



2014-10
Tine L. Mundbjerg Eriksen
PhD Thesis

Essays on Bullying: an Economist's Perspective



Essays on Bullying: an Economist's Perspective

By Tine L. Mundbjerg Eriksen

A PhD thesis submitted to
School of Business and Social Sciences, Aarhus University,
in partial fulfilment of the requirements of
the PhD degree in
Economics and Business

August 2014



Preface

This PhD thesis was written from September 2009 to August 2014 while I was enrolled as a PhD student at the Department of Economics and Business at Aarhus University. I am grateful to the department for providing financial support and an excellent research environment.

First of all I would like to thank my two supervisors, Helena Skyt Nielsen and Marianne Simonsen. I really appreciate that you encouraged me to focus on bullying. It is not an easy topic to investigate due to obvious identification issues. That never the less, does not make it any less important, and I needed to be reminded of that now and then. And although it has been tough at times I have learned a lot about all aspects of doing research. From our co-authorship I've learned invaluable lessons on writing papers. It's been two great processes, and I hope that I one day will be able to structure a paper the way you can. I admire you both, not just because of your excellent work, but for your approach to academia as a whole, as individuals, as colleagues, and as supervisors. I could not have asked for better supervisors. To Helena, I especially want to thank you for investing time and thoughts in my future. You have focused on how to help me in the best possible way, and I can't explain how much it means that you believe in me. Because of you I have had experiences that I would not have had otherwise. To Annie and Åse, who I had the privilege of working with on the third chapter of this thesis. I first of all want to say, thank you for trusting me with your data. Second, thank you for giving me another perspective on things and opening my eyes to another field of research. When one works on a topic that is not traditional within Economics, one needs to acknowledge that there were others before you with great experience. All though we did not always agree on things, I want to say that I highly respect the work that you do.

In the fall of 2011 Rasmus Lentz kindly invited me to visit University of Wisconsin - Madison. My husband and I spend four wonderful months there, and we hope to go back again sometime. Rasmus, thank you for many great conversations in your office. I am confident that they were the beginning of a great and interesting project, which I am looking forward to start in this fall.

A special thank you to Henning Bunzel and Søren Leth Sørensen for immense data support. The third chapter would not have been written if it had not been for you.

When you spent five years as a PhD student you get to have a lot of wonderful colleagues,

both professors, and new and old PhD students. I want to thank you all for making it interesting and enjoyable both socially as well as academically.

Over the years I've been blessed with a lot of great office mates, so thank you Kenneth, Lene, Ritwik, Stine, Jonas, Kai, and Julia, for many great conversations, laughs, and discussions. Furthermore I want to thank Morten, Anne, Louise and Bastien. You have been just as much office mates as the others above. A very special thanks to my fellow PhD girls who have been there all the way, Anne, Jannie, Jeanne and Sanni. Thank you for listening, sharing, helping, supporting and always being there, in good and bad times. Finally to Rune; back in 2008 we worked together on the best bachelor project ever, and I think that was the first step on the long journey taking me to where I am today. Since then we joined forces multiple times. Thank you for your support, it has always been comforting to know that you were just down the hall.

To my family, thank you for always believing in me, for providing accommodations and food, and later babysitting, when things got a little bit too busy. I know that it has not always been easy to understand what I was rambling on about, but you have always listened interestingly, asked critical questions, and challenged me in my sometimes too narrow way of approaching things.

To my husband, Kasper, I cannot express how much I love you. They say that behind every man stands a great woman. Behind me stands an even greater man. I don't think I realized what I dragged you into when I applied for a PhD back in 2008. But you have been more supportive, constructive and caring than I could have wished for. You believed in me when I didn't believe in myself, for that I will always be grateful.

To our son Peter, thank you for reminding me that there are more important things in life than a PhD, such as tractors, playing ball, watching you count to ten, reading a book at night, etc. I love you with all my heart.

Tine L. Mundbjerg Eriksen Aarhus, August 2014

Updated Preface

The predefence took place on October 6th, 2014. I am very grateful to the members of the assessment committee Joseph Price, Knut Røed, and Niels Skipper (chair), for their careful reading of the dissertation, and their constructive comments and suggestions. Some of the suggestions have been incorporated, while others remain for the future.

Tine L. Mundbjerg Eriksen Aarhus, November 2014

Contents

Preface	iii
Summary	ix
Dansk resumé (Danish summary)	xiii
Chapter 1 Bullying in Elementary School	1
1.1 Introduction	4
1.2 Background	5
1.3 Institutional Context and Data	7
1.4 Baseline OLS Results	14
1.5 Identifying Relationships between Bullying and GPA: Exploiting Troubled Children in the Classroom	15
1.6 Robustness Analyses and Heterogeneity	18
1.7 Conclusion	23
1.8 Bibliography	25
Appendices	29
Chapter 2 Rank in Classroom: Student Well-being and Behaviors	35
2.1 Introduction	38
2.2 Background and literature	39
2.3 Institutional set-up	41
2.4 Data	43
2.5 Empirical strategy	51
2.6 Results	52
2.7 Sensitivity analyses	55
2.8 Conclusion	63
2.9 Bibliography	63
Appendices	67

Chapter 3 Long-term Consequences of Workplace Bullying on Sickness Absence	77
3.1 Introduction	80
3.2 Workplace Bullying and Absenteeism	82
3.3 Who are the Targets of Bullying?	85
3.4 Data	87
3.5 Results	95
3.6 Robustness	98
3.7 Health and Coping Strategies	103
3.8 Conclusion	109
3.9 Bibliography	110
Appendices	115

Summary

Economists have long been interested in what determines academic performance in school. A long list of inputs has been considered ranging from individual characteristics such as cognitive and more recently non-cognitive abilities to teacher quality, classroom size, peer effects and school resources. Less focus has been given to the psychological work environment of children, and whether psychological well-being affects school performance. At the same time few papers investigate how inputs affect well-being in school. It is, however, not only the psychological work environment of children that may impact later performance. The psychological work environment of employees is also likely to impact productivity. The aim of this thesis has been to investigate the consequences of a specific aspect of the psychological work environment, bullying. While the first and third chapter investigate how bullying affects performance in school and absenteeism in the workplace, the second chapter investigates whether ordinal rank, a characteristic of every classroom, is predictive of well-being measured in terms of bullying and absenteeism, and behavior.

The first chapter of the thesis considers the consequences of exposure to bullying (co-authored with Helena Skyt Nielsen and Marianne Simonsen). 27% of the children in our sample are exposed to bullying and similar numbers are reported for Britain and the US (Brown and Taylor, 2008, and Centers for Disease Control and Prevention, 2010). Using regression based techniques, Brown and Taylor find that being exposed to bullying is associated with reduced educational attainment and wages. Bullying is thus a widespread problem and may be extremely costly to children, both in terms of psychological welfare and of later academic achievement. We investigate the link between bullying in elementary school and later academic performance on a sample of children born in a region of Denmark during 1990-1992. We exploit that this data include exceptionally rich survey- and register-based information on physical and mental health as well as socio-emotional and psychological well-being measured prior to exposure to bullying. Identification is based on an idea by Carrell and Hoekstra (2010) who find that domestic violence affects not only children in the family but also their peers in the classroom. We propose an instrumental design where we use the fact that criminal behavior of the parents of one child increases the likelihood that other children in the classroom are being bullied. Our results suggest that being bullied significantly lowers 9th grade GPA, and the effects tend to

increase with severity.

The second chapter considers another aspect of well-being and school performance (co-authored with Helena Skyt Nielsen and Marianne Simonsen). In recent years there has been an ever-increasing focus on evaluating pupils' performance in school. In Denmark the most recent development was the introduction of the National Tests in 2010. Although the purpose of the tests has not been to control student performance but instead provide the teachers with an evaluation tool to target the teaching to the individual level of the student, one can imagine that an increased focus on testing and performance will put emphasis on how well a student fares compared to a certain peer group. In this paper we investigate how a student's ordinal rank among beginning of 6th grade classmates affect behavior and school performance measured at the end of 6th grade. Faris and Felmlee (2011) show that student aggression and victimization depends on peer status as measured by network centrality calculated based on friendship network data. Murphy and Weinhardt (2014) find that being high ranked (ordinal) in primary school has a positive effect on academic performance in secondary school. They further show that the effect is likely to work through an increase in self-concept. We use a survey, containing, amongst other things, the Strength and Difficulties Questionnaire, gathered in connection with a randomized controlled trial among 6th graders in a sample of 231 schools in Denmark. The survey data is merged with rich register data containing information on key measures such as classrooms, absenteeism, test scores, parental background and student health. Students are ranked according to their 3rd grade math and 4th grade reading scores, as well as parental income measured before the child entered school. We argue that the ordinal rank of students is exogenous when conditioning on the rich set of child and parental characteristics, a third degree polynomial of previous test scores and parental income, and classroom fixed effects. Results indicate that being ranked at the bottom of the math test score distribution, is associated with more victimization but less truancy. The association is strong and insensitive to a number of robustness checks.

Bullying may however not be restricted to the schoolyard, but can also be a serious problem within workplaces. Prevalence rates of bullying range between 4-25% across countries (Nielsen et al., 2010) and in so far that bullying has a negative effect on individuals' health and well-being (see e.g. Niedhammer et al., 2006) this may have detrimental consequences on individual and firm productivity as well as being costly to society. The third chapter of this thesis investigates how bullying affects long-term sickness absence among employees in a sample of Danish workplaces (co-authored with Annie Høgh and Åse Marie Hansen). Ose (2005) finds that a poor work environment increases long-term sickness absence, and Fevang et al. (2014) find that firm incentives matter for the duration of long-term sickness absence indicating that management can influence the level of absenteeism within the workplace. Similarly bullying has been linked to e.g. poor leadership (Samnani and Singh, 2012). This suggests that bullying is

likely to affect absenteeism and productivity within organizations. The data used in this study is obtained from “The Bullying Cohort”-Study conducted by the National Research Centre for the Working Environment. It is merged with rich register data containing information on variables descriptive of both exposure to bullying and sickness absence. Examples include previous sickness absence, unemployment history, prescription drug usage and mental health. Identification relies on conditional independence, and we argue that once we condition on the rich set of controls as well as workplace fixed effects, being exposed to bullying is exogenous. We conduct a series of robustness checks including conditioning on work environment and personality characteristics. We find that gender does not significantly explain exposure to bullying once we condition on workplace fixed effects. Results indicate that being exposed to bullying is associated with negative immediate self-reported health for both men and women. However, we only find that being a target of bullying is related to higher and persistent increases in long-term sickness absence and adverse long-term health for female employees. This suggests that men and women have different coping strategies. We investigate plausible explanations and find that the differences cannot be explained by an increase in short-term sickness absence or by turnover.

The thesis concludes that bullying is likely to have widespread negative consequences for both children and adults. From an individual and a societal point of view, it may therefore be beneficial to reduce bullying in schools and workplaces. When investigating an inevitable feature of classroom compositions; ordinal rank, we find that this seems to matter for the likelihood of being exposed to bullying in school. Understanding peer compositions may therefore be an important step in the battle against school bullying.

Bibliography

- BROWN, S. AND K. TAYLOR (2008): “Bullying, education and earnings: evidence from the National Child Development Study.” *Economics of Education Review*, 27, 387–401.
- CARRELL, S. E. AND M. L. HOEKSTRA (2010): “Externalities in the classroom: How children exposed to domestic violence affect everyone’s kids.” *American Economic Journal: Applied Economics*, 2, 211–228.
- CENTERS FOR DISEASE CONTROL AND PREVENTION (2010): “Youth Risk Behavior Surveillance-United States, 2009.” *MMWR Surveill Summ*, 59.
- FARIS, R. AND D. FELMLEE (2011): “Status struggles network centrality and gender segregation in same-and cross-gender aggression.” *American Sociological Review*, 76, 48–73.
- FEVANG, E., S. MARKUSSEN, AND K. RØ ED (2014): “The Sick Pay Trap.” *Journal of Labor Economics*, 32, pp. 305–336.
- MURPHY, R. AND F. WEINHARDT (2014): “Top of the Class: The Importance of Rank Position.” *CESifo Working Paper No. 4815*.
- NIEDHAMMER, I., S. DAVID, AND S. DEGIOANNI (2006): “Association between workplace bullying and depressive symptoms in the French working population.” *Journal of Psychosomatic Research*, 61, 251 – 259.
- NIELSEN, M. B., S. B. MATTHIESEN, AND S. EINARSEN (2010): “The Impact of Methodological Moderators on Prevalence Rates of Workplace Bullying. A Meta-Analysis.” *Journal of Occupational and Organizational Psychology*, 83, 955 – 979.
- OSE, S. O. (2005): “Working conditions, compensation and absenteeism.” *Journal of health economics*, 24, 161–188.
- SAMNANI, A.-K. AND P. SINGH (2012): “20 years of workplace bullying research: a review of the antecedents and consequences of bullying in the workplace.” *Aggression and Violent Behavior*, 17, 581–589.

Dansk resumé (Danish summary)

Økonomer har længe været interesseret i at forstå, hvilke faktorer der kan forklare elevens performance i skolen. En lang række karakteristika rangerende fra kognitive – og på det seneste også ikke-kognitive færdigheder – til kvaliteten af lærere, klassestørrelser, peer-effekter og skoleressourcer er blevet undersøgt. Mindre fokus har været rettet mod børns psykiske arbejdsmiljø, og om psykologisk trivsel påvirker, hvordan de klarer sig i skolen. Yderligere er der kun få papirer, der undersøger, hvordan ovenstående faktorer påvirker trivsel i skolen.

Det psykiske arbejdsmiljø er ikke kun relevant i en skolekontekst. Det vil sandsynligvis også påvirke medarbejderes produktivitet i virksomheder. Imens forskere har haft en øget interesse i at forstå, hvad der kan forklarer medarbejderes produktivitet, har hidtidig forskning inden for økonomi lagt meget lidt vægt på det psykiske arbejdsmiljø. Formålet med denne afhandling har været at undersøge konsekvenserne af et bestemt aspekt af det psykiske arbejdsmiljø: mobning. Det første og tredje kapitel i afhandlingen undersøger, hvordan mobning påvirker performance i skoler og sygefravær på arbejdspladser. Det andet kapitel fokuserer på, om rangering efter ordenstal i skoleklasser kan prædiktere trivsel målt via mobning, fravær og adfærd.

Det første kapitel undersøger konsekvenserne af at være udsat for mobning i skolen (skrevet med Helena Skyt Nielsen og Marianne Simonsen). 27% af børnene i vores sample har været udsat for mobning. Sammenlignelige tal kan findes i Storbritannien og USA (Brown and Taylor, 2008, Centers for Disease Control and Prevention, 2010). Mobning er altså et udbredt problem, der kan have alvorlige konsekvenser for børns psykologiske trivsel og senere akademiske resultater. Vi undersøger sammenhængen mellem mobning i folkeskole og karakterer målt via niende klasses afgangseksamen i et udtræk af børn født i en region i Danmark i årene 1990 til 1992. Vi udnytter, at disse data indeholder usædvanligt mange spørgeskema- og registerbaserede informationer på fysisk og psykisk helbred såvel som socio-emotionel og psykologisk trivsel målt inden børnene blev udsat for mobning. Identifikationen er baseret på en idé af Carrell and Hoekstra (2010), hvis resultater viser, at vold i hjemmet ikke kun har en negativ effekt på barnet i familien, men også på dette barns klassekammerater. Vores idé er at bruge et instrument variabel design, hvor vi udnytter, at et barns forældres kriminelle baggrund øger sandsynligheden for, at de andre børn i barnets klasse udsættes for mobning. Vores resultater indikerer, at mobning signifikant reducerer niende klasses karaktergennemsnit, og denne effekt synes at stige med graden af

mobning.

Det andet papir undersøger et andet aspekt af trivsel og performance i skolen (skrevet med Helena Skyt Nielsen og Marianne Simonsen). I de seneste år har der været et øget fokus på at evaluere, hvordan børn klarer sig i skolen. I Danmark er det senest kommet til udtryk via indførslen af de National Tests i 2010. Selvom formålet med disse tests ikke er at kontrollere elevernes præstationer, men derimod give læreren et evalueringsredskab til at målrette undervisningen til den enkelte elev, er det svært at forestille sig, at et øget fokus på prøver og præstation ikke vil fremhæve, hvordan eleven klarer sig i relation til sine klassekammerater. Tidligere studier viser, at gruppestatus har betydning for børns trivsel og performance. Faris and Felmlee (2011) finder, at elevens niveau af aggression mod klassekammerater og udsættelse for mobning afhænger af deres status i gruppen målt ved netværkets centralisering baseret på netværksdata på baggrund af vennenomineringer. Murphy and Weinhardt (2014) viser, at ordinale højt rangerende børn i grundskolen i England (målt da de var 11 år) klarer sig bedre i deres Key Stage 3-eksamen som 14-årig. Yderligere viser de, at effekten sandsynligvis virker igennem en bedre selvopfattelse.

I denne artikel undersøger vi, om en elevs ordinale rang blandt klassekammerater i begyndelsen af sjette klasse påvirker adfærd, trivsel og performance i slutningen af sjette klasse. Vi bruger spørgeskemadata indhentet igennem et randomiseret kontrolleret forsøg blandt sjette klasses elever i 231 skoler i Danmark. Dette spørgeskema indeholder blandt andet det udbredte Strengths and Difficulties-spørgeskema (SDQ) som bruges til at få et mål for adfærd. Spørgeskemaet er koblet til registerdata, som indeholder nøgleinformationer såsom klasseidentifikationer, fravær, testresultater, forældrebaggrund og elevhelbred. Eleverne rangeres på baggrund af deres tredje klasses matematikkarakter, deres fjerde klasses karakter i læsning, samt forældres indkomst målt før de startede i skole. Vi argumenterer for, at elevens ordinale rang er eksogen, når vi betinger på vores store mængde af barn- og forældrekaraktistika, et tredjegrads polynomium i tidligere karakterer og forældreindkomst samt klasse fixed effects. Resultaterne antyder, at en høj rang i matematik reducerer sandsynligheden for at blive udsat for mobning men øger mængden af ulovligt fravær. Disse konklusioner er robuste overfor en række alternative specifikationer.

Mobning er dog ikke nødvendigvis et fænomen, der kun forekommer i skolegården. Det kan også være et seriøst problem på arbejdspladser. Prevalensrater rangerer mellem fire og 25% på tværs af lande (Nielsen et al., 2010) og såfremt, mobning har en negativ effekt på individets helbred og trivsel (se f.eks. Niedhammer et al., 2006) kan det have store konsekvenser for individets og virksomhedens produktivitet samt være dyrt for samfundet. Det tredje og sidste kapitel af afhandlingen undersøger, hvordan mobning påvirker langtidssygefravær blandt medarbejdere i et udtræk af danske arbejdssteder (skrevet med Annie Høgh og Åse Marie Hansen). Ose (2005) viser, at et dårligt arbejdsmiljø øger langtidssygefraværet, og Fevang et al. (2014) vi-

ser, at virksomhedens incitamenter har betydning for varigheden af langtidssygefravær, hvilket indikerer, at ledelsen kan påvirke niveauet af fravær på arbejdspladsen. Samtidig er mobning blevet relateret til for eksempel dårlig ledelse (Samnani and Singh, 2012). Dette antyder, at mobning på arbejdspladsen kan påvirke fravær og produktivitet i virksomheder. Vi bruger data fra ”Mobningskohorten” indsamlet af det Nationale Center for Arbejdsmiljø. Igen er data koblet til registerdata, der indeholder information om variabler, der kan forklare, om individet udsættes for mobning samt sygefravær. Som eksempler kan nævnes tidligere sygefravær, arbejdsløshedshistorik, brug af receptpligtig medicin og mentalt helbred. Identifikation beror på betinget uafhængighed, og vi argumenterer for, at når vi betinger på vores store mængde af kontrolvariabler samt arbejdssted fixed effects, så er det, at man udsættes for mobning eksogent. Vi udfører en række robusthedstjek, blandt andet ved at kontrollere for arbejdsmiljø og personlighedskarakteristika. Resultaterne viser, at køn ikke forklarer, om man udsættes for mobning, når vi kontrollerer for arbejdssted fixed effects. Samtidig indikerer resultaterne, at individer, der udsættes for mobning, selvrapporterer signifikant dårligere øjeblikkeligt helbred. Derimod angiver resultaterne også, at mobning kun har en øget og vedvarende effekt på langtidssygefravær og en negativ effekt på længerevarende helbred for kvindelige medarbejdere. Dette tyder på, at mænd og kvinder har forskellige måder at håndtere mobning på. Vi undersøger sandsynlige forklaringer og finder, at forskellene hverken forklares ved øget korttidssygefravær eller udskiftning af medarbejdere.

Denne afhandling konkluderer, at mobning kan have udbredte negative konsekvenser for både børn og voksne. Fra et individs og samfunds synspunkt kan det derfor være fordelagtigt at reducere mængden af mobning i skoler og på arbejdspladser. Samtidig viser resultaterne, at en uundgåelig egenskab ved klassekompositioner, ordinal rang, har betydning for sandsynligheden for, at man bliver udsat for mobning i skolen. En dybere forståelse af peer kompositioner er derfor et vigtigt skridt i kampen mod mobning i skolen.

Litteratur

- BROWN, S. AND K. TAYLOR (2008): “Bullying, education and earnings: evidence from the National Child Development Study.” *Economics of Education Review*, 27, 387–401.
- CARRELL, S. E. AND M. L. HOEKSTRA (2010): “Externalities in the classroom: How children exposed to domestic violence affect everyone’s kids.” *American Economic Journal: Applied Economics*, 2, 211–228.
- CENTERS FOR DISEASE CONTROL AND PREVENTION (2010): “Youth Risk Behavior Surveillance-United States, 2009.” *MMWR Surveill Summ*, 59.
- FARIS, R. AND D. FELMLEE (2011): “Status struggles network centrality and gender segregation in same-and cross-gender aggression.” *American Sociological Review*, 76, 48–73.
- FEVANG, E., S. MARKUSSEN, AND K. RØ ED (2014): “The Sick Pay Trap.” *Journal of Labor Economics*, 32, pp. 305–336.
- MURPHY, R. AND F. WEINHARDT (2014): “Top of the Class: The Importance of Rank Position.” *CESifo Working Paper No. 4815*.
- NIEDHAMMER, I., S. DAVID, AND S. DEGIOANNI (2006): “Association between workplace bullying and depressive symptoms in the French working population.” *Journal of Psychosomatic Research*, 61, 251 – 259.
- NIELSEN, M. B., S. B. MATTHIESEN, AND S. EINARSEN (2010): “The Impact of Methodological Moderators on Prevalence Rates of Workplace Bullying. A Meta-Analysis.” *Journal of Occupational and Organizational Psychology*, 83, 955 – 979.
- OSE, S. O. (2005): “Working conditions, compensation and absenteeism.” *Journal of health economics*, 24, 161–188.
- SAMNANI, A.-K. AND P. SINGH (2012): “20 years of workplace bullying research: a review of the antecedents and consequences of bullying in the workplace.” *Aggression and Violent Behavior*, 17, 581–589.

Chapter 1

Bullying in Elementary School

Bullying in Elementary School*

Tine L. Mundbjerg Eriksen

Helena Skyt Nielsen

teriksen@econ.au.dk

hnielsen@econ.au.dk,

Marianne Simonsen

msimonsen@econ.au.dk

Department of Economics and Business, Aarhus University

Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark

September 2013

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

*We thank the Danish Psychiatric Central Register for access to data, and Carsten Obel for valuable discussions and for kindly allowing us access to the Aarhus Birth Cohort. Financial support from the Strategic Research Council (Grant 09-070295) is gratefully acknowledged. We appreciate valuable comments from three anonymous referees, our editor David Figlio, Kristina Risom Jespersen, and Erik Lindqvist and from participants at the conferences: Human Capital Formation in Childhood and Adolescence (IFAU), ESPE 2011, the 2nd International Workshop on Applied Economics of Education as well as seminar participants at the University of Wisconsin and Aarhus University.

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.

1.1 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 and Prevention, 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 1.2 surveys the literature on bullying and its determinants and consequences. Section 1.3 discusses the institutional context and the available data while Section 1.4 presents baseline OLS regressions and Section 1.5 our main empirical strategy and associated results. Section 1.6 shows robustness analyses and investigates heterogeneity, while Section 1.7 concludes.

1.2 Background

As discussed above, bullying is the exposure to repeated negative actions over time on the part of one or more students (Olweus, 1993 and Olweus, 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.

1.2.1 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.

1.2.2 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.

1.3 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.

1.3.1 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 day. However, after-school care may also take place at a recreation centre detached from schools (7%).³ Thus

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

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

³The 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).

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.

1.3.2 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 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 1.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.

⁴99.8% of all pregnant women received this type of care. See Delvaux et al. (2001).

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

1.3.2.1 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 (1.1) 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 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.

⁶In 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).

⁷See 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.

⁸These issues turn out to be particularly severe when the subjective measure is used as an 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 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 parents' 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 by parents to be bullied and 12% are reported by teachers to be bullied). 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.

1.3.2.2 Characteristics of Children and Parents

Means of selected characteristics of children and their parents by bullying status are shown in Tables (1.1), (1.2) and (1.3). 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 10-12⁹ as does a higher than average number of early emergency ward visits that may be

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

indicative of hyperactive behavior; see Dalsgaard et al. (2014). 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 1.B presents a detailed description of the items used and the factor analyses including validity measures. From Table (1.1), 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 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 (1.2) and (1.3), 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.

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

¹⁰We 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 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 1.1 Means of selected child characteristics by bullying status^a

	# obs	Victims		Controls	
		Mean ^a	Std. Dev.	Mean	Std. Dev.
<i>Intensity of victimization:</i>					
Severe bullying (0/1)	1,151	0.198	0.399		
<i>Outcomes:</i>					
9 th grade GPA	4,255	-0.019	0.788	0.340	0.730
<i>Instrument:</i>					
Prop. of peers' parents convicted of crime	4,255	0.252	0.189	0.220	0.160
<i>Register-based control variables:</i>					
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	<i>0.573</i>	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
Nervous System Drugs (0/1)	4,255	0.012	0.110	0.011	0.103
Diag. 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	<i>0.030</i>	0.169	0.020	0.139
<i>Psychosocial factors:</i>					
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
<i>Other controls measured in 2001:</i>					
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	

Notes: 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 1.2 Means of Selected Characteristics of the Mother by Bullying Status^a

	# obs	Victims		Controls	
		Mean ^a	Std. Dev.	Mean	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
Nervous System Drugs (0/1)	4,255	0.247	0.431	0.216	0.411
Diag. 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

Notes: All variables are measured at age 6/before age 7. If at age 6 indicated with an *.

^aMeans 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.

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 (1.1) 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.

¹¹The 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.

Table 1.3 Means of Selected Characteristics of the Father by Bullying Status^a

	# obs	Victims		Controls	
		Mean ^a	Std. Dev.	Mean	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
Nervous System Drugs (0/1)	4,255	<i>0.165</i>	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

Notes: All variables are measured at age 6/before age 7. If at age 6 indicated with an *.

^aMeans 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

1.4 Baseline OLS Results

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

$$GPA_i = X_i' \gamma + \beta \cdot bul_i + \epsilon_i \quad (1.1)$$

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. 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 1.1) and parent specific variables (shown in Tables 1.2-1.3). 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 1.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 (1.4). 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 1.C we show the full set of estimates revealing that many of the variables that predicted victimization (Tables 1.2-1.3) 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 1.4 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%		

^aFor fixed effects we report standard errors clustered at the classroom level and the within R².

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

1.5 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:

$$bul_i = 1[Trouble^{-i}\alpha + X^i\delta + \theta_i > 0] \quad (1.2)$$

where θ_i is the error term. We model the relationship between GPA and victim status as detailed in equation (1.2) above. In practice we estimate the consequences of bullying using 2SLS.

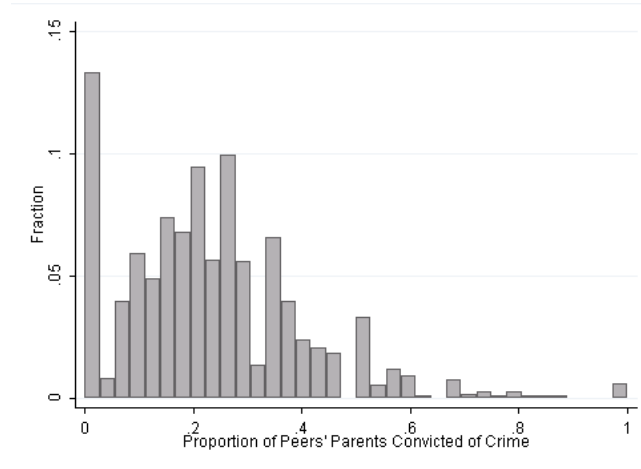
We first investigate the variation of the instrument. Table (1.1) shows that 25% of victimized children and 22% of non-victimized children have a classmate, whose parents has been convicted of crime. Figure (1.1) depicts the distribution of the instrument and illustrates that 13% of the children attend classes with no such classmates. Around 80% 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.

¹²Previous 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.

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

¹⁴A 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.

Figure 1.1 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 (1.5) 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 suggests 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.

¹⁵Note that class fixed effects are not identifiable.

Table 1.5 IV Results: Bullying and Standardized 9th Grade GPA

	2SLS		First stage: Peers'		
	Victimization Coef.	Std. Err.	Parents Convicted of Crime 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.

1.6 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.

1.6.1 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 (1.6) 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 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 1.6 Sibling Variation in Bullying Status

		Sibling 2:			# pairs
		Victim	Non-victim	All	
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 (1.7). 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 1.7 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 R². **Bold**: significant at the 5% level.
Italic: significant at the 10% level.

¹⁶Of these sibling pairs 12 are twin pairs.

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

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

1.6.2 Gender heterogeneity

In Table (1.1), we saw that bullying status does not vary significantly by gender. In Table (1.8), 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.

Table 1.8 OLS and IV Results: Bullying and Standardized 9th Grade GPA, Gender differences

	Class FE ^a			2SLS		First stage: Peers' Parents Convicted of Crime		
	Victimization Coef.	Std. Err.	R2	Victimization Coef.	Std. Err.	Coef.	Std. Err.	R ²
<i>Boys</i>								
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	<i>-1.856</i>	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%							
<i>Girls</i>								
No Controls	-0.253	0.0464	0.0235	-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 models we report standard errors clustered at the classroom level and the within R²

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

1.6.3 Intensity of bullying

In Table (1.1) 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 (1.9), we redefine the

¹⁸In 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.

¹⁹When we compare the importance of background characteristics across gender, 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.

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 1.9 OLS and IV Results: Bullying and Standardized 9th Grade GPA, Intensity of bullying

	Class FE ^a			2SLS		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 R²

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

1.6.4 Measurement of Bullying

In Table (1.10) 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 (1.10) 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 (1.10) as adding on to the results on the importance of intensity of victimization (see 1.9). 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.

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

Table 1.10 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 Crime		
	Coef.	Std. Err.	R ²	Coef.	Std. Err.	Coef.	Std. Err.	R ²
<i>Definition of victimization based on:</i>								
				<i>Teacher or Parents</i>				
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%							
				<i>Only Parents</i>				
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	<i>-1.781</i>	0.950	0.090	0.039	0.067
+ Psychosocial Factors	-0.118	0.029	0.292	<i>-1.949</i>	1.223	0.073	0.037	0.167
Full List of Controls	-0.121	0.029	0.296	<i>-1.784</i>	1.150	0.073	0.037	0.171
Sample size	4,241							
Proportion of victims	23%							
				<i>Only Teacher</i>				
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	<i>-2.002</i>	1.077	0.083	0.035	0.055
+ Psychosocial Factors	-0.191	0.042	0.296	<i>-1.977</i>	1.353	<i>0.065</i>	0.034	0.119
Full List of Controls	-0.192	0.042	0.303	<i>-1.686</i>	1.214	0.068	0.034	0.121
Sample size	3,316							
Proportion of victims	12%							
				<i>Teacher and Parents</i>				
Unadjusted	-0.395	0.063	0.018	<i>-10.494</i>	5.718	<i>0.047</i>	0.026	0.001
+ Register-based Controls	-0.259	0.053	0.269	<i>-6.162</i>	6.727	0.025	0.027	0.058
+ Psychosocial Factors	-0.156	0.054	0.292	<i>-15.762</i>	52.621	0.007	0.025	0.155
Full List of Controls	-0.161	0.054	0.298	<i>-13.528</i>	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 R²

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

conditions are the true reasons for weak educational performance rather than victimization as such.

1.7 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 in 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.

1.8 Bibliography

- ACHENBACH, T. (1993): “Manual for the Child Behavior Checklist/4-18.” *Burlington: University of Vermont, Department of Psychology*.
- AGNEW, R. (1992): “Foundation for a general strain theory of crime and delinquency.” *Criminology*, 30, 47–88.
- BERTRAND, M. AND S. MULLAINATHAN (2001): “Do people mean what they say? Implications for subjective survey data.” *American Economic Review*, 67–72.
- BROWN, S. AND K. TAYLOR (2008): “Bullying, education and earnings: evidence from the National Child Development Study.” *Economics of Education Review*, 27, 387–401.
- CARRELL, S. E. AND M. L. HOEKSTRA (2010): “Externalities in the classroom: How children exposed to domestic violence affect everyone’s kids.” *American Economic Journal: Applied Economics*, 2, 211–228.
- CENTERS FOR DISEASE CONTROL AND PREVENTION (2010): “Youth Risk Behavior Surveillance-United States, 2009.” *MMWR Surveill Summ*, 59.
- CURRIE, J. AND M. STABILE (2006): “Child mental health and human capital accumulation: the case of ADHD.” *Journal of health economics*, 25, 1094–1118.
- CURRIE, J. AND E. TEKIN (2012): “Understanding the cycle childhood maltreatment and future crime.” *Journal of Human Resources*, 47, 509–549.
- DALSGAARD, S., H. S. NIELSEN, AND M. SIMONSEN (2014): “Consequences of ADHD Medication Use for Children’s Outcomes.” *Journal of Health Economics*, 37, 137–151.
- DELVAUX, T., P. BUEKENS, I. GODIN, AND M. BOUTSEN (2001): “Barriers to prenatal care in Europe.” *American Journal of Preventive Medicine*, 21, 52–59.
- ESPELAGE, D. L., K. BOSWORTH, AND T. R. SIMON (2000): “Examining the social context of bullying behaviors in early adolescence.” *Journal of Counseling & Development*, 78, 326–333.
- FARRINGTON, D. P. AND M. M. TTOFI (2009): “School-based programs to reduce bullying and victimization.” *KiVa*, 6.
- FIGLIO, D. N. (2007): “Boys named Sue: Disruptive children and their peers.” *Education*, 2, 376–394.

- FLETCHER, J. AND B. WOLFE (2008): “Child mental health and human capital accumulation: the case of ADHD revisited.” *Journal of health economics*, 27, 794–800.
- HECKMAN, J. J. (2008): “Schools, skills, and synapses.” *Economic inquiry*, 46, 289–324.
- HEINESEN, E. (2010): “Estimating Class-size Effects using Within-school Variation in Subject-specific Classes.” *The Economic Journal*, 120, 737–760.
- HENNINGSEN, I. (2009): “Sammenhænge mellem mobning, barndomserfaringer og senere livskvalitet.” in *Mobning - sociale processer på afveje*, ed. by J. Kofoed and D.-M. Søndergaard, Hans Reitzel.
- MINISTRY OF EDUCATION (2009): “Private Schools in Denmark.” .
- MUNK-JØRGENSEN, P. AND P. B. MORTENSEN (1997): “The Danish Psychiatric Central Register.” *Danish medical bulletin*, 44, 82–84.
- NORDHAGEN, R., A. NIELSEN, H. STIGUM, AND L. KÖHLER (2005): “Parental reported bullying among nordic children: a population-based study.” *Child: care, health and development*, 31, 693–701.
- OLIVER, C. AND M. CANDAPPA (2003): *Tackling bullying: Listening to the views of children and young people.*, Thomas Coram Research Unit, Institute of Education.
- OLWEUS, D. (1993): *Bullying at school: What We Know and What We Can Do.*, Blackwell Publishing.
- (1997): “Bully/victim problems in school: Facts and intervention.” *European Journal of Psychology of Education*, 12, 495–510.
- OUELLET-MORIN, I., C. L. ODGERS, A. DANESE, L. BOWES, S. SHAKOOR, A. S. PAPPADOPOULOS, A. CASPI, T. E. MOFFITT, AND L. ARSENEAULT (2011): “Blunted cortisol responses to stress signal social and behavioral problems among maltreated/bullied 12-year-old children.” *Biological psychiatry*, 70, 1016–1023.
- PATCHIN, J. W. AND S. HINDUJA (2011): “Traditional and nontraditional bullying among youth: A test of general strain theory.” *Youth & Society*, 727–751.
- PERSSON, M. AND M. SVENSSON (2010): “Evidence of Class-size Effects on Bullying in Swedish Schools.” Tech. rep., Mimeo, Örebro University.
- RUTTER, M. (1967): “A children’s behaviour questionnaire for completion by teachers: preliminary findings.” *Journal of child Psychology and Psychiatry*, 8, 1–11.

- SAUFLER, C. AND C. GAGNE (2000): "Maine Project against Bullying. Final Report." Tech. rep., Maine State Dept. of Education, Augusta.
- STATISTICS DENMARK (2010): "Børnepasning mv. (In English: Child Care etc.)." *NYT*, 66.
- WADDELL, G. R. (2006): "Labor-Market Consequences of Poor Attitude and Low Self-Esteem in Youth." *Economic Inquiry*, 44, 69–97.
- WOLKE, D., S. WOODS, K. STANFORD, AND H. SCHULZ (2001): "Bullying and victimization of primary school children in England and Germany: Prevalence and school factors." *British Journal of Psychology*, 92, 673–696.

Appendices

1.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 9th 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.

1.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 1.11 presents the four factors with their respective loadings and Cronbach's α . 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 α 's 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.

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

Table 1.11 Questions, Loadings and Cronbach's α

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Cronbach's α
<i>Anxious (Factor 4)</i>					0.655
Seems sad and worried	.356	.100	.143	.627	
Confused and hazy	.438	.219	.252	.530	
Afraid of changes	.217	.103	-.008	.781	
<i>Absent minded (Factor 2)</i>					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	
<i>Empathic (Factor 3)</i>					0.687
Good at cooperating	.111	-.038	.807	.000	
Good at team plays	.189	.016	.792	-.017	
Good at understanding others emotions	-.014	.019	.721	.254	
<i>Hyperactive (Factor 1)</i>					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	

1.C Additional Results

Table C1 OLS Results Full Set of Estimates.

<i>Model: Class FE^b</i>	Register-based		+ Psychosocial		Full List	
	Controls		Factors		of Controls	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
<i>Child's Char.^a (Omit. Cat.):</i>						
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

Continued on next page -

Notes: Means are tested against the mean of the Control Group. (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Table C1 Continued -

<i>Model: Class FE^b</i>	Register-based		+ Psychosocial		Full List	
	Controls		Factors		of Controls	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
# 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
Nervous System Drugs	-0.047	0.104	-0.022	0.098	-0.036	0.097
Diagnosis of mental/behav. disorder	<i>-0.317</i>	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
<i>Mother's Char.^a (Omitted Cat.):</i>						
Age at birth	0.009	0.004	0.009	0.004	0.008	0.004
High School (Elem. School)	0.269	0.047	0.272	0.047	0.273	0.047
Long Further Educ. (Elem. School)	0.382	0.061	0.379	0.060	0.387	0.059
Medium Further Educ. (Elem. School)	0.233	0.047	0.229	0.047	0.230	0.047
Short Further Educ. (Elem. School)	0.258	0.065	0.248	0.064	0.248	0.064
Vocational Degree (Elem. School)	0.122	0.038	0.117	0.038	0.115	0.038
Enrolled in Educ.*	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 (Unempl.)*	0.230	0.082	0.245	0.082	0.238	0.082
Lower level employee (Unempl.)*	0.049	0.075	0.058	0.075	0.055	0.075
Medium Level Employee (Unempl.)*	0.211	0.079	0.222	0.078	0.217	0.078
Selfemployed (Unempl.)*	0.040	0.118	0.073	0.117	0.071	0.117
Top Management Level (Unempl.)*	0.160	0.128	0.175	0.127	0.157	0.126
Full time empl. (Part Time empl.)*	-0.039	0.062	-0.028	0.062	-0.029	0.063

Continued on next page -

Notes: Means are tested against the mean of the Control Group. (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Table C1 Continued -

<i>Model: Class FE^b</i>	Register-based		+ Psychosocial		Full List	
	Controls		Factors		of Controls	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
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
Nervous System Drugs	-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/beh. 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
<i>Father's Char.^a (Omitted Cat.):</i>						
Age at birth	0.003	0.003	0.003	0.003	0.003	0.003
High School (Elem. School)	0.241	0.054	0.227	0.054	0.229	0.054
Long Further Educ. (Elem. School)	0.294	0.049	0.280	0.049	0.286	0.050
Medium Further Educ. (Elem. School)	0.240	0.047	0.231	0.046	0.235	0.046
Short Further Educ. (Elem. School)	0.132	0.055	0.131	0.055	0.126	0.055
Vocational Degree (Elem. School)	0.045	0.038	0.045	0.038	0.048	0.038
Enrolled in Educ.*	0.024	0.063	0.026	0.059	0.022	0.060
Higher management Level (Unempl.)*	0.062	0.090	0.032	0.089	0.031	0.090
Lower level employee (Unempl.)*	-0.103	0.088	-0.134	0.087	-0.132	0.088
Medium Level Employee (Unempl.)*	-0.021	0.089	-0.059	0.089	-0.057	0.089
Selfemployed (Unempl.)*	-0.036	0.116	-0.084	0.114	-0.087	0.114
Top Management Level (Unempl.)*	0.028	0.103	-0.011	0.104	-0.009	0.105
Full Time Empl. (Part Time empl.)*	-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
Nervous System Drugs	-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

Continued on next page -

Notes: Means are tested against the mean of the Control Group. (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Table C1 Continued -

<i>Model: Class FE^b</i>	Register-based		+ Psychosocial		Full List	
	Controls		Factors		of Controls	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Diagnosis of mental/beh. disorder	-0.073	0.087	-0.036	0.083	-0.032	0.084
Violence conviction	<i>-0.157</i>	0.092	<i>-0.165</i>	0.091	<i>-0.167</i>	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	<i>-0.115</i>	0.060	<i>-0.115</i>	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 an *

^b For fixed effects models we report standard errors clustered at the classroom level and the within R2.

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

Chapter 2

Rank in Classroom: Student Well-being and Behaviors

Rank in the Classroom: Student Well-being and Behaviors*

Tine L. Mundbjerg Eriksen

teriksen@econ.au.dk

Helena Skyt Nielsen

hnielsen@econ.au.dk,

Marianne Simonsen

msimonsen@econ.au.dk

Department of Economics and Business, Aarhus University

Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark

August 2014

Abstract

This paper uses a combination of survey- and register-based Danish data to study the link between rank in the classroom and student well-being and behaviors. We consider rank in terms of students' test scores and parental background characteristics. We separate the role of ordinal rank from ability and family background by carefully and flexibly conditioning on these variables in levels, by allowing for classroom fixed effects, and via a rich conditioning set predictive of student well-being as well as school performance. We document that being ranked at the bottom of the math test score distribution, is associated with more victimization but less truancy. The association is strong and insensitive to a number of robustness checks.

JEL classification: I21; I31; J24.

Keywords: Peer Effects, Education, Performance, Relative position.

*Acknowledgements: Simonsen gratefully acknowledges financial support from CIRRAU. The usual disclaimers apply.

2.1 Introduction

This paper investigates the link between ordinal rank in the classroom and student well-being and associated behaviors. Social scientists have long been interested in effects of relative position in the pay distribution on the well-being of agents (e.g. Charness and Rabin, 2002 and Card et al., 2012). Recently it has been documented that not only the relative position in the pay distribution matters but also the ordinal rank position (e.g. Brown et al., 2008, Card et al., 2012 and Kuziemko et al., 2014).

The motivation for our focus on student well-being and behaviors is twofold: first, a recent paper by Faris and Felmlee (2011) has shown that student aggression and victimization depends on peer status as measured by network centrality that is calculated based on friendship network data. Interestingly, their analysis shows that aggression escalates with increases in peer status until social status peaks. Secondly, a number of recent papers indicate that being highly ranked in terms of grades during school has large and robust effects on future school performance and they suggest that part of the explanation should be found in psychological mechanisms which would exist even when the ordinal rank is not disclosed and the benefits of rank are intangible (see Tran and Zeckhauser, 2012, Azmat and Iriberry, 2010 and Murphy and Weinhardt, 2014).

Our approach differs from the previous literature in that we do not focus solely on the relationship between ordinal rank and performance or effort. Instead we consider the direct link between rank in the classroom and well-being and behaviors, thus shedding light on the potential mechanism through which ordinal rank impacts performance. As suggested by the existing literature, one relevant measure of social status is rank as defined by the distribution of test scores. But family background may just as well contribute to one's placement in the hierarchy. We specifically consider rank as determined by parental income.

Our analysis relies on a combination of survey- and register-based Danish data with key information about classrooms, test scores, family background, and student well-being and behaviors. We separate the role of ordinal rank from ability and family background by carefully and flexibly conditioning on these variables in levels, by allowing for classroom (and in some specifications school) fixed effects, and via a rich conditioning set predictive of student well-being as well as school performance. We begin by showing that ordinal rank in terms of previous test scores is indeed generally positively associated with later school performance also in our sample; both rank in terms of 3rd grade math scores and 4th grade reading scores significantly increase 6th grade reading performance while rank in terms of 4th grade reading scores increases 6th grade math performance. We then show that particularly rank in math is important for student well-being and behaviors: interestingly, a high rank in terms of math significantly decreases exposure to bullying yet at the same time increases the amount of unauthorized absence. Previous studies have found that math skills are strongly related to future career outcomes,

and this may be the reason why rank in math stands out.¹

The paper is structured as follows: Section 2.2 details the background for the analysis and links our work to the existing literature; Section 2.3 presents the institutional detail, and Section 2.4 discusses our data. Section 2.5 shows our empirical strategy, Section 2.6 presents the results, and Section 2.7 conducts sensitivity analyses while Section 2.8 concludes.

2.2 Background and literature

Social scientists have long been interested in effects of relative position in the wage distribution on the well-being of agents and recently it has been documented that not only the relative position in the pay distribution matters, but also the ordinal rank position. Brown et al. (2008), for example, study job satisfaction of 16,000 British employees. The authors find that job satisfaction and well-being is associated with not only the relative wages but also the wage rank in a relevant comparison group. Card et al. (2012) study the same issue in a field experiment involving employees at University of California. The authors informed a randomly chosen subset of employees about a new website listing the pay of University employees.² They find an asymmetric response to the information about peer salaries: workers with salaries below the median for their comparison group report lower job satisfaction and higher rate of job search, while those earning above the median report no higher satisfaction. The authors investigate whether the result is driven by relative wages or ordinal rank and find that the ordinal rank wins this race.

Having established a connection between ordinal rank and well-being, it is natural to ask to what extent rank-order incentives motivates workers. Delfgaauw et al. (2013) study sales competitions in Dutch department stores. They find large effects of tournament incentives on sales growth both with and without monetary rewards, which suggest that there is a high symbolic value of winning such a tournament. Bandiera et al. (2013) find a similar result. Eastern European workers at a British soft fruit farm were organized in teams. They were exposed to team-based incentives with increasing incentive power; piece rate, piece rate plus ranking and piece rate plus tournament scheme. The rank incentives induced a higher extent of sorting by ability relative to friendship, while also reducing productivity at the bottom of the distribution. The tournament incentives showed strong enough to improve productivity at the top of the ability distribution while leaving it unaffected in the middle and bottom of the distribution.

¹Several studies document that math ability and math training improve short-term and long-term educational and labor market performance (Paglin and Rufolo, 1990, Joensen and Nielsen, 2009, Falch et al., 2014 and Cortes et al., 2014).

²In early 2008 the newspaper *Sacramento Bee* established a website that made it possible to search for the salary of any state employee, including faculty and staff at the University of California (UC).

It has also been documented in a laboratory context that such mechanisms are relevant. A recent contribution is Kuziemko et al. (2014) who find evidence of what they denote as “last place aversion” Their laboratory experiments and survey evidence suggest that low-income individuals are less willing to redistribute in favor of individuals just beneath them in the pay distribution. This study not only confirms that rank affects own behavior, it also suggests that rank influences how an individual is perceived and treated by peers. This perspective on rank is relevant in our context of rank and well-being in a classroom.

In the context of education, there is a vast literature suggesting that classroom composition impacts performance and that the effects vary across the distribution; see the overview by Sacerdote (2011) and the recent contribution by Lavy et al. (2012).³

A growing literature studies the importance of ordinal rank for performance and behavior in school. As discussed above, Faris and Felmlee (2011) investigate peer aggression. They collect friendship network data and correlate this information with information about victims and aggressors in class.⁴ They find that aggression is closely related to status as defined by network centrality and that it escalates in peer status. Individuals at the very bottom and at the very top of the status hierarchy are found to be the least aggressive students.

Azmat and Iriberry (2010) exploit that a high school in Spain informed students about average classroom performance on their report cards in the academic year of 1990-91. Their findings show that giving students relative feedback increases performance across the entire ability distribution, and the effect disappears once the information is removed. As effects are positive and significant independent of the ability level of the student, they argue that this supports their hypothesis that students have preferences for competition in contrast to affecting self-perceived ability, and thereby affecting the choice of effort. Murphy and Weinhardt (2014) show that being high ranked in terms of grades during primary school has large and robust effects on performance in secondary school conditional on absolute ability. Their preferred hypothesis is that local ordinal rank determines academic self-concept in a particular subject. They suggest that students with a positive self-concept in a given subject have a lower perceived cost of effort and therefore they shift more work effort to this subject in order to improve total grades. The most direct evidence supporting this explanation comes from survey data, which documents that subject-specific self-concept at age 14 is strongly associated with primary school rank after controlling for primary school and current test scores.

In a similar line of thinking, Tran and Zeckhauser (2012) disentangle whether the impact of rank-based grading merely comes from the impact of social ranking or because people have an inherent preference for a high rank. They study Vietnamese students, and they find that even

³However, there is a growing discussion about how to identify such peer effects correctly, see Angrist (2014).

⁴Respondents were asked to nominate up to five schoolmates who “picked on or were mean to” them, and up to five peers whom they “picked on or were mean to.” They merged the two networks and calculated the number of students a respondent had harassed or attacked according to own or others’ survey response.

when ranking information cannot be reliably communicated, there is a psychological effect on performance. However, students who receive their rank publicly outperform those who receive their rank privately.

While Tran and Zeckhauser (2012), Azmat and Iriberry (2010) and Murphy and Weinhardt (2014) study the impact of ranking on school performance, Jalava et al. (2013) investigate if this is because rank incentives impact short-run effort in a particular test situation. Jalava et al. (2013) use field experiments to infer about the impact of grading schemes on student motivation and effort. They include more than 1000 Swedish sixth graders in a field experiment where they perform a math test and are treated with different subsequent grading schemes. They show that norm-referenced grading schemes motivate highly skilled students' performance in a test situation, while criterion-based grading schemes do not. In particular, ranking of students by singling out the top three performers has a large effect. However, there may be unintended negative effects of relative grading systems because the lower skilled students in some cases tend to reduce their effort, and thus inequality will inevitably increase.

A high rank may in itself work as a motivator among students because it impacts individual well-being in different ways. A high rank may influence the way classmates, friends or family view or treat the individual, which is a tangible benefit, or it may influence the individual's self-confidence and self-concept, which is a less tangible benefit. Tran and Zeckhauser (2012) point at such intangible benefits of rank which may influence performance psychologically even when rank is not publicly visible, while Murphy and Weinhardt (2014) point at academic self-concept. Either of those mechanisms is in line with the symbolic effects that Delfgaauw et al. (2013) and Bandiera et al. (2013) report.

We focus on such psychological channels broadly reflecting student well-being by investigating the relationship between rank in academic performance and a difficulties score (based on SDQ), bullying and absenteeism among sixth graders. In order to relate our results to those found previously in the literature we also investigate the link between rank and future performance as measured by math and reading scores obtained in the second half of 6th grade. Furthermore we also investigate the association between the mentioned outcomes and rank of parental income, which so far has not been considered in the literature.

2.3 Institutional set-up

For the period relevant to our study, education is compulsory from the calendar year the child turns 7 until the child has completed 9th grade. Before the 1st grade there is an optional preschool year, which has become compulsory by now. After the completion of 9th grade the pupil can either enrol in high school or in vocational school. The preschool class, 1st to 9th grade, as well as post-compulsory schooling are free of charge as long as they are taken on

public schools; private schools and boarding schools charge tuition fees. Each child is attached to a district school based on residence. Since 2005, parents have had the opportunity to choose freely between schools outside the school district, but enrolment has been conditional on the chosen school having a free slot. A report from the Ministry of Children and Education shows that 12% of parents invoked their right to free school choice in 2008 (Ministry of Children and Education, 2011). In our sample, the fraction of children who attended 6th grade together with who also attended 4th grade together was 85% suggesting a rather low turnover.

Children are allocated to classrooms upon school entry in grade 0. This allocation is likely to follow them throughout school, and will only change if they change school or classrooms become so small that a merger is called upon. Class size is by law suppose to be below 28 students.⁵ It is up to the headmaster at a given school to decide how the children are distributed in classrooms. Most schools however have allocation rules where they try to allocate equal amounts of pupils, equal amounts of boys and girls, equal amounts of pupils with non-Danish origin, etc. in each classroom.

In the preschool class, pupils are taught by a form teacher, but from 1st grade to 9th grade, pupils are taught by subject specific teachers. The same subject specific teacher follows the pupils through several grades.

Since 2010 it has been mandatory to participate in The Danish National Tests in different subjects throughout compulsory schooling. They were developed with the purpose of providing the teacher with information about the pupil's level of ability within specific areas, and on the basis of these results, the teacher should target his teaching to each individual student. The tests consist of 10 mandatory tests in grade 2 through 8. From grade 2 and every second year students are tested in reading. In grade 3 and 6 they are tested in math.⁶ In grade 7 they are tested in English and in grade 8 in geography, physics/chemistry and biology as well as reading.

The National Tests are IT-based, self-scoring and adaptive tests. The tests are performed on a computer where the student is continuously presented with questions which difficulty level is determined by the difficulty level of the previous question he or she answered. The test is terminated when a stopping rule is met. The test outcome is termed the estimated student ability (the "Theta Score"). By construction this roughly corresponds to the difficulty level of the final question. The test outcome is transformed into a percentile scale from 1 to 100, which is again split into a five-group scale. The teacher is informed of the percentile score, while the student and his or her parents are presented with the five-group scale.

Over the years we expect the pupils to get a fairly good notion of their own ability level

⁵Rules of exemption apply. For information on class size in our sample see table (2.3).

⁶In 2010 there was a two-week computer breakdown during the test period, which affected our sample of students, as they were to take the math test in 3rd grade in that year. In total 15.43% of the test results were missing in 2010. An investigation of descriptive characteristics suggests that the sample affected by the breakdown appeared to be random (Rambøll, 2013). We include a missing dummy for those observations with missing test scores in all our estimations.

compared to that of their classmates. The majority of pupils will experience roughly the same peer group throughout elementary school, and since the introduction of the National Tests students are informed about their position in the tested areas on a scale from one to five compared to a national comparison group. Thus although rank is not communicated explicitly we do expect the children to have some notion of their performance relative to their classmates. This argument is supported in Murphy and Weinhardt (2014) since they find effects across the entire rank distribution in a system where rank is not communicated explicitly.

2.4 Data

We make use of a combination of survey- and register-based data maintained by Statistics Denmark. The survey data were originally gathered in connection with a randomization-based evaluation (RCT) of a 6th grade classroom intervention (see Andersen et al. (2014)). 69 municipalities (out of 98) volunteered to participate in the study. 18 municipalities were selected to participate giving a total sample of 231 schools. Survey data were collected in two rounds; one from September 7 to October 17, 2012 and another from June 7 to July 5, 2013. We use the final survey for our investigation.

The individual level survey data is linked to register-based data, maintained by Statistics Denmark, via a personal identifier. The register-based data includes a range of standard socio-economic background characteristics informative about the children and their parents, information on classrooms attended in addition to children's National Test Scores in 2010 and 2011, and monthly information about school absence.

Our point of departure is the sample of children participating in the RCT. 10,654 pupils were registered to participate. Of those, 10,313 had a valid personal identifier. This is the sample of respondents that we base our rank measure on. For the final analyses we delete another 84 observations as they attended a special needs classroom and another 64 observations because of missing parental information. The final sample consists of 10,165 pupils, covering 532 classrooms at 224 schools. Out of these 8,456 pupils responded to the post intervention survey, equivalent to a response rate of 79%.

2.4.1 Outcome variables

We consider three different measures of student well-being: a) a total difficulties score (Goodman, 1997), b) self-reported exposure to bullying, and c) school absences. The total difficulties score is calculated based on the one-sided self-rated Strengths and Difficulties Questionnaire (SDQ) for 11-17 year olds. The SDQ was collected in the survey data and we make use of the information gathered in the last survey round. The difficulties measure varies between 0 and 40 with a higher number indicating more difficulties. Information about bullying status is

generated based on a specific question in the SDQ, which says: “Other children or young people pick on me or bully me”. Children can answer this question with “not true”, “somewhat true”, and “certainly true”. We label individuals as being exposed to bullying if they report “certainly true”. The information about school absence stem from monthly reports from schools. The data distinguishes between authorized absences, absences due to sickness, and unauthorized absences. Authorized absences are based on specific agreements between the head master and the parents. Unauthorized absences can both be because the child skips school, or because the head master didn’t authorize a requested leave and the parents chose to take the child out anyway. We consider the number of school absence days due to sickness and unauthorized absences in the 2012-2013 school year.⁷

In order to relate our results to the existing literature we also investigate how ordinal rank affects future school performance. In this analysis we exploit that the students in our sample took the obligatory national tests in reading and math in 6th grade. The children were tested from January 21st to April 30th 2013 and again from May 27th to June 28th 2013. The test scores are standardized within each subject-year to have mean zero and standard deviation one.

Table (2.1) shows descriptive statistics for our outcome variables. The average difficulties score is around 10, which corresponds to the values found in a community sample in Goodman et al. (1998). We also see that the maximum score obtained in this sample is 34 out of a possible 40. 3.6% of the sample is exposed to bullying. The number may not seem high, but recall that we only define children as subject to bullying if they answered, “certainly true”. We argue that we thereby capture the worst instances of bullying, realizing that some of the children in the reference group may also be affected by bullying, in which case we underestimate the effects. The pupils have on average 7 sick days and one day of unauthorized absence per school year. Below, we report means of the outcomes by rank.

Table 2.1 Descriptive Statistics of the Outcomes

	Mean	Std. Dev.	Min	Max	No. Obs
Difficulties Score	9.493	5.547	0	36	8,456
High Frequency Bullying	0.036	0.187	0	1	8,457
Sickness Absence 2013	6.848	7.980	0	147.253	9,809
Illegal Absence 2013	1.300	4.991	0	133.702	9,809
Reading Score 6 th Grade	0.074	0.956	-8.179	3.711	9,810
Math Score 6 th Grade	0.077	0.975	-8.838	4.677	9,801

⁷Each municipality is by law required to fulfill a given amount of lessons each school year at each grade level. It is however up to the municipality council to decide the number of school days in each municipality. In order to make the absence data comparable across schools we standardize each type of absence to 200 school days per year.

2.4.2 Rank in the classroom

Our rank measures are based on the composition of the 6th grade classroom. We consider child rank in terms of their parents' income (measured just prior to the child's school enrolment in grade 1.) and in terms of their own 3rd grade National Test Score in math and 4th grade National Test Score in reading. We use the exact "Theta Score" discussed above to define rank.

In order to have a comparable rank across different classroom sizes we normalize rank according to classroom size and thereby obtain a measure of rank R_{icx} between zero and one, where one is ranked top and zero ranked bottom.

$$R_{icx} = \frac{n_{icx} - 1}{N_{cx} - 1} \in [0, 1]. \quad (2.1)$$

Here n_{icx} is the ordinal rank position of individual i in classroom c according to characteristic $x = \{\text{Mother's Income, Father's Income, 3}^{rd} \text{ grade Math Score, 4}^{th} \text{ grade Reading Score}\}$. If individual i is ranked top in x in a class of 20 students, n_{icx} is equal to 20. N_{cx} is the number of children in the classroom.

The effect of rank is identified through the fact that two individuals with the same math score, reading score or parental income will be ranked differently in two different classrooms. Identification thus requires that there is variation in test scores between classrooms. The graph in figure (2.1) plots the density of 4th grade reading scores among the 10% highest ranked students and 10% lowest ranked students in classrooms. We see that there is a large variation in the test scores that are required to be ranked amongst the top or the bottom in different classrooms. For instance, pupils who score at the population mean (zero) would be among the top 10% test scores in some class rooms and among the bottom 10% test scores in other class rooms.⁸

Before we continue to our analysis we need to make an important decision related to timing, namely when, or at which grade level, to calculate rank. Because classrooms are not entirely fixed over time (85% of children who are classmates in 6th grade were also classmates in 4th grade), this may impact our results. This is, in other words, a question of how and when to define peer groups. One option is to consider previous rank (based on the peer group in 4th grade) and while this is predetermined to our outcome measures it is, on the other hand, further away in terms of time. Our main analysis will therefore consider rank in 6th grade but we will investigate rank in 4th grade as a robustness check. The correlation between the two alternative rank measures is 0.95 or higher for all measures. Around 10% of students move more than one decile in income ranks when we consider the 4th grade classroom instead of the 6th grade classroom, and 8.5% and 17% move more than one decile in reading and math

⁸A decomposition of the variance in mean classroom test scores show that 40% come from between school variation while 19% come from within school variation.

ranks, respectively. Further considerations about identification and the choice of peer group are discussed below.

Figure 2.1 Density Reading Scores: Top and Bottom 10% Ranked Students

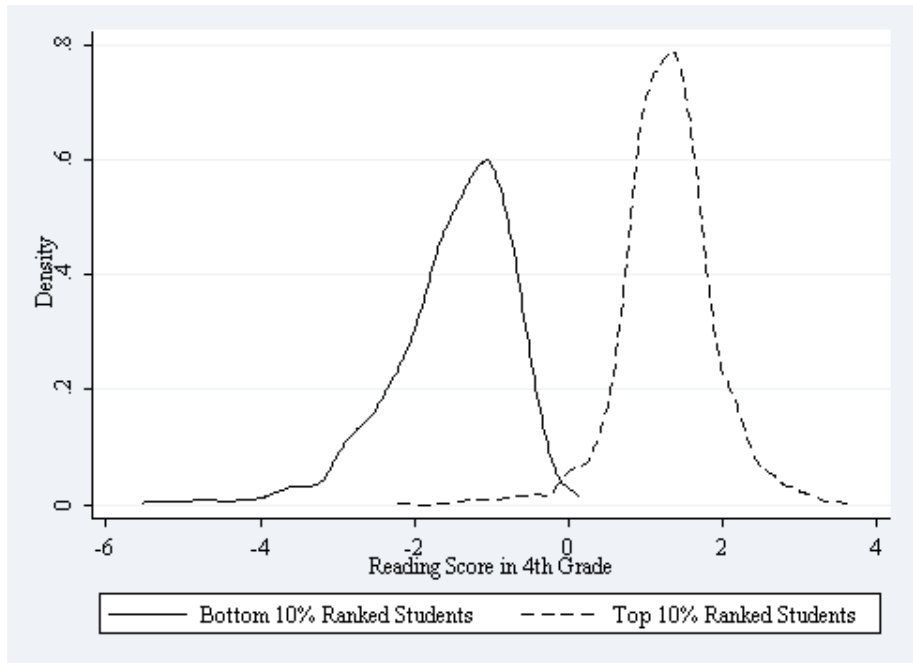


Table (2.2) reports outcome measures for children in the top or bottom decile of the rank distribution. As is visible from the table, top ranked students have a significantly lower difficulties score. They have more unauthorized absence, and perform better in reading and math irrespective of how we measure rank. Children ranked in the top decile are also less bullied than their classmates ranked in the bottom in all rank measures, except from math. Finally, top ranked students have significantly less absence, except when ranked according to the 4th grade reading score. These mean comparisons do not take any confounding factors into account, neither does the control for parental income and academic performance. The results may therefore merely reflect that the top ranked students perform better and have parents with higher income. In the following analyses we will therefore take possible confounders into account while carefully conditioning on previous academic performance.

2.4.3 Conditioning set

Our analyses control for a wide range of characteristics of both the child and his or her parents. These characteristics are likely to explain the child’s rank in the classroom as well as the outcomes of the child. In broad categories we include demographic variables of the child and parents, information pertaining the birth of the child, type of daycare, child and parental physical and mental health, criminal history of the parents, socio-economic status (SES) of

Table 2.2 Outcome Measures by Rank

	Difficulties		High Freq.		Sickness		Unauthorized		Reading		Math	
	Score		Bullying		Abs. 2013		Abs. 2013		6 th Grade		6 th Grade	
<i>Mother's Income</i>												
Top	8.749	***	0.028	***	5.993	***	0.569	***	0.354	***	0.383	***
	5.161		0.166		7.279		2.497		0.882		0.498	
Bottom	10.073		0.057		7.713		2.118		-0.134		-0.110	
	5.72		0.231		7.975		6.938		1.010		0.988	
No. of observations	1,700		1,700		2,004		2,004		2,001		1,989	
<i>Father's Income</i>												
Top	8.441	***	0.014	***	5.976	***	0.681	***	0.375	***	0.349	***
	5.151		0.117		7.630		2.729		0.863		0.955	
Bottom	10.002		0.038		7.309		2.080		-0.092		-0.974	
	5.648		0.192		7.842		6.946		0.986		0.971	
No. of observations	1,742		1,742		2,015		2,015		2,005		2,009	
<i>Reading Score</i>												
Top	8.290	***	0.031	***	6.785	**	0.735	***	1.262	***	0.898	***
	5.375		0.173		8.787		2.862		0.700		1.046	
Bottom	11.720		0.059		7.544		2.099		-1.037		-0.609	
	5.992		0.236		8.113		6.709		0.824		0.866	
No. of observations	1,707		1,708		2,005		2,005		2,002		2,002	
<i>Math Score</i>												
Top	8.171	***	0.038		6.015	***	0.849	***	0.854	***	1.046	***
	5.369		0.191		6.325		3.893		0.834		1.013	
Bottom	10.677		0.047		7.177		2.038		-0.434		-0.443	
	5.758		0.212		7.701		5.580		0.990		0.903	
No. of observations	2,101		2,102		2,467		2,467		2,441		2,437	

Notes: Means of the children in the top 10 percent are tested against the mean of children in the bottom 10 percent. ***: 1% level of significance. **: 5% level of significance *: 10% level of significance.

the parents, and previous test scores. All characteristics are measured in 2006 unless stated otherwise.

Tables (2.3-2.4) show summary statistics of selected child and parental characteristics and the following describes the conditioning set in detail.⁹All children in our sample were born between 1998 and 2001. As children are supposed to enroll in school in the calendar year they turn 6 we see that a few children started school one year early whereas others have either started school later, or have been subject to grade retention. However, 80% of the children were born in 2000, which is to be expected when entering 6th grade in 2012.

We condition on information pertaining the birth of children such as birth weight, premature birth etc. Studies have shown that e.g. low birth weight may be indicative of later cognitive problems (Black et al., 2007). 10% of the children were born prematurely but only 1% had complications at birth. Other studies have shown that type of daycare matter for later academic

⁹The full table is presented in Appendix 2.B.

Table 2.3 Means of Selected Characteristics of the Child

	Mean	Std. Dev.	Min	Max	No. Obs
Child's Characteristics					
Boy	0.507	0.500	0	1	10,165
Birth Year	2.000	0.417	1.998	2.001	10,165
Birthweight (Grams)	3.522	599	534	5.800	9,605
Premature Birth (Before week 37)	0.106	0.308	0	1	9,647
Complications at Birth	0.006	0.080	0	1	9,574
Ethnicity	0.182	0.386	0	1	10,165
# younger siblings	0.675	0.828	0	7	10,165
# older siblings	0.991	1.149	0	11	10,165
Divorce	0.222	0.415	0	1	9,992
Centerbased Care (Age 2)	0.382	0.486	0	1	9,420
Private Care (Age 2)	0.490	0.500	0	1	9,420
Diagnosis of Mental or Behavioral Disorder	0.008	0.091	0	1	10,165
Nervous System Drugs	0.103	0.304	0	1	10,165
# visits to the emergency ward	1.082	1.462	0	14	10,165
Reading Test Score 4th Grade	0.020	0.975	-5,519	3,631	9,796
Math Test Score 3rd Grade	0.005	0.995	-6,599	4,503	8,860
Rank Mother's Income	0.500	0.303	0	1	9,971
Rank Father's Income	0.501	0.304	0	1	9,736
Rank Danish Test Score	0.500	0.303	0	1	9,791
Rank Math Test Score	0.501	0.305	0	1	8,850
Classroom Size (6th Grade)	21.453	3.738	5	41	10,165
School Size (6th Grade)	56.292	21.700	5	107	10,165

Notes: All characteristics are measured in 2006 unless stated otherwise. The rank measures are based on their classmates in 6th grade but the characteristics are measured at age 6 except for math and reading, which is measured at grade 3 and grade 4.

performance and behavior (Datta Gupta and Simonsen, 2010 and Datta Gupta and Simonsen, 2014). 38% of the children in our sample went to centerbased care and 49% went to family daycare when they were 2 years of age.

In order to capture possible confounding variables such as health and mental health we condition on the number of visits to the emergency ward and three types of diagnoses: mental or behavioral diagnoses, diagnoses of respiratory diseases, and of cardio-vascular diseases. The diagnoses of mental or behavioral disorders include diagnoses such as depression and ADHD. As not all children receive a formal diagnosis, but do however receive treatment, we also include whether the child receives any nervous system drug (ATC code "N") or cardiovascular medicine (ATC code "C"). Furthermore, mental health problems such as depression and ADHD have been shown to have high heritability,¹⁰ thus in order to capture that a child may not have been diagnosed as early as at the age of 6, we also include information on whether the mother or father have been diagnosed with the aforementioned diagnoses before 2006. At the same time this information is also likely to influence parental investment in the child, providing another reason for including it as a control. Table (2.3) shows that only 1% of children are diagnosed

¹⁰See Levy et al. (1997) and McGuffin et al. (2003).

with a mental or behavioral disorder in 2006, reflecting our concern that it may be too early to have received a formal diagnosis. At the same time see from table (2.4) that 6% of mothers and fathers have been diagnosed with a mental or behavioral disorder in 2006. Again, since parents may not have received a formal diagnosis either, we also include their use of nervous system and cardiovascular medicine. 47% of mothers have received some type of prescription for nervous system drugs before 2007. This may seem like a lot, but half of these prescriptions are of analgesics (pain killers), while around 40% of the prescriptions are of either antidepressants or psycholeptics, which are used to treat anxiety. 38% of fathers had a prescription for nervous system drugs before 2007.

We further include information on parents' criminal record, more specifically we include whether the father or the mother had a prison sentence before 2006. Carrell and Hoekstra (2010) show that children from homes with domestic violence have higher levels of misbehavior and lower academic performance. 12% of the fathers in our sample have a prison sentence, whereas this only applies to 2% of the mothers.

In order to capture SES we include highest completed education, level of employment, degree of previous unemployment and income for both parents measured prior to 2007. From table (2.4) we see that mothers were on average two years younger than fathers when the child was born. 17(18)% of mothers (fathers) only obtained elementary school education, and most parents have a vocational education as their highest completed education. Mothers were slightly more unemployed in 2006 compared to fathers and had a lower income level.

Characteristics pertaining the classroom are also likely to affect both rank and the different outcomes. E.g. an exceptional good teacher may affect both child performance and behavior. Similarly classroom size may matter. We include either classroom or school fixed effects in our analyses. In the models of school fixed effects we also include classroom size. The average classroom size in our sample is 21 pupils, which is below the maximum class size rule of 28. The school cohort size is on average 56 students, suggesting that schools have an average of two 6th grade classrooms.

Finally, in order to distinguish performance/income from ordinal rank, we include a third-degree polynomial of the math score obtained in 3rd grade and the reading score obtained in 4th grade as well as the log income of the mother and father. The test scores are standardized to mean zero and standard deviation one across the entire cohort thus the students in this sample performed slightly above the average of the cohort in reading in 4th grade.

Table 2.4 Means of Selected Characteristics of the Child's Parents

	Mean	Std. Dev.	Min	Max	No. Obs
Mother's Characteristics					
Age at Birth of the Child	29.893	4.734	14	46	9,979
Smoked During Pregnancy	0.249	0.432	0	1	9,666
<i>Highest Completed Education</i>					
Elementary School	0.173	0.378	0	1	9,828
High School	0.083	0.275	0	1	9,828
Vocational Training	0.364	0.481	0	1	9,828
Short Further Education	0.053	0.224	0	1	9,828
Medium Further Education	0.233	0.423	0	1	9,828
Long Further Education	0.094	0.292	0	1	9,828
Lower Level Employee	0.296	0.457	0	1	9,972
Medium Level Employee	0.225	0.418	0	1	9,972
Higher Management Level	0.128	0.334	0	1	9,972
Top Management Level	0.010	0.099	0	1	9,972
Degree of Year Unemployed 2006	5.869	16.107	0	100	9,911
Log Income	9.934	4.687	0	13,80	9,972
Prison Sentence	0.017	0.128	0	1	9,975
Diagnosis of Mental or Behavioral Disorder	0.060	0.237	0	1	10,097
Nervous System Drugs	0.477	0.499	0	1	10,097
Father's Characteristics					
Age at Birth of the Child	32.678	5.717	15	71	9,897
<i>Highest Completed Education</i>					
Elementary School	0.181	0.385	0	1	9,553
High School	0.059	0.236	0	1	9,553
Vocational Training	0.427	0.495	0	1	9,553
Short Further Education	0.074	0.261	0	1	9,553
Medium Further Education	0.143	0.350	0	1	9,553
Long Further Education	0.117	0.321	0	1	9,553
Lower Level Employee	0.288	0.453	0	1	9,804
Medium Level Employee	0.139	0.346	0	1	9,804
Higher Management Level	0.156	0.363	0	1	9,804
Top Management Level	0.040	0.195	0	1	9,804
Degree of Year Unemployed 2006	3.233	12.035	0	100	9,975
Log Income	10.797	4.342	0	14,90	9,737
Prison Sentence	0.116	0.320	0	1	9,975
Diagnosis of Mental or Behavioral Disorder	0.063	0.243	0	1	9,975
Nervous System Drugs	0.381	0.486	0	1	9,975

Notes: All variables are measured in 2006 unless stated otherwise.

2.5 Empirical strategy

Our goal is to investigate the link between student outcomes, W , and ordinal rank position in terms of variables Y , $R(Y)$, in the classroom:

$$W_i = R(Y_i)\gamma + f(Y_i) + X\beta + u_i, \quad (2.2)$$

where $R(Y)$ is a rank vector defined above and γ is the associated parameters. $f(Y)$ is a flexible function of the variables Y that underlie the rank measures and X is the rich conditioning set mentioned above in addition to school or classroom fixed effects. Our analysis thus relies on the assumption that position variables are exogenous given $f(Y)$ and X . We present arguments below that this is a plausible assumption, but we do also exert caution in the interpretation of our results due to the unavailability of a truly exogenous variation in rank. In order to separate rank from relative position, we include as a control the distance between Y and $E(Y)$, the classroom mean of Y . In practice $f(Y)$ is a third degree polynomial in Y and the distance in Y from the classroom mean.

Threats to identification will occur if parents are able to select classrooms based on rank, and if this selection is related to the outcome conditional on X . We distinguish between two types of selection: selection at school entry and selection during the course of schooling. Parents tend to enter their children into the school in their own school district, although they have free school choice (see section 2.3). In the cases where parents invoke their free school choice or enroll their child in a private school, we find it highly unlikely that conditional on X , parents select certain classrooms based on rank. First of all, parents will need to have full information on their child's classmates' ability in both the current classroom and future classroom, and they will need some control over the allocation mechanism. Second, what is often seen is that parents with high socio-economic status sort their children into high performing schools, which would not be the optimal strategy if parents selected based on rank. The other type of selection might arise because of selection based on 3rd or 4th grade test results. For instance, some parents may decide to move their child to another school if he or she did the best (or the worse) in the test. It is not obvious how this type of selection would bias our results. If parents focused on rank, high ability students and low ability students should all sort into low ability classrooms. However, in the event of positive peer effects, both types of students would fare worse and the effect of rank would be ambiguous. Similarly, if parents focused on peer effects, both types of students should sort into higher ability classrooms, in which case, both types would perform better and the effect of rank would once again be ambiguous. If one considers two individuals with identical ability but with high vs. low achieving classmates, respectively, then the individual with the high achieving classmates would achieve higher grades but be lower ranked. The individual with the low achieving peers would be higher ranked but attain lower scores. Let's say, that based on their rank, the students select into another school. The

high ranked student selects into a better school with better peers. Even if the other student stays within the same classroom, the high ranked student will perform better due to better peers, whereas the low ranked student will perform worse or stay the same. As we condition on previous test scores, which in the case of the high ranked student were too low and in the case of the low ranked student too high, *ceteris paribus*, we tend to over-estimate the effect of rank if this type of selection is present.

It is thus obvious that in the event of turnover the final composition of the classroom matter. We therefore base our rank measures on current peers (measured at the beginning of 6th grade), but use early test scores/income in order to circumvent the reflection problem. Any peer effects up until 4th grade, that have a permanent effect on later outcomes, are taken into account by conditioning on early test scores/income. Similarly, by performing a classroom fixed effects analysis, we take into account any linear contemporaneous peer effects in grade 6.

Our outcomes are measured at the end of grade 6.¹¹ As the outcomes are measured so close to rank, one may be concerned that they have affected the peer composition leaving us with a problem of reverse causality. We therefore conduct a robustness check where rank is based on 4th grade peer composition. This rank will definitely be predetermined to the outcomes, but may cause other problems. As was highlighted above, it may cause concern due to selection in and out of classrooms, but as turnover is low between the two points in time, and because we conduct a fixed effects analysis based on 6th grade performance, this should be of minor concern. In addition, we have changed the composition of the peer group and are therefore possibly answering a different question.

2.6 Results

This section presents our results. We first discuss the findings from our main analysis and then show a range of sensitivity and robustness analyses.

2.6.1 Main analysis

The regression results for each of the outcomes are presented in table (2.5). For the school fixed effects estimations, standard errors are clustered on the school level, for the classroom fixed effects models standard errors are clustered on the classroom level. The full set of estimates is presented in Appendix 2.B.

Interestingly, rank in parental income and academic performance in reading and math does not appear to matter for the difficulties score. Thus, being the best or the worst performing student in the classroom does apparently not affect behavior.

¹¹Absence is accumulated over the entire school year, and the National Tests were taken in a window between January and April, and May and June 2013.

When we consider bullying, on the other hand, the child's rank in math has a significant impact on bullying: going from being ranked lowest to highest in math reduces the probability of being bullied by 5 percentage points, irrespective of whether we take school or classroom fixed effects into account. This implies that an advancement of 10 rank units in math in a class of 24 students lowers the propensity for victimization with 2 percentage points (compared to a mean of 3.6%). In comparison increasing the mothers income from 20,000 DKK (app. \$3600) to 40,000 DKK reduces the propensity to become bullied by 1 percentage point.

Rank position does not matter for sickness absence, but for unauthorized absence the school fixed effects model shows that a higher rank in mother's income is associated with a significant (at 10% significance level) increase. Again we see that the rank in math matters. Going from being ranked bottom to ranked top in math is associated with an increase in unauthorized absence of 1.3 days independently of model specification. This implies that an advancement of 10 rank units in math, in a class of 24 students, increases unauthorized absence by half a day (compared to a mean of 1.16). This result may seem surprising at first. But recall that unauthorized absence is defined as absence not approved by the head master. Therefore, a head master may reject a request by the family to go on vacation outside the school holidays. Still, the parents may choose to take the child out after all. If you as a parent know that your child performs very well in school, you may be more likely to disregard the decision of the head master and take you child out of school anyway. It may also suggest that the top ranked pupils get bored and therefore skip school. Unfortunately, the questionnaire does not address questions such as whether the student finds a subject too easy, too boring, etc.

When considering the reading score in 6th grade we see that a better rank in reading in 4th grade and math in 3rd grade, is associated with a higher reading score in 6th grade. In terms of size of the effects we see that for the school fixed effects estimates these corresponds to 15(18)% of a standard deviation in reading (math). Surprisingly, we do not find any relationship between rank and math score. The estimates of rank in reading on math are almost equivalent to the estimate of rank in reading, on the reading score in 6th grade. However, it is insignificant in the classroom fixed effects specification due to larger standard errors. Similarly, we see that the sign on the estimate on rank in math is negative albeit insignificant. This suggests that the higher ranked students in math in 3rd grade perform worse in math in 6th grade, compared to the low ranked pupils, had it been significant. Taken together with the results on unauthorized absence, the increase in unauthorized absence due to rank in math may have severe consequences to the pupils if this is what is reflected in the later math test score. Murphy and Weinhardt (2014) find effect sizes of 29% of a standard deviation when conditioning on ethnicity, gender, free school meals, and special needs education, as well as a third degree polynomial in test scores and "primary school-cohort-subject" fixed effects and "secondary school-cohort-subject" fixed effects. These estimates are slightly larger than our results on reading but recall that we have

Table 2.5 School and Classroom FE Results: 6th Grade Rank

	School FE		Classroom FE		School FE		Classroom FE					
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE				
	<i>Total Difficulties Score</i>				<i>High Frequency Bullying</i>							
Rank Mother Income	0.586	(0.433)	0.383	(0.492)	0.030	*	(0.017)	0.025	(0.017)			
Mother Income	-0.743	(0.690)	-0.796	(0.714)	-0.057	***	(0.017)	-0.058	***	(0.021)		
Mother Income - Sq	0.147	(0.127)	0.131	(0.127)	0.011	***	(0.003)	0.010	***	(0.003)		
Mother Income - Cu	-0.007	(0.006)	-0.006	(0.006)	-0.001	***	(0.000)	-0.000	***	(0.000)		
Rank Father Income	-0.172	(0.450)	-0.244	(0.464)	-0.015		(0.016)	-0.009		(0.015)		
Father Income	-0.827	(0.610)	-1.122	*	(0.629)	-0.015	(0.023)	-0.029		(0.021)		
Father Income - Sq	0.119	(0.108)	0.130	(0.113)	0.003		(0.004)	0.004		(0.004)		
Father Income - Cu	-0.005	(0.005)	-0.005	(0.005)	-0.000		(0.000)	-0.000		(0.000)		
Rank Danish Sc. 4 th G.	-0.068	(0.695)	0.015	(0.707)	0.014		(0.026)	0.018		(0.025)		
Danish Sc. 4 th G.	-0.910	**	(0.362)	-0.245	(1.225)	-0.008	(0.013)	0.055		(0.059)		
Danish Sc. 4 th G. - Sq	0.239	***	(0.047)	0.240	***	(0.047)	0.004	***	(0.002)	0.004	**	(0.002)
Danish Sc. 4 th G. - Cu	0.068	***	(0.022)	0.071	***	(0.023)	0.002	***	(0.001)	0.001	***	(0.001)
Rank Math Sc. 3 rd G.	-0.432		(0.605)	-0.437	(0.648)	-0.049	**	(0.022)	-0.049	**	(0.023)	
Math Sc. 3 rd G.	-0.376		(0.281)	-0.250	(0.557)	-0.004		(0.011)	-0.015		(0.027)	
Math Sc. 3 rd G. - Sq	0.101	***	(0.036)	0.091	**	(0.038)	0.003	*	(0.001)	0.003	*	(0.001)
Math Sc. 3 rd G. - Cu	0.026	*	(0.015)	0.023	(0.016)	0.000		(0.000)	0.000		(0.000)	
No. Observations	8,448		8,448		8,449		8,449					
Adj. R ²	0.086		0.085		0.011		0.012					
No. Groups	225		466		225		466					
	<i>Sickness Absence 2013</i>				<i>Unauthorized Absence 2013</i>							
Rank Mother Income	0.002	(0.559)	-0.035	(0.592)	0.688	*	(0.384)	0.523		(0.393)		
Mother Income	-0.671	(0.917)	-0.796	(0.944)	-1.251	**	(0.519)	-1.338	**	(0.571)		
Mother Income - Sq	0.175	(0.166)	0.135	(0.168)	0.239	**	(0.102)	0.248	**	(0.101)		
Mother Income - Cu	0.248	**	(0.123)	0.209	*	(0.117)	0.058	(0.082)	0.070	(0.075)		
Rank Father Income	0.313	(0.606)	0.056	(0.568)	0.038		(0.287)	0.045		(0.308)		
Father Income	-1.793	***	(0.682)	-1.320	**	(0.659)	-0.357	(0.461)	-0.375	(0.464)		
Father Income - Sq	-0.009	(0.008)	-0.008	(0.008)	-0.012	**	(0.005)	-0.013	**	(0.005)		
Father Income - Cu	-0.012	**	(0.006)	-0.010	*	(0.005)	-0.003	(0.004)	-0.003	(0.003)		
Rank Danish Sc. 4 th G.	1.209	(0.841)	1.278	(0.846)	-0.685		(0.592)	-0.681		(0.619)		
Danish Sc. 4 th G.	-0.207	(0.656)	-0.299	(2.003)	0.626		(0.451)	3.375	***	(1.135)		
Danish Sc. 4 th G. - Sq	0.197	**	(0.078)	0.214	***	(0.068)	0.109	***	(0.040)	0.105	***	(0.038)
Danish Sc. 4 th G. - Cu	0.061	**	(0.028)	0.069	***	(0.025)	-0.018	(0.030)	-0.017	(0.029)		
Rank Math Sc. 3 rd G.	0.839	(0.950)	0.779	(0.889)	1.346	**	(0.626)	1.304	**	(0.566)		
Math Sc. 3 rd G.	-0.089	(0.533)	-1.146	(0.845)	-0.846	**	(0.343)	-0.383		(0.543)		
Math Sc. 3 rd G. - Sq	-0.053	(0.052)	-0.067	(0.048)	0.035		(0.029)	0.035		(0.031)		
Math Sc. 3 rd G. - Cu	0.026	(0.017)	0.023	(0.015)	0.006		(0.015)	0.005		(0.013)		
No. Observations	9,789		9,789		9,789		9,789					
Adj. R ²	0.052		0.056		0.053		0.053					
No. Groups	228		483		228		483					
	<i>Reading Score 6th Grade</i>				<i>Math Score 6th Grade</i>							
Rank Mother Income	-0.011	(0.058)	-0.019	(0.054)	-0.041		(0.064)	-0.020		(0.063)		
Mother Income	0.102	(0.069)	0.108	(0.076)	0.195	**	(0.088)	0.148		(0.093)		
Mother Income - Sq	-0.016	(0.013)	-0.016	(0.013)	-0.037	**	(0.016)	-0.030	*	(0.016)		
Mother Income - Cu	-0.001	(0.010)	-0.005	(0.010)	-0.023	**	(0.011)	-0.024	**	(0.012)		
Rank Father Income	0.002	(0.046)	-0.005	(0.045)	-0.067		(0.054)	-0.057		(0.055)		
Father Income	0.015	(0.057)	0.018	(0.054)	0.114	*	(0.062)	0.141	**	(0.069)		
Father Income - Sq	0.001	(0.001)	0.001	(0.001)	0.002	**	(0.001)	0.001	*	(0.001)		
Father Income - Cu	0.000	(0.000)	0.000	(0.000)	0.001	**	(0.001)	0.001	**	(0.001)		
Rank Danish Sc. 4 th G.	0.149	**	(0.067)	0.163	**	(0.068)	0.146	*	(0.087)	0.148	(0.091)	
Danish Sc. 4 th G.	0.592	***	(0.048)	0.278	(0.185)	0.245	***	(0.060)	0.317	**	(0.125)	
Danish Sc. 4 th G. - Sq	0.016	*	(0.009)	0.016	**	(0.008)	0.024	***	(0.008)	0.022	***	(0.008)
Danish Sc. 4 th G. - Cu	-0.007	*	(0.004)	-0.007	*	(0.003)	0.007	*	(0.004)	0.006	(0.004)	
Rank Math Sc. 3 rd G.	0.182	**	(0.070)	0.180	***	(0.069)	-0.119	(0.080)	-0.130	(0.085)		
Math Sc. 3 rd G.	0.100	**	(0.042)	0.148	**	(0.070)	0.276	***	(0.056)	0.317	***	(0.089)
Math Sc. 3 rd G. - Sq	-0.007	(0.005)	-0.007	(0.005)	0.028	***	(0.008)	0.027	***	(0.007)		
Math Sc. 3 rd G. - Cu	-0.001	(0.002)	-0.001	(0.002)	-0.005	**	(0.002)	-0.006	**	(0.002)		
No. Observations	9,792		9,792		9,784		9,784					
Adj. R ²	0.623		0.631		0.419		0.428					
No. Groups	231		491		231		491					

Notes: Standard errors are in parentheses. All standard errors are clustered at the school (classroom) level for the school (classroom) fixed effects estimates. ***: 1% level of significance. **: 5% level of significance. *: 10% level of significance.

a much larger conditioning set. Similarly Murphy and Weinhardt do not distinguish between subjects so we cannot compare the effects directly. However, the children in our sample are slightly younger, and rank may have an even bigger impact as the age of the children increase and the child gets closer to high stake exams. Unfortunately, we do not have the opportunity to investigate the persistence of the effect of rank on reading until our sample take the 8th grade reading test in 2015 or on core subjects until they take their 9th grade exit exam in 2016.

2.7 Sensitivity analyses

This section tests the sensitivity of our conclusions from the main analysis above. We first discuss non-linearities in the effects of rank and then turn to analyses that vary the timing of the peer group. We then vary the timing of the measurement of a key rank variable (parental income) and end with heterogeneity analyses.

2.7.1 Non-linearities

So far we have assumed that the effect of rank is linear across the distribution. In order to test for non-linear effects of rank we divide rank into deciles and include a dummy for each decile. The results can be found in table (2.13) Appendix 2.C. They show that for bullying only the 7th decile in math is significant. However, across the distribution we see that there is a tendency that the estimates become more negative as the rank increases, indicating a linear relationship. For unauthorized absence we see that the deciles are more or less significantly larger compared to the first decile, and the estimate increases as rank increases. The same holds for rank in reading and math when considering 6th grade reading scores, all though only the top deciles are significant. We also observe significant estimates for the 3rd, 4th and 8th decile of rank in father's income. However, the pattern across the distribution is not consistent, which reflects why it turns out insignificant in the main results. For 6th grade math we see quite consistently that all children ranked above the first decile perform worse than individuals in the first decile. The estimates are slightly increasing in rank up until the 7th decile, after which they are larger but not necessarily increasing. The higher the child is ranked in math the worse he or she performs. These estimates support the explanation that high-ranked students in math in 3rd grade actually get punished due to more unauthorized absence, which results in worse performance in 6th grade. Over all the effects of rank appear to be linear and by and large significant across the distribution suggesting that the effect of rank exists throughout.

2.7.2 Peer group choice

As mentioned above selection in and out of classrooms based on rank will bias our results. We test the sensitivity of our results by defining rank based on 4th grade classmates instead of 6th grade classmates. Hereby we minimize issues regarding selection on rank, which may be related to our outcomes that we measure in 6th grade. Meanwhile, as mentioned previously, this is also a different way of interpreting rank, as it is now not the current composition of peers that matter and we therefore expect that rank affects investment decisions, future confidence, etc. The results are reported in table (2.6).

Table 2.6 School and Classroom FE Results: 4th Grade Rank

Rank	Difficulties Score	Bullying	Sickness Abs. 2013	Unauthorized Abs. 2013	Reading 6 th Grade	Math 6 th Grade
Mother's Income	0.354 (0.449)	0.012 (0.018)	-0.059 (0.649)	0.091 (0.355)	-0.040 (0.056)	0.049 (0.064)
Father's Income	-0.234 (0.431)	-0.010 (0.016)	-0.269 (0.556)	-0.584 (0.300)	0.009 (0.047)	-0.027 (0.054)
Danish Sc. 4 th G.	0.214 (0.661)	0.023 (0.029)	1.279 (0.776)	-0.332 (0.652)	0.120 (0.065)	0.058 (0.089)
Math Sc. 3 rd G.	-0.324 (0.602)	-0.030 (0.024)	1.227 (0.959)	1.128 (0.616)	0.136 (0.069)	-0.150 (0.083)
School FE	x	x	x	x	x	x
Classroom FE	x	x	x	x	x	x
No. obs	8,396	8,397	9,727	9,727	9,726	9,717
Adj. R-squared	0.086	0.012	0.054	0.058	0.634	0.432
No. Groups	225	225	483	483	231	491

Notes: Standard errors are in parentheses. All standard errors are clustered at the school (classroom) level for the school (classroom) fixed effects estimates. ***, 1% level of significance. **, 5% level of significance. *, 10% level of significance.

When using 4th grade classmates to construct rank we again do not observe any effects on the difficulties score and we also don't see any effect on bullying anymore. The estimates are still negative but now slightly smaller and thus insignificant. These results could suggest that it is not ones former peer composition that matters, whether one is subject to bullying but instead the current peer group that one is exposed to. When considering sickness absence we now observe significant affects for rank in reading, in that the higher your rank in reading, the more sickness absence. The estimates are larger in the school fixed effects specification but of the same magnitude in the classroom fixed effects estimation compared to previous results, but standard errors drop a bit given the significant result at a 10% level. For unauthorized absence we see that the higher ranked in paternal income, the less less unauthorized absent the child is. As before we see that being higher ranked in math increases unauthorized absence, although the significance level of the estimates drop to 10%. For reading the size of the estimates drop a bit, changing the significance level slightly, but by and large we retrieve the relationships from the previous results. For math we now see a significant negative relationship of being high ranked in math in 3rd grade on the 6th grade math score. Again this supports the theory that high-ranked students in math skip school more which then results in worse performance in math later in life.

As done immediately above, we also test the non-linearity of our rank measures. The results are reported in table (2.14) in Appendix 2.C. For bullying we now observe significant results for the 6th to 9th decile, and throughout the distribution the estimates are decreasing in rank. Quite a few estimates turn out significant in rank in mother's and father's income on sickness absence. However, the estimates jump around quite a bit and it is not obvious how the non-linear relationship looks. When considering rank in reading we see that the students ranked in the top half of the distribution have more sickness absence than the individuals ranked in the bottom. The results on unauthorized absence we find that a few of the bottom deciles are significantly larger than the very first decile but in general the estimates appear to be the same across the distribution. For rank in math we see the previous pattern that the higher your rank in math the more unauthorized absence compared to being in the bottom decile of the classroom. With respect to the reading score in 6th grade we find a slight indication that the reading score is increasing in rank in math, however most of the estimates are insignificant. Once again we find persistent results in that the higher the child was ranked according to math in 3rd grade the lower the math score in 6th grade. In general the results are quite robust to the composition of peers, on which the rank measures are based on in this sample. This is likely to do with the fact that very little selection is present in public schools in Denmark in that on average 85% of the classrooms in 6th grade are preserved in 4th grade. This means that on average 18 students in a classroom of 21 students in 6th grade also attended the same classroom in 4th grade. The change in rank is therefore not likely to be severe.

2.7.3 Time of measurement of parental income

So far we have used parental income measured at the time of school entry in order to avoid issues with sorting based on rank in parental income. It is not obvious, however, that the children in a classroom know how to rank classmates according to income that was only observed in 2006. Therefore, as a sensitivity check we use income measured in 2010 when defining rank. The corresponding results are reported in table (2.7). The results obtained in the main analyses are practically unchanged. Only the coefficient on Mother's income in classroom fixed effects analysis is changed from being positive significant at a 10% level, to now being negative significant at a 10% level. This means that the higher the child's rank in income, the less unauthorized absence we observe. In addition to the previous results we now find that mother's income has a significant effect on bullying, in that the higher one is ranked in maternal income the more likely one is to be bullied. This may seem surprising at first, but recall that any effect of high income has been removed by the third degree polynomial in income. This is only the effect of rank. And according to the definition of bullying minorities are more likely to be bullied. Thus, if you stand out in your classroom, which may be because you are the wealthiest, then you may be more likely to be bullied. Rank in mother's income is now also significant and negative at a 10% level for the school fixed effects specification. However, the effect disappears when taking classroom fixed effects into account. One may wonder why we only see changes in the results for mother's income. This is probably because mothers' income is more likely to change over this period compared to the fathers': A mother's attachment to the workforce is more affected by her children. When they are young she is probably more likely to work part time, if at all. We do, however, only see a small change in average log income for the mother. In 2010 the average was 10.06 while it was 9.93 in 2006.¹² Instead this points to the fact that it is current information rather than previous information that matters for how the child is treated in the classroom.

¹²These are inflation adjusted numbers.

Table 2.7 School and Classroom FE Results: 6th Grade Rank (Parental Income Measured in 2010)

Rank	Difficulties Score	Bullying	Sickness Abs. 2013	Unauthorized Abs. 2013	Reading 6 th Grade	Math 6 th Grade										
Mother's Income	0.117 (0.468)	-0.178 (0.473)	0.040 (0.016)	**	0.034 (0.017)	-0.982 (0.595)	-0.935 (0.635)	-0.398 (0.377)	-0.623 (0.365)	*	-0.101 (0.058)	*	-0.086 (0.052)	0.017 (0.064)	0.018 (0.062)	
Father's Income	0.042 (0.451)	0.000 (0.468)	0.011 (0.016)		0.012 (0.017)	0.423 (0.692)	0.202 (0.668)	0.428 (0.352)	0.362 (0.355)		0.053 (0.045)		0.059 (0.044)	0.059 (0.054)	0.084 (0.055)	
Danish Sc. 4 th G.	-0.069 (0.701)	0.032 (0.711)	0.012 (0.026)		0.015 (0.025)	1.312 (0.836)	1.251 (0.847)	-0.774 (0.625)	-0.729 (0.623)	**	0.155 (0.067)	**	0.165 (0.067)	0.145 (0.087)	* (0.091)	
Math Sc. 3 rd G.	-0.382 (0.606)	-0.392 (0.646)	-0.046 (0.022)	**	-0.049 (0.023)	1.072 (0.960)	0.906 (0.898)	1.331 (0.605)	1.356 (0.574)	**	0.199 (0.070)	***	0.187 (0.069)	-0.119 (0.080)	-0.128 (0.086)	
School FE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Classroom FE																
No. obs	8,452	8,452	8,453		8,453	9,790	9,790	9,790	9,790	9,790	9,792	9,792	9,792	9,784	9,784	
Adj. R-squared	0.086	0.085	0.012		0.012	0.056	0.060	0.052	0.053	0.053	0.624	0.624	0.631	0.419	0.428	
No. Groups	225	470	248		508	229	484	229	484	484	231	231	491	231	491	

Notes: Standard errors are in parentheses. All standard errors are clustered at the school (classroom) level for the school (classroom) fixed effects estimates. ***: 1% level of significance. **: 5% level of significance. *: 10% level of significance.

2.7.4 Heterogeneity Analysis

In order to investigate the heterogeneity of the results we split the sample by gender. The results are presented in table (2.8). Again we observe no effect on the difficulties score. However a close inspection of the size of the estimates could indicate that boys ranked high in math have a lower difficulties score, but the estimates are insignificant due to the large standard error, possibly due to the small sample size. The results for bullying are only borderline significant for girls in the school fixed effects specification, although the estimate barely changes between the two specifications. For boys both estimates for rank in math on bullying are the same, and significantly negative at a 10% level. Being highly ranked in math significantly decreases the probability of being bullied. The results on unauthorized absence seemed to be driven by the boys. Here a student going from being ranked bottom to ranked top have 2 days more of unauthorized absence per school year. This is equal to 39% of a standard deviation. For girls we see that those ranked high in reading in 4th grade perform better in reading in 6th grade. This is the case for boys ranked in math. Similarly girls ranked high in reading perform better in math in 6th grade. It thus appears that being high ranked in reading in 4th grade is important for later academic performance for girls, while math has positive influence on reading scores and bullying, and negative influence on unauthorized absence.¹³

¹³We have also performed these analyses using rank within one's own gender. These results are very volatile because the peer groups become smaller.

Table 2.8 School and Classroom FE Results By Gender: 6th Grade Rank

Rank	Difficulties Score	Bullying	Sickness Abs. 2013	Unauthorized Abs. 2013	Reading 6 th Grade	Math 6 th Grade
<i>Girls</i>						
Mother's Income	0.454 (0.708)	0.021 (0.025)	0.988 (0.887)	0.824 (0.917)	0.708 (0.691)	0.035 (0.092)
Father's Log	-0.287 (0.668)	-0.018 (0.025)	0.333 (0.885)	0.048 (0.915)	-0.258 (0.419)	-0.012 (0.071)
Reading Sc. 4 th G.	0.014 (1.014)	0.005 (0.039)	1.214 (1.276)	-0.317 (0.896)	0.174 (0.095)	0.325 (0.115)
Math Score 3 rd G.	-0.018 (0.870)	0.116 (0.032)	-0.054 (1.530)	0.657 (0.921)	0.105 (0.091)	-0.096 (0.117)
School FE	x	x	x	x	x	x
Classroom FE	x	x	x	x	x	x
No. obs	4,183	4,184	4,842	4,842	4,855	4,830
Adj. R-squared	0.092	0.091	0.050	0.053	0.643	0.418
No. Groups	223	466	227	482	490	230
<i>Boys</i>						
Mother's Income	0.477 (0.648)	0.022 (0.024)	-1.165 (0.754)	-1.121 (0.828)	0.408 (0.491)	-0.052 (0.085)
Father's Income	-0.700 (0.615)	-0.020 (0.023)	-0.323 (0.869)	-0.257 (0.817)	0.466 (0.500)	-0.094 (0.082)
Reading Score 4 th G.	-0.128 (1.003)	0.014 (0.035)	0.621 (1.214)	0.968 (1.168)	-0.625 (0.895)	-0.020 (0.117)
Math Score 3 rd G.	-1.000 (0.957)	-0.066 (0.034)	1.006 (1.147)	0.487 (1.140)	0.282 (0.104)	-0.079 (0.127)
School FE	x	x	x	x	x	x
Classroom FE	x	x	x	x	x	x
No. obs	4,269	4,269	4,948	4,948	4,937	4,954
Adj. R-squared	0.077	0.078	0.059	0.065	0.621	0.427
No. Groups	224	464	228	482	489	230

Notes: Standard errors are in parentheses. All standard errors are clustered at the school (classroom) level for the school (classroom) fixed effects estimates. ***, 1% level of significance. **, 5% level of significance. *, 10% level of significance.

2.8 Conclusion

This paper uses a combination of survey- and register-based Danish data to study the link between rank in the classroom and student well-being and behaviors. We consider rank in terms of students' test scores and parental background characteristics. We document that being ranked at the bottom of the math test score distribution is associated with more victimization, but less truancy. Neither rank in the reading test score distribution nor rank in terms of parental background characteristics is associated with these behaviors.

We perform a range of sensitivity checks which suggest that the relationship is strong and robust. An advancement of 10 rank units in math in a class of 24 students is associated with a 2 percentage points lower probability of being victimized (compared to a mean of 3.6%) and half a day more truancy per year (compared to a mean of 1.16 days). The results are insensitive to changing the timing of measurement of the peer group and to changing the timing of measurement of parental background characteristics. The results are homogeneous across gender.

Why is exactly rank in math linked to these behaviors? Math is known to be a very good predictor of future academic and labor market success, and consequently also future status rank. Assuming that students, parents and peers know this, our findings comport with recent evidence suggesting that peer aggression and altruism vary across the social hierarchy. Furthermore, our study advances the research showing that pupils respond to rank incentives in math tests by exerting a higher effort: Students may reduce their risk of being victimized by responding to rank incentives.

2.9 Bibliography

ANDERSEN, S. C., L. V. BEUCHERT-PEDERSEN, AND H. S. NIELSEN (2014): "The Danish Co-teacher Experiment." *Unpublished Manuscript, Aarhus University*, 0, 0.

ANGRIST, J. D. (2014): "The perils of peer effects." *Forthcoming in Labour Economics*.

AZMAT, G. AND N. IRIBERRI (2010): "The importance of relative performance feedback information: Evidence from a natural experiment using high school students." *Journal of Public Economics*, 94, 435–452.

BANDIERA, O., I. BARANKAY, AND I. RASUL (2013): "Team incentives: Evidence from a firm level experiment." *Journal of the European Economic Association*, 11, 1079–1114.

BLACK, S. E., P. J. DEVEREUX, AND K. G. SALVANES (2007): "From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes." *Quarterly Journal of Economics*, 122, 409 – 439.

- BROWN, G. D., J. GARDNER, A. J. OSWALD, AND J. QIAN (2008): “Does Wage Rank Affect Employees’ Well-being?” *Industrial Relations*, 47, 355–389.
- CARD, D., A. MAS, E. MORETTI, AND E. SAEZ (2012): “Inequality at Work: The Effect of Peer Salaries on Job Satisfaction.” *American Economic Review*, 102, 2981–3003.
- CARRELL, S. E. AND M. L. HOEKSTRA (2010): “Externalities in the classroom: How children exposed to domestic violence affect everyone’s kids.” *American Economic Journal: Applied Economics*, 2, 211–228.
- CHARNESS, G. AND M. RABIN (2002): “Understanding social preferences with simple tests.” *Quarterly journal of Economics*, 817–869.
- CORTES, K. E., J. GOODMAN, AND T. NOMI (2014): “Intensive Math Instruction and Educational Attainment: Long-Run Impacts of Double-Dose Algebra.” *Forthcoming in Journal of Human Resources*.
- DATTA GUPTA, N. AND M. SIMONSEN (2010): “Non-cognitive child outcomes and universal high quality child care.” *Journal of Public Economics*, 94, 30–43.
- (2014): “Academic Performance and Type of Early Childhood Care.” *Unpublished Manuscript*.
- DELFGAAUW, J., R. DUR, J. SOL, AND W. VERBEKE (2013): “Tournament incentives in the field: Gender differences in the workplace.” *Journal of Labor Economics*, 31, 305–326.
- FALCH, T., O. H. NYHUS, AND B. STROM (2014): “Causal Effects of Mathematics.” *Forthcoming in Labour Economics*.
- FARIS, R. AND D. FELMLEE (2011): “Status struggles network centrality and gender segregation in same-and cross-gender aggression.” *American Sociological Review*, 76, 48–73.
- GOODMAN, R. (1997): “The Strengths and Difficulties Questionnaire: a research note.” *Journal of child psychology and psychiatry*, 38, 581–586.
- GOODMAN, R., H. MELTZER, AND V. BAILEY (1998): “The Strengths and Difficulties Questionnaire: a pilot study on the validity of the self-report version.” *European child & adolescent psychiatry*, 7, 125–130.
- JALAVA, N., J. S. JOENSEN, AND E. M. PELLAS (2013): “Grades and Rank: Impacts of Non-Financial Incentives on Test Performance.” *Available at SSRN 2362002*.
- JOENSEN, J. S. AND H. S. NIELSEN (2009): “Is there a causal effect of high school math on labor market outcomes?” *Journal of Human Resources*, 44, 171–198.

- KUZIEMKO, I., R. W. BUELL, T. REICH, AND M. I. NORTON (2014): ““Last-place Aversion”: Evidence and Redistributive Implications.” *Forthcoming in Quarterly Journal of Economics*.
- LAVY, V., M. D. PASERMAN, AND A. SCHLOSSER (2012): “Inside the Black Box of Ability Peer Effects: Evidence from Variation in the Proportion of Low Achievers in the Classroom.” *The Economic Journal*, 122, 208–237.
- LEVY, F., D. A. HAY, M. MCSTEPHEN, C. WOOD, AND I. WALDMAN (1997): “Attention-deficit hyperactivity disorder: a category or a continuum? Genetic analysis of a large-scale twin study.” *Journal of the American Academy of Child & Adolescent Psychiatry*, 36, 737–744.
- MCGUFFIN, P., F. RIJSDIJK, M. ANDREW, P. SHAM, R. KATZ, AND A. CARDNO (2003): “The heritability of bipolar affective disorder and the genetic relationship to unipolar depression.” *Archives of general psychiatry*, 60, 497–502.
- MINISTRY OF CHILDREN AND EDUCATION (2011): ““Evaluation of Free School Choice” (In Danish: “Evaluering af Mere Frit Skolevalg”).” Tech. rep., Ministry of Children and Education.
- MURPHY, R. AND F. WEINHARDT (2014): “Top of the Class: The Importance of Rank Position.” *CESifo Working Paper No. 4815*.
- PAGLIN, M. AND A. M. RUFOLO (1990): “Heterogeneous human capital, occupational choice, and male-female earnings differences.” *Journal of Labor Economics*, 123–144.
- RAMBØLL (2013): “Evaluation of the National Tests in Public School. (In Danish: Evaluering af de Nationale Test i Folkeskolen).” Tech. rep., Ministry of Education, Denmark.
- SACERDOTE, B. (2011): “Peer effects in education: How might they work, how big are they and how much do we know thus far?” *Handbook of the Economics of Education*, 3, 249–277.
- TRAN, A. AND R. ZECKHAUSER (2012): “Rank as an inherent incentive: Evidence from a field experiment.” *Journal of Public Economics*, 96, 645–650.

Appendices

2.A Summary Statistics

Table 2.9 Summary Statistics of Child's Characteristics

	Mean	Std. Dev.	Min	Max	No. Obs
Child's Characteristics					
Boy	0.507	0.500	0	1	10.165
Birth Year	2.000	0.417	1.998	2.001	10.165
Birthweight (grams)	3.522	599,36	534	5.800	9.605
Premature Birth (Before week 37)	0.106	0.308	0	1	9.647
Complications at Birth	0.006	0.080	0	1	9.574
Ethnicity	0.182	0.386	0	1	10.165
# younger siblings	0.675	0.828	0	7	10.165
# older siblings	0.991	1.149	0	11	10.165
Divorce	0.222	0.415	0	1	9.992
Centerbased Care (Age 2)	0.382	0.486	0	1	9.420
Private Care (Age 2)	0.490	0.500	0	1	9.420
Home Care (Age 2)	0.118	0.323	0	1	9.420
Other Care (Age 2)	0.003	0.050	0	1	9.420
Diagnosis of Mental or Behavioral Disorder	0.008	0.091	0	1	10.165
Diagnosis of Respiratory Disease	0.195	0.396	0	1	10.165
Diagnosis of Cardiovascular Disease	0.005	0.072	0	1	10.165
Cardiovascular Medicine	0.029	0.167	0	1	10.165
Nervous System Drugs	0.103	0.304	0	1	10.165
# visits to the emergency ward	1.082	1.462	0	14	10.165
Reading Test Score 4 th Grade	0.020	0.975	-5,52	3,63	9.796
Math Test Score 3 rd Grade	0.005	0.995	-6,60	4,50	8.860
Rank Mother's Income	0.500	0.303	0	1	9.971
Rank Father's Income	0.501	0.304	0	1	9.736
Rank Danish Test Score	0.500	0.303	0	1	9.791
Rank Math Test Score	0.501	0.305	0	1	8.850
Dev. Mean Mother's Income	0.006	4.331	-11,96	10,27	9.972
Dev. Mean Father's Income	-0.007	4.103	-12,37	9,69	9.737
Dev. Mean Danish Test Score	-0.000	0.911	-5,01	3,24	9.796
Dev. Mean Math Test Score	0.001	0.910	-5,65	4,33	8.860
Classroom Size	21.453	3.738	5	41	10.165
School Size	56.292	21.700	5	107	10.165

Notes: All characteristics are measured in 2006 unless stated otherwise. The rank measures are based on their classmates in 6th grade but the characteristics are measured at age 6 except for math and reading, which is measured at grade 3 and grade 4.

Table 2.10 Summary Statistics of Mother's Characteristics

	Mean	Std. Dev.	Min	Max	No. Obs
Mother's Characteristics					
Age at Birth of the Child	29.893	4.734	14	46	9.979
Smoked During Pregnancy	0.249	0.432	0	1	9.666
<i>Highest Completed Education</i>					
Elementary School	0.173	0.378	0	1	9.828
High School	0.083	0.275	0	1	9.828
Vocational Training	0.364	0.481	0	1	9.828
Short Further Education	0.053	0.224	0	1	9.828
Medium Further Education	0.233	0.423	0	1	9.828
Long Further Education	0.094	0.292	0	1	9.828
Lower Level Employee	0.296	0.457	0	1	9.972
Medium Level Employee	0.225	0.418	0	1	9.972
Higher Management Level	0.128	0.334	0	1	9.972
Top Management Level	0.010	0.099	0	1	9.972
Other Employment	0.277	0.447	0	1	9.972
Selfemployed	0.027	0.162	0	1	9.972
Unemployed	0.037	0.189	0	1	9.972
Degree of Year Unemployed 2004	7.987	18.932	0	100	9.882
Degree of Year Unemployed 2005	7.242	18.164	0	100	9.904
Degree of Year Unemployed 2006	5.869	16.107	0	100	9.911
Log Income	9.934	4.687	0	13,80	9.972
Prison Sentence	0.017	0.128	0	1	9.975
Diagnosis of Mental or Behavioral Disorder	0.060	0.237	0	1	10.097
Diagnosis of Respiratory Disease	0.112	0.315	0	1	10.097
Diagnosis of Cardiovascular Disease	0.088	0.284	0	1	10.097
Cardiovascular Medicine	0.421	0.494	0	1	10.097
Nervous System Drugs	0.477	0.499	0	1	10.097

Notes: All variables are measured in 2006 unless stated otherwise.

2.B Full Set of Estimates

Table 2.11 Summary Statistics of Father's Characteristics

	Mean	Std. Dev.	Min	Max	No. Obs
Father's Characteristics					
Age at Birth of the Child	32.678	5.717	15	71	9.897
<i>Highest Completed Education</i>					
Elementary School	0.181	0.385	0	1	9.553
High School	0.059	0.236	0	1	9.553
Vocational Training	0.427	0.495	0	1	9.553
Short Further Education	0.074	0.261	0	1	9.553
Medium Further Education	0.143	0.350	0	1	9.553
Long Further Education	0.117	0.321	0	1	9.553
Lower Level Employee	0.288	0.453	0	1	9.804
Medium Level Employee	0.139	0.346	0	1	9.804
Higher Management Level	0.156	0.363	0	1	9.804
Top Management Level	0.040	0.195	0	1	9.804
Other Employment	0.278	0.448	0	1	9.804
Selfemployed	0.077	0.267	0	1	9.804
Unemployed	0.023	0.150	0	1	9.804
Degree of Year Unemployed 2004	5.216	16.372	0	100	9.680
Degree of Year Unemployed 2005	4.404	15.069	0	100	9.676
Degree of Year Unemployed 2006	3.233	12.035	0	100	9.975
Log Income	10.797	4.342	0	14,90	9.737
Prison Sentence	0.116	0.320	0	1	9.975
Diagnosis of Mental or Behavioral Disorder	0.063	0.243	0	1	9.975
Diagnosis of Respiratory Disease	0.125	0.331	0	1	9.975
Diagnosis of Cardiovascular Disease	0.081	0.272	0	1	9.975
Cardiovascular Medicine	0.244	0.430	0	1	9.975
Nervous System Drugs	0.381	0.486	0	1	9.975

Notes: All variables are measured in 2006 unless stated otherwise.

Table B1 Classroom FE Results: Full Set of Estimates.

	Difficulties Score		Bullying		Sickness Abs. 2013		Illegal Abs. 2013		Reading 6 th Grade		Math 6 th Grade	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Child's Characteristics												
Boy	-0.058	(0.120)	0.001	(0.004)	0.111	(0.160)	0.221	(0.092)	-0.070	(0.013)	0.057	(0.016)
Birth Year	0.036	(0.140)	0.013	(0.006)	-0.240	(0.209)	-0.096	(0.124)	0.079	(0.015)	0.091	(0.020)
Birthweight	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	-0.000	(0.000)	0.000	(0.000)
Premature Birth (<37)	0.116	(0.214)	0.007	(0.008)	0.040	(0.294)	0.041	(0.194)	0.025	(0.022)	0.027	(0.026)
Comp. at Birth	-0.623	(0.609)	-0.011	(0.028)	-0.993	(0.743)	-0.652	(0.414)	-0.040	(0.060)	-0.017	(0.105)
Ethnicity	-0.393	(0.175)	0.004	(0.008)	-1.196	(0.274)	0.152	(0.192)	-0.063	(0.022)	-0.005	(0.025)
# younger siblings	-0.182	(0.079)	0.002	(0.003)	-0.619	(0.091)	-0.074	(0.073)	-0.009	(0.008)	-0.004	(0.009)
# older siblings	0.341	(0.066)	0.000	(0.003)	0.065	(0.087)	0.211	(0.070)	-0.040	(0.007)	-0.052	(0.008)
Divorce	0.493	(0.156)	0.002	(0.006)	0.511	(0.216)	0.283	(0.146)	0.035	(0.016)	-0.064	(0.019)
<i>Daycare Age 2 (Ref. Private Care)</i>												
Center-based Care	-0.425	(0.157)	-0.006	(0.006)	0.216	(0.215)	-0.025	(0.152)	0.005	(0.016)	-0.007	(0.021)
Home Care	0.843	(1.558)	0.084	(0.077)	3.932	(1.933)	-0.186	(0.410)	0.158	(0.080)	-0.244	(0.147)
Other Care	-0.504	(0.212)	-0.002	(0.009)	0.628	(0.301)	0.215	(0.261)	-0.000	(0.024)	-0.031	(0.028)
Men. or Behav. Disorder	0.589	(0.623)	0.013	(0.028)	0.238	(1.076)	-0.610	(0.381)	-0.118	(0.062)	-0.076	(0.084)
Respiratory Disease	-0.188	(0.143)	-0.007	(0.005)	0.366	(0.216)	0.072	(0.126)	0.003	(0.015)	-0.001	(0.019)
Cardiovascular Disease	-0.737	(0.744)	-0.002	(0.036)	1.325	(0.934)	0.145	(0.594)	-0.011	(0.085)	-0.017	(0.104)
Cardiovascular Medicine	-0.325	(0.309)	-0.001	(0.013)	-0.372	(0.505)	-0.386	(0.184)	-0.024	(0.038)	-0.062	(0.042)
Nervous System Drugs	-0.147	(0.188)	-0.005	(0.007)	0.139	(0.256)	-0.057	(0.133)	-0.007	(0.021)	-0.023	(0.024)
# visits emergency ward	0.105	(0.041)	0.003	(0.002)	0.254	(0.070)	0.062	(0.042)	-0.007	(0.005)	-0.002	(0.005)
Reading Score 4 th Grade	-0.055	(0.904)	0.055	(0.059)	-0.296	(2.003)	3.379	(1.133)	0.278	(0.185)	0.316	(0.125)
Reading Score Squared	0.206	(0.043)	0.004	(0.002)	0.214	(0.068)	0.105	(0.038)	0.016	(0.008)	0.022	(0.008)
Reading Score Cubed	0.088	(0.017)	0.002	(0.001)	0.069	(0.025)	-0.017	(0.028)	-0.007	(0.003)	0.006	(0.004)
Math Score 3 rd Grade	0.059	(0.547)	-0.015	(0.027)	-1.145	(0.845)	-0.382	(0.541)	0.148	(0.070)	0.317	(0.089)
Math Score Squared	0.010	(0.035)	0.003	(0.001)	-0.067	(0.048)	0.036	(0.031)	-0.007	(0.005)	0.027	(0.007)
Math Score Cubed	0.010	(0.010)	0.000	(0.000)	0.024	(0.015)	0.005	(0.014)	-0.001	(0.002)	-0.006	(0.002)
Rank Mother's Income	0.184	(0.477)	0.029	(0.017)	0.115	(0.581)	1.000	(0.427)	-0.048	(0.052)	-0.004	(0.060)
Rank Father's Income	-0.240	(0.433)	-0.016	(0.015)	-0.042	(0.558)	-0.129	(0.292)	0.009	(0.046)	-0.042	(0.055)
Rank Reading Score	-0.258	(0.628)	0.018	(0.025)	1.276	(0.846)	-0.681	(0.616)	0.163	(0.067)	0.148	(0.091)
Rank Math Score	-0.521	(0.618)	-0.049	(0.023)	0.779	(0.889)	1.299	(0.568)	0.181	(0.069)	-0.130	(0.085)
Dev. Mean Moth's Income	0.090	(0.218)	0.006	(0.011)	0.207	(0.232)	0.065	(0.243)	-0.011	(0.033)	0.005	(0.028)
Dev. Mean Fath's Income	0.135	(0.189)	0.008	(0.007)	0.220	(0.241)	-0.048	(0.209)	0.014	(0.028)	-0.017	(0.025)

Continued on next page -

Notes: Standard errors are in parentheses. All standard errors are clustered at the classroom level. ***, 1% level of significance. **, 5% level of significance. *, 10% level of significance.

Table B1 Continued -

	Difficulties Score		Bullying		Sickness Abs. 2013		Illegal Abs. 2013		Reading 6 th Grade		Math 6 th Grade	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Dev. Mean Reading Score	-0.946	(0.920)	-0.074	(0.060)	-0.202	(2.078)	-3.296	(1.173)	0.352	(0.185)	-0.107	(0.128)
Dev. Mean Math Score	-0.418	(0.596)	0.030	(0.028)	0.484	(0.894)	-0.101	(0.566)	-0.059	(0.073)	0.153	(0.094)
Mother's Characteristics												
Age (Birth of the Child)	-0.249	** (0.124)	0.007	(0.005)	0.113	(0.194)	-0.122	(0.153)	0.005	(0.015)	-0.013	(0.016)
Age sq. (Birth of the Child)	0.003	* (0.002)	-0.000	(0.000)	-0.001	(0.003)	0.002	(0.003)	0.000	(0.000)	0.000	(0.000)
Smoked During Pregnancy	0.734	*** (0.143)	0.007	(0.006)	1.147	*** (0.218)	0.287	** (0.126)	0.005	(0.015)	-0.041	** (0.018)
<i>Highest Completed Education (Ref. Elementary School)</i>												
High School	-0.760	*** (0.253)	-0.008	(0.010)	-1.050	*** (0.381)	-0.562	** (0.227)	0.076	*** (0.026)	0.045	(0.032)
Vocational Training	-0.270	(0.190)	-0.012	*	-1.158	*** (0.285)	-0.496	** (0.193)	0.034	(0.022)	0.023	(0.023)
Short Further Education	0.066	(0.308)	-0.009	(0.011)	-1.277	*** (0.377)	-0.087	(0.315)	0.061	*	0.023	(0.039)
Medium Further Education	-0.390	* (0.233)	-0.005	(0.009)	-0.954	*** (0.332)	-0.492	** (0.212)	0.116	*** (0.024)	0.034	(0.029)
Long Further Education	-0.116	(0.295)	-0.015	(0.010)	-1.201	*** (0.448)	-0.363	(0.248)	0.108	*** (0.032)	0.059	(0.041)
<i>Level of Employment (Ref. Lower Level Employee)</i>												
Medium Level Employee	-0.102	(0.177)	-0.002	(0.007)	-0.174	(0.256)	-0.013	(0.121)	0.018	(0.018)	0.041	*
Higher Management Level	-0.135	(0.231)	0.009	(0.009)	0.030	(0.369)	0.145	(0.153)	0.038	(0.025)	0.046	(0.032)
Top Management Level	-0.424	(0.540)	0.016	(0.022)	-1.175	*	0.112	(0.217)	0.037	(0.052)	-0.002	(0.061)
Other Employment	0.137	(0.197)	-0.001	(0.007)	-0.165	(0.263)	-0.070	(0.167)	0.006	(0.019)	0.008	(0.023)
Selfemployed	-0.497	(0.399)	-0.007	(0.016)	-0.216	(0.536)	-0.670	** (0.313)	0.010	(0.043)	0.018	(0.053)
Unemployed	-0.098	(0.397)	-0.005	(0.015)	0.614	(0.542)	-0.017	(0.368)	-0.040	(0.041)	0.036	(0.053)
Degree of Year Unemp. 2004	0.008	** (0.004)	-0.000	(0.000)	-0.005	(0.005)	0.002	(0.003)	-0.000	(0.000)	-0.001	*
Degree of Year Unemp. 2005	-0.005	(0.004)	-0.000	(0.000)	0.005	(0.006)	-0.004	(0.004)	-0.001	(0.001)	0.000	(0.001)
Degree of Year Unemp. 2006	0.002	(0.005)	0.000	(0.000)	-0.006	(0.007)	-0.010	** (0.004)	0.001	(0.001)	0.000	(0.001)
Log Income	0.059	(0.696)	-0.061	*** (0.021)	-0.896	(0.941)	-1.655	*** (0.600)	0.127	*	0.138	(0.093)
Log Income Squared	-0.022	(0.122)	0.010	*** (0.003)	0.157	(0.167)	0.317	*** (0.104)	-0.020	(0.013)	-0.028	*
Long Income Cubed	0.001	(0.006)	-0.001	*** (0.000)	-0.009	(0.008)	-0.016	*** (0.005)	0.001	(0.001)	0.001	*
Prison Sentence	0.007	(0.491)	-0.012	(0.020)	-0.931	(0.710)	0.954	(0.709)	-0.003	(0.051)	-0.082	(0.068)
Men. or Behav. Disorder	0.815	*** (0.273)	0.008	(0.010)	0.507	(0.397)	0.401	(0.299)	-0.013	(0.030)	0.000	(0.032)
Respiratory Disease	-0.055	(0.177)	0.000	(0.007)	0.430	(0.284)	-0.072	(0.146)	-0.050	** (0.020)	-0.061	** (0.026)
Cardiovascular Disease	-0.019	(0.207)	-0.018	*** (0.007)	0.019	(0.290)	-0.189	(0.129)	0.004	(0.021)	-0.014	(0.026)
Cardiovascular Medicine	-0.031	(0.107)	-0.005	(0.004)	0.222	(0.161)	-0.238	*** (0.090)	0.012	(0.012)	0.017	(0.016)
Nervous System Drugs	0.227	* (0.117)	0.010	** (0.004)	0.900	*** (0.159)	0.148	(0.100)	-0.018	(0.012)	-0.034	** (0.014)
Father's Characteristics												

Continued on next page -

Notes: Standard errors are in parentheses. All standard errors are clustered at the classroom level. ***; 1% level of significance. **; 5% level of significance. *; 10% level of significance.

Table B1 Continued -

	Difficulties Score		Bullying		Sickness Abs. 2013		Illegal Abs. 2013		Reading 6 th Grade		Math 6 th Grade	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Age (Birth of the Child)	0.082	(0.077)	-0.001	(0.004)	0.073	(0.112)	0.002	(0.070)	-0.012	(0.008)	0.004	(0.010)
Age sq. (Birth of the Child)	-0.001	(0.001)	0.000	(0.000)	-0.001	(0.001)	-0.000	(0.001)	0.000	(0.000)	-0.000	(0.000)
<i>Highest Completed Education (Ref. Elementary School)</i>												
High School	-0.648	** (0.263)	-0.014	(0.010)	-0.610	*	-0.038	(0.202)	0.039	(0.028)	0.051	(0.036)
Vocational Training	-0.283	* (0.168)	-0.002	(0.007)	-0.613	** (0.250)	-0.360	** (0.164)	-0.000	(0.019)	0.066	*** (0.022)
Short Further Education	-0.282	(0.255)	0.006	(0.011)	-0.270	(0.380)	0.010	(0.237)	-0.009	(0.029)	0.099	*** (0.033)
Medium Further Education	-0.642	*** (0.218)	-0.011	(0.009)	-0.376	(0.293)	-0.072	(0.193)	0.048	*	0.111	*** (0.032)
Long Further Education	-0.641	** (0.249)	-0.013	(0.011)	-0.749	*	-0.256	(0.183)	0.098	*** (0.029)	0.179	*** (0.039)
<i>Level of Employment (Ref. Lower Level Employee)</i>												
Medium Level Employee	-0.246	(0.193)	0.009	(0.007)	-0.479	*	0.063	(0.097)	0.018	(0.020)	0.049	** (0.025)
Higher Management Level	-0.109	(0.209)	0.015	*	0.296	(0.308)	0.035	(0.141)	0.023	(0.023)	0.028	(0.031)
Top Management Level	-0.665	** (0.299)	-0.005	(0.009)	-0.077	(0.445)	0.065	(0.175)	0.023	(0.032)	0.032	(0.044)
Other Employment	0.144	(0.164)	0.003	(0.006)	0.156	(0.241)	0.082	(0.143)	0.016	(0.018)	0.014	(0.021)
Selfemployed	0.259	(0.304)	0.027	** (0.013)	-0.858	** (0.403)	-0.634	** (0.252)	0.043	(0.033)	0.069	*
Unemployed	-0.668	(0.460)	0.012	(0.021)	-0.869	(0.723)	-0.233	(0.414)	0.099	*	0.065	(0.063)
Degree of Year Unemp. 2004	0.011	** (0.004)	0.000	(0.000)	0.001	(0.006)	-0.004	(0.005)	0.000	(0.001)	0.000	(0.001)
Degree of Year Unemp. 2005	-0.004	(0.006)	-0.000	(0.000)	0.012	(0.008)	0.004	(0.007)	-0.000	(0.001)	-0.000	(0.001)
Degree of Year Unemp. 2006	0.009	(0.007)	-0.000	(0.000)	-0.016	(0.011)	0.003	(0.008)	-0.001	(0.001)	-0.000	(0.001)
Log Income	-0.795	(0.555)	-0.025	(0.021)	-1.262	*	-0.260	(0.472)	0.009	(0.054)	0.134	*
Log Income Squared	0.102	(0.099)	0.003	(0.004)	0.196	*	0.045	(0.075)	-0.003	(0.010)	-0.023	*
Log Income Cubed	-0.004	(0.005)	-0.000	(0.000)	-0.009	*	-0.002	(0.003)	0.000	(0.000)	0.001	** (0.001)
Prison Sentence	0.483	** (0.199)	-0.008	(0.007)	0.478	*	0.285	(0.205)	0.000	(0.020)	-0.022	(0.024)
Men. or Behav. Disorder	0.066	(0.249)	0.009	(0.011)	1.131	** (0.458)	0.205	(0.293)	0.017	(0.029)	0.017	(0.033)
Respiratory Disease	0.391	** (0.192)	-0.000	(0.007)	-0.219	(0.239)	-0.029	(0.200)	0.005	(0.019)	0.004	(0.022)
Cardiovascular Disease	-0.057	(0.224)	-0.001	(0.009)	0.201	(0.316)	0.331	(0.216)	-0.040	*	-0.087	*** (0.028)
Cardiovascular Medicine	-0.480	*** (0.130)	-0.003	(0.005)	0.172	(0.197)	-0.186	*	0.006	(0.014)	0.023	(0.018)
Nervous System Drugs	0.386	*** (0.124)	0.004	(0.005)	0.189	(0.163)	0.185	** (0.094)	-0.017	(0.013)	-0.014	(0.016)
Constant	-60.02	(279.7)	-24.44	** (11.13)	439.8	(415.4)	196.5	(248.4)	-158.8	*** (30.78)	-182.5	*** (39.27)
No. Obs.	9,612		8,449		9,789		9,789		9,792		9,784	
No. Groups	489		466		483		483		491		491	
Adj. R-squared	0.095		0.012		0.056		0.053		0.631		0.428	

Notes: Standard errors are in parentheses. All standard errors are clustered at the classroom level. ***, 1% level of significance. **, 5% level of significance. *, 10% level of significance.

2.C Grouped Rank Results

Table 2.13 Classroom FE Results: Grouped 6th Grade Rank

Rank (Decile)	Difficulties Score		Bullying		Sickness Abs. 2013		Illegal Abs. 2013		Reading 6 th Grade		Math 6 th Grade	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Mother's Income (2nd)	-0.027	(0.279)	-0.013	(0.011)	0.053	(0.339)	0.303	(0.292)	0.001	(0.029)	0.000	(0.032)
Mother's Income (3rd)	-0.029	(0.329)	-0.015	(0.012)	0.067	(0.403)	0.537	(0.336)	-0.016	(0.032)	0.021	(0.037)
Mother's Income (4th)	0.052	(0.376)	-0.008	(0.013)	0.093	(0.428)	0.253	(0.337)	-0.016	(0.033)	-0.019	(0.041)
Mother's Income (5th)	-0.461	(0.387)	-0.001	(0.014)	-0.295	(0.452)	0.317	(0.384)	-0.019	(0.037)	-0.009	(0.045)
Mother's Income (6th)	0.110	(0.415)	-0.004	(0.015)	0.064	(0.469)	0.347	(0.381)	-0.012	(0.039)	-0.050	(0.048)
Mother's Income (7th)	0.420	(0.432)	0.004	(0.016)	-0.024	(0.471)	0.425	(0.386)	-0.024	(0.040)	-0.019	(0.049)
Mother's Income (8th)	0.222	(0.464)	0.003	(0.016)	0.559	(0.524)	0.719	(0.429)	-0.024	(0.042)	0.007	(0.052)
Mother's Income (9th)	-0.205	(0.492)	-0.002	(0.017)	-0.215	(0.549)	0.423	(0.418)	-0.026	(0.047)	-0.013	(0.057)
Mother's Income (10th)	0.168	(0.576)	0.012	(0.020)	0.421	(0.654)	0.730	(0.503)	-0.028	(0.054)	0.013	(0.064)
Father's Income (2nd)	0.043	(0.294)	0.024	(0.013)	-0.216	(0.375)	0.107	(0.327)	-0.027	(0.028)	0.010	(0.035)
Father's Income (3rd)	-0.185	(0.337)	0.008	(0.013)	0.214	(0.447)	0.087	(0.354)	-0.075	(0.035)	-0.083	(0.040)
Father's Income (4th)	-0.296	(0.363)	-0.002	(0.013)	0.085	(0.495)	0.137	(0.378)	-0.086	(0.036)	-0.069	(0.043)
Father's Income (5th)	-0.159	(0.404)	0.008	(0.015)	0.125	(0.531)	0.042	(0.366)	-0.036	(0.038)	0.000	(0.048)
Father's Income (6th)	-0.007	(0.390)	0.010	(0.014)	-0.221	(0.524)	-0.017	(0.360)	-0.043	(0.039)	-0.062	(0.048)
Father's Income (7th)	-0.272	(0.397)	0.001	(0.015)	0.135	(0.521)	0.154	(0.362)	-0.049	(0.041)	-0.029	(0.048)
Father's Income (8th)	-0.151	(0.439)	0.010	(0.016)	0.117	(0.544)	0.063	(0.376)	-0.083	(0.044)	-0.064	(0.053)
Father's Income (9th)	-0.436	(0.463)	0.006	(0.016)	-0.059	(0.577)	0.052	(0.382)	-0.051	(0.046)	-0.056	(0.052)
Father's Income (10th)	-0.630	(0.535)	-0.013	(0.019)	-0.115	(0.754)	0.065	(0.402)	-0.031	(0.054)	-0.094	(0.067)
Reading Score (2nd)	-0.324	(0.304)	-0.013	(0.011)	-0.047	(0.351)	-0.110	(0.293)	0.026	(0.030)	-0.002	(0.034)
Reading Score (3rd)	-0.413	(0.351)	0.016	(0.013)	0.212	(0.408)	0.107	(0.325)	0.048	(0.034)	-0.005	(0.040)
Reading Score (4th)	-0.374	(0.405)	0.006	(0.015)	0.270	(0.468)	-0.118	(0.354)	0.060	(0.040)	0.005	(0.044)
Reading Score (5th)	-0.215	(0.424)	0.016	(0.016)	0.283	(0.537)	-0.256	(0.395)	0.052	(0.043)	0.040	(0.049)
Reading Score (6th)	-0.205	(0.486)	0.015	(0.018)	0.258	(0.544)	-0.394	(0.438)	0.065	(0.046)	-0.004	(0.055)
Reading Score (7th)	-0.399	(0.516)	0.011	(0.019)	0.540	(0.613)	-0.346	(0.466)	0.103	(0.051)	0.050	(0.059)
Reading Score (8th)	-0.747	(0.566)	0.011	(0.020)	0.254	(0.638)	-0.395	(0.535)	0.129	(0.054)	0.071	(0.067)
Reading Score (9th)	-0.102	(0.612)	0.014	(0.022)	0.956	(0.734)	-0.488	(0.569)	0.143	(0.059)	0.065	(0.075)
Reading Score (10th)	-0.016	(0.706)	0.023	(0.026)	1.054	(0.867)	-0.744	(0.621)	0.192	(0.069)	0.046	(0.088)
Math Score (2nd)	0.196	(0.289)	-0.012	(0.010)	0.309	(0.348)	0.117	(0.191)	0.001	(0.033)	-0.099	(0.034)
Math Score (3rd)	0.075	(0.309)	-0.002	(0.012)	0.299	(0.391)	0.516	(0.254)	0.037	(0.031)	-0.081	(0.039)
Math Score (4th)	-0.141	(0.353)	-0.020	(0.014)	0.687	(0.462)	0.561	(0.289)	0.050	(0.036)	-0.091	(0.043)
Math Score (5th)	0.054	(0.383)	-0.007	(0.014)	0.531	(0.480)	0.444	(0.331)	0.057	(0.040)	-0.123	(0.050)
Math Score (6th)	0.238	(0.417)	-0.016	(0.015)	0.372	(0.559)	0.840	(0.345)	0.067	(0.041)	-0.129	(0.052)
Math Score (7th)	-0.290	(0.429)	-0.031	(0.016)	0.411	(0.539)	0.865	(0.365)	0.077	(0.045)	-0.175	(0.055)
Math Score (8th)	-0.091	(0.459)	-0.025	(0.017)	1.245	(0.681)	0.759	(0.412)	0.110	(0.051)	-0.169	(0.060)
Math Score (9th)	0.084	(0.516)	-0.029	(0.018)	1.174	(0.669)	0.892	(0.455)	0.107	(0.056)	-0.149	(0.070)
Math Score (10th)	0.233	(0.578)	-0.020	(0.021)	1.278	(0.771)	1.052	(0.550)	0.104	(0.064)	-0.174	(0.082)
No. obs.	8,456		8,449		9,809		9,809		9,810		9,801	
Adj. R-Squared	0.086		0.013		0.055		0.052		0.630		0.428	
Number of groups	474		466		503		503		509		508	

Notes: Standard errors are in parentheses. All standard errors are clustered at the classroom level. ***: 1% level of significance. **: 5% level of significance. *: 10% level of significance.

Table 2.14 Classroom FE Results: Grouped 4th Grade Rank

Rank (Decile)	Difficulties Score		Bullying		Sickness Abs. 2013		Illegal Abs. 2013		Reading 6 th Grade		Math 6 th Grade	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Mother's Income (2nd)	0.003	(0.447)	0.013	(0.016)	1.180	(0.585)	0.429	(0.244)	-0.049	(0.046)	-0.045	(0.059)
Mother's Income (3rd)	0.452	(0.452)	0.011	(0.017)	1.001	(0.574)	0.373	(0.350)	-0.013	(0.046)	0.012	(0.058)
Mother's Income (4th)	0.181	(0.469)	0.013	(0.018)	1.036	(0.602)	0.380	(0.316)	-0.045	(0.047)	-0.003	(0.061)
Mother's Income (5th)	0.168	(0.465)	0.003	(0.018)	0.724	(0.601)	0.243	(0.342)	0.011	(0.050)	0.026	(0.064)
Mother's Income (6th)	0.603	(0.484)	0.023	(0.019)	0.980	(0.587)	0.333	(0.370)	-0.028	(0.052)	-0.014	(0.064)
Mother's Income (7th)	0.375	(0.499)	0.013	(0.019)	0.473	(0.621)	0.465	(0.396)	-0.019	(0.054)	0.052	(0.066)
Mother's Income (8th)	0.522	(0.526)	0.015	(0.020)	1.136	(0.659)	0.250	(0.391)	-0.045	(0.055)	0.035	(0.067)
Mother's Income (9th)	0.267	(0.528)	0.008	(0.020)	0.990	(0.694)	0.354	(0.427)	-0.057	(0.061)	0.041	(0.073)
Mother's Income (10th)	0.369	(0.609)	0.030	(0.024)	0.901	(0.775)	0.328	(0.477)	-0.038	(0.066)	0.105	(0.080)
Father's Income (2nd)	0.281	(0.375)	0.016	(0.013)	-1.941	(0.602)	-0.164	(0.469)	-0.026	(0.037)	0.003	(0.046)
Father's Income (3rd)	0.521	(0.361)	0.010	(0.013)	0.698	(0.631)	-0.339	(0.452)	-0.047	(0.038)	-0.074	(0.046)
Father's Income (4th)	0.092	(0.384)	0.011	(0.013)	-1.171	(0.645)	0.020	(0.506)	-0.020	(0.040)	-0.049	(0.050)
Father's Income (5th)	0.116	(0.415)	0.016	(0.014)	-0.923	(0.664)	-0.075	(0.460)	0.005	(0.043)	-0.019	(0.054)
Father's Income (6th)	0.475	(0.392)	0.012	(0.014)	-1.175	(0.638)	-0.289	(0.453)	-0.030	(0.043)	-0.063	(0.052)
Father's Income (7th)	-0.116	(0.414)	0.016	(0.015)	-1.099	(0.671)	-0.406	(0.441)	-0.022	(0.044)	-0.048	(0.055)
Father's Income (8th)	0.566	(0.438)	0.006	(0.014)	-1.229	(0.676)	-0.413	(0.460)	-0.016	(0.046)	0.002	(0.055)
Father's Income (9th)	0.136	(0.456)	0.009	(0.015)	-1.117	(0.697)	-0.413	(0.453)	0.009	(0.050)	-0.078	(0.057)
Father's Income (10th)	-0.107	(0.529)	0.005	(0.018)	-0.940	(0.831)	-0.482	(0.467)	0.009	(0.057)	-0.108	(0.072)
Reading Score (2nd)	-0.538	(0.300)	-0.013	(0.012)	-0.015	(0.348)	0.360	(0.252)	0.025	(0.031)	-0.006	(0.035)
Reading Score (3rd)	-0.194	(0.310)	-0.009	(0.012)	0.516	(0.388)	0.689	(0.275)	0.004	(0.034)	0.015	(0.040)
Reading Score (4th)	-0.303	(0.367)	-0.011	(0.015)	0.737	(0.451)	0.549	(0.275)	0.033	(0.040)	-0.038	(0.045)
Reading Score (5th)	-0.264	(0.383)	-0.012	(0.016)	0.452	(0.501)	0.574	(0.336)	0.001	(0.041)	0.037	(0.048)
Reading Score (6th)	-0.198	(0.427)	-0.010	(0.017)	1.462	(0.556)	0.623	(0.341)	-0.002	(0.045)	-0.008	(0.053)
Reading Score (7th)	-0.319	(0.474)	-0.013	(0.019)	1.324	(0.605)	0.557	(0.437)	0.056	(0.048)	0.031	(0.059)
Reading Score (8th)	-0.545	(0.519)	-0.017	(0.021)	0.861	(0.620)	0.693	(0.457)	0.060	(0.054)	0.062	(0.066)
Reading Score (9th)	0.295	(0.568)	-0.006	(0.022)	1.918	(0.719)	0.643	(0.488)	0.071	(0.059)	0.022	(0.074)
Reading Score (10th)	0.269	(0.670)	0.003	(0.026)	2.173	(0.846)	0.513	(0.544)	0.131	(0.068)	0.044	(0.086)
Math Score (2nd)	0.022	(0.268)	-0.015	(0.011)	-0.141	(0.388)	0.134	(0.218)	-0.013	(0.030)	-0.090	(0.033)
Math Score (3rd)	-0.177	(0.291)	-0.011	(0.012)	0.599	(0.423)	0.729	(0.263)	0.013	(0.029)	-0.083	(0.034)
Math Score (4th)	-0.108	(0.326)	-0.020	(0.012)	0.733	(0.485)	0.488	(0.265)	0.067	(0.035)	-0.074	(0.041)
Math Score (5th)	0.107	(0.335)	-0.022	(0.014)	0.739	(0.508)	0.823	(0.320)	0.005	(0.038)	-0.127	(0.044)
Math Score (6th)	-0.263	(0.379)	-0.032	(0.014)	0.563	(0.568)	1.000	(0.354)	0.015	(0.039)	-0.127	(0.047)
Math Score (7th)	-0.397	(0.412)	-0.032	(0.015)	0.459	(0.622)	0.947	(0.375)	0.079	(0.044)	-0.138	(0.052)
Math Score (8th)	-0.136	(0.477)	-0.035	(0.017)	1.218	(0.753)	1.022	(0.408)	0.067	(0.052)	-0.150	(0.056)
Math Score (9th)	-0.231	(0.487)	-0.035	(0.018)	1.441	(0.769)	1.421	(0.482)	0.076	(0.055)	-0.143	(0.066)
Math Score (10th)	-0.183	(0.591)	-0.024	(0.023)	1.449	(0.891)	1.420	(0.546)	0.073	(0.065)	-0.144	(0.078)
Number of obs.	8,396		8,397		9,727		9,727		9,726		9,717	
Adj. R-Squared	0.088		0.012		0.056		0.058		0.634		0.433	
Number of groups	466		466		483		483		491		491	

Notes: Standard errors are in parentheses. All standard errors are clustered at the classroom level. ***, 1% level of significance. **, 5% level of significance. *, 10% level of significance.

Chapter 3

Long-term Consequences of Workplace Bullying on Sickness Absence

Long-term Consequences of Workplace Bullying on Sickness Absence*

Tine L. Mundbjerg Eriksen[†], Annie Høgh[‡] and Åse Marie Hansen[§]

August 2014

Abstract

Bullying is a problem within workplaces which is thought to harm individual productivity. We analyze employees from a sample of workplaces and document the detrimental effects of being exposed to workplace bullying on sickness absence. We avoid bias related to self-labeling of being bullied by using the Negative Acts Questionnaire - Revised. We account for important confounders such as historical information on sickness absence and mental health. We find that gender does not significantly explain exposure to bullying once we condition on workplace fixed effects. Furthermore being exposed to bullying is associated with negative immediate self-reported health. However we only find that being a target of bullying is related to higher and persistent increases in long-term sickness absence and adverse long-term health for female employees. This suggests that men and women have different coping strategies. We investigate plausible explanations and find that the differences cannot be explained by an increase in short-term sickness absence or by turnover or labor force participation.

JEL classification: J15; J24; J81.

Keywords: Working Environment, Harassment, Absenteeism, Health, Gender.

* We thank the Danish Psychiatric Central Register for access to data. We further thank the Working Environment Research Foundation (j.nr. 20050072524/4) and the National Research Centre for the Working Environment (NRCWE), Denmark for supporting the study. The data used stem from the project Samarbejde og Arbejdsklima - Forbyggelse af Mobning på Arbejdspladsen, from the NRCWE. Tine Louise Mundbjerg Eriksen conducted all the analyses and is therefore responsible for the conclusions. We appreciate valuable comments from Helena Skyt Nielsen and Marianne Simonsen, participants at the 9th International Conference on Workplace Bullying and Harassment, as well as seminar participants at Aarhus University.

[†]Corresponding Author: Department of Economics and Business, Aarhus University, Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark; E-mail: teriksen@econ.au.dk

[‡]Department of Psychology, Copenhagen University.

[§]Department of Public Health, Copenhagen University and National Research Centre for the Working Environment, Copenhagen, Denmark.

3.1 Introduction

Workplace bullying can have severe detrimental effects on the individual's health and well-being, which is likely to induce reduced productivity in firms and society (Vartia, 2001, Kivimäki et al., 2003, Niedhammer et al., 2006). Prevalence rates across countries show that on average 4-10% of workers in Scandinavian countries, 14-25% of workers in other European countries, and 20-25% of workers in non-European countries report that they are being exposed to bullying at work (Nielsen et al., 2010).¹ Despite this, studies documenting the effect of bullying on economic outcomes are scarce. Kivimaki et al. (2000) find a positive relationship between bullying and sickness absence in hospital staff, as do Ortega et al. (2011) in a sample of employees in the elderly care sector. However both studies only to a minor extent correct for previous health and sickness absence, and they only consider absence spells within the first year after bullying is observed. In the case that exposure to bullying leads to severe health issues such as depression it is likely that individuals also suffer in the long run. This paper investigates the long-term consequences of workplace bullying for men and women while, in contrast to previous literature, adjusting for important confounders such as previous employee health and sickness absence history.

Ose (2005) finds that a poor work environment increases long-term sickness absence, and Fevang et al. (2014) find that firm incentives matter for the duration of long-term sickness absence indicating that management can influence the level of absenteeism within the company. At the same time bullying has been related to a long range of work environmental factors, for example poor leadership (Samnani and Singh, 2012). Bullying is therefore likely to affect absenteeism and productivity in organizations. Similarly bullying may also be costly to society in many countries due to large public expenses on sickness benefits.² If bullying increases sickness absence this may further motivate the importance of reducing workplace bullying.

The empirical analyses are based on data from "The Bullying Cohort"-study conducted by the National Research Centre for the Working Environment (NRCWE) in Denmark in 2006. These data are merged with the Danish Registers using the respondent's civil registration number.

We contribute to the existing literature in several ways: As mentioned above there is very little knowledge of the impact of workplace bullying on sickness absence, especially the long-term consequences have not previously been investigated. Second, our analyses employ the well-documented Negative Acts Questionnaire to measure bullying (Einarsen et al., 2009). Unlike asking the individual to self-assess whether he or she feels bullied, the questionnaire asks about exposure to specific actions, thus a more objective measure of bullying comparable across individuals. The questionnaire consists of 21 negative actions. Following the literature (e.g.

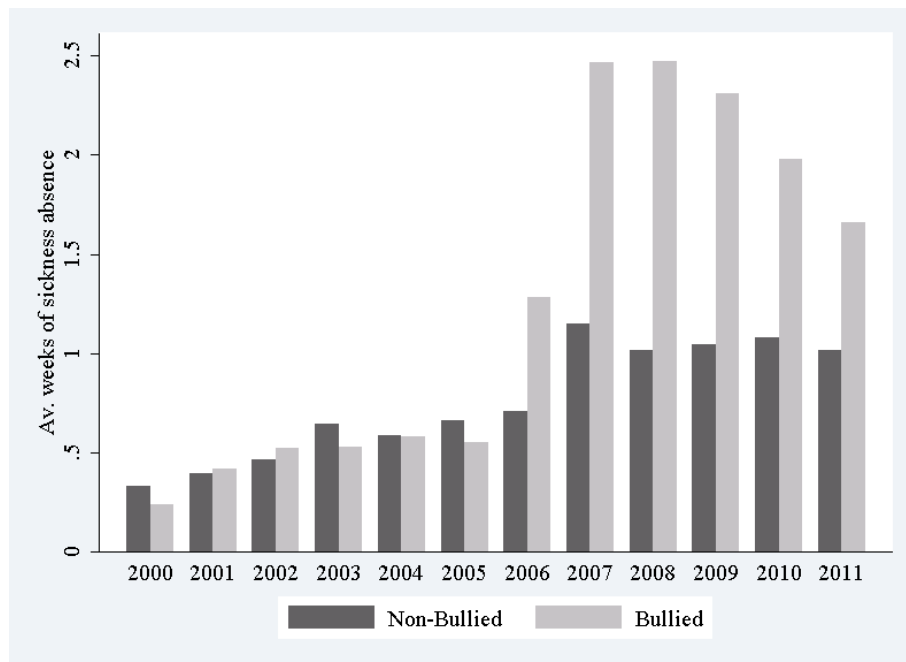
¹Prevalence rates depends on the measure of bullying being used.

²0.8% of GDP in OECD countries in 2008, (OECD, 2010)

Mikkelsen and Einarsen, 2001 and Nielsen et al., 2009), an individual is defined as a target of bullying if he or she has been subject to at least two negative actions daily or weekly within the past 6 months. Third, while we acknowledge that identification is particularly difficult due to non-random selection of targets this study controls for a rich set of variables descriptive of both exposure to bullying and worker health: previous sickness absence, prescription drug usage, mental and behavioral diagnoses, socio-economic status, workplace fixed effects, and demographics.³ As one may still worry about possible confounders we test the robustness of our results to the inclusion of personality traits and work environment characteristics. Finally, as our outcomes are measured through the Danish Registers we do not have issues with common variance bias.

In "The Bullying Cohort"-study 7% of the respondents are identified as exposed to bullying in 2006. Figure (3.1) plots long-term sickness absence, as defined by absence in excess of 3 weeks,⁴ by bullying status observed in the survey in 2006. According to the figure sickness absence of targets and their non-bullied coworkers appear to be identical in the years prior to the point where we observe bullying. However, after bullying is observed we see a spike in sickness absence for the targets, whereas the trend seems to be constant for the non-bullied workers.

Figure 3.1 Long-term Sickness Absence Measured by Bullying Status in 2006 for the Sample of Survey Respondents.



Our results show that it appears to be random who is subject to bullying once we condition

³All control variables are measured in 2005 or earlier.

⁴The Danish register data only contains sickness absence in excess of three weeks for private sector employees, see below.

on workplace fixed effects. However, we only find a significant and negative relationship between workplace bullying and sickness absence for women in that being exposed to workplace bullying is associated with double the amount of long-term sickness absence for females compared to their non-bullied coworkers. The relationship persists for two years before fading away. The results are robust to the inclusion of personality and work environment characteristics. A further investigation of the health of the individuals show that although men and women are bullied to the same extent and being exposed to bullying is associated with adverse immediate self-reported health for both men and women, we only find that bullying is associated with adverse long-term health for women. This suggests that men and women have different coping strategies. We investigate a number of plausible explanations and find that neither men nor women have more short term sickness absence spells (spells of less than two weeks duration) when exposed to workplace bullying compared to their non-bullied coworkers. Differences do not appear to be due to turnover or labor force participation either.

The remainder of the paper unfolds as follows: The following section discusses why workplace bullying is likely to have negative consequences for the individual. Section 3.3 surveys possible determinants of workplace bullying. Section 3.4 presents the available data and describes the outcomes, how we identify bullying, and the conditioning set. Section 3.5 presents the results. Section 3.6 conducts a range of robustness checks, while section 3.7 discusses possible mechanisms. Section 3.8 concludes.

3.2 Workplace Bullying and Absenteeism

“Bullying is defined as a situation where a person is repeatedly, over a longer period of time, subject to negative actions from which he or she finds it difficult to defend him- or herself.”

(e.g. Hansen et al. (2011)).

Negative actions are defined as behaviours which when they occur on a regular basis can cause severe harm to the individual (Einarsen et al., 2009). Examples include social exclusion, being yelled at and physical violence. According to this definition, in order for the actions to qualify as bullying, they have to persist for a longer period of time,⁵ and there has to be asymmetry in the power relationship between the target and the perpetrator(s) such that the target cannot defend him- or herself. However, as mentioned above, little is known about the long-term consequences of these negative actions.

We motivate the investigation of workplace bullying on sickness absence by establishing a connection from management practices to bullying and from bullying to absenteeism. From the emerging literature on Human Resource Management (HRM) practices we explain how

⁵The norm within the existing literature is 6 months.

management practices are associated with productivity, and summarize findings indicating that different workplace characteristics, including management practices, affect bullying. We then review findings connecting workplace characteristics, in particular bullying, to absenteeism, which may be viewed as a direct loss of productivity. Bullying is therefore likely to be one of the channels through which management practices affect productivity. We then mention why bullying affects health from a theoretical point of view established within psychology. Finally, we briefly highlight the large costs to society of payments to sickness benefits, and in so far that bullying increases sickness absence, this further motivates initiatives to reduce bullying.

In recent years differences in HRM practices have been considered as part of the explanation of differences in productivity across firms. HRM practices include performance pay, self-managed teams, job rotation, promotion, fixing/firing under-performers, reward systems, etc. Findings indicate that individual incentive schemes increase firm performance as do group-incentive schemes (for an overview see Bloom and Van Reenen, 2011). However causal chains are particularly difficult to establish within this literature: It is hardly random which firms choose to incorporate certain management practices. Often practices are introduced in bundles making it difficult to distinguish the effects, and often samples are very small (one firm). One exception is Bloom et al. (2013). They focus on plant level practices in a randomized controlled trial in India, and find that improving management practices in textile factories have large positive effects on productivity. Bartel et al. (2011) investigate the relationship between employee attitudes and organizational performance in branches of a major U.S. bank. They find a high correlation between attitudes and sales performance, and argue for the existence of a branch specific factor that affects both. They perform tests of whether this effect is due to characteristics of the external market of the branch rather than internal operations and find support for the latter. The literature thus suggests that management practices can affect productivity, and as stated in Bloom and Van Reenen (2011) if we do find a positive effect of HRM on productivity we are interested in the mechanisms through which it operates. Bullying may very well be one of these channels. Although current results do not consider causal relationships, leadership style has long been considered a major antecedent of workplace bullying (Samnani and Singh, 2012 and Nielsen, 2013) suggesting that management style affects the level of bullying in the workplace. One reason is the imbalance in power between the manager and subordinate, highlighted in the definition above. Research within organizational psychology suggests that work related characteristics such as quantitative and cognitive demands, influence, and job insecurity encourage bullying both directly and in that they may induce conflicts which can escalate into bullying.⁶ Salin (2002) finds positive correlations between organizational politics and bullying. Organizational politics refer to situations where individuals use deliberate acts to protect or improve their own position within the organization. Bullying may consequently

⁶See e.g. Reknes et al. (2014), and Notelaers et al. (2009).

be more prevalent in organizations that encourage competition, have performance-based wages, face increased competition, etc. Management practices are thus likely to affect bullying in the workplace. According to OECD (2010) p. 125 “Employers are key players in preventing health problems at work and facilitating a swift return to work for people absent from work due to sickness.” A recent paper by Fevang et al. (2014) investigate a reform that removes pay liability for pregnant workers and find that firm incentives matter for the duration of sickness absence. Removing liability increases short-term absence but decreases long-term absence as costs of resuming work are removed for the firm. Their results thus suggest that management can also influence the level of sickness absence among their employees.

At the same time aspects of the working environment, such as bullying, are likely to affect absenteeism. Absence may be seen as a direct loss in productivity through the forgone production, especially when skills are not easily replaced, and an indirect loss through lost human capital accumulation. Ose (2005) incorporates working conditions in an efficiency wage model in order to explain voluntary and involuntary absences. The model is tested on Norwegian data. In Norway long-term sickness absence spells requires a doctor certificate whereas short-term sickness absence spells (duration of less than 3 days) do not, therefore short-term absence (STA) is considered voluntary absence and long-term absence (LTA) involuntary absence due to actual illness. Ose’s results support the theoretical model in that wages only affects STA. The working environment factors influence both STA and LTA indicating that workers are not fully compensated. Johansson and Palme (1996) find that accidents at work, and work-related diseases, increase work absence. Similarly studies within the field of organizational psychology show that bullying is associated with increased levels of sickness absence. In a study of hospital staff in Finland, Kivimaki et al. (2000) find that being subject to bullying was associated with an increase in medically certified sickness absence.⁷ Ortega et al. (2011) find in a sample of elderly care workers (96,3% were women), that frequent bullying was associated with increased levels of long-term sickness absence (more than 6 consecutive weeks) within the year after observed bullying.⁸ On the same sample Clausen et al. (2012) find that bullying was also associated with an increase in the probability of having sickness absence periods of more than eight consecutive weeks.⁹ Other studies find that being exposed to bullying as well as witnessing bullying is associated with depressive symptoms, general stress and mental stress reactions, psychosomatic, and psychological stress symptoms (Niedhammer et al., 2006, Ager-vold and Mikkelsen, 2004, Hansen et al., 2011, Vartia, 2001). In general targets of bullying report lower well-being, lower self esteem, sleep problems, anxiety, concentration difficulties,

⁷The results were adjusted for demographic characteristics, occupational background, behavioral risks, chronic diseases and sickness absence at baseline.

⁸They control for age, gender, occupational groups, BMI, smoking habits, children, cohabitation, and psychosocial work environment factors. They do not account for previous health.

⁹The three previous studies all measure bullying by self-labelling. To our knowledge no other study considers the relationship between bullying measured by negative actions and sickness absence.

fatigue, burn-out, anger, depression and stress symptoms (see e.g. Nielsen and Einarsen, 2012). The previous literature thus suggests that bullying leads to increased absenteeism and adverse health, although causal relationships have not been established.

The above indicates that bullying may very well affect productivity, at least through increased absence (voluntary or involuntary). In the case of involuntary absence we expect that bullying affects the individual's health. A question is why this should be the case? According to stress theory, stress occurs when there exists an imbalance in demands or challenges facing an individual and own resources (Bakker and Demerouti, 2007). At the workplace these (often referred to as stressors) typically consist of workload, role uncertainty, time pressure, conflicts, etc. Most people will experience stressful events during their life course but if the event persists over a longer period of time it will become harmful to the health of the individual. Bullying may very well be one of these stressors that persist over time. Similarly Strain Theory (Agnew, 1992) also suggests that bullying may have negative consequences for the individual's health. Individuals who experience a strain (such as bullying) may produce negative emotions such as anger, frustration, anxiety or depression, which may lead to a corrective action in terms of wrongdoing, self-harm, suicide, etc. Thus bullying is also from a theoretical perspective likely to affect the individual's health and level of sickness absence.

Finally, from a societal perspective yearly costs of sickness absence are high. In 2007 average OECD spending on sickness benefits was 0.8% of GDP (OECD, 2010). In addition there is a great tendency that individuals on long-term sick leave will resume on disability benefits thereby leaving the workforce all together.¹⁰ Ways in which to reduce sickness absence are therefore also highly relevant from this point of view.

3.3 Who are the Targets of Bullying?

An important question when conducting an empirical analysis of the consequences of workplace bullying is to understand the characteristics of individuals exposed to workplace bullying. Researchers in psychology and sociology have long tried to identify traits that increase the risk of exposure to bullying. A vast amount of antecedents have been considered ranging from the target's personality and demographics to work related characteristics and organizational changes. This section reviews some of the results found within the psychological literature on a range of characteristics. These characteristics serve as a guideline to the relevant conditioning set in the analyses below.

According to the definition of bullying some asymmetry in the power relationship between the parties has to persist in order for episodes to classify as bullying. Thus, characteristics such as seniority, age, level of education, ethnicity, etc. are likely to be antecedents of bullying.

¹⁰Only 2% of individuals who are on disability benefits return to the workforce (OECD, 2010).

An example is age. Theoretical considerations point in two directions: Older individuals often have more experience and induce more respect. Thus one would expect younger individuals to be more subject to bullying. At the same time, younger individuals often have more knowledge about recent developments within research, technology, etc. which might be threatening to the older generation, pointing in the direction that older individuals will be more exposed to bullying. Mikkelsen and Einarsen (2001) find no significant age difference between targets and non-targets. In Einarsen and Skogstad (1996) older respondents reported more bullying compared to younger respondents. However, when they split the sample into different industries, younger respondents working in academia report more bullying compared to older respondents. Hoel and Cooper (2000) find that younger and middle aged workers were more subject to bullying compared to older workers.

Education is a main determinant of socio-economic status, and it is reasonable to expect that education can create a wedge between colleagues where higher educated workers feel superior to the unskilled workers. Notelaers et al. (2009) find that higher educated are less likely to report to be bullied. Hogh et al. (2005), however, find no significant effect of education between the exposed and non-exposed. The latter result may reflect a large proportion of highly educated individuals due to free access to higher education in Denmark.

Looking at gender differences the general finding is that no gender differences in exposure to bullying prevail (Hoel and Cooper, 2000 and Hogh et al., 2005). However, it seems as if there is a tendency to have higher levels of bullying in gender-dominated workplaces which we will return to below.

Personality traits of the target have also received a lot of attention from researchers. In the late seventies Olweus (1978) identified two subgroups of targets among school children: The submissive targets being those who were socially withdrawn, insecure and anxious, quiet, and had low self-esteem; and the provocative targets being those who were highly aggressive. Aquino and Bradfield (2000) argue that the same target types can be found within organizations, and as a result hypothesize that highly aggressive personalities, as well as individuals with high negative affectivity (NA), are more subject to bullying.¹¹ Their empirical correlations support this theory. Aquino (2000) argues, on the basis of a victim precipitation model, that a person's conflict style, that is how one reacts in conflicts, may increase the likelihood of being bullied.¹² If an employee has a tendency to give in to others' demands or in general avoid conflicts, i.e. a submissive conflict style, he or she will most likely present him- or herself as a submissive

¹¹Aggressiveness is defined as the underlying trait that predisposes some individuals to aggress or attack more readily than others in response to environmental stimuli (Aquino and Bradfield, 2000). The fact that a person reacts more aggressively to threats might encourage retaliation of the other part. NA refers to a unidimensional, pervasive disposition to experience high levels of distressing emotions such as anger, hostility, fear or anxiety.

¹²A victim precipitation model suggests that victims may contribute to their own victimization because of how they behave in certain situations.

target and therefore be an easy target of bullying. His empirical findings support that the way a person reacts to conflicts influences bullying directly and indirectly.

As mentioned above a long list of work related characteristics such as demands, leadership style, job security, organizational changes, etc. have been associated with workplace bullying. Although gender does not seem to affect whether the individual is exposed to bullying, bullying does seem to thrive in workplaces dominated by one gender (Matthiesen and Einarsen, 2007 and Eriksen and Einarsen, 2004). Minorities are viewed to be more subject to bullying as they create a natural difference in power (see the definition of bullying). Belonging to the dominated gender can be viewed as belonging to a minority. At the same time the perception of the pattern of gender roles may further induce bullying of the minority (e.g. male nurses, female carpenters). Similarly employees with lower hierarchical status in the workplace are more exposed to bullying (Aquino, 2000).

The results above emphasize the importance of including various individual and firm related characteristics in the analyses. Individual characteristics should preferably include measures of standard socio-economic variables such as gender, age, seniority and ethnic origin, as well as personal characteristics such as personality traits. Firm related characteristics should include industry, firm size, gender ratio, etc. A review of the variables included in the analyses is found in section 3.4.3.

3.4 Data

This section summarizes the data used in the empirical analysis. We start by introducing the sample. Second we explain the outcomes that we employ in the main analyses. We then describe how we identify targets of bullying, and make a note on the timing of exposure to bullying in relation to observed sickness absence. The final subsection describes our conditioning set and conducts a probit regression of the propensity to be bullied.

The data stem from “The Bullying Cohort”-Study conducted by the National Research Centre for the Working Environment (NRCWE) in Denmark in 2006.¹³ The participants of the survey were obtained through the following process: Workplaces were recruited through an open invitation on the Internet, and among other things, on web pages of professional organizations. Through the invitation 90 companies signed up for participation (28 private and 62 public). Only companies with more than 30 employees were asked to participate.¹⁴ Of the 79 invited companies 22 private and 38 public workplaces agreed to participate. The companies provided NFA with mail addresses of their employees, and questionnaires were sent directly to

¹³The questionnaires were collected from September to November in 2006.

¹⁴A few day care centers were allowed to participate although their number of employees were below 30.

the employees with a return envelope to NFA. 3,358 individuals responded to the questionnaire giving a response rate of 45.9%.¹⁵

The questionnaire does not focus solely on bullying but instead contains a long list of items of demographic character as well as questions about the psychosocial work environment, negative acts, bullying, physical and psychological stress reactions, health, sleep and sickness absenteeism. The survey data is merged with the Danish Registers using the respondents' civil registration number. The register data contains information on a large range of important characteristics such as demographics, socio-economic status, current employment, workplace characteristics, prescription drug usage, and somatic and psychiatric diagnoses from general hospitals. In addition the data is augmented with the Danish Register for Evaluation of Marginalization (DREAM) obtained from the Danish Ministry of Employment. It contains weekly information on every person in Denmark who collects government benefits. This enables us to obtain more precise information on sickness absenteeism as well as information on unemployment, previous labor market history, previous sickness absence history, etc.

We restrict the sample to the 54 companies where more than 10 employees responded to the questionnaire.¹⁶ We are able to identify the corresponding workplaces in the registers resulting in 136 workplaces. We further delete workplaces where less than three employees responded to the survey. This gives us a final sample of 54 companies divided into 104 workplaces with 3,227 respondents. We further delete 27 observations as they are observed as retired in the data before the survey period. Finally we delete another 18 observations as these did not respond to the Negative Acts Questionnaire. The final sample comprises of 3,182 observations in 104 workplaces.

3.4.1 Outcomes

Our main outcome is the average amount of yearly long-term sickness absence in each of the years from 2007 to 2011. In Denmark individuals are entitled to compensation due to sickness absence for 52 weeks of the past 78 weeks whether they are receiving unemployment benefits, in subsidized employment, or employed.¹⁷ If a person is employed the right to wage during sick leave depends on the contract. However, the employer is in any case obliged to pay the equivalent of sickness benefits in the first 3 weeks of absence. Afterwards the municipality will cover the payments equal to the amount of sickness benefits (about \$700/week in 2013). DREAM only registers the benefits covered by the municipality, which is why only sickness absence durations of more than three weeks will appear in the data for individuals employed in

¹⁵Appendix 3.A contains information on attrition.

¹⁶The survey is obtained from September to November whereas the employment place in the registers are obtained in November. To make sure that we match workers and workplaces correctly we require a minimum of 10 respondents per company.

¹⁷In special cases it can be extended for a maximum of an year.

the private sector. For this reason we only consider absence in excess of three weeks. In each year from 2007 to 2011 we have added together the individual's weeks of sickness absence in excess of three weeks, if the periods were at least three weeks long.

Table 3.1 Weeks of Long-term Sickness Absence by Bullying Status

	Bullied		Non-Bullied		No. Obs	
	Mean	Std. Dev.	Mean	Std. Dev.		
Sickness Absence 2000	0.241	1.768	0.331	2.605	3,182	
Sickness Absence 2001	0.421	2.480	0.393	3.047	3,182	
Sickness Absence 2002	0.522	3.491	0.464	2.945	3,182	
Sickness Absence 2003	0.531	3.626	0.644	3.921	3,182	
Sickness Absence 2004	0.583	3.699	0.587	3.668	3,182	
Sickness Absence 2005	0.553	3.119	0.660	3.839	3,182	
Sickness Absence 2006	1.281	**	5.331	0.711	3.794	3,182
Sickness Absence 2007	2.465	***	8.488	1.149	5.615	3,182
Sickness Absence 2008	2.474	***	8.580	1.015	5.282	3,182
Sickness Absence 2009	2.311	***	8.422	1.045	5.484	3,182
Sickness Absence 2010	1.978	**	8.568	1.082	5.383	3,182
Sickness Absence 2011	1.658	*	7.003	1.015	4.951	3,182

Notes: Means are tested against the mean of the Non-Bullied. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level.

Table (3.1) presents mean values and standard deviations of long-term sickness absence by bullying status for the years 2000 to 2011. From 2000 to 2005 we observe no significant differences between targets and their non-bullied co-workers. In 2006, where the survey is conducted, we see that individuals exposed to bullying have significantly more sickness absence. This is to be expected as respondents are asked whether they have been subject to a set of negative actions within the past six months prior to the time of the survey which was conducted in the second half of 2006. We will get back to this below. We keep observing significant differences in weeks of long-term sickness absence between bullied employees and their non-bullied coworkers from 2007 till 2010. The average amount of sickness absence ranges between two and three weeks. In the next section we investigate whether these differences persist when controlling for possible confounders, and workplace fixed effects.

Since 2010 employers have been obligated to have a conversation with the employee who is off sick within the first four weeks of absence. The purpose of this talk is first of all to provide the municipality with information regarding the absence, and talk about how the situation is best tackled in order to facilitate a quick return to work. The employee is not required to hand in a doctor's certificate, but the employer may ask for it (Arbejdsmarkedsstyrelsen, 2010). As in Ose (2005) we therefore expect our observed sickness absence to reflect actual absence due to illness. We will however discuss the mechanism that bullying affects the individual's health as an explanation to why absence increases.

3.4.2 Identifying Bullying

We identify exposure to workplace bullying using the Negative Acts Questionnaire - Revised (Einarsen et al., 2009). The scale is widely used within the workplace bullying literature, and its external validity has been confirmed in a number of studies.¹⁸ It comprises of 21 items measuring different negative actions such as “Someone withholding information which affects your performance”, “Being humiliated or ridiculed in connection with your work”, “Being ignored or excluded”. The respondents are asked how often they have been exposed to the negative actions (“Never”, “Now and then”, “Monthly”, “Weekly”, or “Daily”) within the past 6 months. The scale shows good internal validity with a Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) of 0.93 and a Cronbach’s Alpha of 0.88. Notice in particular that the Negative Acts Questionnaire - Revised was asked before any mention of the word bullying in the questionnaire.

Following the literature (e.g. Mikkelsen and Einarsen, 2001 and Nielsen et al., 2009) we identify a respondent as being a target of bullying if the individual replied that he or she had been subject to at least two negative actions daily or weekly during the past six months. Using this definition 7% of the respondents are exposed to workplace bullying. This is about the same size as previous reported prevalence rates using two negative actions as the cut-off criterion (Nielsen et al., 2009 and Mikkelsen and Einarsen, 2001).¹⁹

A natural concern when measuring bullying is measurement error. Although the individuals are asked to rate exposure to a set of specific actions instead of self-labeling to be bullied, whether one feels for example “being excluded” is still a subjective judgement. Thus what may make one person feel excluded may not make another person feel excluded. The questionnaire also presents the respondents with the definition of bullying and asks whether any of their colleagues have been exposed to bullying within the past six months. We use this measure to see whether there is a relationship between a person being identified as exposed to bullying through the self-reporting of negative actions and coworkers reporting that one of their colleagues is exposed to bullying. Only in two out of 105 workplaces do we observe that an individual is self-reporting to experience at least two negative actions daily or weekly and that none of his or her colleagues report that they witness bullying. In 72 workplaces we observe a target of bullying and coworkers reporting that they are witnessing bullying. In 16 workplaces we observe that a colleague reported that they witness bullying, while no one self-reported at least two negative actions daily or weekly. This could point to a tendency to underreport negative actions as there

¹⁸Nielsen et al. (2010) find 16 studies based on NAQ in a meta-analysis of measurement methods of workplace bullying.

¹⁹The conclusions are robust to the alternative definition of bullying where targets are grouped into two categories 1) two negative actions and 2) more than two negative actions. We find that the more negative actions the individual is exposed to, the larger the coefficient on bullying. Results are available from the authors upon request.

are plausible negative connotations related to them, or that the non-respondents in a workplace are more likely to be exposed to bullying. In so far that bullying leads to poorer health and more sickness absence, this selection will tend to bias our results downwards.

3.4.2.1 Timing of Exposure to Bullying

An important concern is whether individuals are being bullied due to their sickness absence, in which case we cannot rule out reverse causality. Figure (3.2) plots average long-term sickness absence for bullied and non-bullied individuals on a weekly basis. The grey area defines the weeks in which individuals were surveyed. It is reassuring that we do not observe a spike in sickness absence before the survey as this would give rise to concerns about reverse causality. It does seem as if the targets of bullying have slightly more sickness absence prior to the survey but recall that they are asked about negative actions within the past 6 months. We would therefore expect to see some differences in sickness absence prior to the survey period.

However this graph may also imply that there is no or little persistence in bullying, or at least that the individuals who had previously been exposed to bullying did not experience higher levels of sickness absence. As our sample is implicitly conditioned on being employed in the weeks of the survey in 2006, one can imagine that those hurt most by bullying in the past will not enter the sample. The survey further includes a question on whether the individual had previously been exposed to bullying. A mean comparison of the targets and non-targets show that targets were no more likely to have previously been bullied than non-targets suggesting that persistence is not a big issue in this sample.

Another concern is that being surveyed on questions such as bullying causes individuals to call off sick. By the look of the graph we cannot rule out that this is the case. We do however find it highly implausible that merely asking individuals about bullying will lead to the large persistence in sickness absence that we observe in figure (3.2). Recall that in figure (3.2) we only observe absence spells with a total duration of more than three weeks.

We are only able to consider long-term sickness absence as absence spells below three weeks are not observed in DREAM for private sector employees. We therefore construct the same graph as before for public sector employees. For this sample sickness absence is recorded from day one. If being exposed to workplace bullying is driven by many short-term absence spells this graph would pick it up. Figure (3.3) looks very similar to figure (3.2). Thus we are not concerned that, at least in the public sector, short-term sickness absence spells drives bullying.

3.4.3 The Conditioning Set

As mentioned above a vast amount of characteristics, both related to the individual and to the workplace, may influence whether the individual is exposed to bullying in the workplace. At the same time these characteristics may be related to sickness absence. Failure to account for

Figure 3.2 Weekly Average Long-term Sickness Absence by Bullying Status in 2006

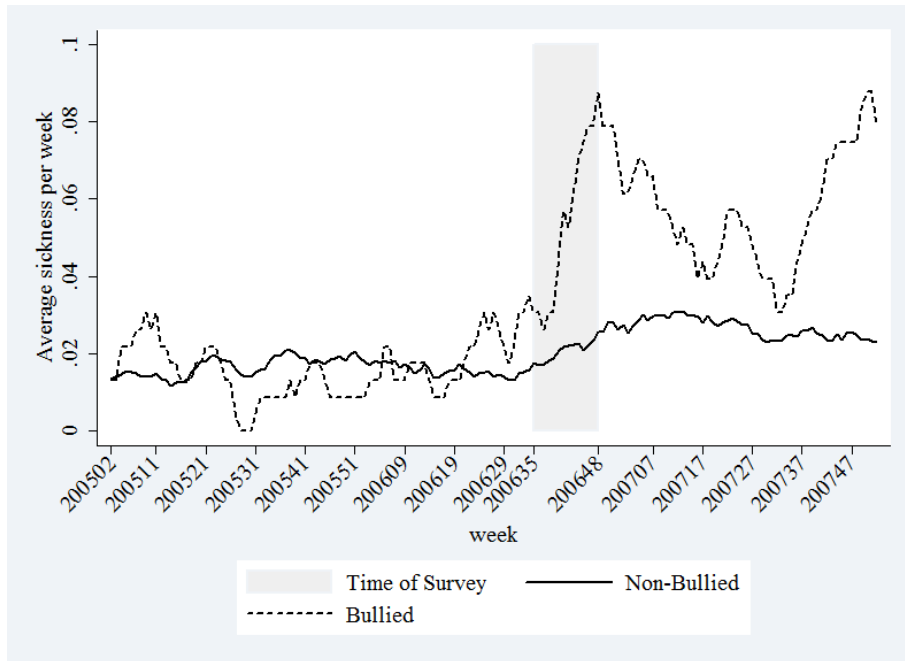
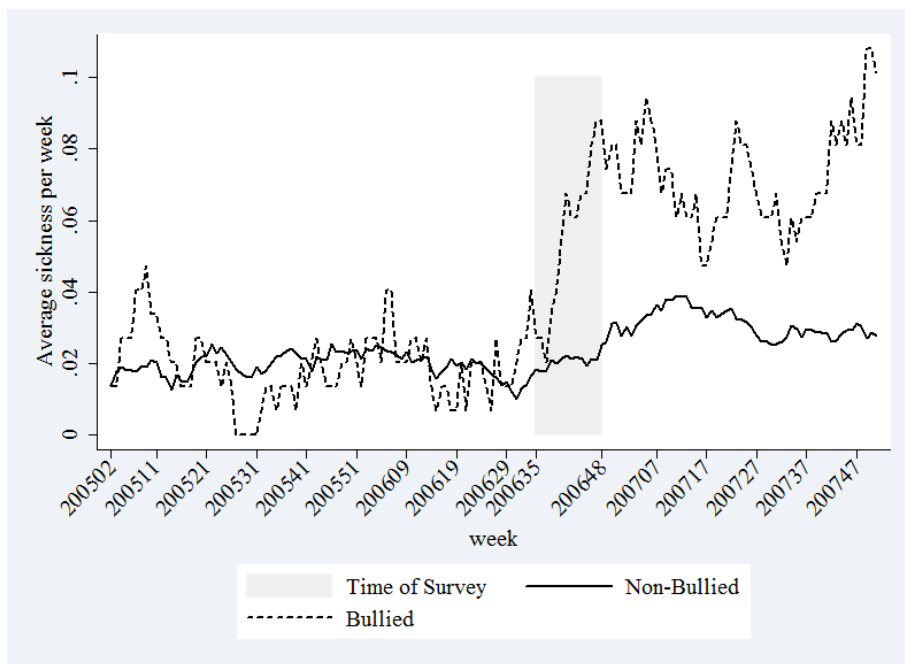


Figure 3.3 Weekly Average Sickness Absence by Bullying Status in 2006 Public Sector Employees



variables which affect both the propensity to be bullied and the outcome of interest, will bias our results. To minimize bias due to endogeneity all conditioning variables are measured in the year prior to the survey (2005) or earlier.

We exploit that we have access to the extremely rich Danish Register Data. We control for individual characteristics such as gender, age, education, ethnicity and civil status. Previous

literature points to the importance of personality traits but unfortunately we do not have information on traits such as negative affectivity prior to observed bullying status. We do however have access to information on whether the individual has received any diagnoses of a mental or behavioral disorder through the Danish Psychiatric Central Register which covers all contacts with the regional psychiatric treatment system prior to observed bullying. These diagnoses include depression, anxiety, schizophrenia, ADHD, etc. To our knowledge no other study includes register-based information on diagnoses.

We also account for work related factors such as tenure, sector, earnings, and working hours. In order to account for workplace specific factors we include a workplace fixed effect. This accounts for organizational traits that are constant within the firms in 2006 such as a particularly poor leader, high workloads, industry, etc. It further accounts for the gender ratio and overall level of sickness absence in the workplace.

Lechner and Wunsch (2013) highlight the importance of controlling for pre-treatment outcomes in studies that rely on selection on observables for identification. We therefore include information on historic prescription drug usage in terms of antidepressants and psycholeptics, as well as previous sickness absence. Finally we control for pre-survey unemployment history.

Table (3.2) presents means and standard deviation of a selection of characteristics by bullying status.²⁰ We see that targets of bullying differ from their non-bullied colleagues on most demographic characteristics. They are younger, more likely to be male, less likely to be married and more likely to be divorced.

They also differ on a range of work related characteristics. Targets have less tenure in the company and are more likely to be employed in the public sector. The individual's position in the company does not seem to matter for exposure to bullying. Unemployment history also differs by bullying status in that targets have a history of more unemployment compared to their non-bullied coworkers.²¹ In relation to information on previous sickness absence and health, we find that targets of bullying appear to have less albeit insignificant sickness absence prior to 2006. Mean values on the use of antidepressants and psycholeptics are higher for individuals exposed to bullying, but again the differences are only borderline significant for the use of antidepressant medicine in 2004.

3.4.3.1 Propensity to be a Target of Bullying

We model the propensity to be exposed to workplace bullying by the following equation:

$$Bullied_{iw} = \mathbf{1}[\mathbf{Z}'_i\gamma + \nu_w + \epsilon_i > 0], \quad \text{where} \quad (3.1)$$

$$\mathbf{Z} = (\mathbf{X}, \mathbf{W}, \mathbf{H}).$$

²⁰For the full set of variables see Appendix 3.B.

²¹Sickness absence for unemployed individuals is also registered in DREAM under the same rules that apply to public employees. Here the unemployment fund is considered their employer.

Table 3.2 Means and Standard Deviations on Selected Characteristics by Bullying Status.

	Bullied		Non-Bullied		No. Obs	
	Mean	Std. Dev.	Mean	Std. Dev.		
<i>Individual Characteristics (X)</i>						
Male (0/1)	0.425	***	0.495	0.310	0.463	3,182
Age	42.158	***	9.251	44.168	9.975	3,182
Ethnicity (0/1)	0.079	**	0.270	0.041	0.198	3,179
Married (0/1)	0.478	***	0.501	0.666	0.472	3,179
Cohabiting (0/1)	0.237	***	0.426	0.134	0.341	3,179
Single (0/1)	0.285	***	0.452	0.200	0.400	3,179
Divorced (0/1)	0.145	***	0.353	0.086	0.281	3,179
Children 0-2 yrs. (0/1)	0.092		0.290	0.099	0.299	3,179
Children 3-5 yrs. (0/1)	0.136		0.344	0.123	0.328	3,179
Years since Divorce	1.039		3.864	0.781	3.385	3,179
Higher Education	0.179		0.384	0.151	0.358	3,154
<i>Work-related Characteristics (W)</i>						
Tenure	4.602	***	4.995	7.757	7.436	3,106
Fulltime Employee (0/1)	0.978		0.147	0.976	0.154	3,179
Parttime Employee (0/1)	0.022		0.147	0.024	0.154	3,179
Private Sector (0/1)	0.351	***	0.478	0.271	0.445	3,177
Public Sector (0/1)	0.649	***	0.478	0.729	0.445	3,177
Top management (0/1)	0.018		0.132	0.025	0.156	3,179
Higher Management (0/1)	0.246		0.431	0.225	0.418	3,179
Medium Level Empl. (0/1)	0.294		0.457	0.327	0.469	3,179
Lower Level Empl. (0/1)	0.250		0.434	0.274	0.446	3,179
Other Employment (0/1)	0.184	**	0.389	0.136	0.343	3,179
Unemployed (0/1)	0.009		0.093	0.010	0.100	3,179
Earnings 2003	11.672	**	2.910	11.996	2.124	3,165
Earnings 2004	12.102		2.076	12.135	1.875	3,170
Earnings 2005	12.329		1.521	12.338	1.209	3,179
Weeks of Unemp. 2003	2.803	***	9.494	1.405	6.520	3,182
Weeks of Unemp. 2004	2.908	***	8.600	1.465	6.623	3,182
Weeks of Unemp. 2005	1.895	**	6.781	1.126	5.599	3,182
<i>Previous Health (H)</i>						
Weeks of Sick. Ab. 2003	0.531		3.626	0.644	3.921	3,182
Weeks of Sick. Ab. 2004	0.583		3.699	0.587	3.668	3,182
Weeks of Sick. Ab. 2005	0.553		3.119	0.660	3.839	3,182
Antidepressives 2003 (0/1)	0.057		0.232	0.038	0.192	3,182
Antidepressives 2004 (0/1)	0.061	*	0.241	0.039	0.193	3,182
Antidepressives 2005 (0/1)	0.057		0.232	0.043	0.202	3,182
Psycholeptics 2003 (0/1)	0.061		0.241	0.048	0.213	3,182
Psycholeptics 2004 (0/1)	0.061		0.241	0.045	0.208	3,182
Psycholeptics 2005 (0/1)	0.061		0.232	0.056	0.230	3,182
Mental or Behavioral Diag. (0/1)	0.057		0.232	0.042	0.200	3,182
Number of observations	228		2,954			

Notes: Means are tested against the mean of the Non-Bullied. (***): Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

where \mathbf{X} is a vector of individual characteristics, \mathbf{W} is a vector of work- and employment-related characteristics, and \mathbf{H} is a vector of previous health history. Finally we include workplace fixed effects ν_w . (3.1) is estimated by a standard probit regression. The marginal effects evaluated at the mean of the independent variables are reported in table (3.3).²² Once we condition on all the covariates and workplace fixed effects we see that not many characteristics matter for the probability of being exposed to bullying. Being married and having more tenure decrease the probability of being a target. Being unemployed in 2005 make you less likely to be bullied, compared to being a lower level employee, which indicates that a person needs to be settled in the workplace to a certain extent in order to experience bullying.

In general the workplace fixed effects seem to be of high importance. The joint significance test of the fixed effects is very high, indicating that there is something important going on within the workplaces in relation to workplace bullying. The results indicate that it is not only individual characteristics but possibly low leadership quality, bad culture, the composition of colleagues, etc. captured by the fixed effects that explain exposure to bullying, and in so far that these have a direct effect on sickness absence they are important to account for in our subsequent analyses.

3.5 Results

We estimate the relationship between workplace bullying and long-term sickness absence using Ordinary Least Squares estimation (OLS). The regression can be summarized by the following equation:

$$y_{iw} = \mathbf{Z}'_i \gamma + \beta' \text{Bullied} + \nu_w + \epsilon_i, \quad \text{where} \quad (3.2)$$

$$\mathbf{Z} = (\mathbf{X}, \mathbf{W}, \mathbf{H}).$$

y_{iw} refers to sickness absence in years 2007-2011 of individual i in workplace w . *Bullied* is an indicator for being a target of workplace bullying and \mathbf{Z} is the rich set of conditioning variables mentioned in section 3.4.3. ν_w is a workplace fixed effect. β is the parameter of interest. We gradually expand the conditioning set in the regressions. First we estimate the relationship between bullying and the outcome excluding any confounders. Next we include the individual characteristics \mathbf{X} . This conditioning set resembles what is most often available to researchers through registers. We then expand \mathbf{Z} to also include register information on labor market history and employment related characteristics \mathbf{W} , as well as workplace fixed effects ν_w . Finally we include previous sickness absence, prescription drug usage and diagnosis of a behavioral or mental disorder \mathbf{H} in the conditioning set. Again note that all conditioning variables are measured in 2005 or earlier. The corresponding results are reported in table (3.4).

²²For the full set of variables see Appendix 3.C.

Table 3.3 Probit Regression: Propensity to be a Target of Bullying in the Workplace

	Bullied	
	Coef.	Std. Error
<i>Individual Characteristics (X)</i>		
Male (0/1)	0.012	0.009
Age	0.000	0.001
Divorce (0/1)	0.021	0.026
Cohabiting (omit. var = Single)	0.017	0.016
Married (omit. var = Single)	-0.040 ***	0.014
Ethnic (0/1)	0.012	0.018
Higher Educational Level (0/1)	0.012	0.012
Children 0-2 yrs. (0/1)	-0.005	0.015
Children 3-5 yrs. (0/1)	0.017	0.016
<i>Work-related Characteristics (W)</i>		
Tenure	-0.003 ***	0.001
Full Time Employee (omit. var = Part)	-0.027	0.046
Private Sector (omit. var = Public)	0.014	0.047
<i>Employment (omit. var = Lower Level Employee)</i>		
Top Management	-0.023	0.018
Higher Management	0.016	0.019
Medium Level Empl.	0.004	0.012
Other Employment	0.004	0.018
Unemployed	-0.044 ***	0.013
Earnings 2003	-0.004 *	0.003
Earnings 2004	0.005 *	0.003
Earnings 2005	0.003	0.006
Weeks of Unemp. 2003	0.001	0.001
Weeks of Unemp. 2004	0.000	0.001
Weeks of Unemp. 2005	0.001	0.001
<i>Previous Health (H)</i>		
Weeks of Sick. Abs. 2003	0.000	0.001
Weeks of Sick. Abs. 2004	0.001	0.001
Weeks of Sick. Abs. 2005	0.000	0.001
Antidepressives 2003 (0/1)	-0.007	0.027
Antidepressives 2004 (0/1)	0.022	0.042
Antidepressives 2005 (0/1)	-0.004	0.026
Psycholeptics 2003 (0/1)	-0.005	0.021
Psycholeptics 2004 (0/1)	0.010	0.033
Psycholeptics 2005 (0/1)	-0.005	0.022
Mental or Behavioral Diag. (0/1)	0.017	0.022
Workplace Fixed Effects	Yes	
Number of Observations	3.182	
Pseudo R ²	0.114	

Notes: Marginal effects are evaluated at the means of the dependent variables. Standard Errors are clustered at the workplace level. (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Targets of workplace bullying have a significantly higher level of long-term sickness absence compared to their non-bullied colleagues in the first three years after we observe bullying. The relationship slightly fades away and has completely disappeared in 2011: five years after we observed the bullying status. The results are only affected to a minor extent by the expansion of the conditioning set, which means that they are not driven by certain individual characteristics, previous sickness absence, poor leadership or a bad culture at the workplace, previous use of antidepressant medicine, or even diagnosis of mental or behavioral disorder.

Table 3.4 OLS Results: Workplace Bullying and Sickness Absence

	Weeks of Long-term Sickness Absence (Year)								
	2007		2008		2009		2010		2011
Bullied (0/1)	1.316	**	1.459	**	1.266	**	0.896		0.643
Std. Error	(0.584)		(0.558)		(0.546)		(0.557)		(0.445)
<i>+ Individual Char. (X)</i>									
Bullied (0/1)	1.422	**	1.601	***	1.346	**	0.896		0.646
Std. Error	(0.593)		(0.559)		(0.554)		(0.564)		(0.475)
<i>+ Workrelated Char. (W)</i>									
Bullied (0/1)	1.324	**	1.462	***	1.390	**	0.921		0.543
Std. Error	(0.616)		(0.557)		(0.566)		(0.572)		(0.491)
<i>+ Previous Health (H)</i>									
Bullied (0/1)	1.212	**	1.317	**	1.277	**	0.853	*	0.509
Std. Error	(0.596)		(0.560)		(0.542)		(0.513)		(0.485)
No. Observations	3,182								

Notes: The standard errors are clustered at the workplace level. (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. The full set of estimates for the final model can be found in Appendix 3.D.

Estimates are also significant in an economic sense: the final model suggests that being exposed to workplace bullying in 2006 increases long-term sickness absence in 2007-2009 by about 1.2 weeks. In other words, individuals exposed to bullying have twice as much sickness absence as their non-bullied colleagues.

We investigate the heterogeneity of the results by splitting the sample by gender.²³ There is no reason to believe that men and women will react similarly when experiencing workplace bullying, and it is not obvious that the different characteristics will affect the exposure to bullying in the same way across genders. For instance, a highly educated man may induce respect whereas a highly educated woman may be a threat. Table (3.5) presents the results of the separate regressions for the female and male sample. Now we only observe a positive and significant correlation between bullying and sickness absence for women in 2007 till 2009. Excluding any other explanatory variables, women exposed to bullying have on average 2.3

²³However, we cannot reject the Chow Test of equal coefficients of men and women.

weeks more long-term sickness absence compared to their non-bullied female colleagues in 2007, and this result is only reduced with 0.15 weeks equal to about one day after including the full conditioning set. If we compare this to an average of 1.6 weeks of long-term sickness absence for non-bullied women, bullying more than doubles the amount of absence. As before the relationship is persistent but now only significant at a 10% level in 2009. Before the size of the estimates were constantly equal to 1.2 weeks from 2007 to 2009 but now they seem to reduce by about a day per year. In contrast to the results for women we observe no significant differences for men. The coefficients are small and they are only slightly affected by the expansion of the conditioning set. This suggests that the lack of relationship is not merely due to the small sample size. Men apparently do not seem to have more long term sickness absence when exposed to bullying. A possible explanation for the gender differences in the results could be that men and women are also exposed to different bullying behavior. However a thorough investigation of the type and frequency of the negative acts shows that men are exposed to more negative acts than women and at a higher frequency. When dividing the sample into work-related, person-related and physical intimidating bullying men is at least as likely to be exposed to work- and person-related bullying and more likely to be physically intimidated.

Another thing to notice is that the effect for women disappears after 3 years. There are different explanations to this. Either bullying is dealt with, or the composition of workers in the workplace has changed such that either the target or the perpetrator(s) are not working together anymore. This is very plausible in Danish workplaces in that more than 50% of employees in this sample have left their workplace after four years. We will return to turnover below.

According to the propensity score above we cannot identify a target profile once workplace fixed effects are included. Similarly men and women appear to be exposed to the same type of bullying behavior. Still our results show that being bullied at work significantly increases long-term sickness absence for women but not for men. These results point toward 1) the health of men and women are affected differently or 2) they employ different coping strategies when exposed to workplace bullying. In order to understand why the differences in sickness absence emerge we investigate the relationship between bullying, health and turnover in section 3.7. However, first we conduct a series of robustness checks to the results above.

3.6 Robustness

Even though our results are robust to the inclusion of the extensive conditioning set, we conduct a series of robustness checks to further increase our confidence in the results. We add plausible confounders such as personality and work environment characteristics. These robustness checks are reported for the female employees, as results above were not significant

Table 3.5 OLS Results: Workplace Bullying and Sickness Absence - By Gender

	Weeks of Long-term Sickness Absence (Year)								
	2007		2008		2009		2010		2011
Female Sample									
Bullied (0/1)	2.261	**	2.086	**	1.986	**	1.261		1.257
Std. Error	(0.919)		(0.857)		(0.921)		(0.812)		(0.758)
<i>+ Individual Char. (X)</i>									
Bullied (0/1)	2.333	**	2.107	**	1.969	**	1.213		1.269
Std. Error	(0.943)		(0.852)		(0.922)		(0.814)		(0.772)
<i>+ Workrelated Char. (W)</i>									
Bullied (0/1)	2.319	**	2.057	**	1.881	*	1.098		1.200
Std. Error	(0.929)		(0.876)		(0.952)		(0.856)		(0.821)
<i>+ Previous Health (H)</i>									
Bullied (0/1)	2.117	**	1.955	**	1.789	*	1.031		1.116
Std. Error	(0.891)		(0.878)		(0.915)		(0.792)		(0.789)
No. observations	2,169								
Male Sample									
Bullied (0/1)	0.182		0.729		0.447		0.524		-0.105
Std. Error	(0.632)		(0.674)		(0.581)		(0.582)		(0.758)
<i>+ Individual Char. (X)</i>									
Bullied (0/1)	0.206		0.798		0.433		0.544		-0.183
Std. Error	(0.631)		(0.662)		(0.569)		(0.621)		(0.772)
<i>+ Workrelated Char. (W)</i>									
Bullied (0/1)	0.296		0.731		0.582		0.526		-0.350
Std. Error	(0.732)		(0.724)		(0.690)		(0.548)		(0.821)
<i>+ Previous Health (H)</i>									
Bullied (0/1)	0.027		0.507		0.526		0.191		-0.288
Std. Error	(0.757)		(0.735)		(0.621)		(0.434)		(0.789)
No. observations	1,013								

Notes: The standard errors are clustered at the workplace level. (***) : Significant at a 1% level. (**) : Significant at a 5% level. (*) : Significant at a 10% level. The full set of estimates is available from the authors upon request.

for male employees and this is not changed when including variables on personality and the working environment. In all models we condition on the full set of individual and work related characteristics, workplace fixed effects, and previous health.

3.6.1 Personality Characteristics

As mentioned previously personality characteristics are likely to affect whether a person is subject to bullying and may also very well affect the individual's sickness absence level. Previous studies have found positive correlations between personality traits such as negative affectivity (NA) and workplace bullying (Aquino and Bradfield, 2000). People with high NA view themselves and aspects of the world negatively. NA roughly corresponds to the personality factor of anxiety/neuroticism. Positive affectivity (PA) on the other hand refers to how people experience positive emotions. It roughly corresponds to the extraversion personality factor (Costa and McCrae, 1980). Both measures of affectivity are believed to be fairly stable over time, and having high NA does not imply low PA and vice versa (Watson and Clark, 1984). The questionnaire contains the PANAS scale measuring negative and positive affectivity (Watson et al., 1988). It contains 20 items measuring different emotions, and individuals are asked to state to what extent they have had these emotions within the past 4 weeks.²⁴ The questionnaire also contains the scale *Sense of Coherence* by Setterlind and Larsson (1995). This measures to what extent people believe events happen to them on purpose or by chance. This is important in relation to coping strategies. If a person do not believe that he or she can change the course of an event, they are probably less likely to try. We measure both Sense of Coherence using nine different items.²⁵ The personality measures are not included in our main specification as we worry that they are affected by exposure to bullying as everything is measured simultaneously in the questionnaire. Although one can argue that affectivity is believed to be a stable trait, the questionnaire asks to feelings experienced within the past four weeks which we believe are likely to be affected by exposure to bullying.

All four factors are extracted through confirmatory principal component analysis and scores are obtained using the regression method. Table (3.6) reports the results of our preferred specification and the results when extending the conditioning set to include all four personality characteristics. We see that the size of the estimates is slightly reduced when conditioning on personality characteristics but they remain significant in 2007 and 2008. Where significant the coefficients on the personality characteristics have the expected sign: PA is negative, NA is positive, and coherence is only marginally significant and positive in 2011 (results not shown here).

²⁴We exclude one item "Alert" as it loads on NA instead of PA, unlike the original scale. Cronbach's Alpha on NA is 0.88 and 0.87 on PA indicating excellent internal validity. Loadings and Cronbach's Alphas are found in Appendix 3.E.

²⁵Cronbach's Alpha on NC is 0.78.

Table 3.6 OLS Results: Workplace Bullying and Sickness Absence for the Female Sample

Extended Conditioning Set - Personality								
Weeks of Long-term Sickness Absence (Year)								
	2007		2008		2009		2010	2011
<i>Main Conditioning Set</i>								
Bullied (0/1)	2.117	**	1.955	**	1.789	*	1.031	1.116
Std. Error	(0.891)		(0.878)		(0.915)		(0.792)	(0.789)
<i>+ Personality</i>								
Bullied (0/1)	1.784	**	1.925	**	1.518		0.474	0.847
Std. Error.	(0.897)		(0.898)		(0.933)		(0.731)	(0.764)
No. Observations	2,169							

Notes: The main conditioning set includes individual and work-related characteristics, and previous health. The standard errors are clustered at the workplace level. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level. The full set of estimates is available from the authors upon request.

3.6.2 Work Environment Characteristics

The questionnaire also contains a long range of items relating to different aspects of the working environment. As mentioned previously a vast amount of work environment characteristics have been considered as antecedents of bullying, in addition they may affect sickness absence in their own right. The questions in the survey are obtained from the Copenhagen Psychosocial Questionnaire (COPSOQ II) (Pejtersen et al., 2010). It has been developed in order to measure the psychosocial work environment among Danish employees. The factors are extracted using confirmatory factor analysis on the COPSOQ II scales and the factors are grouped as proposed in Pejtersen et al. (2010). The validity of the factors is assessed by Cronbach's Alpha. All alphas range between 0.535 and 0.878.²⁶ Table (3.7) summarizes the results. Again we see that the results are robust to the expansion of the conditioning set. In 2007 the coefficient on bullying is only significant at a 10% level after adjusting for job content, and remains significant at a 10% level after including additional controls. The results in 2008 are not affected at all by the inclusion of the workplace characteristics. However we stress that one should be cautious when interpreting these results as we believe that characteristics like "leader perception", "trust in colleagues", "meaning", and "loyalty" are very likely to be affected by the exposure to bullying. Nevertheless our results are to a large extent robust to the inclusion of work environment characteristics.

The robustness checks support the previous findings. Being exposed to workplace bullying is associated with increases in long-term sickness absence for women even when conditioning on personality and work environment characteristics.²⁷ The next section discusses different

²⁶For the full set of scales, Cronbach's Alpha's and loadings see Appendix 3.E.

²⁷The results are also robust to previous exposure to bullying for both men (insignificant) and women.

Table 3.7 OLS Results: Workplace Bullying and Sickness Absence for the Female Sample

Extended Conditioning Set - Work Environment Characteristics

	Weeks of Long-term Sickness Absence (Year)								
	2007		2008		2009		2010		2011
<i>Main Conditioning Set</i>									
Bullied (0/1)	2.117	**	1.955	**	1.789	*	1.031		1.116
Std. Error	(0.891)		(0.878)		(0.915)		(0.792)		(0.789)
<i>+ Demands</i>									
Bullied (0/1)	1.960	**	1.952	**	1.908	**	1.087		0.828
Std. Error	(0.868)		(0.914)		(0.929)		(0.771)		(0.770)
<i>+ Work Organization</i>									
Bullied (0/1)	1.677	*	1.865	**	1.751	*	0.880		0.562
Std. Error	(0.854)		(0.939)		(0.955)		(0.771)		(0.724)
<i>+ Job Content</i>									
Bullied (0/1)	1.584	*	1.869	*	1.631	*	0.891		0.484
Std. Error	(0.870)		(0.952)		(0.952)		(0.765)		(0.707)
<i>+ Interpersonal Relations & Leadership</i>									
Bullied (0/1)	1.595	*	1.952	**	1.481		0.713		0.225
Std. Error	(0.855)		(0.945)		(0.937)		(0.713)		(0.855)
<i>+ Insecurity</i>									
Bullied (0/1)	1.601	*	1.955	**	1.476		0.718		0.232
Std. Error	(0.861)		(0.946)		(0.935)		(0.711)		(0.672)
<i>+ Workplace Values</i>									
Bullied (0/1)	1.620	*	1.940	**	1.529		0.742		0.249
Std. Error	(0.865)		(0.953)		(0.940)		(0.728)		(0.671)
No. Observations	2,169								

Notes: The main conditioning set includes individual and work-related characteristics, and previous health. The standard errors are clustered at the workplace level. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level. The full set of estimates is available from the authors upon request.

explanations to why we find a relationship for women and not for men.

3.7 Health and Coping Strategies

The results above show that being exposed to workplace bullying increases sickness absence for women but not for men. If bullying deteriorates health we would expect equal effects for men and women but this is not what we find. A plausible explanation is that men and women have different coping strategies, it may be the case that men leave the workplace whereas women stay, or they attend work although they feel poor. A third explanation could be a greater tendency among men to shirk which our sample of public employees allow us to identify in so far that short term absence can be viewed as shirking behaviour as in Ose (2005). The relevant question is thus whether bullying affects health, or whether the results reflect different coping strategies for men and women. In this section we discuss four possible explanations: Short-term sickness absence or shirking, health, presenteeism, turnover and labor force participation. As before regressions are performed controlling for the main conditioning set including individual characteristics, work related characteristics, workplace fixed effects, and previous health.

3.7.1 Public Sector Employees

As mentioned previously, sickness absence is only registered in DREAM for private employees after 3 weeks of absence, whereas we can observe absence from day one for individuals employed in the public sector.²⁸ We therefore run our regressions on the restricted sample of public sector employees. The outcome is now sickness absence weeks measured from week one and contains both short- and long-term spells. The results are reported in table (3.8).

Targets of bullying employed in the public sector have on average 2 weeks more absence compared to non-bullied public sector employees. As found previously these results are persistent for 2 years before gradually decreasing. The results are thus robust to the inclusion of short-term absence. In terms of magnitude the estimates are slightly larger compared to the results on the full sample, but this is due to public sector employees having more long-term sickness absence compared to private sector employees since running the regressions on short-term absence (spells below 2 weeks) we find no difference among targets and non-bullied coworkers, for men and women.²⁹ These results support the theoretical model in Ose (2005). She argues that a poor work environment should affect health and therefore only long-term and

However we don't know exactly when bullying occurred and it could be the case that the previous episode is actually reflecting a current episode. Furthermore the results for men (insignificant) and women are also robust to the inclusion of indicator variables for being underweight, normal weight, overweight, and extreme overweight (defined by Body-Mass-Index) measured in 2006. Results are available from the authors upon request.

²⁸This is due to a liability payment period for private companies in Denmark for the first three weeks of sickness absence.

²⁹Results available from the authors upon request.

not short-term sickness absence, as long-term absence should reflect actual health impairment whereas short-term absence is likely to reflect shirking behavior. In Denmark, individuals who are away from work due to long-term illness are in contact with the workplace on a regular basis and the employer can ask for a doctor’s certificate in which case they would catch shirking behaviour, whereas short-term absence is not monitored. Therefore if being exposed to workplace bullying increases shirking behavior we would expect to see differences in short-term and not in long-term sickness absence which we do not.

Table 3.8 OLS Results: Workplace Bullying and Sickness Absence - Public Sector Employees

	Weeks of Sickness Absence (Year)				
	2007	2008	2009	2010	2011
<i>Main Conditioning Set</i>					
Full Sample					
Bullied (0/1)	1.959 **	1.948 **	1.285 *	0.626	0.246
Std. Error	(0.898)	(0.764)	(0.762)	(0.640)	(0.579)
No. Observations	2.316				
Women					
Bullied (0/1)	2.447 **	2.319 **	1.485	0.990	0.597
Std. Error	(1.132)	(0.937)	(1.019)	(0.871)	(0.767)
No. Observations	1.788				
Men					
Bullied (0/1)	0.493	0.785	0.759	-0.829	-0.747
Std. Error	(1.291)	(1.179)	(0.520)	(0.532)	(0.681)
No. Observations	528				

Notes: The main conditioning set includes individual and work-related characteristics, and previous health. The standard errors are clustered at the workplace level. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level. The full set of estimates is available from the authors upon request.

3.7.2 Health Measures

The questionnaire allows us to address an immediate measure of the respondent’s health, which is not obtained through the registers. Respondents were asked to assess their overall health: “How good do you find your health?”. It is measured on a five point Likert Scale and recoded on a scale from one to five, five indicating excellent health. In this case we are faced with common concerns when using self-reported measures such as common source bias and in this case reverse causality, and we stress that the results should be interpreted with caution. However we still believe that a subjective measure may provide additional information as objective measures may not reflect whether the person actually feels hampered due to health issues.

From the register data we can obtain information on prescription drug usage and diagnoses. As mentioned above bullying has been positively related to anxiety and depression in a number of studies (e.g. Nielsen and Einarsen, 2012). We construct two dummy variables: *Antidepressives* is equal to one if the respondent purchased antidepressant medicine (ATC Code “N06A”), and *Psycholeptics* is equal to one if the he or she purchased psycholeptics (ATC Code “N05”), within a given year. Psycholeptics are usually used in the treatment of neuroses and psychosomatic disorders related anxiety and tension. Finally we construct a dummy variable indicating whether the respondent had been diagnosed with a mental or behavioral disorder four years after we observe bullying (ICD-10 code “F”).³⁰ From table (3.9) we see that targets of bullying report worse self-rated health compared to non-bullied colleagues, and men seem to report at least as worse health as women. However bullied men do not tend to receive more antidepressant medicine or psycholeptics, or to be diagnosed with a mental or behavioral disorder in 2010 compared to non-bullied men. Bullied men thus have worse immediate health compared to their non-bullied coworkers, but this difference is not observed in the health variables measured through the registers suggesting that health consequences for men are temporary or they cope with the issues themselves and do not involve general practitioners. For women we only see significant differences in the use of antidepressant medicine in 2008, 2010 and 2011. The small lag in the effects compared to sickness absence is to be expected in that it takes time to determine the diagnosis, and it is common that doctors recommend that the patient keeps on taking his or her medication at least six months after recovery to avoid relapse.³¹

³⁰We also constructed two other variables, a depression diagnosis variable and an anxiety diagnosis variable. However the coincidences of these diagnosis in the data was limited to 13 cases each out of the 3,208 respondents in 2007. Results were therefore not reliable, and hence not reported.

³¹<http://www.netdokter.dk/sygdomme/fakta/medicinhvorlaenge.htm>

Table 3.9 OLS Results: Workplace Bullying and Potential Mechanisms

Possible Mechanisms	Women		Men		No. Obs
	Bullied	Std. Err.	Bullied	Std. Err.	
Self-rated Health	-0.301 ***	(0.091)	-0.429 ***	(0.108)	1,002
Antidepressiva 2007 (0/1)	0.004	(0.023)	-0.004	(0.017)	1,013
Antidepressiva 2008 (0/1)	0.052 **	(0.025)	-0.002	(0.023)	1,013
Antidepressiva 2009 (0/1)	0.026	(0.020)	-0.011	(0.022)	1,013
Antidepressiva 2010 (0/1)	0.045 *	(0.024)	-0.008	(0.025)	1,013
Antidepressiva 2011 (0/1)	0.047 **	(0.022)	0.012	(0.024)	1,013
Psycholeptics 2007 (0/1)	-0.022	(0.021)	0.020	(0.023)	1,013
Psycholeptics 2008 (0/1)	0.015	(0.022)	0.021	(0.021)	1,013
Psycholeptics 2009 (0/1)	0.001	(0.014)	0.014	(0.013)	1,013
Psycholeptics 2010 (0/1)	-0.005	(0.026)	0.009	(0.012)	1,013
Psycholeptics 2011 (0/1)	-0.003	(0.025)	0.014	(0.027)	1,013
Mental or Behavioral Diag. 2010 (0/1)	-0.005	(0.016)	0.019	(0.019)	1,013
Presenteeism	1.218	(0.909)	2.780	(3.017)	984
Employed at Same Workplace 2007 (0/1)	0.015	(0.021)	0.012	(0.021)	1,013
Employed at Same Workplace 2008 (0/1)	-0.040	(0.037)	-0.023	(0.034)	1,013
Employed at Same Workplace 2009 (0/1)	-0.051	(0.046)	-0.017	(0.041)	1,013
Employed at Same Workplace 2010 (0/1)	-0.083 **	(0.036)	-0.034	(0.039)	1,013
Employed at Same Workplace 2011 (0/1)	-0.084 **	(0.036)	-0.046	(0.041)	1,013
Outside the Labor Force 2010	-0.014	(0.020)	0.004	(0.016)	1,013

Notes: All regressions include the main conditioning set (individual and work-related characteristics, and previous health). The standard errors are clustered at the workplace level. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level. The full set of estimates is available from the authors upon request.

3.7.3 Presenteeism

More recently psychologists and sociologists have addressed the phenomenon of *presenteeism*. Presenteeism refers to the incident where a person attends work even though he or she is ill. Researchers argue that the effect of bullying on sickness absence might not be as obvious as first expected because bullied individuals will have a greater tendency to attend work although they feel poor. There are several reasons for this. Not attending work might show lack of commitment to the workplace. In highly stressed workplaces where notification of illness causes grief for colleagues, targets might be afraid of creating yet another reason for being harassed. The targets will also lose control of their work when they are away. They might be excluded from important decisions, or they might be deprived of their original work tasks. Hogh et al. (2007) find that bullied individuals more often attend work although they are ill compared to non-bullied individuals. The questionnaire asks respondents to state how many days they went to work during the past year. Again this measure is subject to issues such as recall bias, reverse causality and common source bias, and results should be interpreted keeping this in mind. The coefficient on presenteeism in table (3.9) is equal to 1.2 days for women and 2.7 days for men, however both estimates are insignificant due to large standard errors. We can not reject that the bullied individuals have the same amount of presenteeism as non-bullied individuals, but the results point in the direction that men may have a greater tendency to attend work although they feel poor. This could be a possible explanation as to why we don't observe more sickness absence among men subject to workplace bullying.

3.7.4 Turnover and Attachment to The Labor Force

As mentioned above bullying is also likely to affect the individual's attachment to the workplace and the labor force, as leaving both could be possible possible coping strategies. We consider the case that men might be more likely to leave the workplace if they are exposed to workplace bullying, whereas women stay and try to mend things. For each year we construct a dummy variable equal to one if the respondent is still employed in the same workplace as at the time of the survey in 2006. The results are reported in table (3.9). Apart from 2007, the coefficients are all negative indicating that bullied individuals are more likely to leave the workplace. However almost all estimates are insignificant (except for women in 2010 and 2011) so we cannot be sure that this is the case. So if the targets do not tend to be more likely to leave the workplace why do we then observe that the relationship between bullying and sickness absence vanishes after 3 years for women? Recall that 50% of employees in this sample have left their workplace in 2010. Thus the composition of employees in the workplace is very different and in so far that the composition of colleagues, a bad culture, etc. explain bullying this is very likely to be different three years after we observed bullying as both targets of bullying and their colleagues have left the workplace.

A final reason for why we see a drop in sickness absence for bullied individuals could be that they leave the labor force in which case we may not observe sickness absence. In order to measure whether an individual is outside the labor force we construct a measure which is equal to one if an individual has spent more than half a year in either of the states; Maternity leave, parental leave, as incapacity benefits recipient or outside DREAM (we observe no income or income transfer for the individual). Incapacity benefits can be given to individuals whose ability to work has been reduced significantly making them unable to provide for themselves. Severe cases of bullying have been linked to post traumatic stress disorder (Mikkelsen and Einarsen, 2001), thus one can imagine that bullying can cause severely psychological damage which inhibits the individual's ability to work. In each of the states the individual is not observed as being on sickness benefits if he or she is ill.³² which could explain the drop in sickness absence after three years for women. In addition one can imagine that an individual may use these as escape routes from the workplace, a possible coping strategy.

Five percent of the women in the sample are observed as being outside the labor force in 2010, the same holds for two percent of the men. As is visible from table (3.9) neither bullied men nor women are more likely to be outside the labor force in 2010 compared to the non-bullied individuals. This suggests that leaving the workforce is not a coping strategy used by either gender.

Although men and women seem to be exposed to the same kind of bullying behavior and both genders have significantly worse immediate health when exposed to bullying, this section indicates that bullying only has adverse long-term effects on health for women. Either the health of men are not severely affected by bullying, it could be that it is too stigmatizing for them to seek medical attention due to bullying, or they have a tendency to attend work although they feel poor. Our results are consistent with this explanation but it is difficult to draw inference upon them. The results do not appear to be due to shirking behavior of neither men nor women. We further test whether the lack of results for men is due to the fact that they leave the workplace or work force. This also does not seem to be the case for neither men nor women.

One thing that we do not address in this paper is the perception of bullying. Thus although men report at least as many, if not more, and more frequent negative actions, they might not perceive the actions to be as negative as women. Similarly we cannot address who is committing the negative actions. From the questionnaire we know that 10% of the women and 15% of the men report that they have committed at least one of the negative actions themselves. It could be the case that the actions are more harmful if committed by the opposite gender in which case we would expect women to be more affected. Another concern is that women are

³²Individuals on parental or maternity leave can in case the employer allow it, prolong their leave period in case of illness.

highly overrepresented in this sample.³³ It would be relevant to conduct the same analysis on a representative sample of workplaces before concluding that men are not affected by bullying.

3.8 Conclusion

This paper investigates the detrimental effects of being exposed to workplace bullying in a sample of Danish workplaces. As a measure of workplace bullying we employ the Negative Acts Questionnaire, which is thought to be more reliable compared to self-labeling of being bullied. In addition we obtain register-based information on previous sickness absence as well as mental health measures such as prescription drug usage and diagnoses of behavioral and mental disorders, which are plausible confounders. Our results indicate that although men and women are exposed to the same types of negative behavior and both have significantly worse immediate health when exposed to bullying we only find a significant relationship on long-term sickness absence for women. The estimates show that being exposed to workplace bullying doubles long-term sickness absence (about 2 weeks) for women. The results are robust to the inclusion of personality traits and workplace characteristics. It is puzzling that the exposure to bullying does not lead to increased levels of absence for men, and we test different explanations to why this may be the case in terms of health and coping strategies. We find support that bullying is only associated with long-term sickness absence for women, and not with short-term sickness absence for either gender in the sample of public employees. In so far that we consider long-term sickness absence to reflect poor health and not shirking behavior, being exposed to workplace bullying is associated with adverse individual health for women, and neither gender is more likely to shirk as a result of bullying. For women we find increases in the use of antidepressant medicine in the years after bullying indicating long-term health consequences of exposure to bullying. For men we find no significant effects. Finally we investigate whether the lack of results is due to turnover, this is not the case either. We are not able to investigate whether the differences in the results for men and women are due to differences in characteristics of the perpetrators. Previous studies (Kivimaki et al., 2000, Ortega et al., 2011) do unfortunately not consider heterogeneity in gender so further investigation is needed in order to observe whether this is a general finding. Finally we want to stress that effects of the exposure to workplace bullying are particularly difficult to identify and our estimates should be interpreted cautiously with this in mind.

The results point towards significant benefits to the firms and society of the reduction in workplace bullying. It thus seems to be best practice from a managers point of view to implement strategies to reduce workplace bullying. So why haven't firms done so yet? One reason is lack of knowledge. First of all bullying needs to be acknowledged as a problem within work-

³³Appendix 3.A show that men are more likely to answer the survey though.

places. Second, only a few intervention studies on workplace bullying have been conducted and none of them have been of satisfying quality and thereby able to give unambiguous recommendations (Hodgins et al., 2014). This study also reveals the puzzling finding that exposure to bullying is only to a minor extent explained by individual characteristics. Neither demographic nor work-related characteristics of the individuals themselves can explain exposure to bullying once we condition on workplace fixed effects. In fact, what seems to matter is the workplace. Therefore, an important next step for future research is to look into the black box of the workplaces in order to investigate which workplace compositions and characteristics are predictive of bullying. First then are we able to understand how to prevent it.

3.9 Bibliography

- AGERVOLD, M. AND E. G. MIKKELSEN (2004): “Relationships between bullying, psychosocial work environment and individual stress reactions.” *Work and Stress*, 18, 336 – 351.
- AGNEW, R. (1992): “Foundation for a general strain theory of crime and delinquency.” *Criminology*, 30, 47–88.
- AQUINO, K. (2000): “Structural and individual determinants of workplace victimization: the effects of hierarchical status and conflict management style.” *Journal of Management*, 26, 171 – 193.
- AQUINO, K. AND M. BRADFIELD (2000): “Perceived Victimization in the Workplace: The Role of Situational Factors and Victim Characteristics.” *Organization Science*, 11, 525–537.
- ARBEJDSMARKEDSSTYRRELSEN (2010): *Når en medarbejder melder sig syg - nye muligheder og pligter.*, Arbejdsmarkedsstyrelsen.
- BAKKER, A. B. AND E. DEMEROUTI (2007): “The job demands-resources model: State of the art.” *Journal of managerial psychology*, 22, 309–328.
- BARTEL, A. P., R. B. FREEMAN, C. ICHNIOWSKI, AND M. M. KLEINER (2011): “Can a workplace have an attitude problem? Workplace effects on employee attitudes and organizational performance.” *Labour Economics*, 18, 411–423.
- BLOOM, N., B. EIFERT, A. MAHAJAN, D. MCKENZIE, AND J. ROBERTS (2013): “Does management matter? Evidence from India.” *The Quarterly Journal of Economics*, 128, 1–51.
- BLOOM, N. AND J. VAN REENEN (2011): “Human resource management and productivity.” *Handbook of labor economics*, 4, 1697–1767.

- CLAUSEN, T., A. HOGH, AND V. BORG (2012): “Acts of offensive behaviour and risk of long-term sickness absence in the Danish elder-care services: a prospective analysis of register-based outcomes.” *International archives of occupational and environmental health*, 85, 381–387.
- COSTA, P. T. AND R. R. MCCRAE (1980): “Influence of extraversion and neuroticism on subjective well-being: happy and unhappy people.” *Journal of personality and social psychology*, 38, 668.
- EINARSEN, S., H. HOEL, AND G. NOTELAERS (2009): “Measuring exposure to bullying and harassment at work: Validity, factor structure and psychometric properties of the Negative Acts Questionnaire-Revised.” *Work and Stress*, 23, 24 – 44.
- EINARSEN, S. AND A. SKOGSTAD (1996): “Bullying at Work: Epidemiological Findings in Public and Private Organizations.” *European Journal of Work and Organizational Psychology*, 5, 185.
- ERIKSEN, W. AND S. EINARSEN (2004): “Gender minority as a risk factor of exposure to bullying at work: The case of male assistant nurses.” *European Journal of Work and Organizational Psychology*, 13, 473 – 492.
- FEVANG, E., S. MARKUSSEN, AND K. RØ ED (2014): “The Sick Pay Trap.” *Journal of Labor Economics*, 32, pp. 305–336.
- HANSEN, Å. M., A. HOGH, AND R. PERSSON (2011): “Frequency of bullying at work, physiological response, and mental health.” *Journal of psychosomatic research*, 70, 19–27.
- HODGINS, M., S. MACCURTAIN, AND P. MANNIX-McNAMARA (2014): “Workplace bullying and incivility: a systematic review of interventions.” *International Journal of Workplace Health Management*, 7, 54–72.
- HOEL, H. AND C. L. COOPER (2000): *Destructive conflict and bullying at work.*, Manchester School of Management, UMIST Manchester, UK.
- HOGH, A., M. E. HENRIKSSON, AND H. BURR (2005): “A 5-Year Follow-up Study of Aggression at Work and Psychological Health.” *International Journal of Behavioral Medicine*, 12, 256 – 265.
- HOGH, A., A. ORTEGA, H. GIVER, AND V. BORG (2007): *Mobning af personale i ældreplejen.*, Det Nationale Forskningscenter for Arbejdsmiljø, Copenhagen, Denmark, ISBN 978-87-7904-181-3.

- JOHANSSON, P. AND M. PALME (1996): “Do economic incentives affect work absence? Empirical evidence using Swedish micro data.” *Journal of Public Economics*, 59, 195–218.
- KIVIMAKI, M., M. ELOVAINIO, AND J. VAHTERA (2000): “Workplace bullying and sickness absence in hospital staff.” *Occupational and Environmental Medicine*, 57, 656–660.
- KIVIMÄKI, M., M. VIRTANEN, M. VARTIA, M. ELOVAINIO, J. VAHTERA, AND L. KELTIKANGAS-JÄRVINEN (2003): “Workplace bullying and the risk of cardiovascular disease and depression.” *Occupational and Environmental Medicine*, 60, 779–783.
- LECHNER, M. AND C. WUNSCH (2013): “Sensitivity of matching-based program evaluations to the availability of control variables.” *Labour Economics*, 21, 111–121.
- MATTHIESEN, S. B. AND S. EINARSEN (2007): “Perpetrators and targets of bullying at work: Role Stress and individual differences.” *Violence and Victims*, 22, 735 – 753.
- MIKKELSEN, E. G. AND S. EINARSEN (2001): “Bullying in Danish work-life: Prevalence and health correlates.” *European Journal of Work and Organizational Psychology*, 10, 393 – 413.
- NIEDHAMMER, I., S. DAVID, AND S. DEGIOANNI (2006): “Association between workplace bullying and depressive symptoms in the French working population.” *Journal of Psychosomatic Research*, 61, 251 – 259.
- NIELSEN, M. B. (2013): “Bullying in work groups: The impact of leadership.” *Scandinavian Journal of Psychology*, 54, 127–136.
- NIELSEN, M. B. AND S. EINARSEN (2012): “Outcomes of exposure to workplace bullying: A meta-analytic review.” *Work & Stress*, 26, 309–332.
- NIELSEN, M. B., S. B. MATTHIESEN, AND S. EINARSEN (2010): “The Impact of Methodological Moderators on Prevalence Rates of Workplace Bullying. A Meta-Analysis.” *Journal of Occupational and Organizational Psychology*, 83, 955 – 979.
- NIELSEN, M. B., A. SKOGSTAD, S. B. MATTHIESEN, L. GLASØ, M. S. AASLAND, G. NOTELAERS, AND S. EINARSEN (2009): “Prevalence of workplace bullying in Norway: Comparisons across time and estimation methods.” *European Journal of Work and Organizational Psychology*, 18, 81–101.
- NOTELAERS, G., H. DE WITTE, AND S. EINARSEN (2009): “A jobcharacteristic approach to explain workplace bullying.” *European Journal of Work and Organizational Psychology*, 20, –.
- OECD (2010): “Sickness, Disability and Work: Breaking the Barriers.” Tech. rep., OECD, ISBN 978-92-64-08885-6.

- OLWEUS, D. (1978): *Aggression in the schools: Bullies and whipping boys.*, Oxford, England: Hemisphere, ISBN: 1979-32242-000.
- ORTEGA, A., K. B. CHRISTENSEN, A. HOGH, R. RUGULIES, AND V. BORG (2011): “One-year prospective study on the effect of workplace bullying on long-term sickness absence.” *Journal of Nursing Management*, 19, 752–759.
- OSE, S. O. (2005): “Working conditions, compensation and absenteeism.” *Journal of health economics*, 24, 161–188.
- PEJTERSEN, J. H., T. S. KRISTENSEN, V. BORG, AND J. B. BJORNER (2010): “The second version of the Copenhagen Psychosocial Questionnaire.” *Scand J Public Health*, 38, 8–24.
- REKNES, I., S. EINARSEN, S. KNARDAHL, AND B. LAU (2014): “The prospective relationship between role stressors and new cases of self-reported workplace bullying.” *Scandinavian Journal of Psychology*, 55, 45–52.
- SALIN, D. (2002): “Bullying and organisational politics in competitive and rapidly changing work environments.” *International Journal of Management and Decision Making*, 4, 35 – 46.
- SAMNANI, A.-K. AND P. SINGH (2012): “20 years of workplace bullying research: a review of the antecedents and consequences of bullying in the workplace.” *Aggression and Violent Behavior*, 17, 581–589.
- SETTERLIND, S. AND G. LARSSON (1995): “The stress profile: a psychosocial approach to measuring stress.” *Stress Medicine*, 11, 85–92.
- VARTIA, M. (2001): “Consequences of workplace bullying with respect to the well-being of its targets and the observers of bullying.” *Scandinavian Journal of Work, Environment and Health*, 27, 63 – 69.
- WATSON, D. AND L. A. CLARK (1984): “Negative affectivity: the disposition to experience aversive emotional states.” *Psychological bulletin*, 96, 465.
- WATSON, D., L. A. CLARK, AND A. TELLEGEN (1988): “Development and validation of brief measures of positive and negative affect: the PANAS scales.” *Journal of personality and social psychology*, 54, 1063.

Appendices

3.A Attrition

The response rate in the questionnaires was 45,9%. Through the Integrated Database for labor Market Research (IDA) we can obtain all the individuals registered to be working at the workplaces of the respondents. This enables us to compare characteristics of the respondents and non-respondent observed in the Danish Register Data. Note that our sample here is larger than the original sample of respondents who received the questionnaires. In IDA we only observe workplaces, while it may be particular departments of a workplace that received the questionnaire. Unfortunately we do not have access to the civil registration numbers of the non-respondents. Our results do however give an indication of the differences between the respondents and the population of workers at their workplaces. We run a probit regression of a range of characteristics on a binary indicator of whether the individual answered the questionnaire or not. Marginal effects and standard errors are summarized in table (A1). We observe significant differences in many demographic characteristics, however these differences are likely to be due to a large sample size since the coefficients are close to zero, e.g. age and tenure. In general there is no clear pattern in the coefficients, respondents are slightly less likely to have a higher education (bachelor degree and above) however at the same time they are much more likely to be employed in a top management position. Sickness absence in 2001 and 2003 is significant but again the coefficients are very small and the signs are in opposite directions. If anything, the table indicates that it is the better-employed individuals who are married and of Danish origin, thus individuals we would expect to be less likely to be bullied, who responded to the questionnaire. In so far that bullying increases sickness absence this would downward bias our results.

Table A1 Probit Regression: Propensity to Answer Survey

	Answered Survey (0/1)	
	Mean	Std. Error
<i>Individual Characteristics (X)</i>		
Male (0/1)	0.011 **	(0.005)

Continued on next page -

Notes: (***) Significant at a 1% level. (**) Significant at a 5% level. (*) Significant at a 10% level. All variables are measured in 2005 unless stated otherwise

Table A1 Continued -

	Answered Survey (0/1)		
	Mean		Std. Error
Age	0.002	***	(0.000)
Divorce (0/1)	0.009		(0.012)
Years since Divorce	-0.001		(0.001)
Cohabiting (omit var. = Single)	0.010		(0.007)
Married (omit Var.= Single)	0.018	***	(0.007)
Ethnic (0/1)	-0.028	***	(0.008)
Higher Educational Level (0/1)	-0.036	***	(0.007)
Children 0-2 yrs. (0/1)	-0.006		(0.007)
Children 3-5 yrs. (0/1)	0.014	*	(0.007)
Children 6-10 yrs. (0/1)	0.001		(0.006)
Children 11-18 yrs. (0/1)	0.011	**	(0.005)
<i>Work-related Characteristics (W)</i>			
Tenure	-0.001	***	(0.000)
<i>Employment (omit. var = Lower Level Employee)</i>			
Top Management Level	0.151	***	(0.030)
Higher Management Level	0.063	***	(0.010)
Medium Level Employee	0.024	***	(0.008)
Other employment	0.018	**	(0.008)
Selfemployment	-0.027		(0.050)
Unemployment	0.019		(0.025)
Earnings 2000	0.001		(0.001)
Earnings 2001	0.002	*	(0.001)
Earnings 2002	-0.001		(0.001)
Earnings2003	-0.001		(0.001)
Earnings 2004	0.001		(0.001)
Earnings 2005	0.010	***	(0.002)
Weeks of Unemployment 2000	0.000		(0.000)
Weeks of Unemployment 2001	-0.000		(0.000)
Weeks of Unemployment 2002	0.000		(0.000)
Weeks of Unemployment 2003	-0.000		(0.000)
Weeks of Unemployment 2004	0.000		(0.000)
Weeks of Unemployment 2005	0.000		(0.000)
<i>Previous Health (H)</i>			
Weeks of sickness Absence 2000	-0.000		(0.001)
Weeks of sickness Absence 2001	-0.002	**	(0.001)
Weeks of sickness Absence 2002	0.000		(0.001)
Weeks of sickness Absence 2003	0.001	**	(0.001)
Weeks of sickness Absence 2004	-0.001	*	(0.001)
Weeks of sickness Absence 2005	-0.000		(0.001)
Antidepressives 2000 (0/1)	-0.014		(0.015)
Antidepressives 2001 (0/1)	0.035	*	(0.018)
Antidepressives 2002 (0/1)	-0.014		(0.015)
Antidepressives 2003 (0/1)	0.014		(0.017)
Antidepressives 2004 (0/1)	-0.005		(0.015)
Antidepressives 2005 (0/1)	-0.003		(0.014)
Psycholeptics 2000 (0/1)	-0.009		(0.012)

Continued on next page -

Notes: (***): Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise

Table A1 Continued -

	Answered Survey (0/1)	
	Mean	Std. Error
Psycholeptics 2001 (0/1)	-0.017	(0.012)
Psycholeptics 2002 (0/1)	-0.017	(0.012)
Psycholeptics 2003 (0/1)	-0.001	(0.012)
Psycholeptics 2004 (0/1)	-0.019 *	(0.011)
Psycholeptics 2005 (0/1)	0.006	(0.012)
Diag. of Mental or Behavioral Disorder (0/1)	0.005	(0.011)
Workplace Fixed Effects	Yes	
Number of Observations	25.902	
Pseudo R ²	0.025	

Notes: (***) Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise

3.B Additional Means and Standard Deviations

Table B1 Means and Standard Deviations on Selected Characteristics by Bullying Status.

			Bullied		Non-Bullied		No. Obs
			Mean	Std. Dev.	Mean	Std. Dev.	
<i>Individual Characteristics (X)</i>							
Male (0/1)	0.425	***	0.495	0.310	0.463	3,182	
Age	42.158	***	9.251	44.168	9.975	3,182	
Ethnicity (0/1)	0.079	**	0.270	0.041	0.198	3,179	
Married (0/1)	0.478	***	0.501	0.666	0.472	3,179	
Cohabiting (0/1)	0.237	***	0.426	0.134	0.341	3,179	
Single (0/1)	0.285	***	0.452	0.200	0.400	3,179	
Divorced (0/1)	0.145	***	0.353	0.086	0.281	3,179	
Children 0-2 yrs. (0/1)	0.092		0.290	0.099	0.299	3,179	
Children 3-5 yrs. (0/1)	0.136		0.344	0.123	0.328	3,179	
Children 6-10 yrs. (0/1)	0.206		0.405	0.188	0.391	3,179	
Children 11-18 yrs. (0/1)	0.276		0.448	0.270	0.444	3,179	
Years since Divorce	1.039		3.864	0.781	3.385	3,179	
Higher Education (0/1)	0.179		0.384	0.151	0.358	3,154	
<i>Work-related Characteristics (W)</i>							
Tenure	4.602	***	4.995	7.757	7.436	3,106	
Fulltime Employee (0/1)	0.978		0.147	0.976	0.154	3,179	
Parttime Employee (0/1)	0.022		0.147	0.024	0.154	3,179	
Private Sector (0/1)	0.351	***	0.478	0.271	0.445	3,177	
Public Sector (0/1)	0.649	***	0.478	0.729	0.445	3,177	
Top management (0/1)	0.018		0.132	0.025	0.156	3,179	
Higher Management (0/1)	0.246		0.431	0.225	0.418	3,179	
Medium Level Empl. (0/1)	0.294		0.457	0.327	0.469	3,179	
Lower Level Empl. (0/1)	0.250		0.434	0.274	0.446	3,179	

Continued on next page -

Notes: Means are tested against the mean of the Non-Bullied. (***) Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Table B1 Continued -

			Bullied		Non-Bullied		No. Obs
			Mean	Std. Dev.	Mean	Std. Dev.	
Other Employment (0/1)	0.184	**	0.389	0.136	0.343	3,179	
Unemployed (0/1)	0.009		0.093	0.010	0.100	3,179	
Earnings2000	11.520		3.079	11.906	2.390	3,143	
Earnings2001	11.762		2.469	11.906	2.188	3,143	
Earnings2002	11.682	*	2.759	11.943	2.221	3,158	
Earnings2003	11.672	**	2.910	11.996	2.124	3,165	
Earnings2004	12.102		2.076	12.135	1.875	3,170	
Earnings2005	12.329		1.521	12.338	1.209	3,179	
Weeks of Unemp. 2000	3.140	***	9.812	1.658	7.106	3,182	
Weeks of Unemp. 2001	2.921	***	10.014	1.420	6.532	3,182	
Weeks of Unemp. 2002	2.281	*	8.412	1.447	6.856	3,182	
Weeks of Unemp. 2003	2.803	***	9.494	1.405	6.520	3,182	
Weeks of Unemp. 2004	2.908	***	8.600	1.465	6.623	3,182	
Weeks of Unemp. 2005	1.895	**	6.781	1.126	5.599	3,182	
<i>Previous Health (H)</i>							
Weeks of Sick. Ab. 2000	0.241		1.768	0.331	2.605	3,182	
Weeks of Sick. Ab. 2001	0.421		2.480	0.393	3.047	3,182	
Weeks of Sick. Ab. 2002	0.522		3.491	0.464	2.945	3,182	
Weeks of Sick. Ab. 2003	0.531		3.626	0.644	3.921	3,182	
Weeks of Sick. Ab. 2004	0.583		3.699	0.587	3.668	3,182	
Weeks of Sick. Ab. 2005	0.553		3.119	0.660	3.839	3,182	
Antidepressives 2000 (0/1)	0.048	**	0.215	0.025	0.156	3,182	
Antidepressives 2001 (0/1)	0.057	*	0.232	0.035	0.184	3,182	
Antidepressives 2002 (0/1)	0.048		0.215	0.032	0.176	3,182	
Antidepressives 2003 (0/1)	0.057		0.232	0.038	0.192	3,182	
Antidepressives 2004 (0/1)	0.061	*	0.241	0.039	0.193	3,182	
Antidepressives 2005 (0/1)	0.057		0.232	0.043	0.202	3,182	
Psycholeptics 2000 (0/1)	0.057		0.232	0.040	0.196	3,182	
Psycholeptics 2001 (0/1)	0.061		0.241	0.041	0.197	3,182	
Psycholeptics 2002 (0/1)	0.070	**	0.256	0.042	0.201	3,182	
Psycholeptics 2003 (0/1)	0.061		0.241	0.048	0.213	3,182	
Psycholeptics 2004 (0/1)	0.061		0.241	0.045	0.208	3,182	
Psycholeptics 2005 (0/1)	0.061		0.232	0.056	0.230	3,182	
Mental or Behavioral Diag. (0/1)	0.057		0.232	0.042	0.200	3,182	
No. Observations			228		2,954		

Notes: Means are tested against the mean of the Non-Bullied. (***): Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

3.C Propensity to be bullied

Table C1 Probit Regression: Propensity to be bullied.

	Mean	Bullied	Std. Error
<i>Individual Characteristics (X)</i>			
Male (0/1)	0.012		0.009
Age	0.000		0.001
Divorce (0/1)	0.021		0.026
Years Since Divorce	-0.001		0.002
Cohabiting (omit. var = Single)	0.017		0.016
Married (omit. var = Single)	-0.040	***	0.014
Ethnic (0/1)	0.012		0.018
Higher Education (0/1)	0.012		0.012
Children 0-2 yrs. (0/1)	-0.005		0.015
Children 3-5 yrs. (0/1)	0.017		0.016
Children 6-10 yrs. (0/1)	0.018		0.012
Children 11-18 yrs. (0/1)	0.010		0.012
<i>Work-related Characteristics (W)</i>			
Tenure	-0.003	***	0.001
Full Time Employee (omit. var = Part)	-0.027		0.046
Private Sector (omit. var = Public)	0.014		0.047
<i>Employment (omit. var = Lower Level Employee)</i>			
Top Management	-0.023		0.018
Higher Management	0.016		0.019
Medium Level Empl.	0.004		0.012
Other Employment	0.004		0.018
Unemployed	-0.044	***	0.013
Earnings 2000	0.001		0.003
Earnings 2001	0.001		0.003
Earnings 2002	0.001		0.002
Earnings 2003	-0.004	*	0.003
Earnings 2004	0.005	*	0.003
Earnings 2005	0.003		0.006
Weeks of Unemp. 2000	0.001		0.001
Weeks of Unemp. 2001	0.000		0.001
Weeks of Unemp. 2002	-0.001		0.001
Weeks of Unemp. 2003	0.001		0.001
Weeks of Unemp. 2004	0.000		0.001
Weeks of Unemp. 2005	0.001		0.001
<i>Previous Health (H)</i>			
Weeks of Sick. Ab. 2000	-0.003		0.002
Weeks of Sick. Ab. 2001	-0.001		0.001
Weeks of Sick. Ab. 2002	0.001		0.002
Weeks of Sick. Ab. 2003	0.000		0.001
Weeks of Sick. Ab. 2004	0.001		0.001
Weeks of Sick. Ab. 2005	0.000		0.001
antidepressives 2000 (0/1)	0.052		0.056
antidepressives 2001 (0/1)	-0.006		0.030
antidepressives 2002 (0/1)	-0.007		0.029

Continued on next page -

Notes: (***) : Significant at a 1% level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise

Table C1 Continued -

	Mean	Bullied Std. Error
antidepressives 2003 (0/1)	-0.007	0.027
antidepressives 2004 (0/1)	0.022	0.042
antidepressives 2005 (0/1)	-0.004	0.026
Psycholeptics 2000 (0/1)	0.017	0.027
Psycholeptics 2001 (0/1)	0.014	0.028
Psycholeptics 2002 (0/1)	0.015	0.032
Psycholeptics 2003 (0/1)	-0.005	0.021
Psycholeptics 2004 (0/1)	0.010	0.033
Psycholeptics 2005 (0/1)	-0.005	0.022
Mental or Behavioral Diag. (0/1)	0.017	0.022
Workplace Fixed Effects	Yes	
No. Observations	3.182	
Pseudo R ²	0.114	

Notes: (***) Significant at a 1% level. (**) Significant at a 5% level. (*) Significant at a 10% level. All variables are measured in 2005 unless stated otherwise

3.D OLS Results - Full tables

This section presents the full set of estimates for the main specifications.

Table D1 OLS Results: Workplace Bullying and Long-Term Sickness Absence

	Weeks of Long-Term Sickness Absence (Year)														
	2007			2008			2009			2010			2011		
	Bullied	Std.Err.		Bullied	Std.Err.		Bullied	Std.Err.		Bullied	Std.Err.		Bullied	Std.Err.	
<i>Individual Char. (X)</i>															
Bullied (0/1)	1.212	**	(0.596)	1.317	**	(0.560)	1.277	**	(0.542)	0.853	*	(0.513)	0.509	(0.485)	
Male (0/1)	-0.614	**	(0.239)	-0.427	*	(0.225)	-0.627	**	(0.277)	-0.530	***	(0.199)	-0.344	(0.210)	
Age	0.024		(0.017)	0.010		(0.013)	-0.032	**	(0.013)	-0.013		(0.012)	-0.014	(0.014)	
Divorce (0/1)	-0.461		(0.510)	0.775	*	(0.632)	0.481		(0.620)	1.162	**	(0.703)	1.266	(0.626)	
Years Since Divorce	-0.025		(0.042)	-0.083	*	(0.045)	-0.052		(0.038)	-0.019		(0.054)	-0.007	(0.043)	
Cohabiting (omit var. = Single)	0.410		(0.399)	0.046		(0.308)	-0.076		(0.369)	-0.385		(0.446)	0.058	(0.423)	
Married (omit Var. = Single)	0.160		(0.440)	0.372	***	(0.293)	0.336		(0.364)	0.230		(0.417)	0.407	(0.278)	
Ethnic (0/1)	-0.171		(0.506)	-1.337	***	(0.289)	-0.104		(0.785)	1.170	***	(0.752)	0.250	(0.549)	
Higher Education (0/1)	0.210		(0.362)	0.665	*	(0.367)	-0.031		(0.277)	-0.767	***	(0.286)	-1.118	(0.278)	
Children 0-2 yrs. (0/1)	-0.464	*	(0.260)	-0.056		(0.345)	-0.909	***	(0.319)	0.022		(0.444)	0.373	(0.420)	
Children 3-5 yrs. (0/1)	0.666	*	(0.381)	0.377		(0.361)	0.632		(0.401)	0.195		(0.307)	0.016	(0.395)	
Children 6-10 yrs. (0/1)	-0.105		(0.227)	-0.131		(0.238)	-0.087	**	(0.377)	-0.159		(0.248)	0.468	(0.333)	
Children 11-18 yrs. (0/1)	0.364		(0.279)	0.091		(0.227)	-0.485	**	(0.235)	-0.010		(0.290)	-0.067	(0.237)	
<i>Work-Related Char. (W)</i>															
Tenure	-0.031		(0.021)	-0.001		(0.021)	0.016		(0.018)	-0.002		(0.015)	-0.021	(0.015)	
Full Time Employee (omit. var = Part)	0.083		(1.033)	0.400		(0.648)	0.507		(0.867)	0.507		(0.708)	1.225	(0.447)	
Private Sector (omit. var = Public)	-0.981		(1.519)	-1.569	*	(0.853)	-0.968		(0.723)	-1.108		(1.690)	-0.815	(1.635)	
<i>Employment (omit. var = Lower Level Emp.)</i>															
Top Management	-0.291		(0.418)	-0.575		(0.787)	-0.753		(0.524)	-0.584		(0.356)	0.171	(0.543)	
Higher Management	-0.677		(0.468)	-1.063	**	(0.458)	-0.600		(0.380)	0.021		(0.344)	-0.135	(0.403)	
Medium Level Emp.	-0.428		(0.314)	-0.766	*	(0.441)	-0.581	*	(0.342)	0.375		(0.339)	0.176	(0.418)	
Other Employment	-0.279		(0.551)	-0.289		(0.429)	0.313		(0.505)	0.664	*	(0.354)	0.887	(0.421)	
Selfemployed	-0.902		(0.703)	-1.293		(1.002)	-0.536		(0.833)	-1.695		(1.104)	-1.741	(1.176)	
Unemployed	-1.286		(0.899)	0.064		(1.189)	-0.245		(1.178)	1.455		(1.709)	1.502	(0.985)	
Earnings 2000	-0.026		(0.116)	-0.043		(0.098)	-0.045		(0.079)	0.058		(0.065)	-0.061	(0.064)	
Earnings 2001	0.013		(0.175)	0.022		(0.125)	0.102		(0.075)	-0.074		(0.071)	0.030	(0.084)	
Earnings 2002	-0.062		(0.120)	0.041		(0.112)	0.048		(0.123)	0.109		(0.085)	0.081	(0.056)	
Earnings 2003	-0.133		(0.129)	-0.062		(0.093)	0.071		(0.092)	0.027		(0.098)	0.012	(0.070)	
Earnings 2004	0.094		(0.091)	0.066		(0.052)	-0.192		(0.128)	-0.287	**	(0.131)	-0.122	(0.071)	
Earnings 2005	0.124		(0.084)	-0.023		(0.126)	0.145		(0.096)	0.236	***	(0.084)	0.061	(0.109)	
Weeks of Unemp. 2000	-0.005		(0.017)	-0.015		(0.020)	-0.020		(0.023)	0.012		(0.021)	0.007	(0.018)	
Weeks of Unemp. 2001	-0.011		(0.019)	0.027		(0.026)	0.054	*	(0.028)	-0.001		(0.020)	0.027	(0.023)	
Weeks of Unemp. 2002	-0.019		(0.021)	-0.025		(0.023)	-0.020		(0.024)	-0.013		(0.030)	-0.048	(0.018)	
Weeks of Unemp. 2003	0.031		(0.025)	0.023		(0.030)	0.023		(0.033)	0.092	***	(0.034)	0.054	(0.023)	
Weeks of Unemp. 2004	-0.042	*	(0.023)	0.016		(0.033)	-0.018		(0.025)	-0.066	***	(0.021)	0.011	(0.023)	
Weeks of Unemp. 2005	0.032		(0.028)	-0.040		(0.029)	0.027		(0.031)	0.037		(0.029)	-0.045	(0.021)	
<i>Previous Health (H)</i>															
Weeks of Sick. Ab. 2000	0.030		(0.080)	0.009		(0.070)	-0.099	**	(0.049)	-0.037		(0.035)	0.005	(0.039)	

Continued on next page -

Notes: Standard Errors are clustered at the workplace level. (**): Significant at a 1% level. (*): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

Table D1 Continued -

	Weeks of Long-Term Sickness Absence (Year)							
	2007		2008		2010		2011	
	Bullied	Std.Err.	Bullied	Std.Err.	Bullied	Std.Err.	Bullied	Std.Err.
Weeks of Sick. Ab. 2001	0.087	(0.089)	0.050	(0.078)	0.105	(0.100)	-0.003	(0.049)
Weeks of Sick. Ab. 2002	0.082	(0.058)	0.026	(0.055)	0.016	(0.066)	0.045	(0.055)
Weeks of Sick. Ab. 2003	0.001	(0.031)	0.042	(0.030)	0.029	(0.038)	0.017	(0.042)
Weeks of Sick. Ab. 2004	0.004	(0.050)	-0.057	(0.042)	0.023	(0.061)	0.016	(0.035)
Weeks of Sick. Ab. 2005	0.149	(0.066)	0.171	(0.065)	0.071	(0.053)	0.010	(0.030)
Antidepressives 2000 (0/1)	1.895	(1.168)	1.784	(1.687)	0.484	(1.139)	1.728	(1.599)
Antidepressives 2001 (0/1)	1.312	(1.069)	2.590	(1.078)	0.342	(1.181)	-1.530	(0.987)
Antidepressives 2002 (0/1)	-1.281	(1.456)	-1.810	(1.249)	-0.094	(1.187)	2.443	(1.550)
Antidepressives 2003 (0/1)	0.537	(1.394)	-0.151	(0.753)	-0.821	(1.203)	0.009	(0.763)
Antidepressives 2004 (0/1)	-0.436	(1.431)	0.573	(0.985)	1.743	(1.064)	0.298	(0.785)
Antidepressives 2005 (0/1)	2.411	(1.654)	-0.284	(1.399)	0.253	(1.519)	-0.683	(0.905)
Psycholeptics 2000 (0/1)	-1.116	(0.790)	-0.337	(0.948)	0.010	(0.748)	0.767	(0.729)
Psycholeptics 2001 (0/1)	-0.581	(0.897)	-0.104	(0.868)	-0.460	(0.850)	-0.801	(0.899)
Psycholeptics 2002 (0/1)	0.256	(0.739)	1.072	(0.911)	0.733	(0.814)	-0.922	(0.613)
Psycholeptics 2003 (0/1)	0.266	(0.893)	-1.404	(0.757)	-0.207	(0.733)	0.595	(0.869)
Psycholeptics 2004 (0/1)	2.322	(1.211)	2.818	(1.228)	1.001	(0.903)	-0.460	(0.616)
Psycholeptics 2005 (0/1)	-0.860	(0.839)	0.242	(0.742)	0.713	(0.928)	0.802	(0.784)
Mental or Behavioral Diag. (0/1)	1.152	(0.922)	1.774	(0.901)	1.599	(0.963)	0.937	(0.867)
Constant	0.149	(1.931)	0.923	(1.726)	0.201	(1.441)	1.497	(1.905)
Workplace Fixed Effects	Yes		Yes		Yes		Yes	
No. Observations	3,182		3,182		3,182		3,182	
Adjusted R ²	0.059		0.061		0.026		0.025	

Notes: Standard Errors are clustered at the workplace level. (**): Significant at a 5% level. (*): Significant at a 10% level. All variables are measured in 2005 unless stated otherwise.

3.E Factor Specifications

This section specifies the factors used in the two robustness sections on personality and work environment characteristics. The Factors are all extracted using confirmatory principal component analysis, and factor scores are obtained using the regression method. The table presents loadings and Cronbach's Alphas.

Table E1 Scales: Loadings and Cronbach Alpha's

Category/Scale	Loadings	Cronbach's Alpha	Source
Personality			
<i>Positive Affectivity</i>		0.872	PANAS
Attentive	0.632		
Strong	0.698		
Inspired	0.731		
Active	0.725		
Excited	0.577		
Proud	0.685		
Enthusiastic	0.763		
Determined	0.756		
Interested	0.787		
<i>Negative Affectivity</i>		0.881	PANAS
Jittery	0.734		
Scared	0.776		
Afraid	0.727		
Upset	0.714		
Irritable	0.652		
Guilty	0.615		
Nervous	0.756		
Hostile	0.633		
Distressed	0.751		
Ashamed	0.588		
<i>Coherence</i>		0.782	Setterlind/ COPSOQ I
I believe I can cope with most situations in life.	-0.508		
I feel that what I do in my daily life is meaningful.	-0.536		
I feel that I have a great deal to live for.	0.615		
I feel I understand most of what is going on in my everyday life.	-0.669		
So far, I have not had any clear direction or purpose in life.	0.588		
I do not feel that I am able to influence my future to any great extent.	0.587		
Often things happen around me that I do not understand.	0.565		
I know what I ought to do in my life, but I do not believe that I am able to do it.	0.682		
It is difficult for me to see how different pieces in my life are connected.	0.727		
Demands			
<i>Quantitative Demands</i>		0.809	COPSOQ II
Is your workload unevenly distributed so it piles up?	0.732		
How often do you not have time to complete all your work tasks?	0.833		

Continued on next page -

Table E1 Continued -

Category/Scale	Loadings	Cronbach's Alpha	Source
Do you get behind with your work?	0.887		
Do you have enough time for your work tasks?	-0.735		
<i>Cognitive Demands</i>		0.746	COPSOQ II
Do you have to keep your eyes on lots of things while you work?	0.784		
Does your work require that you remember a lot of things?	0.736		
Does your work demand that you are good at coming up with new ideas?	0.728		
Does your work require you to make difficult decisions?	0.772		
<i>Emotional Demands</i>		0.832	COPSOQ II
Does your work put you in emotionally disturbing situations?	0.835		
Is your work emotionally demanding?	0.887		
Do you get emotionally involved in your work?	0.842		
Do you have to relate to other people's personal problems as part of your work?	0.734		
Work organization			
<i>Influence at work</i>		0.784	COPSOQ II
Do you have a large degree of influence concerning your work?	0.807		
Do you have a say in choosing who you work with?	0.754		
Can you influence the amount of work assigned to you?	0.709		
Do you have any influence on what you do at work?	0.848		
<i>Skill Discretion</i>		0.794	COPSOQ II
Does your work require you to take the initiative?	0.660		
Do you have the possibility of learning new things through your work?	0.855		
Can you use your skills or expertise in your work?	0.732		
Does your work give you the opportunity to develop your skills?	0.883		
Job Content			
<i>Meaning of Work</i>		0.658	COPSOQ II
Is your work meaningful?	0.864		
Do you feel that the work you do is important?	0.864		
<i>Commitment to the Workplace</i>		0.752	COPSOQ II
Do you enjoy telling others about your place of work?	0.808		
Do you feel that your place of work is of great importance to you?	0.697		
Would you recommend a good friend to apply for a position at your workplace?	0.806		
How often do you consider looking for work elsewhere?	-0.720		
Interpersonal Relations and Leadership			
<i>Predictability</i>		0.759	COPSOQ II
At your place of work, are you informed well in advance concerning for example important decisions, changes, or			

Continued on next page -

Table E1 Continued -

Category/Scale	Loadings	Cronbach's Alpha	Source
plans for the future?	0.899		
Do you receive all the information you need in order to do your work well?	0.899		
<i>Recognition</i>		0.821	COPSOQ II
Is your work recognised and appreciated by the management?	0.868		
Does the management at your workplace respect you?	0.900		
Are you treated fairly at your workplace?	0.809		
<i>Role Clarity</i>		0.769	COPSOQ II
Does your work have clear objectives?	0.793		
Do you know exactly which areas are your responsibility?	0.842		
Do you know exactly what is expected of you at work?	0.855		
<i>Role Conflicts</i>		0.535	COPSOQ II
Do you sometimes have to do things, which ought to have been done in a different way?	0.826		
Do you sometimes have to do things, which seem to be unnecessary?	0.826		
<i>Quality of Leadership</i>		0.871	COPSOQ II
To what extent would you say that your immediate superior makes sure that the individual member of staff has good development opportunities?	0.824		
gives high priority to job satisfaction?	0.877		
is good at work planning?	0.841		
is good at solving conflicts?	0.857		
<i>Social Support from Colleagues</i>		0.805	Söderfeldt
Do you get sufficient support from your colleagues, when you have too much to do?	0.861		
Do you get sufficient support from you colleagues, when you have to solve difficult problems?	0.866		
Do you get sufficient encouragement and appraisal from your colleagues, in how you do your job?	0.817		
<i>Social Support from Leader</i>		0.835	Söderfeldt
Do you get sufficient support from your nearest leader, when you have too much to do?	0.867		
Do you get sufficient support from you nearest leader, when you have to solve difficult problems?	0.883		
Do you get sufficient encouragement and appraisal from your nearest leader, in how you do your job?	0.854		
<i>Social Community at Work</i>		0.809	COPSOQ II
Is there a good atmosphere between you and your			

Continued on next page -

Table E1 Continued -

Category/Scale	Loadings	Cronbach's Alpha	Source
colleagues?	0.858		
Is there good co-operation between the colleagues at work?	0.874		
Do you feel part of a community at your place of work?	0.838		
Insecurity			
<i>Job insecurity</i>		0.799	COPSOQ II
Are you worried about becoming unemployed?	0.865		
Are you worried about being redundant?	0.844		
Are you worried about being transferred to another job against your will?	0.766		
Are you worried about it being difficult for you to find another job if you became unemployed?	0.717		
Values at the Workplace			
<i>Mutual Trust Between Employees</i>		0.806	COPSOQ II*
Do the employees withhold information from each other?	0.917		
Do the employees withhold information from the management?	0.917		
<i>Trust Regarding Management</i>		0.878	COPSOQ II*
Does the management trust the employees to do their work well?	0.746		
Can you trust the information that comes from the management?	0.822		
Are the employees able to express their views and feelings?	0.788		
Are conflicts resolved in a fair way?	0.817		
Are employees appreciated when they have done a good job?	0.751		
Are all suggestions from employees treated seriously by the management?	0.827		

* These two scales are constructed from the three scales horizontal and vertical trust, and justice and respect. The three scales did not discriminate well against one another. Therefore an explorative principal component analysis was conducted and items that were cross loading were deleted. 2 factors were extracted with loadings above 0.68 and named as shown.

DEPARTMENT OF ECONOMICS AND BUSINESS

AARHUS UNIVERSITY

SCHOOL OF BUSINESS AND SOCIAL SCIENCES

www.econ.au.dk

PhD Theses since 1 July 2011

- 2011-4 Anders Bredahl Kock: Forecasting and Oracle Efficient Econometrics
- 2011-5 Christian Bach: The Game of Risk
- 2011-6 Stefan Holst Bache: Quantile Regression: Three Econometric Studies
- 2011:12 Bisheng Du: Essays on Advance Demand Information, Prioritization and Real Options in Inventory Management
- 2011:13 Christian Gormsen Schmidt: Exploring the Barriers to Globalization
- 2011:16 Dewi Fitriasari: Analyses of Social and Environmental Reporting as a Practice of Accountability to Stakeholders
- 2011:22 Sanne Hiller: Essays on International Trade and Migration: Firm Behavior, Networks and Barriers to Trade
- 2012-1 Johannes Tang Kristensen: From Determinants of Low Birthweight to Factor-Based Macroeconomic Forecasting
- 2012-2 Karina Hjortshøj Kjeldsen: Routing and Scheduling in Liner Shipping
- 2012-3 Soheil Abginehchi: Essays on Inventory Control in Presence of Multiple Sourcing
- 2012-4 Zhenjiang Qin: Essays on Heterogeneous Beliefs, Public Information, and Asset Pricing
- 2012-5 Lasse Frisgaard Gunnensen: Income Redistribution Policies
- 2012-6 Miriam Wüst: Essays on early investments in child health
- 2012-7 Yukai Yang: Modelling Nonlinear Vector Economic Time Series
- 2012-8 Lene Kjærsgaard: Empirical Essays of Active Labor Market Policy on Employment
- 2012-9 Henrik Nørholm: Structured Retail Products and Return Predictability
- 2012-10 Signe Frederiksen: Empirical Essays on Placements in Outside Home Care

- 2012-11 Mateusz P. Dziubinski: Essays on Financial Econometrics and Derivatives Pricing
- 2012-12 Jens Riis Andersen: Option Games under Incomplete Information
- 2012-13 Margit Malmose: The Role of Management Accounting in New Public Management Reforms: Implications in a Socio-Political Health Care Context
- 2012-14 Laurent Callot: Large Panels and High-dimensional VAR
- 2012-15 Christian Rix-Nielsen: Strategic Investment
- 2013-1 Kenneth Lykke Sørensen: Essays on Wage Determination
- 2013-2 Tue Rauff Lind Christensen: Network Design Problems with Piecewise Linear Cost Functions
- 2013-3 Dominyka Sakalauskaite: A Challenge for Experts: Auditors, Forensic Specialists and the Detection of Fraud
- 2013-4 Rune Bysted: Essays on Innovative Work Behavior
- 2013-5 Mikkel Nørlem Hermansen: Longer Human Lifespan and the Retirement Decision
- 2013-6 Jannie H.G. Kristoffersen: Empirical Essays on Economics of Education
- 2013-7 Mark Strøm Kristoffersen: Essays on Economic Policies over the Business Cycle
- 2013-8 Philipp Meinen: Essays on Firms in International Trade
- 2013-9 Cédric Gorinas: Essays on Marginalization and Integration of Immigrants and Young Criminals – A Labour Economics Perspective
- 2013-10 Ina Charlotte Jäkel: Product Quality, Trade Policy, and Voter Preferences: Essays on International Trade
- 2013-11 Anna Gerstrøm: World Disruption - How Bankers Reconstruct the Financial Crisis: Essays on Interpretation
- 2013-12 Paola Andrea Barrientos Quiroga: Essays on Development Economics
- 2013-13 Peter Bodnar: Essays on Warehouse Operations
- 2013-14 Rune Vammen Lesner: Essays on Determinants of Inequality
- 2013-15 Peter Arendorf Bache: Firms and International Trade
- 2013-16 Anders Laugesen: On Complementarities, Heterogeneous Firms, and International Trade

- 2013-17 Anders Bruun Jonassen: Regression Discontinuity Analyses of the Disincentive Effects of Increasing Social Assistance
- 2014-1 David Sloth Pedersen: A Journey into the Dark Arts of Quantitative Finance
- 2014-2 Martin Schultz-Nielsen: Optimal Corporate Investments and Capital Structure
- 2014-3 Lukas Bach: Routing and Scheduling Problems - Optimization using Exact and Heuristic Methods
- 2014-4 Tanja Groth: Regulatory impacts in relation to a renewable fuel CHP technology: A financial and socioeconomic analysis
- 2014-5 Niels Strange Hansen: Forecasting Based on Unobserved Variables
- 2014-6 Ritwik Banerjee: Economics of Misbehavior
- 2014-7 Christina Annette Gravert: Giving and Taking – Essays in Experimental Economics
- 2014-8 Astrid Hanghøj: Papers in purchasing and supply management: A capability-based perspective
- 2014-9 Nima Nonejad: Essays in Applied Bayesian Particle and Markov Chain Monte Carlo Techniques in Time Series Econometrics
- 2014-10 Tine L. Mundbjerg Eriksen: Essays on Bullying: an Economist's Perspective

