
Log income*	4,241	**9.93**	4.54	10.80	3.72
Degree of year unemployed*	4,241	**0.102**	0.224	0.073	0.183
Full time employment (0/1)*	4,255	**0.795**	0.404	0.865	0.341
Top management level (0/1)*	4,226	0.014	0.118	0.009	0.097
Higher management level (0/1)*	4,226	**0.108**	0.310	0.163	0.370
Medium level employee (0/1)*	4,226	**0.222**	0.416	0.309	0.462
Lower level employee (0/1)*	4,226	**0.339**	0.473	0.287	0.452
Cardiovascular medicine (0/1)	4,255	0.149	0.356	0.146	0.353
Antidepressant medicine (0/1)	4,255	**0.247**	0.431	0.216	0.411
Diagnosis of mental or behavioral disorder (0/1)	4,255	**0.034**	0.181	0.019	0.137
Violence Conviction (0/1)	4,255	0.002	0.042	0.000	0.018
Property Conviction (0/1)	4,255	**0.051**	0.221	0.031	0.174
Prison Sentence (0/1)	4,255	**0.014**	0.117	0.005	0.074

All variables are measured at age 6/ before age 7. If at age 6 indicated with a *

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold**: 5%-level; *italic* : 10%-level.

TABLE 1C *Means of Selected Characteristics of the Father by Bullying Status*[a]

	# obs	Victims Mean[a]	Victims Std. Dev.	Controls Mean	Controls Std. Dev.
Age at birth of child	4,230	**32.0**	5.9	32.5	5.3
Elementary school (0/1)	4,148	**0.194**	0.396	0.127	0.333
High school (0/1)	4,148	0.064	0.245	0.076	0.265
Vocational degree (0/1)	4,148	**0.415**	0.493	0.360	0.480
Short further education (0/1)	4,148	0.059	0.235	0.053	0.223
Medium further education (0/1)	4,148	**0.147**	0.354	0.197	0.398
Long further education (0/1)	4,148	**0.120**	0.326	0.187	0.390
Log income*	4,181	**11.01**	3.94	11.34	3.67
Degree of year unemployed*	4,181	**0.060**	0.178	0.044	0.152
Full time employment (0/1)*	4,255	**0.842**	0.365	0.864	0.343
Top management level (0/1)*	4,127	0.043	0.203	0.043	0.204
Higher management level (0/1)*	4,127	**0.179**	0.384	0.266	0.442
Medium level employee (0/1)*	4,127	**0.158**	0.365	0.201	0.401
Lower level employee (0/1)*	4,127	**0.328**	0.470	0.276	0.447
Cardiovascular medicine (0/1)	4,255	0.090	0.287	0.081	0.273
Antidepressant medicine (0/1)	4,255	*0.165*	0.371	0.144	0.351
Diagnosis of mental or behavioral disorder (0/1)	4,255	**0.030**	0.169	0.018	0.132
Violence Conviction (0/1)	4,255	**0.046**	0.210	0.018	0.133
Property Conviction (0/1)	4,255	**0.151**	0.358	0.100	0.300
Prison Sentence (0/1)	4,255	**0.084**	0.278	0.050	0.218

All variables are measured at age 6/ before age 7. If at age 6 indicated with a *

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold**: 5%-level; *italic* : 10%-level.

Outcome

Our empirical analysis is concerned with potential consequences of victimization on 9th grade GPA obtained from Danish register data. A particular advantage of this study compared to other studies using surveys is that we obtain our outcome from a different data source than our treatment variable, removing concern about common variance. Furthermore because the register information is available for the population of children born in Denmark, we do not face the problem of missing values in our outcome variables due to non-response.

The *outcome measure* is 9th grade GPA based on the marks at the end of 9th grade in the subjects written and oral Danish, and written Mathematics. The average is taken over the

preliminary mark (given by the teacher based on the pupil's effort and achievement throughout the school year) and the mark at the national school exit exam (written and oral exams that are comparable across schools).[11] To be able to compare grades across cohorts, we standardize grades to zero mean and unit standard deviation within each cohort.

Table 1A above shows mean outcome by bullying status and indicates that being a victim of bullying correlates negatively with school performance measured by the 9th grade GPA. We stress that these observations do not represent causal pathways.

IV. Baseline OLS Results

We begin by estimating the relationship between bullying and GPA using OLS. Our baseline estimating equation is

$$GPA^i = X^{i'}\gamma + \beta \cdot bul^i + \varepsilon^i \quad (1)$$

where *GPA* indicates the outcome of interest, *bul* is an indicator for being a victim of bullying at age 10-12, and *X* is a rich conditioning set that includes the child and parental variables informative both about exposure to bullying and about GPA. β is our parameter of interest.

[11] The written exams are identical across the country and all exams, whether written or oral, are graded by the teacher and an external examiner, where the opinion of the external examiner dominates the opinion of the teacher. The teachers involved in the 9th grade exam (taking place at age 15-16) are unlikely to be the same teacher who informed about bullying at age 9-11. However, as a robustness check we also compute a GPA based on written Danish and Math, which are the most centralized and objective exams. The results are robust to this alternative measure of the outcome variable, and available on request. Only 92 % of the children sit the 9th grade exam. We ignore the selection into taking the exam.

Remember that we measure bullying status in 2001 and 2002. This implies that we must interpret our parameter of interest as the effect of victimization in elementary school, generally speaking. Victimization could have started earlier on and it may very well continue afterwards.

We gradually expand the conditioning set: We first include classroom fixed effects to address the importance of teacher and classroom characteristics. Next, we add the set of register-based individual (first block of Table 1A) and parent specific variables (shown in Tables 1B-1C). We think of these as representing socio-economic background (as most often available from administrative data or surveys) plus detailed information about health and criminal records. Third, we consider the consequences of adding the four psychosocial factors*:* (*hyperactive*, *absent minded, empathic and anxious)* described above and in Appendix B. Finally, we add information about minor disabilities and height as measured in 2001 in an attempt to isolate the effect of bullying from effects of physical appearance.

The corresponding OLS results are shown in Table 2. We see that victims perform significantly worse than others in terms of 9th GPA. The size of the estimate is reduced somewhat by adjusting for background variables. When we include classroom fixed effects the estimate is reduced by about 15%. This means that the association between victimization and GPA is not driven by potentially troublesome variation between well-functioning classrooms and badly-functioning classrooms. When we include the sets of register-based variables and psychosocial factors the estimate is substantially reduced, but once these are added the estimate is robust to the inclusion of additional variables measuring physical appearance. Remember that all register-based variables are measured before school start, and therefore the potential for reverse causality up to this point is most likely minor even if bullying has taken place from school start onwards. In Appendix C we show the full set of estimates revealing that many of the variables that predicted victimization (Tables 1A-1C) are

also important conditioning variables: the quality of the family environment, behavioral diagnoses, psychosocial factors and crime in parents are significant determinants.

Estimates are significant in an economic sense: our richest models suggest that exposure to bullying is associated with a reduced 9th grade GPA of more than 10 % of a standard deviation (comparable to the effect of adding 4 extra pupils to the classroom; see Heinesen (2010)).

TABLE 2 *OLS Results: Bullying and Standardized 9th Grade GPA*

	Coef.	Std. Error	R^2
OLS Unadjusted	**-0.359**	0.026	0.044
Class FE: No Controls[a]	**-0.284**	0.028	0.029
Class FE: + Register-based Controls[a]	**-0.185**	0.025	0.273
Class FE: Register-based Controls + Psychosocial Factors[a]	**-0.136**	0.026	0.293
Class FE: Full List of Controls[a]	**-0.139**	0.027	0.297
Sample size		4,255	
Proportion of victims		27%	

a. For fixed effects we report standard errors clustered at the classroom level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

V. Identifying Relationships between Bullying and GPA: Exploiting Troubled Children in the Classroom

The key problem facing us is that it is not random who is bullied. In fact, as indicated by the literature review and our descriptive statistics above, victims are negatively selected in terms of observable characteristics. Moreover, children involved in conflict are also likely to be negatively selected in terms of *unobservable* characteristics. While our conditioning set described above is incredibly rich, we cannot rule out that such unobserved characteristics will lead us to overstate the effects of bullying. An additional complication relates to the

measurement of bullying as discussed above. For these reasons, it would be convenient to be able to rely on a more objective measure of classroom conflict.

In an attempt to solve these issues, we implement an instrumental variables strategy inspired by Carrell and Hoekstra (2010): Here we instrument victim status with the proportion of the child's classroom peers whose parents have a criminal conviction (violent crime, property crime and other non-traffic related crime) or have served time in prison.[12] For this to constitute a valid instrument, it must affect victim status (and the effect must only go in one direction) yet cannot directly affect academic outcomes for the other children. This means, for example, that we assume that teachers do not redirect resources away from the other children because of the presence of a troubled child, which is not an innocuous assumption.[13] We also plausibly assume that the behavior of peers cannot cause a child's parents to engage into crime.

Let $Trouble^{-i}$ be the proportion of peers whose parents have a criminal conviction (violent crime, property crime or other non-traffic related crime) or have served time in prison.[14] We can then model victim status as:

[12] Previous research by Espelage et al (2000) suggests that children who are slapped or hit when they break the rules at home or who lack positive adult role models for conflict management engage in more negative actions towards other students. We cannot check this directly in our data set.

[13] Figlio (2007) finds that boys who are disruptive because of the stigma associated with their feminine names create disruptive ramification for peer learning.

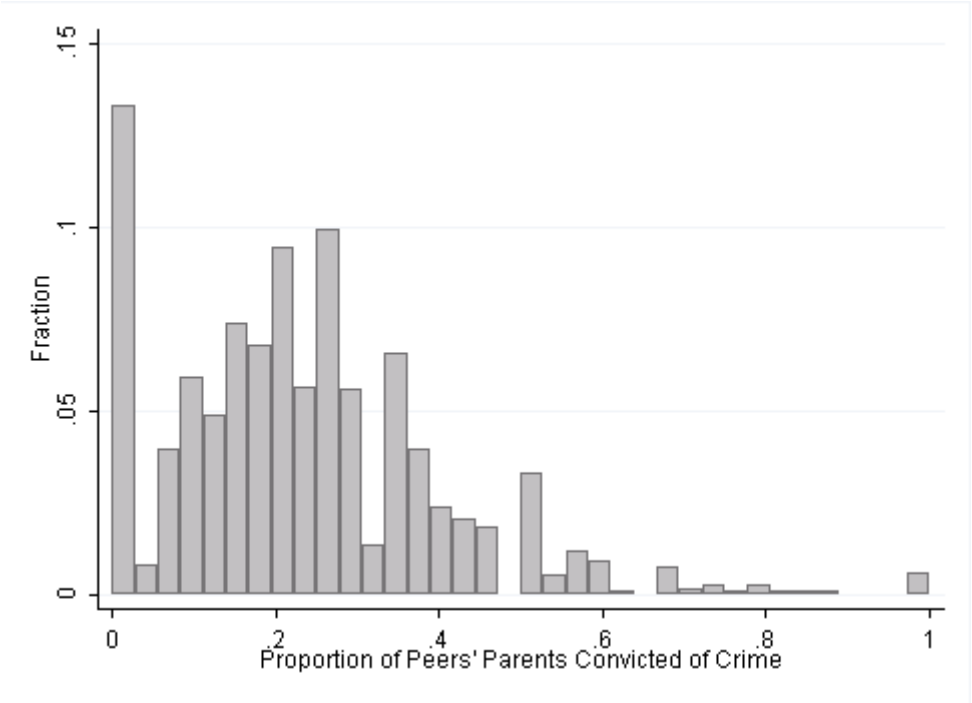
[14] A more direct approach would be to use the number of reported bullies in class as an instrument for victimization. When we do that the first stage is incredibly weak, and we suspect that this has to do with under- and misreporting of perpetrators.

(2) $$bul^i = 1\left[trouble^{-i}\alpha + X^{i\prime}\delta + \theta^i > 0\right]$$

where θ^i is the error term. We model the relationship between GPA and victim status as detailed in equation (1) above. In practice we estimate the consequences of bullying using 2SLS.

We first investigate the variation of the instrument. Table 1A shows that 25 percent of victimized children and 22 percent of non-victimized children have a classmate, whose parent has been convicted of crime. Figure 1 depicts the distribution of the instrument and illustrates that 13 percent of the children attend classes with no such classmates. Around 80 percent of the children are concentrated in the span from 5% to 50%. We observe a few individuals where the instrument equals one, which may be explained by some of the classes being incompletely observed. In the empirical analyses, we investigate robustness of the results to excluding extreme values of the instrument and excluding implausibly small classes.

FIGURE 1 *Distribution of the instrument*



We then investigate the correlation between the instrument and observable characteristics. In practice we regress the instrument on the full set of observable characteristics except for victim status (available on request). Coefficient estimates are small and most are insignificant, although own parents' criminal record as well as education of the mother are significant correlates and thus important control variables in the IV analyses to come.

Table 3 shows the results from the instrumental variables analysis. As in the simple OLS analysis above, we gradually expand the conditioning set.[15] We find that the presence of criminal peer parents significantly increases the likelihood that a given child is bullied. The size of the first stage is slightly reduced with the inclusion of additional controls but even the model with the most extensive conditioning set suggest a positive effect of 1 percentage point increase in victimization when the proportion of troubled kids increases from 0 to 10%. The estimated effect on 9th grade GPA is large and negative but unfortunately also somewhat noisy. The second stage estimates are reduced when the conditioning set is enriched.

Before we proceed, we investigate which parts of the distribution of the instrument drives the results. The results are robust to excluding the 13% of individuals with no class mate parents convicted of crimes but not robust to excluding the 7% of the distribution with more than half of class mate parents convicted of crimes. This indicates that the variation coming from classes with a high fraction of troubled children is important for the strategy to work. Above we raised a concern that the high fractions were explained by incomplete classes. However, the IV results are literally unchanged when we exclude implausibly small classes (<5 or <10). In the next section we investigate heterogeneity of the results and perform further robustness checks including sibling comparisons.

[15] Note that class fixed effects are not identifiable.

TABLE 3 *IV Results: Bullying and Standardized 9th Grade GPA*

	2SLS Victimization		First stage: Peers' Parents Convicted of		
	Coef.	Std. Err.	Coef.	Std. Err.	R^2
No Controls	**-2.623**	0.516	**0.221**	0.040	0.007
+ Register-based Controls	**-1.240**	0.533	**0.137**	0.041	0.063
+ Psychosocial Factors	**-1.256**	0.609	**0.119**	0.039	0.154
Full List of Controls	**-1.141**	0.575	**0.122**	0.039	0.159
Sample size			4,255		
Proportion of victims			27%		

Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

VI. Robustness Analyses and Heterogeneity

In this section we present a long range of robustness analyses. We show results from including mother FE, heterogeneity of results by gender and by intensity of victimization. Finally, we explore how our estimates vary with different measurements of bullying.

A. Mother Fixed Effects

As mentioned above bullying is related to standard socio-economic measures such as family resources and ethnic origin as well as personal characteristics such as personality traits, psychological factors, disabilities, physical appearance, and physical weakness/strength. To the extent that these characteristics are not already captured by our extensive conditioning set and assuming they are fixed within a family, a mother fixed effects estimator will account for them.

Our data allow us to account for mother fixed effects for siblings who are born within the 1990-1992 time period. That is, we consider closely spaced siblings. We exploit sibling pairs

where one sibling is the victim of bullying and the other is not. The outcome of the non-victim sibling can then be used as the counterfactual outcome.

The fixed effects strategy assumes that comparing siblings, perhaps conditional on attributes, eliminates selective differences between victims and controls. A common concern is exactly that although siblings are born into the same family and share this environment, they may still differ along a wide range of characteristics. If less able siblings are more likely to be exposed to bullying, the sibling comparison estimator will tend to bias the effect of bullying upwards, just as the simple OLS is expected to do. To accommodate this criticism, our estimations include a wide range of variables descriptive of the child himself and his abilities; see above.

A second concern with within-family estimators is that the identifying population is potentially very small: 141 mothers in our final sample gave birth to more than one child during 1990-1992 (43 gave birth to twins, 2 gave birth to triplets). Of these, we observe 33 sibling pairs where one is a victim of bullying and the other is not; these pairs identify our parameter of interest in the sibling analysis.[16] Table 4 shows the percentages of sibling pairs in the different combinations of bullying status.[17] Bullying status of the oldest sibling (sibling 1) is on the vertical axis and bullying status of the younger sibling (sibling 2) is on the horizontal axis. The table illustrates that the younger sibling is more likely to be reported as a victim of bullying if the older sibling is a victim of bullying and vice versa. Furthermore, we see that slightly more of the older siblings experience bullying.

A final concern with this estimator is that we need to assume that one sibling is not affected if the other sibling is exposed or unexposed to bullying. Negative spillovers from exposed

[16] Of these sibling pairs 12 are twin pairs.

[17] Families who give birth to 3 children in the period constitute 2 sibling pairs; sibling 2 and 3 are each paired with sibling 1.

siblings will cause a bias towards zero in the fixed effects estimations, while positive spillovers stemming from protective effects from unexposed siblings would cause a bias in the opposite direction.

TABLE 4 *Sibling Variation in Bullying Status*[a]

		Sibling 2:			
		Victim	Non-victim	All	# pairs
Sibling 1	Victim	12%	13%	25%	36
	Non-victim	10%	65%	75%	107
	All	22%	78%	100%	
	# pairs	31	112		143

We report the coefficients for the mother fixed effects specification in Table 5. As the sample size decreases significantly when we run the mother fixed effects model we also report the unadjusted OLS estimates for this reduced sample.

TABLE 5 *Mother FE Results: Bullying and Standardized 9th Grade GPA*

	Coef.	Std. Error	R^2
OLS Unadjusted	**-0.358**	0.107	0.038
Mother FE: No Controls[a]	**-0.281**	0.115	0.040
Mother FE: + Register-based Controls[a]	-0.210	0.136	0.472
Mother FE: + Psychosocial Factors[a]	-0.142	0.131	0.515
Mother FE: Full List of Controls[a]	-0.130	0.173	0.538
Sample size		284	
Proportion of victims		24%	
Number of identifying pairs		33	

a. For fixed effects models we report standard errors clustered at the family level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

The important message from the mother fixed effects analysis is that the conclusions from the simple OLS seem largely robust. However, when we include psychosocial factors, the coefficient estimate is no longer statistically significant due to the small sample size.[18]

B. Gender heterogeneity

In Table 1A, we saw that bullying status does not vary significantly by gender. In Table 6, we investigate if the relationship between GPA and victimization varies by gender. The estimates suggest that although the first stage is stronger for girls than for boys, the statistically significant effects of victimization tend to be driven by boys rather than girls.[19] However, the samples are too small to draw firm statistical inference about the difference.

[18] In an additional specification we have included an indicator variable for being the oldest of the sibling pair. In this specification the estimated effect of victimization increases which reflects that the older sibling is more often bullied and do better in school on average.

[19] When we compare the importance of background characteristics across genders, some differences show up: type of child care and a high score on the hyperactivity factor are important for boys but not for girls and the association with mother's labor market activities differ.

TABLE 6 *OLS and IV Results: Bullying and Standardized 9th Grade GPA, Gender differences*

	Class FE[a] Victimization			2SLS Victimization		First stage: Peers' Parents Convicted of		
	Coef.	Std. Err.	R^2	Coef.	Std. Err.	Coef.	Std. Err.	R^2
				Boys				
No Controls	**-0.296**	0.0426	0.0329	**-3.055**	0.971	**0.188**	0.057	0.005
+ Register-based Controls	**-0.216**	0.0362	0.2696	*-1.856*	1.023	**0.125**	0.059	0.087
+ Psychosocial Factors	**-0.166**	0.0397	0.2888	-2.179	1.582	0.088	0.056	0.180
Full List of Controls	**-0.169**	0.0394	0.2946	-2.158	1.565	0.088	0.056	0.188
Sample size				2,156				
Proportion of victims				28%				
				Girls				
No Controls	**-0.253**	0.0464	0.0235 0	**-2.306**	0.573	**0.253**	0.056	0.010
+ Register-based Controls	**-0.149**	0.0404	0.2881	-0.740	0.557	**0.159**	0.059	0.091
+ Psychosocial Factors	**-0.104**	0.0414	0.3087	-0.667	0.536	**0.161**	0.056	0.182
Full List of Controls	**-0.111**	0.0419	0.3127	-0.556	0.518	**0.164**	0.056	0.188
Sample size				2,099				
Proportion of victims				26%				

a. For fixed effects we report standard errors clustered at the classroom level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

C. Intensity of bullying

In Table 1A we see that 20% of the victims report to experience bullying "to a large extent" over the last six months, which we consider as severe bullying. In Table 7, we redefine the endogenous variable to take the values zero (no bullying), one (minor bullying) and two (severe bullying). Also when we use this linear measure of victimization, we find detrimental effects which increase with the intensity of bullying. This robustness check supports the validity of the measurement of bullying.

TABLE 7 *OLS and IV Results: Bullying and Standardized 9th Grade GPA, Intensity of bullying*

	Class FE[a] Victimization			2SLS Victimization		First stage: Peers' Parents Convicted of Crime		
	Coef.	Std. Err.	R^2	Coef.	Std. Err.	Coef.	Std. Err.	R^2
No Controls	**-0.212**	0.0217	0.0261	**-1.896**	0.355	**0.305**	0.052	0.008
+ Register-based Controls	**-0.137**	0.0193	0.2715	**-0.862**	0.357	**0.197**	0.053	0.067
+ Psychosocial Factors	**-0.095**	0.0209	0.2915	**-0.868**	0.404	**0.173**	0.050	0.174
Full List of Controls	**-0.098**	0.0209	0.2956	**-0.790**	0.385	**0.176**	0.050	0.179
Sample size				4,255				
Proportion of minor victims				22%				
Proportion of severe victims				5%				

a. For fixed effects models we report standard errors clustered at the classroom level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

D. Measurement of Bullying

In Table 8 we explore how the association between GPA and victimization varies with the exact definition of victimization. In the main analysis, we define an individual to be victimized if *either* the parent or the teacher indicates that the child was victimized. In Table 8 we compare the main results to the results from using the teacher's report only, the parents' report only and from requiring that both informants agree that the individual is being bullied.

One may view Table 8 as adding on to the results on the importance of intensity of victimization (see Table 7). The four measures of bullying identify effects at four different margins of severity: from the top to the bottom, the bullying measures identify 27%, 23%, 12% and 7% as victims. Interpreting the point estimates at face value suggests that effects tend to increase with severity.

TABLE 8 *OLS and IV Results: Bullying and Standardized 9th Grade GPA,*

Different definitions of victimization

	Class FE[a] Victimization			2SLS Victimization		First stage: Peers' Parents Convicted of		
	Coef.	Std. Err.	R^2	Coef.	Std. Err.	Coef.	Std. Err.	R^2
Definition of victimization based on:				*Teacher or Parents*				
Unadjusted	**-0.284**	0.028	0.029	**-2.623**	0.516	**0.221**	0.040	0.007
+ Register-based Controls	**-0.185**	0.025	0.273	**-1.240**	0.533	**0.137**	0.041	0.063
+ Psychosocial Factors	**-0.136**	0.026	0.293	**-1.256**	0.609	**0.119**	0.039	0.154
Full List of Controls	**-0.139**	0.027	0.297	**-1.141**	0.575	**0.122**	0.039	0.159
Sample size				4,255				
Proportion of victims				27%				
				Only Parents				
Unadjusted	**-0.277**	0.031	0.025	**-3.295**	0.760	**0.174**	0.038	0.005
+ Register-based Controls	**-0.173**	0.027	0.271	*-1.781*	0.950	**0.090**	0.039	0.067
+ Psychosocial Factors	**-0.118**	0.029	0.292	-1.949	1.223	**0.073**	0.037	0.167
Full List of Controls	**-0.121**	0.029	0.296	-1.784	1.150	**0.073**	0.037	0.171
Sample size				4,241				
Proportion of victims				23%				
				Only Teacher				
Unadjusted	**-0.359**	0.047	0.024	**-4.449**	1.368	**0.114**	0.034	0.003
+ Register-based Controls	**-0.256**	0.041	0.274	*-2.002*	1.077	**0.083**	0.035	0.055
+ Psychosocial Factors	**-0.191**	0.042	0.296	-1.977	1.353	*0.065*	0.034	0.119
Full List of Controls	**-0.192**	0.042	0.303	-1.686	1.214	**0.068**	0.034	0.121
Sample size				3,316				
Proportion of victims				12%				
				Teacher and Parents				
Unadjusted	**-0.395**	0.063	0.018	*-10.494*	5.718	*0.047*	0.026	0.001
+ Register-based Controls	**-0.259**	0.053	0.269	-6.162	6.727	0.025	0.027	0.058
+ Psychosocial Factors	**-0.156**	0.054	0.292	-15.762	52.621	0.007	0.025	0.155
Full List of Controls	**-0.161**	0.054	0.298	-13.528	44.418	0.008	0.025	0.159
Sample size				3,302				
Proportion of victims				7%				

a. For fixed effects models we report standard errors clustered at the classroom level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

When we apply measures that require the teacher to agree on the child being bullied, the estimates of the effect of victimization become larger. One explanation might be that teachers apply another threshold than parents and identify more severe cases. Another explanation

might be that the teacher's report is more strongly associated with the outcome, and one may be concerned that teachers misclassify some victims if their academic achievement is fine. For the measures which require the teacher to agree with the parents, the instrument becomes weak when controls are added, and as a consequence the estimated effect of victimization becomes noisier. This might indicate that the teacher applies a relative standard and potentially misclassifies children as victims due to other conditions, or it might indicate that these other conditions are the true reasons for weak educational performance rather than victimization as such.

VII. Conclusion

This paper investigates the determinants and potential effects of bullying in elementary school on educational performance measured by 9th grade GPA. We employ a number of strategies in order to come closer to identifying impacts of such experiences than previous research. We exploit a rich conditioning set which includes classroom information, parents' socio-economic background plus detailed information about health and criminal records as well as detailed accounts of children's early physical and mental health outcomes and psychosocial factors measured just prior to exposure to bullying. In our main analysis, we implement an IV strategy inspired by Carrell and Hoekstra (2010) where we instrument victim status with the proportion of peers from troubled homes in one's classroom. We show that bullied children suffer in terms of 9th grade GPA and that the effects of victimization tend to increase with severity. We emphasize that effects of exposure to bullying are particularly difficult to identify and caution that our estimates should be interpreted with this is mind. Of course, Denmark is a very homogenous society, which may limit the potential for conflict and it is

therefore possible that the nature of bullying is less severe than in other places. As such, we think of our estimates as lower bounds.

We show that the quality of the family environment as well as individual child characteristics such as poor early mental health, indicators of hyperactive behavior and physical appearance are important drivers of victimization.

Given that bullying is likely so costly, can it be limited? Farrington and Ttofi (2009) systematically review evaluations of 44 school-based anti-bullying programs. They find that the reviewed interventions on average reduce the prevalence of bullying and victimization by roughly 20%. Program effectiveness increases with inclusion of more elements, longer duration and higher intensity. Some of the single elements that are significantly related to successful intervention are teacher and parent training as well as use of disciplinary methods and video and virtual reality video games. Furthermore, programs inspired by the pioneer, Olweus, are found to be more effective than others.

The details of the *Olweus bullying prevention program* are described in Olweus (1997). The idea is to combine warmth and positive involvement from adults with firm limits to unacceptable behavior. Violation of the limits and rules should be followed by non-hostile, non-physical sanctions. The program implicitly requires some monitoring of behavior as well as adults acting as authorities at least in some respects. This relatively simple skeleton underlies bullying prevention programs implemented all over the world. Yet bullying prevails. Of course, such intensive programs are likely expensive and rely at least partly on very specific – and possibly limited – human resources. However, our results indicate that such programs may have longer run aggregate effects in improving education and subsequently income of the population.

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Appendix A Attrition

10,907 children were initially included in the ABC survey. Unfortunately, not all parents and teachers reported in the subsequent survey rounds. Those residing outside the region of Aarhus at the time of the surveys were not even asked to complete the survey.

For this reason, we drop 3,231 observations. Out of the remaining 7,676 children, we can identify classmates at school entry for 4,490. Finally we exclude 235 children, who drop out before the 9^{th} grade exit exam or who skip the exam. We thus include 4,255 children in the empirical analyses.

Among the 10,907 individuals initially included, 70 % of the parents and 52 % of the teachers respond to the bullying question in the 2001 and 2002 round of the questionnaires. This gives rise to concern about possible bias due to attrition, especially because the subject being surveyed is of sensitive nature. Because the survey is linked to register-based information, we are able to test possible differences in the populations of parents who responded and who did not respond. We find that non-respondents are more likely to have worse socio-economic background, were on average younger when the child was born, were more likely to be of ethnic minority origin, and have more psychiatric diagnoses.

Appendix B Additional information regarding psychosocial factors

This appendix presents details behind the factor analyses conducted to arrive at the psychosocial factors. The factor analyses extract the common variance in responses to a set of questions about socio-emotional and psychological issues in the questionnaire conducted in 2001.

The questionnaire contains a range of items from the Child Behavior Check List (CBCL), see Achenbach (1993). However, not all items are included in the questionnaire, and therefore, we are not able to obtain the entire scales. Instead we conduct an explorative factor analysis using principal components where items are chosen based on Children's Behavior Questionnaire (CBQ), see Rutter (1967). Whereas the CBQ focuses on undesirable traits, the CBCL incorporates other aspects such as prosocial behavior. We therefore include additional items not obtained in the CBQ which describe prosocial behavior. Our analysis is based on 14 items. The KMO for all items is 0.875, which validate the use of factor analysis. The explorative factor analysis suggests four factors. Table B1 presents the four factors with their respective loadings and Cronbach's Alpha. Each variable loads highly on one factor and not much on the remaining factors, giving us a clear factor structure. The items loading high on each factor clearly suggests the labels: *anxious*, *hyperactive*, *empathic* and *absent-minded*. Furthermore, Cronbach's Alphas are high which indicates good internal validity of the factors.[20] We obtained factor scores on each of the factors using the regression method. These scores were then incorporated in the regression analysis and denoted psychosocial factors.

[20] We tested the Cronbach's Alpha by deleting and adding items with higher cross loadings. In no case could Cronbach's Alpha be increased.

Table B1 *Questions, Loadings and Cronbach's α*

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Cronbach's α
Anxious (Factor 4)					0.655
Seems sad and worried	.356	.100	.143	.627	
Confused and hazy	.438	.219	.252	.530	
Afraid of changes	.217	.103	-.008	.781	
Absent minded (Factor 2)					0.794
Impulsive	.233	.743	-.033	-.044	
Clumsy or poorly coordinated	.055	.792	.039	.198	
Daydreams or gets lost in oneself	.098	.751	.014	.177	
Inconsiderate and careless	.207	.792	-.013	.041	
Empathic (Factor 3)					0.687
Good at cooporating	.111	-.038	.807	.000	
Good at team plays	.189	.016	.792	-.017	
Good at understanding others emotions	-.014	.019	.721	.254	
Hyperactive (Factor 1)					0.770
Live in one's own world	.535	.166	.109	.315	
Cannot concentrate for a longer period of time	.722	.164	.071	.209	
Restless and fidgety	.765	.134	.064	.199	
Cannot sit still	.798	.156	.112	.122	

Appendix C Additional Results

Table C1 *OLS Results Full Set of Estimates*

Model: Class FE[b]	+ Register-based Controls		+ Psychosocial Factors		Incl. Full List of Controls	
	Coef.	Std.	Coef.	Std.	Coef.	Std.
Child's Characteristics[a] ***(Omitted Category):***						
Victimization	**-0.185**	0.025	**-0.136**	0.026	**-0.139**	0.027
Male	**-0.217**	0.023	**-0.182**	0.023	**-0.184**	0.022
Born in 1991 (Born 1990)	0.089	0.059	0.095	0.058	**0.114**	0.058
Born in 1992 (Born 1990)	0.041	0.079	0.043	0.076	0.072	0.076
# younger siblings	**0.048**	0.018	0.048	0.049	0.018	0.017
# older siblings	**-0.068**	0.013	**-0.068**	0.013	**-0.065**	0.013
Ethnic (Danish)	0.138	0.090	**0.179**	0.088	**0.188**	0.093
Parents divorced	-0.085	0.052	-0.073	0.052	-0.070	0.052
# of divorces	-0.022	0.038	-0.017	0.038	-0.016	0.038
# moves	0.000	0.030	-0.003	0.030	-0.005	0.030
Private daycare (No Registered Care)	**0.199**	0.093	**0.197**	0.091	**0.189**	0.091
Centerbased daycare (No Registered Care)	**0.176**	0.076	**0.174**	0.075	**0.166**	0.075
Home care (No Registered Care)	0.128	0.261	0.147	0.267	0.179	0.270
Born before week 37 (After week 37)	**0.130**	0.043	**0.126**	0.042	**0.113**	0.042
Born before week 28 (After week 37)	**-0.672**	0.291	**-0.663**	0.299	**-0.694**	0.291
Birthweight /1000	0.074	0.021	0.066	0.021	0.053	0.021
Complications at birth	-0.210	0.139	-0.210	0.138	-0.202	0.139
# emergency ward visits at ages 4-6	-0.034	0.022	-0.026	0.022	-0.027	0.022
Cardiovascular Medicine	0.045	0.137	0.107	0.138	0.116	0.138
Antidepressant Medicine	-0.047	0.104	-0.022	0.098	-0.036	0.097
Diagnosis of mental or behavioral disorder	*-0.317*	0.189	-0.275	0.201	-0.275	0.199
Factor 1: Hyperactive			**-0.105**	0.015	**-0.103**	0.015
Factor 2: Absent minded			-0.009	0.014	-0.009	0.014
Factor 3: Empathic			0.009	0.015	0.010	0.015
Factor 4: Anxious			0.000	0.014	0.000	0.014
Height, 2001					**0.006**	0.002
Cross-eyed, 2001					-0.010	0.051
Wears Glasses, 2001					0.059	0.044
Hearing impaired, 2001					0.008	0.057

a. Psychosocial factors, height, impaired hearing, wears glasses and cross-eyedness are measured in 2001. The rest of the control variables are measured before age 7.

b. For fixed effects models we report standard errors clustered at the classroom level and the within R^2.

Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

Table C1 *Continued.*

Model: Class FE[b]	+ Register-based Controls		+ Psychosocial Factors		Incl. Full List of Controls	
	Coef.	Std.	Coef.	Std.	Coef.	Std.
Mother's Characteristics[a] ***(Omitted Category):***						
Age at birth	**0.009**	0.004	**0.009**	0.004	**0.008**	0.004
High School (Elementary School)	**0.269**	0.047	**0.272**	0.047	**0.273**	0.047
Long Further Education (Elementary School)	**0.382**	0.061	**0.379**	0.060	**0.387**	0.059
Medium Further Education (Elementary Schoo	**0.233**	0.047	**0.229**	0.047	**0.230**	0.047
Short Further Education (Elementary School)	**0.258**	0.065	**0.248**	0.064	**0.248**	0.064
Vocational Degree (Elementary School)	**0.122**	0.038	**0.117**	0.038	**0.115**	0.038
Enrolled in Education*	0.072	0.048	0.053	0.048	0.053	0.048
Mother Smoked during pregnancy	**-0.128**	0.034	**-0.117**	0.033	**-0.114**	0.033
Higher management Level (Unemployment)*	**0.230**	0.082	**0.245**	0.082	**0.238**	0.082
Lower level employee (Unemployment)*	0.049	0.075	0.058	0.075	0.055	0.075
Medium Level Employee (Unemployment)*	**0.211**	0.079	**0.222**	0.078	**0.217**	0.078
Selfemployed (Unemployment)*	0.040	0.118	0.073	0.117	0.071	0.117
Top Management Level (Unemployment)*	0.160	0.128	0.175	0.127	0.157	0.126
Full time employment (Part Time Employment)	-0.039	0.062	-0.028	0.062	-0.029	0.063
Private Sector (Public Sector)*	*0.049*	0.026	**0.055**	0.026	**0.054**	0.026
Log income*	0.001	0.006	0.000	0.006	0.000	0.006
Degree of year unemployed at age 4	-0.059	0.063	-0.073	0.063	-0.074	0.064
Degree of year unemployed at age 5	-0.007	0.079	0.001	0.078	0.007	0.078
Degree of year unemployed at age 6	-0.020	0.087	-0.018	0.087	-0.023	0.086
Antidepressant Medicine	-0.008	0.026	-0.001	0.025	-0.001	0.025
Cardiovascular Medicine	0.034	0.031	0.032	0.030	0.032	0.031
Diagnosis of mental or behavioral disorder	0.087	0.073	0.085	0.072	0.086	0.072
Violence conviction	0.269	0.361	0.307	0.356	0.265	0.380
Property Crime Conviction	-0.069	0.071	-0.066	0.070	-0.060	0.070
Conviction of Other Crime	0.352	0.548	0.421	0.571	0.398	0.556
Conviction of Special Crime	-0.028	0.120	-0.058	0.126	-0.073	0.126
Conviction of Traffic offence	**-0.099**	0.050	*-0.091*	0.049	*-0.092*	0.049
Prison Sentence	0.030	0.135	-0.002	0.137	-0.005	0.137

a. All variables are measured at age 6/ before age 7. If at age 6 indicated with a *

b. For fixed effects models we report standard errors clustered at the classroom level and the within R^2.
Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.

Table C1 *Continued.*

Model: Class FE[b]	+ Register-based Controls		+ Psychosocial Factors		Incl. Full List of Controls	
	Coef.	Std.	Coef.	Std.	Coef.	Std.
Father's Characteristics*[a] *(Omitted Category):						
Age at birth	0.003	0.003	0.003	0.003	0.003	0.003
High School (Elementary School)	**0.241**	0.054	**0.227**	0.054	**0.229**	0.054
Long Further Education (Elementary School)	**0.294**	0.049	**0.280**	0.049	**0.286**	0.050
Medium Further Education (Elementary School	**0.240**	0.047	**0.231**	0.046	**0.235**	0.046
Short Further Education (Elementary School)	**0.132**	0.055	**0.131**	0.055	**0.126**	0.055
Vocational Degree (Elementary School)	0.045	0.038	0.045	0.038	0.048	0.038
Enrolled in Education*	0.024	0.063	0.026	0.059	0.022	0.060
Higher management Level (Unemployment)*	0.062	0.090	0.032	0.089	0.031	0.090
Lower level employee (Unemployment)*	-0.103	0.088	-0.134	0.087	-0.132	0.088
Medium Level Employee (Unemployment)*	-0.021	0.089	-0.059	0.089	-0.057	0.089
Selfemployed (Unemployment)*	-0.036	0.116	-0.084	0.114	-0.087	0.114
Top Management Level (Unemployment)*	0.028	0.103	-0.011	0.104	-0.009	0.105
Full Time Employment (Part Time Employment	**-0.285**	0.115	**-0.270**	0.114	**-0.278**	0.115
Private Sector (Public Sector)*	0.011	0.030	0.005	0.029	0.006	0.029
Log income*	0.005	0.006	0.005	0.006	0.004	0.006
Degree of year unemployed at age 4	-0.046	0.087	-0.027	0.087	-0.025	0.086
Degree of year unemployed at age 5	-0.156	0.107	-0.141	0.106	-0.141	0.106
Degree of year unemployed at age 6	0.053	0.114	0.037	0.113	0.038	0.114
Antidepressant Medicine	**-0.092**	0.032	**-0.097**	0.032	**-0.098**	0.032
Cardiovascular Medicine	0.027	0.038	0.024	0.037	0.024	0.038
Diagnosis of mental or behavioral disorder	-0.073	0.087	-0.036	0.083	-0.032	0.084
Violence conviction	*-0.157*	0.092	*-0.165*	0.091	*-0.167*	0.091
Property Crime Conviction	0.034	0.041	0.031	0.041	0.027	0.041
Conviction of Other Crime	0.018	0.140	0.010	0.132	0.031	0.134
Conviction of Special Crime	-0.039	0.057	-0.032	0.056	-0.033	0.056
Conviction of Traffic offence	-0.031	0.026	-0.027	0.026	-0.028	0.026
Prison Sentence	**-0.126**	0.060	*-0.115*	0.060	*-0.115*	0.059
Constant	**-0.520**	0.253	**-0.496**	0.253	**-1.212**	0.333
Within R^2	0.273		0.293		0.297	
Between R^2	0.394		0.429		0.433	
Overall R^2	0.308		0.328		0.333	
Sample size			4,255			

a. All variables are measured at age 6/ before age 7. If at age 6 indicated with a *

b. For fixed effects models we report standard errors clustered at the classroom level and the within R^2.

Bold: significant at the 5 % level. *Italic* : significant at the 10 % level.