Bullying Among Adolescents: The Role of Skills*

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Abstract

Bullying cannot be tolerated as a normal social behavior portraying a child's life. This paper quantifies its negative consequences allowing for the possibility that victims and non-victims differ in unobservable characteristics. To this end, we introduce a factor analytic model for identifying treatment effects of bullying in which latent cognitive and non-cognitive skills determine victimization and multiple outcomes. We use early test scores to identify the distribution of these skills. Individual-, classroom- and district-level variables are also accounted for. Applying our method to longitudinal data from South Korea, we first show that while non-cognitive skills reduce the chances of being bullied during middle school, the probability of being victimized is greater in classrooms with relatively high concentration of boys, previously self-assessed bullies and students that come from violent families. We report bullying at age 15 has negative effects on physical and mental health outcomes at age 18. We also uncover heterogeneous effects by latent skills, from which we document positive effects on the take-up of risky behaviors (18) and negative effects on schooling attainment (19). Our findings suggest that investing in non-cognitive development should guide policy efforts intended to deter this problematic behavior.

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1 Introduction

Psychologists have defined a bullying victim as a person that is repeatedly and intentionally exposed to injury or discomfort by others, with the harassment potentially triggered by violent contact, insulting, communicating private or inaccurate information and other unpleasant gestures like the exclusion from a group (Olweus, 1997). This explains why this aggressive behavior typically emerges in environments characterized by the imbalances of power and the needs for showing peer group status (Faris and Felmlee, 2011). Not surprisingly, schools are the perfect setting for bullying. The combination of peer pressure and diverse groups, together with a sense of self-control still not fully developed, makes schools a petri dish for its materialization.

Bullying is very costly. It should not be considered a normal part of the typical social grouping that occurs throughout an individual's life (NAS, 2016). The fear of being bullied is associated with approximately 160,000 children missing school every day in the United States (15% of those who do not show up to school every day);[1] one out of ten students drops out or changes school because of bullying (Baron, 2016); homicide perpetrators are twice as likely as homicide victims to have been victims of bullying (Gunnison et al., 2016); suicidal thoughts are two to nine times more prevalent among bullying victims than among non-victims (Kim and Leventhal, 2008). Notably, the economic literature has mostly stayed away from research efforts for understanding this aggressive behavior.

Although the prevalence of school bullying is a global phenomenon, in South Korea, the country we examine in this paper, it represents a serious social problem. Suicides and bullying also go hand in hand in the country. Suicides among school-aged Koreans (ages 10 to 19) average one a day.[2] The fierce academic competition resulting from the high value the society gives to education, which in turn makes school grades and test scores extremely high

[1] See stopbullying.gov.

[2] Suicide is the country's largest cause of death among individuals between 15 and 24 years of age. According to the World Health Organization, the overall suicide rate in South Korea is among highest in the world with 28.9 suicides per 100,000 people (2013).

stake events, has been identified as one of the reasons behind the phenomenon. In fact, South Korean households spend 0.8% of the GDP per year out of their pockets on education (more than twice the OECD average), and after-school academies or *hagwon* are increasingly popular (Choi and Choi, 2015).[3] This competitive high-pressure environment has fueled a climate of aggression that frequently evolves into physical and emotional violence.[4]

This paper assesses the determinants and medium-term consequences of being bullied. Our empirical analysis is carried out using South Korean longitudinal information on teenagers, which allows us to examine the extent to which cognitive and non-cognitive skills can deter the occurrence of this unwanted behavior, and also how they might palliate or exacerbate its effects on several outcomes, including depression, life satisfaction, college enrollment, the incidence of smoking, drinking, health indicators and the ability to cope with stressful situations.[5]

Our conceptual framework is based on an empirical model of endogenous bullying, multiple outcomes and latent skills. As we describe below, the setting is flexible enough to incorporate several desirable features. First, it treats bullying as an endogenous behavior dependent on own and peer characteristics. We exploit the fact that students in Korea are randomly allocated to classrooms, so some classrooms may be more or less fostering of an aggressive environment depending on the students assigned to it (Carrell and Hoekstra, 2010). In this setting, each student's stock of skills serves as the mediating mechanism between such

[3]The degree of competition is such that there are *hagwons* exclusively dedicated to prepare students for the admission processes of the more prestigious *hagwons*. These investments are not remedial measures. They do not aim at helping less proficient individuals to keep up with their classmates. Instead, they are intended to make good students even better than their peers. Such are the incentives to study extra hours that the government had to prohibit instruction in *hagwon* after 10PM. See www.economist.com/news/asia/21665029-korean-kids-pushy-parents-use-crammers-get-crammers-cr-me-de-la-cram and www.economist.com/node/21541713.

[4]In fact, the problem of school violence is so prevalent that in an effort to curb this unwanted behavior, the South Korean government installed 100,000 closed circuit cameras in schools in 2012, and since 2013, private insurance companies have been offering bullying insurance policies. www.huffingtonpost.com/2014/02/07/south-korea-bullying-insurance_n_4746506.html.

[5]In this paper we follow the literature and define *cognitive skills* as "all forms of knowing and awareness such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving" (APA, 2006), and *non-cognitive skills* as personality and motivational traits that determine the way individuals think, feel and behave (Borghans et al., 2008).

environment and the probability of being victimized. Second, it recognizes that cognitive and non-cognitive test scores available to the researcher are only proxies for latent skills (Heckman et al., 2006a). This is critical for this paper since, as shown below, ability measures can be influenced by the school environment (Hansen et al., 2004). Third, it avoids strong functional form assumptions on the distribution of latent skills, allowing for a flexible representation of the patterns observed in the data. Formal tests confirm the empirical relevance of this feature. Fourth, the model allows us to simulate counterfactual outcomes for individuals with different latent skill levels, which are then used to document heterogenous and non-linear treatment effects of bullying on multiple variables. This provides a comprehensive perspective of its negative effects. Finally, it accommodates the potential effects of investments (improving school quality and diminishing aggressive behavior within the household) on the probability of being bullied.

The paper contributes to the literature in several ways. First, to the best of our knowledge, this is the first attempt to assess medium-term impacts of school victimization while dealing with its endogeneity (from the point of view of the victim). In particular, longitudinal data allows us to examine the transition from middle school to early adulthood, so we can identify the effects of early victimization during a decisive period of human development. Second, we provide evidence on how skills mediate between the potential supply of violence in the classroom and student's likelihood of being victimized. Namely, we find that a one standard deviation increase in non-cognitive skills reduces the probability of being bullied by more than 6%. Thus, we provide insights that can potentially motivate interventions to reduce its incidence. Third, we find that skills not only affect the probability of victimization, but also palliate the consequences of bullying in subsequent years. In particular, we find that cognitive skills reduce the incidence of bad habits, such as drinking and smoking, proportionally more among bullying victims than among non-victims. Fourth, we quantify the effects bullying has on several behavioral outcomes. Anticipating our results, we find that being bullied at age 15 increases the incidence of sickness by 93%, the incidence of mental health issues by 80%, and raises stress levels caused by friendships by 23.5% of a standard deviation, all

by age 18. We also find that there are differential effects of bullying victimization across skill levels. Bullying increases depression by 11% of a standard deviation among students from the bottom decile of the non-cognitive skill distribution, and reduces the likelihood of going to college by 5.5 to 9.4 percentage points in students that come from the lower half of the non-cognitive skill distribution. We also show that bullying increases the likelihood of smoking by 10.3 percentage points for students in the lowest decile of the cognitive skill distribution.

The paper is organized as follows. Section 2 puts our research in the context of the literature analyzing bullying. Section 3 describes our data. In Section 4, and following the existing literature, we present results from regression analyses of the impact of bullying on different outcomes. Section 5 explains the empirical strategy we adopt in this paper. Section 6 presents and discusses our main results. Section 7 concludes.

2 Related Literature

Research in psychology and sociology has been prolific in describing bullying as a social phenomenon. This literature has shown that younger kids are more likely to be bullied, that this misbehavior is more frequent among boys than among girls (Boulton and Underwood, 1993; Perry et al., 1988), and that school and class size are not significant determinants of the likelihood of bullying occurrence (Olweus, 1997). It has also documented that bullying victims have fewer friends, are more likely to be absent from school, and do not like break times (Smith et al., 2004); that they have lower self-evaluation (self-esteem) (Björkqvist et al., 1982; Olweus, 1997); and that their brains have unhealthy cortisol reactions that make it difficult to cope with stressful situations (Ouellet-Morin et al., 2011). Although mostly descriptive, this research provides insights that are essential for the specification of our empirical model. In particular, the common characterization of victims as individuals lacking social adeptness highlights the importance of controlling for skills, particularly non-cognitive dimensions, when analyzing the determinants and potential consequences of bullying.

But unlike in sociology and psychology, economic research has not paid enough attention to bullying. At least two reasons might explain this. First and foremost, the lack of representative information about bullying in both cross-sectional and longitudinal studies; and second, the fact that selection into this behavioral phenomenon is complex and non-random, reducing the chances of reliable identification strategies. Thus, the consequences of being bullied could be confounded by intrinsic characteristics that made the person a victim (or a perpetrator) in the first place.

In this context, only a handful of papers in economics analyze the effect of bullying, while the efforts to understand its endogeneity have been even more exiguous. Brown and Taylor (2008) estimate linear regression models and ordered probits to examine the associations between bullying and educational attainment as well as labor market outcomes in the United Kingdom. Their findings suggest that being bullied (and being a bully) is correlated with lower educational attainment and, as a result, with lower wages later in life. Le et al. (2005) bundle bullying with several other conduct disorders such as stealing, fighting, raping, damaging someone's property on purpose and conning, among others. Using an Australian sample of twins, these authors control for the potential endogeneity arising from genetic and environmental factors. Through linear regression models, they find that conduct disorders are positively correlated with dropping-out from school and being unemployed later in life. They do not explore, however, the latent dimensions influencing both the conduct disorder and the outcome variables they assess. By implementing an instrumental variable strategy, Eriksen et al. (2014) deal with the endogeneity of bullying. Using detailed administrative information from Aarhus, a region in Denmark, they instrument teacher-parent reported bullying victimization in elementary school with the proportion of classroom peers whose parents have a criminal conviction. They confirm that elementary school bullying reduces 9^{th} grade GPA.

Drawing on these previous efforts, our empirical strategy extends the existing literature on several fronts. First, the setting we examine allows us to leverage on a feature of the Korean schooling system, namely the random allocation of students to classrooms, to account for the

potential selection of students across classrooms.[6] Moreover, in the spirit of the literature, we use classroom-level instrumental variables as source of exogenous variation affecting the probability of being victimized. Second, we control for unobserved heterogeneity in the form of cognitive and non-cognitive skills. In this way, the analysis connects to the literature on skill formation (Cunha and Heckman, 2008) as it treats multiple skills not only as mechanisms that determine the chances of being bullied, but also as traits that palliate or exacerbate its negative effects (potentially on other traits). Since we find that unobserved skills are key determinants of the treatment and outcomes examined, we also shed light on how to identify causal effects when the treatment is driven by unobserved heterogeneity (latent skills) (Angrist and Imbens, 1994; Heckman et al., 2006b). Finally, we provide medium-term impacts of school victimization on multiple outcomes. That is, we acknowledge that bullying affects the victims' lives beyond school, and consequently, we quantify its impacts on other future dimensions (e.g., health status, risky behaviors, social relations, life satisfaction and college attendance).

3 Data

We use the Korean Youth Panel Survey (KYPS), a longitudinal study designed to characterize and explain the behaviors of adolescents after they entered middle school. This panel was first launched in 2003 and collected rich information from a sample of students (age 14 at wave one) who were then interviewed once a year until 2008, covering the transition from middle-school into the beginning of their adult life.

The KYPS is a representative sample of the entire country. Its sampling was stratified into the 12 regions including Seoul Metropolitan City. Within each region, schools were randomly chosen with sampling intervals to represent the region's proportion of middle-school students. In total, 104 schools were sampled. All the students of an entire class in a sampled school

[6] We provide details on how we use the random allocation of students to classrooms in Section 5

were interviewed and followed-up. The resulting panel consists of 3,449 students who were repeatedly interviewed in six waves.[7] Each year, information was collected in two separate questionnaires: one for the teenager, and one for their parents or guardians. Table 1 presents the descriptive statistics.

Table 1: Main Descriptive Statistics of the KYPS Sample

Total sample size	3,449		
Number of Females	1,724	Fathers Education:	
Proportion of urban households	86.7%	High-school	42.94%
Prop. of single-headed households	6%	4yr Coll. or above	36.56%
Median monthly income per-capita	1 mill won	Mothers Education:	
Prop. of Youths in College by 19	56.65%	High-school	56.31%
Prop. of Single-child households	8.8%	4yr Coll. or above	19.51%
Number of Schools	104		
Average Class Size	35		
Minimum Class Size	21		
Maximum Class Size	42		

Note: Data from the KYPS. We define as urban households those that live in a *Dong* as opposed to living in an *Eup* or a *Myeu*.

As this is a sensitive age range regarding life-path choices, the KYPS provides a unique opportunity to understand the effects of cognitive and non-cognitive skills on multiple behaviors. This longitudinal study pays special attention to the life-path choices made by the surveyed population, inquiring not only about their decisions, but also about the environment surrounding their choices. For example, youths are often asked about their motives and the reasons that drive their decision-making process. Future goals and parental involvement in such choices are frequently elicited as well.

Besides inquiring about career planning and choices, the KYPS collects data on academic performance, student effort and participation in different kinds of private tutoring activities. The survey also asks about time allocation, leisure activities, social relations, attachment to friends and family, participation in deviant activity, and the number of times the respondent

[7]The attrition in this longitudinal study is the following: by wave 2, 92% of the sample remained; by wave 3,91% did so; by wave 4,90%; and by wave 5,86% remained in the sample. Sarzosa (2015) shows that attrition is not related with skills or victimizations.

has been victimized in different settings. In addition, the survey performs a comprehensive battery of personality questions from which measures of self-esteem, self-stigmatization, self-reliance, aggressiveness, anger, self-control and satisfaction with life can be constructed.

While parents and guardians answer a short questionnaire covering household composition and their education, occupation and income; the teenagers are often asked about the involvement of their parents in many aspects of their life, which are the sources of information we use to form classroom-level determinants of bullying. We construct, for example the proportion of peers in the classroom from families with a history of violence using the answers to the following statements: "I always get along well with brothers or sisters", "I frequently see parents verbally abuse each other", "I frequently see one of my parents beat the other one", "I am often verbally abused by parents", and "I am often severely beaten by parents". Individual reactions to these statements are recorded using a Likert scale ranging from "very true" to "very untrue". After aggregating the answers, we label students reporting an overall score above the mean as coming from a violent family. Finally, for each student, we count the number of classmates from families with a history of violence.

Non-Cognitive Measures (age 14).[8] The KYPS contains a comprehensive battery of measures related to personality traits. Among them, we select the scales of locus of control, irresponsibility and self-esteem. Locus of control relates to the extent to which a person believes her actions affect her destiny, as opposed to a person that believes that luck is more important than her own actions (Rotter, 1966). People with internal locus of control face life with a positive attitude as they are more prone to believe that their future is in their hands (Tough, 2012). The irresponsibility scale captures the impossibility to carry forward an assigned task to a successful conclusion. Interestingly, students with low levels of responsibility tend to favor short-term rewards and that hampers their ability to exert effort for extended period of time in order to achieve longer-term goals (Duckworth et al., 2007). Thus, this scale might relate negatively to perseverance and grit, that is, the ability

[8]Following the literature on unobserved heterogeneity we use interchangeably the terms "measures" and "scores" to denote the observable or manifest variables that come directly from the data as opposed to the terms "skills" or "skill dimensions" we use to denote the unobserved factors.

to overcome obstacles and giving proportionally greater value to large future rewards over smaller immediate ones (Duckworth and Seligman, 2005). Finally, self-esteem provides a measure of self-worth. Panel A in Table 2 presents the descriptive statistics of the constructed measures.[9]

Table 2: Descriptive Statistics: Scores Collected at age 14

	All		Males		Females		Obs.
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
A. Non-Cognitive Measures							
Locus of Control	10.68	(2.14)	10.84	(2.18)	10.52	(2.09)	3,319
Irresponsibility	8.29	(2.40)	8.31	(2.40)	8.27	(2.41)	3,319
Self-esteem	-4.05	(4.46)	-3.85	(4.445)	-4.25	(4.46)	3,319
B. Academic Performance							
Math and Science	0.12	(1.04)	0.26	(1.04)	-0.02	(1.02)	3,319
Language and Social Studies	-0.002	(1.07)	-0.14	(1.08)	0.008	(1.05)	3,319
Class Grade	-0.14	(1.07)	-0.19	(1.07)	-0.08	(1.08)	3,170

Note: Measures collected from the first wave of the KYPS. Locus of control relates to the extent to which a person believes her actions affect her destiny, as opposed to a person that believes that luck is more important than her own actions (Rotter, 1966). The irresponsibility measure relates negatively to perseverance and grit. The non-cognitive scores were constructed by aggregating the Likert scaled answers ranging from "very true" to "very untrue" across questions regarding each concept. We present the list of questions in Appendix A. Regarding academic test scores, we use i) math and science; ii) language (Korean) and social studies; and iii) overall sum of school grades in the previous semester (1^{st} semester 2003).

The choice of these variables is backed by research that shows that each of these personality traits are important determinants of future outcomes and the likelihood of victimization. For instance, Duckworth and Seligman (2005), Heckman et al. (2006a) and Urzua (2008) show that the unobserved heterogeneity captured by some of these measures are strong predictors of adult outcomes. In fact, our findings presented in the Appendix C attest to that. In the same vein, psychology literature shows that the traits chosen correlate with school bullying victimization (Björkqvist et al., 1982; Olweus, 1997; Smith and Brain, 2000). People with external locus of control or a higher degree of perseverance may have a greater

[9]It should be noted that most of the non-cognitive or socio-emotional information in the KYPS is recorded in categories that group the reactions of the respondent in categories from "strongly agree" to "strongly disagree". In consequence, and following common practice in the literature, we construct socio-emotional skill measures by adding categorical answers of several questions regarding the same topic. The exact questions used can be found in Appendix A.

inclination to avoid/change a victimization situation. Self-esteem, on the other hand, *proxies* prosociality in the following way. On average, prosocial children report higher levels of self-worth (Keefe and Berndt, 1996), and are more likely to have friends (Santavirta and Sarzosa, 2019). Therefore, children with higher levels of self-worth tend to have larger and more stable friendship networks, which in turn, reduce the chances of being bullied in school (Hodges and Perry, 1996).

Academic Performance (age 14). While rich in other dimensions, the KYPS data is somewhat limited regarding cognitive measures. Ideally, we would like to have variables closely linked to pure cognitive ability. However, the lack of such measures forces us to infer cognitive ability from grades and self-assessed scholastic performance. In particular, we use the students' self-reported performance in i) math and science, and ii) language (Korean) and social studies, together with the last semester's overall sum of school grades. The latter is typically based off of a mid-term and a final in each school subject, and is reported at the end of every term (semester). See Panel B in Table 2 for the descriptive statistics of these measures.

Importantly, previous literature has shown that academic performance is not orthogonal to non-cognitive skills (Borghans et al., 2011). That is particularly true for the self-assessed scholastic performance measures we use. Students's *reporting* of those measures may be mediated by emotional traits like, for instance, how confident they are on themselves or their self-worth. In other words, the production function of self-reported scholastic performance has to be modeled using both cognitive and socio-emotional (or non-cognitive) skills as inputs. As described below, our framework takes this into account.

Bullying (ages 14 and 15). Psychological research shows that children tend to restrict their definitions of bullying to verbal and/or physical abuse (Naylor et al., 2010). Accordingly, in the KYPS—where bullying is self-reported—students are considered to be victims if they have been severely teased or bantered, threatened, collectively harassed, severely beaten, or robbed, and zero otherwise. Thus, the bullying victimization variable we focus on is binary.

The reported incidence of bullying in the KYPS for ages 14 and 15, presented in Table 3, is remarkably similar to the 22% incidence of bullying victimization reported in the United States (National Center for Education Statistics, 2015) and in line with the incidence reported in international studies for the same age (see Smith and Brain, 2000, for a summary).[10]

Outcome Variables (ages 18 and 19). According to the existing scientific literature, bullying relates to differences in later physical, psychosocial, and academic outcomes (NAS, 2016). We follow that taxonomy and document the impact of bullying on at least one outcome from each dimension.

When it comes to physical health, we examine medium to long term consequences resulting from somatization—the translation of emotional shocks to physical symptoms like sleep difficulties, gastrointestinal disorders, headaches, and chronic pain (NAS, 2016)—or the take-up of unhealthy behaviors which can be understood as strategies teenagers use to cope with victimization and peer rejection (Carlyle and Steinman, 2007; Niemelä et al., 2011). To this end, we analyze self-reported health at age 18 (an indicator on whether the respondent considers she is in good health or not). In addition, although they are not direct measures of physical health, we also examine the incidence of smoking and drinking alcohol within this category.

We also link to bullying to the incidence of mental health issues and stress. Mental health problems are commonly linked to many types of early life emotional trauma (Institute of Medicine and National Research Council, 2014). School bullying is no different. Available literature often links victimization to an increased incidence of psychotic symptoms (Cunningham et al., 2016), to psychosocial maladjustment like depression and suicides (Hawker and Boulton, 2000; Kim et al., 2009), and the increased presence of cortisol—the stress hormone which modifies many processes in the body, affects the pre-frontal cortex of the brain and in consequence alters behavior (NAS, 2016)—(Ouellet-Morin et al., 2011). In conse-

[10]Bullying after age 15 drops dramatically in the KYPS sample as student mature. The reported proportions of students victimized at ages 16 and 17 are just 4.6% and 3.2%, respectively, so we focus on the available period with a larger prevalence of bullying (14 and 15).

quence, we use a binary variable capturing whether the respondent has been diagnosed with psychological or mental problems, or not; and an index of depression that is constructed based on a battery of questions that assess its symptoms. Furthermore, using a detailed questionnaire, we assess the respondent's stress levels by age 18 with respect to friends, parents, school and poverty. We also aggregate them to construct a total stress index. Finally, we examine the effect of bullying on academic achievement using college attendance by age 19 as the outcome of interest.

Table 3: Descriptive Statistics: Bullying and Outcome Variables

	Mean	SD					
Bullied							
Age 14	0.225	0.418					
Age 15	0.112	0.315					
Outcome	*Overall*		*Not Bullied*		*Bullied*		*Diff*
	Mean	SD	Mean	SD	Mean	SD.	
Age 18							
Depression	0	1	-0.040	0.985	0.141	1.041	0.181***
Drinking	0.459	0.498	0.449	0.498	0.492	0.500	0.043**
Smoking	0.128	0.334	0.120	0.325	0.156	0.363	0.036***
Life Satisfaction	0.465	0.499	0.477	0.500	0.425	0.495	-0.052**
Feeling Sick	0.070	0.256	0.062	0.242	0.098	0.298	0.036***
Mental Health Problems	0.098	0.297	0.087	0.282	0.187	0.390	0.099***
Stress: Friends	0	1	-0.044	0.969	0.155	1.087	0.199***
Stress: Parents	0	1	-0.025	0.985	0.086	1.047	0.110**
Stress: School	0	1	-0.022	0.993	0.077	1.021	0.099**
Stress: Poverty	0	1	-0.034	0.999	0.119	0.996	0.154***
Stress: Total	0	1	-0.043	0.992	0.152	1.024	0.195***
Age 19							
College	0.690	0.463	0.709	0.454	0.623	0.485	-0.086***

Note: Stars indicate the difference is statistically different from zero at *** p<0.01, ** p<0.05, * p<0.1. The depression index is based on a symptoms assessment questionnaire. "Drinking" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. "College" takes the value of 1 if the respondent attends college by age 19. "Stress" variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress.

Table 3 presents descriptive statistics for the outcome variables. We consistently observe

victims having worse outcomes than non-victims. These raw differences are statistically significant at conventional levels. Appendix C shows that academic test scores and non-cognitive measures are strong determinants of the outcomes we analyze.[11] These strong relationships between proxies for skills and later outcomes are critical for the empirical strategy we present in Section 5.

4 Exploratory Regression Analysis

To motive our empirical strategy, we first report reduced-form associations between bullying at age τ_1, D_{τ_1}, and outcomes of interest reported at age τ_2, Y_{τ_2}, accounting for a rich set of controls collected at age τ_0, where $\tau_0 < \tau_1 < \tau_2$. Following the literature (Brown and Taylor, 2008; Eriksen et al., 2012), we posit the following regression model:

$$Y_{\tau_2} = \gamma D_{\tau_1} + \mathbf{T}_{\tau_0}\pi + \mathbf{X}_{\tau_0}\beta + \nu_{\tau_2} \tag{1}$$

where ν_{τ_2} denotes the error term, $\mathbf{T}$ is a vector containing cognitive and non-cognitive test scores and $\mathbf{X}$ is a vector of individual characteristics.[12] In our data τ_0 denotes age 14, τ_1 age 15, and τ_2 ages 18 or 19 depending on the outcome.

Table 4 shows the results from the estimation of equation (1) using the KYPS sample. These suggest positive correlations between being bullied at 15 and depression, the likelihood of being sick, life satisfaction and feeling stressed at 18. We also report a negative association between being bullied and college attendance (by age 19). The estimates, however, do not indicate statistically significant correlations between the problematic behavior and drinking or smoking (age 18).

[11] Our findings indicate that non-cognitive measures (age 14) correlate with all adult outcomes except college enrollment. Academic test scores (14), on the other hand, correlate with the incidence of depression and stress, college enrollment and smoking.

[12] The set of controls include month of birth, gender, number of siblings, household income per capita, whether the kids lives in an urban area, whether the kid lives with both parents, whether the kid lives only with her mother, father's education.

Table 4: Regression Analysis: The Empirical Association Between Bullying and Different Outcomes[†]

	Depression		Smoking		Drinking		Feeling Sick	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bullied (D_{τ_1})	0.216***	0.134***	0.019	0.002	0.019	-0.002	0.042***	0.037***
	(0.042)	(0.042)	(0.014)	(0.014)	(0.021)	(0.021)	(0.012)	(0.012)
Obs.	2,675	2,552	3,241	3,097	3,241	3,097	2,814	2,683
Observables	Y	Y	Y	Y	Y	Y	Y	Y
Test Scores	N	Y	N	Y	N	Y	N	Y

	Mental Health Problems		Life Satisfaction		College		Stress: Friends	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bullied (D_{τ_1})	0.019**	0.012	-0.062***	-0.041*	-0.059***	-0.048**	0.186***	0.144***
	(0.009)	(0.009)	(0.021)	(0.021)	(0.021)	(0.022)	(0.046)	(0.047)
Obs.	2,814	2,683	3,241	3,097	2,681	2,558	2,806	2,676
Observables	Y	Y	Y	Y	Y	Y	Y	Y
Test Scores	N	Y	N	Y	N	Y	N	Y

	Stress: Parents		Stress: School		Stress: Poverty		Stress: Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bullied (D_{τ_1})	0.105**	0.083*	0.147***	0.141***	0.194***	0.145***	0.228***	0.183***
	(0.045)	(0.046)	(0.045)	(0.045)	(0.045)	(0.046)	(0.045)	(0.046)
Obs.	2,806	2,676	2,806	2,676	2,806	2,676	2,806	2,676
Observables	Y	Y	Y	Y	Y	Y	Y	Y
Test Scores	N	Y	N	Y	N	Y	N	Y

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The observables controls used are: month of birth, gender, number of older siblings, number of younger siblings, natural log of household income per capita, urban, whether the kid lives with both parents, whether the kid lives only with her mother, father education: two-year college, father education: four-year college and, father education: graduate school. The tests scores used are: locus of control, irresponsibility, self-esteem, math and science, language and social studies and a class score.

[†] Outcomes are collected at age 18, except college attendance which is measured at age 19.

Of course, the interpretation of these results as causal effects rely on the conditional mean independence assumption of the error term in equation (1), ν_{τ_2}, with respect to the set of controls. In principle, conditional on $\mathbf{T}$ and $\mathbf{X}$ (both collected before the bullying episode occurs), the timing helps to deter reverse causality from Y to D. This view, however, omits at least two fundamental issues. First, the possible presence of measurement error in cognitive and non-cognitive scores might biased the results (Heckman et al., 2006a). Second, unraveled unobserved heterogeneity might perpetuate the endogeneity of bullying. Therefore, in principle, these findings cannot be interpreted as causal effects.

Instrumental variables might be used to identify the impact of bullying in this setting. This is the approach of Eriksen et al. (2014), which we also explore in Appendix D. The causal interpretation of those results, however, critically hinges on the assumption that the problematic behavior does not emerge from circumstances involving unobserved dimensions (Heckman et al., 2006b). As we discuss below, our empirical model takes these potential threats to identification into account and confirm the role of unobserved (essential) heterogeneity.[13]

5 Empirical Model

This section introduces a model of endogenous bullying with unobserved heterogeneity in the form of latent cognitive and non-cognitive skills. The core of the empirical strategy adapts Hansen et al. (2004) and Heckman et al. (2006a) to the analysis of this problematic social behavior. Skills are assumed to be known to the agents (not to the econometrician) and to determine outcomes, treatment (bullying) and early non-cognitive measures and academic

[13]Table D.2 in Appendix D presents IV estimates of the effect bullying at age 15 on later outcomes exploiting the proportion of peers that report being bullies in the class as well as the proportion of peers in the classroom that come from families with a history of violent behavior (both at age 14) as instruments. We provide a detailed discussion of these instruments when we describe our empirical strategy in Section 5. Table D.1 reports the first stage estimates. Overall, the IV results suggest unstable and non-statistically significant effects to bullying. In results available upon request, we implement formal tests for essential heterogeneity (Heckman et al., 2010). They confirm that heterogenous treatment effects cannot be rule out in our context, alerting about the causal interpretation of the IV parameters.

test scores. Bullying, in turn, is also triggered by observed individual- and classroom-level characteristics, and it might affect future outcomes.

As in the previous section, here we assume $\tau_0 < \tau_1 < \tau_2$. Let $\theta^C_{\tau_0}$ and $\theta^N_{\tau_0}$ denote latent cognitive and non-cognitive skill levels, respectively. These are conceptualized as correlated endowments with associated probability density function $f_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$, and cumulative function $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$. Equipped with $(\theta^C_{\tau_0},\theta^N_{\tau_0})$, we introduce a binary indicator characterizing bullying status (being bullied or not) and a vector of subsequent counterfactual outcomes.

Let D_{τ_1} be a dummy variable denoting whether or not an individual has been a victim of bullying at τ_1. We posit the model:

$$D_{\tau_1} = \mathbb{1}\left[\mathbf{Z}_{\tau_1}\beta^{D_{\tau_1}} + \alpha^{D_{\tau_1},C}\theta^C_{\tau_0} + \alpha^{D_{\tau_1},N}\theta^N_{\tau_0} + e^D_{\tau_1} \geq 0\right] \tag{2}$$

where $\mathbb{1}[A]$ denotes an indicator function that takes a value of 1 if A is true, and 0 otherwise. We assume $e^D_{\tau_1} \perp\!\!\!\perp (\theta^C_{\tau_0},\theta^N_{\tau_0},\mathbf{Z}_{\tau_1})$. $\mathbf{Z}_{\tau_1}$ represents a set of individual- and classroom-level observables which determines bullying. Its contribution to the model's identification is discussed below.

Counterfactual outcomes at age τ_2, on other hand, structurally depend on bullying status at age τ_1. Let Y_{0,τ_2}, Y_{1,τ_2} denote an outcome of interest (e.g., the incidence of depression) under $D_{\tau_1} = 0$ and $D_{\tau_1} = 1$, respectively. Thus,

$$Y_{1,\tau_2} = \mathbf{X}_Y\beta^{Y_1} + \alpha^{Y_1,C}\theta^C_{\tau_0} + \alpha^{Y_1,N}\theta^N_{\tau_0} + e^{Y_1}_{\tau_2} \qquad \text{if } D_{\tau_1} = 1 \tag{3}$$

$$Y_{0,\tau_2} = \mathbf{X}_Y\beta^{Y_0} + \alpha^{Y_0,C}\theta^C_{\tau_0} + \alpha^{Y_0,N}\theta^N_{\tau_0} + e^{Y_0}_{\tau_2} \qquad \text{if } D_{\tau_1} = 0 \tag{4}$$

where $(e^{Y_1}_{\tau_2}, e^{Y_1}_{\tau_2}) \perp\!\!\!\perp (\theta^C_{\tau_0},\theta^N_{\tau_0},\mathbf{X}_Y)$. $\mathbf{X}_Y$ contains a set of observed characteristics. Despite the fact that vectors $\mathbf{X}_Y$ and $\mathbf{Z}_{\tau_1}$ can partially share variables, they play different roles. While $\mathbf{Z}_{\tau_1}$ is the vector of variables affecting bullying, $\mathbf{X}_Y$ determines outcomes at τ_2. Note that under our assumptions, although D_{τ_1} is endogenous, once we control for unobserved heterogeneity $\left(\theta^C_{\tau_0},\theta^N_{\tau_0}\right)$ and observed characteristics (including exclusion restrictions), the

error terms $\left(e^{Y_1}_{\tau_2}, e^{Y_0}_{\tau_2}, e^{D}_{\tau_1}\right)$ are jointly independent.

Conceptually, expressions (2), (3), and (4) can be directly used to define different treatment effects of bullying D_{τ_1} on outcome Y_{τ_2} (Heckman and Vytlacil, 2007). Our empirical results focus on two: the average effect of bullying (ATE) and the average effect of bullying among victims (TT). Formally, we study:

$$
\begin{aligned}
ATE_{\tau_2}\left(\theta^{NC}_{\tau_0}, \theta^{C}_{\tau_0}\right) &= \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \theta^{NC}_{\tau_0}, \theta^{C}_{\tau_0} \right.\right], \\
TT_{\tau_2}\left(\theta^{NC}_{\tau_0}, \theta^{C}_{\tau_0}\right) &= \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \theta^{NC}_{\tau_0}, \theta^{C}_{\tau_0}, D_{\tau_1} = 1 \right.\right],
\end{aligned}
$$

where the expectations are taken jointly with respect to the observable characteristics and the idiosyncratic shocks. We also present versions of these parameters after integrating out latent cognitive and non-cognitive skills.[14]

Sufficient conditions for the identification of versions of this model and its associated treatment parameters exist in the literature (Cameron and Heckman, 1998; Heckman et al., 2016). However, our setting involves two additional challenges. First, the natural complexities of modeling bullying among adolescents magnify the importance of accounting for exogenous variation triggering this misbehavior. Its omission could lead to a misspecified model, potentially affecting the interpretation of the latent skills and parameters of interest. Second, since within our framework latent skills are interpreted as predetermined endowments, we must protect them from the potential effects of bullying in both τ_0 and τ_1. This condition makes the identification of the joint distribution of unobserved cognitive and non-cognitive skills particularly challenging. In what follows, we deal with these concerns.

5.1 Identification Arguments

We exploit the longitudinal dimension of our data and the institutional features of the South Korean schooling system to secure the identification of $F_{\theta^C_{\tau_0}, \theta^N_{\tau_0}}(\cdot, \cdot)$. We begin by augmenting

[14] Appendix G extends the set of treatment effects to the analysis of specific policy changes.

the model with a measurement system of test scores collected during τ_0, that is, before D_{τ_1} is realized.

Test scores at τ_0 and latent skills. Let $\mathbf{T}_{\tau_0} = [T_{1,\tau_0}, T_{2,\tau_0}, \ldots, T_{L,\tau_0}]'$ be a vector of test scores collected at age τ_0. Each component is assumed to be the result of a linear technology combining observed characteristics $\mathbf{X}_T$ and cognitive and non-cognitive skills, $\left(\theta^C_{\tau_0}, \theta^N_{\tau_0}\right)$. Therefore, even after conditioning on observables, $\mathbf{T}_{\tau_0}$ is linked to the treatment and outcome equations (2), (3) and (4) through a latent factor structure.

As discussed in Carneiro et al. (2003), under general assumptions, a large enough number of test scores in the measurement system can be used to secure the identification of $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$. In our case, however, the argument requires further considerations as the KYPS data is collected during the school year. As a consequence, students may have been exposed to some degree of treatment (bullying) prior to date of the tests, fueling concerns about reversed causality (scores influenced by bullying and vice-versa). Hansen et al. (2004) face a similar challenge when examining the potential impact of schooling and latent ability on test scores.[15] By extending the measurement system and exploiting limit arguments, they show the parameters of the model, including the distribution of latent abilities, can be identified. This structure is well suited for our setting so we adopt it. Thus, we first expand the measurement system making it functionally dependent on the bullying status at τ_0, D_{τ_0}, as follows:

$$\mathbf{T}_{\tau_0} = \begin{cases} \mathbf{X}_T \beta^T_{D_{\tau_0}=1} + \Lambda_{D_{\tau_0}=1}\Theta'_{\tau_0} + \mathbf{e}^T_{D_{\tau_0}=1} & \text{if } D_{\tau_0}=1 \\ \mathbf{X}_T \beta^T_{D_{\tau_0}=0} + \Lambda_{D_{\tau_0}=0}\Theta'_{\tau_0} + \mathbf{e}^T_{D_{\tau_0}=0} & \text{if } D_{\tau_0}=0 \end{cases}, \tag{5}$$

where D_{τ_0} takes the value of one if the individual is bullied at τ_0, and zero otherwise; $\Theta_{\tau_0} = \begin{bmatrix} \theta^C_{\tau_0} & \theta^N_{\tau_0} \end{bmatrix}$ is the vector of latent skills, and $\Lambda_{D_{\tau_0}=1}$, $\Lambda_{D_{\tau_0}=0}$ and $\Lambda_{D_{\tau_0}}$ are associated loading matrices. $\mathbf{e}^T_{D_{\tau_0}=0}$ and $\mathbf{e}^T_{D_{\tau_0}=1}$ represent the vectors of mutually independent error terms.

[15] In their setting, the threats to identification come from the fact that highly skilled people might attain higher education levels, but schooling, in turn, is believed to develop skills influencing test scores. Hence, when in presence of a high-skilled high-education person, econometricians cannot disentangle whether the person is highly-educated because she was highly skilled or she is highly skilled (reports high test scores) because she acquired more education.

Identification of the model requires a number of equations in each sub-system such that $L \geq 2k+1$, where k is the number of factors. Therefore, the presence of two latent skills implies that there should be *at least* five measures in expression (5). To anchor the scale of each latent factor, we must impose additional normalizations. Within each sub-system, we normalize one leading for each latent skill. This implies other loadings should be interpreted as relative to those used as numeraires. And to pin down the correlation between cognitive and non-cognitive skills, we assume at least one dedicated test score per latent skill (Sarzosa, 2015).[16] These last two assumptions effectively impose restrictions on the elements of $\Lambda_{D_{\tau_0}=1}$ and $\Lambda_{D_{\tau_0}=0}$. One possible configuration for the loading matrices in system (5) when $L=6$ is:

$$\Lambda_{D_{\tau_0}=1} = \begin{bmatrix} \alpha^{T_1,N}_{D_{\tau_0}=1} & 0 \\ \alpha^{T_2,N}_{D_{\tau_0}=1} & 0 \\ 1 & 0 \\ \alpha^{T_4,N}_{D_{\tau_0}=1} & \alpha^{T_4,C}_{D_{\tau_0}=1} \\ \alpha^{T_5,N} & \alpha^{T_5,C} \\ 0 & 1 \end{bmatrix}, \Lambda_{D_{\tau_0}=0} = \begin{bmatrix} \alpha^{T_1,N}_{D_{\tau_0}=0} & 0 \\ \alpha^{T_2,N}_{D_{\tau_0}=0} & 0 \\ \alpha^{T_3,N}_{D_{\tau_0}=0} & 0 \\ \alpha^{T_4,C}_{D_{\tau_0}=0} & \alpha^{T_4,C}_{D_{\tau_0}=0} \\ \alpha^{T_5,N} & \alpha^{T_5,C} \\ 0 & 1 \end{bmatrix},$$

where the first three scores represent "pure" non-cognitive measures, while scores four and five reflect both cognitive and non-cognitive skills. The sixth score is an exclusive cognitive measure. This is the configuration we implement in practice.

As the measurement system is functionally linked to bullying at τ_0, a model for D_{τ_0} completes the identification argument for the parameters in expression (5) and $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$. Consistent with (2), we assume:

$$D_{\tau_0} = \mathbb{1}\left[\mathbf{Z}_{\tau_0}\beta^{D_{\tau_0}} + \Lambda_{D_{\tau_0}}\Theta'_{\tau_0} + e^{D_{\tau_0}} \geq 0\right], \tag{6}$$

where $\Lambda_{D_{\tau_0}} = \left[\alpha^{D_{\tau_0},N}, \alpha^{D_{\tau_0},C}\right]$ and $\mathbf{Z}_{\tau_0}$ is a vector of variables affecting bullying. We assume $(\mathbf{e}^T_{D_{\tau_0}=1}, \mathbf{e}^T_{D_{\tau_0}=0}, e^{D_{\tau_0}})$ are orthogonal with respect to observed variables and latent skills, and that all error terms are mutually independent. $f_{e^{T_l}_{D_{\tau_0}}}(\cdot)$ is the associated probability function

[16] For further details see in Appendix B.

associated with each of the l components of the vector $[\mathbf{e}^T_{D_{\tau_0}=1}, \mathbf{e}^T_{D_{\tau_0}=0}]$.

Following Hansen et al. (2004), if the support of $\mathbf{Z}_{\tau_0}\beta^{D_{\tau_0}}$ matches the support of the error term in equation (6), $(\Lambda_{D_{\tau_0}}\Theta'_{\tau_0} + e^{D_{\tau_0}})$, limit arguments can be used to non-parametrically identify the joint distribution of the unobserved components in the test score equation $\Big((\Lambda_{D_{\tau_0}=1}\Theta'_{\tau_0} + \mathbf{e}^T_{D_{\tau_0}=1}), (\Lambda_{D_{\tau_0}=0}\Theta'_{\tau_0} + \mathbf{e}^T_{D_{\tau_0}=0})\Big)$. Using this distribution as an input, and under the assumptions $(\mathbf{X}_T, \mathbf{Z}_{\tau_0}) \perp\!\!\!\perp (\mathbf{e}^T_{D_{\tau_0}=1}, \mathbf{e}^T_{D_{\tau_1}=1}, \Theta'_{\tau_0})$ and $(\mathbf{e}^T_{D_{\tau_0}=1} \perp\!\!\!\perp \mathbf{e}^T_{D_{\tau_1}=1} \perp\!\!\!\perp \Theta'_{\tau_0})$, the underlying factor structure secures the non-parametric identification of the distributions of latent skills and error terms, as well as the factor loadings.

Outcomes at τ_2 and bullying at τ_1. Once $F_{\theta^C_{\tau_0}, \theta^N_{\tau_0}}(\cdot, \cdot)$ is obtained, the identification of the parameters in (2), (3) and (4) can be secured using standard arguments as we can account for latent skills (see also Heckman et al., 2006a).[17]

The assignment of students to schools as a threat to identification. Strategic responses of schools to bullying can jeopardize the previous identification argument. To see this, consider the case of students selectively allocated across schools/classrooms based on previous bullying events. Such dynamic sorting process should lead to a more complex factor structure than the one explore here, as past social interactions conforming collective constructs of latent skills could determine bullying today as well as its future effects.

Fortunately, an institutional feature of South Korea's schooling system allows us to circumvent this concern. In particular, we benefit from the random allocation of students to classrooms within school districts mandated by the "Leveling Policy" of 1969. The law "requires that elementary school graduates be randomly (by lottery) assigned to middle schools—either public or private—in the relevant residence-based school district" (Kang, 2007). Students then remain with the same group of peers for the next three years. Below we provide ev-

[17] At this stage, exclusion restrictions are not needed to formally secure the identification of the parameters governing equations (2), (3), and (4). This, of course, should not be interpreted as a justification for not paying close attention to the empirical specification of the model, particularly the bulling equation. To what extent the results vary depending on whether we have exclusion restrictions or not in D_{τ_1} is an empirical question Web Appendix B addresses.

idence confirming that the random allocation of students to classrooms mandated by the policy.[18]

5.2 Implementation

We estimate the model using a two-stage maximum likelihood estimation (MLE) procedure. We first consider the information from τ_0, the first year of middle school in our sample, and estimate:

$$\mathcal{L}_{\tau_0} = \prod_{i=1}^{N} \int\int \left\{ \begin{array}{l} \left[\begin{array}{l} f_{e^{T_1}_{0,\tau_0}} \left(\mathbf{X}_{Ti}, T^1_{0i,\tau_0}, \zeta^A, \zeta^B \right) \times \dots \\ \cdots \times f_{e^{T_L}_{0,\tau_0}} \left(\mathbf{X}_{Ti}, T^L_{0i,\tau_0}, \zeta^A, \zeta^B \right) \\ \qquad \times \Pr[D_{i,\tau_0} = 0 | \mathbf{Z}_{i,\tau_0}, \zeta^A, \zeta^B] \end{array} \right]^{1-D_{i,\tau_0}} \\ \times \left[\begin{array}{l} f_{e^{T_1}_{1,\tau_0}} \left(\mathbf{X}_{Ti}, T^1_{1i,\tau_0}, \zeta^A, \zeta^B \right) \times \dots \\ \cdots \times f_{e^{T_L}_{1,\tau_0}} \left(\mathbf{X}_{Ti}, T^L_{1i,\tau_0}, \zeta^A, \zeta^B \right) \\ \qquad \times \Pr[D_{i,\tau_0} = 1 | \mathbf{Z}_{i.\tau_0}, \zeta^A, \zeta^B] \end{array} \right]^{D_{i,\tau_0}} \end{array} \right\} dF_{\theta^A_{\tau_0}, \theta^B_{\tau_0}} \left(\zeta^A, \zeta^B \right),$$

where, given the identification arguments, we approximate $F_{\theta^C_{\tau_0}, \theta^N_{\tau_0}}(\cdot, \cdot)$ using a mixture of Gaussian distributions. This feature grants flexibility and is empirically important. In addition, we parametrize $f_{e^{T_l}_{D_{\tau_0}}}(\cdot)$ as normal distributions, $\mathcal{N}\left(0, \sigma^2_{e^{T_l}_{D_{\tau_0}}}\right)$, for $l = 1, \dots, L$. The error term in the bullying equation, $e^{D_{\tau_0}}$, is assumed to be distributed according to a standardized normal distribution. The model is estimated using two sets—one for each victimization condition at τ_0—of six test scores (Locus of Control, Irresponsibility, Self Esteem, Language and Social Sciences, and Math and Sciences). As it is customary in the literature, the set of controls $\mathbf{X}_T$ includes gender, family structure indicators, father's education attainment, monthly household income (per capita) and the age stated in months starting from March

[18] The "Leveling Policy" explicitly prevents the sorting of students by ability and achievement levels. See details of the policy in Appendix E. Furthermore, according to the KYPS documentation, the survey's sampling was such that the rare cases in which "classes formed based on superiority or inferiority as well as special classes were excluded."

1989.[19] The specification of the bullying equation is less well-established. Moreover, since τ_0 represents the first year of the survey (2003), the set of pre-determined variables to serve as $\mathbf{Z}_{\tau_0}$ is limited within the KYPS study. To enlarge this set, we gather additional information from administrative sources collected by the Korean Educational Development Institute (KEDI).[20] In particular, we use the yearly fraction of students that move out of the district and the yearly proportion of middle school dropouts to capture *variation affecting* bullying prevalence across schools and districts. To avoid cofounding biases we use data from 2002 when conforming $\mathbf{Z}_{\tau_0}$. Thus, we exploit pre-τ_0 variation to characterize bullying in τ_0. Given the random assignment of students to schools, conditional on D_{τ_0} and $\mathbf{X}_T$, $\mathbf{Z}_{\tau_0}$ should not directly affect individual-level test scores. From this analysis, after imposing the abovementioned normalizations, we proceed to estimate the parameters in the measurement system, bullying equation (at τ_0), and distribution characterizing $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$.

Having obtained the first set of parameters, we move on to the estimation of those in equations (2), (3) and (4). In this case, the likelihood function is:

$$\mathcal{L}_{\tau_1} = \prod_{i=1}^{N} \int\int \left\{ \begin{array}{l} \left[\begin{array}{c} f_{e^{Y_0}_{\tau_2}}\left(\mathbf{X}_{Y_0 i}, Y_{0i,\tau_2}, \zeta^A, \zeta^B\right) \\ \times \Pr[D_{i,\tau_1} = 0 | \mathbf{Z}_{\tau_1,i}, \zeta^A, \zeta^B] \end{array} \right]^{1-D_{i,\tau_1}} \\ \times \left[\begin{array}{c} f_{e^{Y_1}_{\tau_2}}\left(\mathbf{X}_{Y_1 i}, Y_{1i,\tau_2}, \zeta^A, \zeta^B\right) \\ \times \Pr[D_{i,\tau_1} = 1 | \mathbf{Z}_{\tau_1,i}, \zeta^A, \zeta^B] \end{array} \right]^{D_{i,\tau_1}} \end{array} \right\} dF_{\theta^A_{\tau_0},\theta^B_{\tau_0}}\left(\zeta^A, \zeta^B\right),$$

where we assume $e^{Y_1}_{\tau_2} \sim \mathcal{N}(0, \sigma^2_{e^{Y_1}_{\tau_2}})$, $e^{Y_0}_{\tau_2} \sim \mathcal{N}(0, \sigma^2_{e^{Y_0}_{\tau_2}})$, and $e^D_{\tau_1} \sim \mathcal{N}(0,1)$. The vector $\mathbf{X}_Y$ includes age, gender, number of siblings, family income, rural residency, parental background and household composition. For $\mathbf{Z}_{\tau_1}$, we mimic the specification of D_{τ_0} and include the yearly fraction of students that move out of the district and the yearly proportion of middle school dropouts. We further include the yearly fraction of students that move into the district and

[19] All individuals in our sample were born within the same academic year, which goes from March to February.

[20] KEDI's dataset has detailed information about the universe of educational institutions from kindergarten to high school over time, including the administrative and educational districts to which they belong. Thus, by combining it with the KYPS through the latter's location information, we were able to back out the school districts of all KYPS schools. See more details in Appendix E.

the yearly per capita tax revenue in the school district. The four variables are constructed using data from KEDI at τ_0, so consistent with our previous formulation we do not rely on contemporaneous information to explain bullying at τ_1. In fact, we exploit this logic to extend the set of controls in D_{τ_1}. From the first round of the KYPS data, we construct variables that, while exogenous to students, encapsulate their previous social interactions and, consequently, affect their chances of being bullied at τ_1 (Sarzosa, 2015). More precisely, we include the proportion of males peers, the proportion of peers that report being bullies and the proportion of peers that come from a violent family. These are constructed using classroom-level data from τ_0. The first two affect the probability of being bullied as it accounts for the supply of violence in the classroom. The last one—inspired by the variable "classroom proportion of incarcerated parents" used by Eriksen et al. (2014), as both relate household emotional trauma with violent behavior in school (Carrell and Hoekstra, 2010)—captures the well established fact that youths with behavioral challenges are more likely to come from violent households (Carlson, 2000; Wolfe et al., 2003). Hence, randomly formed classrooms in which there are more students coming from violent families are more prone to witness violent behavior than classrooms with a lower concentration of students that come from violent families.[21] From $\mathcal{L}_{\tau_1}$ we obtain the parameters from the outcome equations and bullying at τ_1.[22]

[21] Appendix E presents formal tests for the random allocation of students to classrooms within the KYPS sample. Its Table E.1 shows the random allocation mandated by the "Leveling Policy" in fact occurred. It documents that the shares of bully peers and of peers with violent families in the classroom at τ_0 are uncorrelated with a number of important background characteristics while controlling for school district fixed effects. See the distributions, means and standard deviations of the relevant variables in Figure E.1.

[22] Since the two-step procedure does not necessarily deliver asymptotically efficient estimators, we use a Limited Information Maximum Likelihood and correct the variance-covariance matrix of the second stage incorporating the estimated variance-covariance matrix and gradient of the first stage (Greene, 2000). An alternative approach could have been based on the joined estimation of the parameters contained in $\mathcal{L}_{\tau_0}$ and $\mathcal{L}_{\tau_1}$. We favor the two-step procedure as the first step—estimating the test scores measurement system—is the same regardless of the outcome used.

6 Main Results

6.1 Measurement System

In the interest of brevity, here we focus on the main results obtained from the measurement system. Appendix B discusses the results in more detail. Its Table B.1 displays the full set of estimated parameters.

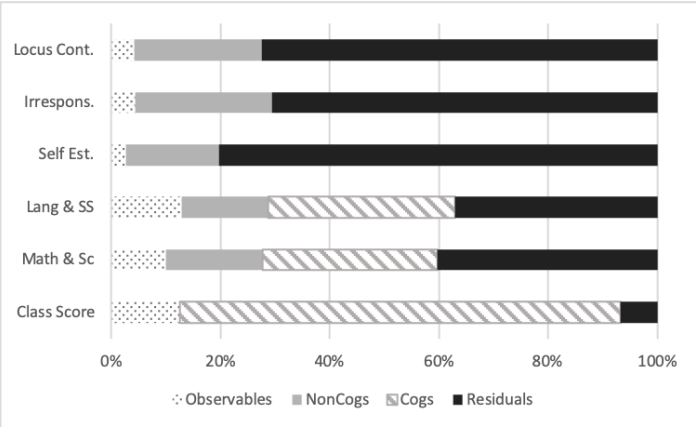
As expected, latent skills determine school grades as well as non-cognitive measures. In fact, the estimated loadings in expression (5) are large and statistically different from zero at the one percent level. For instance, one standard deviation increase in *non-cognitive* skills would increase the Language/Social Studies score by 23% of a standard deviation and the Math/Science score by 26% of a standard deviation. In turn, a one standard deviation increase in *cognitive* skills would increase the Language/Social Studies score by half of a standard deviation and the Math/Science score by 46% of a standard deviation. The importance of both latent skills is consistent with the results in the literature (Heckman et al., 2006a, 2018).

Figure 1 presents the results from a variance decomposition analysis of $\mathbf{T}_{\tau_0}$ as well as the estimated distribution of latent skills. Its Panel (a) shows that the unobserved skills explain a sizable proportion of the variance of non-cognitive measures and academic test scores, being always more prominent than the variance captured by the set of observable characteristics.[23] Using the model's estimates, on the other hand, its Panel (b) recreates the joint distribution of non-cognitive and cognitive skills at τ_0. The estimated correlation is 0.4534, while the density function does not display a "bell-curved" shape. These results highlight the importance of allowing for correlated skills and a flexible functional form for $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$.

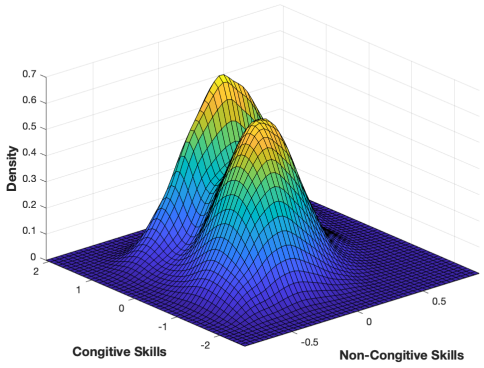
[23] These findings go in line with our argument against the use test scores as proxies for skills in Section 4. The unexplained part of the variance of test scores should correlate with ν_{τ_2} in (1) biasing the regression results. This illustrates some of the advantages of our approach.

Figure 1: Results from the Measurement System

(a) Variance Decomposition of Test Scores



(b) Distributions at τ_0



Note: Panel (a) presents the proportion of the test scores variance explained by $\mathbf{X}_T$ and $\Theta_{\tau_0} = \left[\begin{array}{cc} \theta^C_{\tau_0} & \theta^N_{\tau_0} \end{array} \right]$ (latent cognitive and non-cognitive skills). We label as *Residuals* the portion of the test score variance that remains unexplained. *Locus Cont* stands for Locus of Control, *Irrespons.* stands for Irresponsibility, *Self Est.* stands for Self Esteem, *Lang & SS* stands for Language and Social Sciences, *Math & Sc* stands for Math and Science. Panel (b) displays the estimated joint distribution of skills at τ_0. Namely, $f_{\theta^A_{\tau_0},\theta^B_{\tau_0}}(\cdot,\cdot)$. It was constructed from random draws based on the model's estimates whose full set of estimated parameters can be found in Table B.1 in the Appendix. The distribution is centered at $(0,0)$. The correlation coefficient between cognitive and non-cognitive skills is 0.4534. The standard deviation of the non-cognitive skills marginal distribution is 0.309 and that of the cognitive skills distribution is 0.893. Values in the top and bottom 1% in both dimensions were excluded for this Figure.

6.2 The Determinants of Bullying

We now analyze the determinants of bullying at age 15 (τ_1) and its consequences on outcomes at ages 18 or 19 (τ_2), accounting for latent skills. To this end, we estimate equation (2) as well as (3) and (4) for the same dimensions examined in the context of our regression analysis, i.e., for physical, psychosocial and academic outcomes.

Table 5 presents the results for four different specifications of the bullying equation (2). Its most salient finding is that while cognitive skills do not play a role in deterring or motivating the undesired behavior, non-cognitive skills are important determinants of the likelihood of the event. Our findings indicate that a one standard deviation increase in non-cognitive skills translates into a 0.71 percentage points reduction in the likelihood of being bullied (or 6.7% relative to the overall probability of being a victim of bullying). This significant

Table 5: Non-Cognitive and Cognitive Skills at age 14 and the Probability of Being Bullied at age 15 (τ_1)

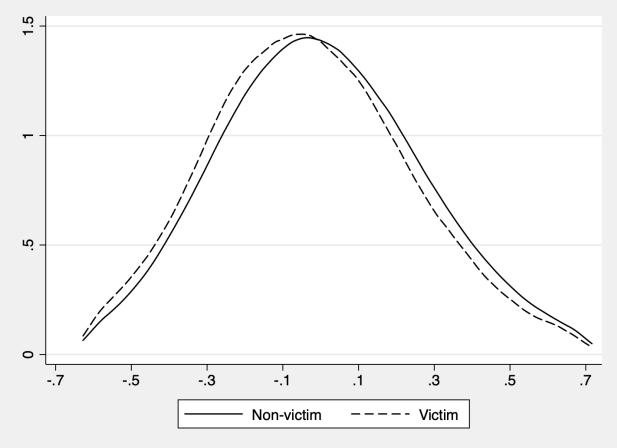
	(1)		(2)		(3)		(4)	
	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.
Age in Months	0.006	(0.009)	0.006	(0.009)	0.005	(0.009)	0.004	(0.009)
Male	0.123	(0.088)	0.123	(0.088)	0.121	(0.088)	0.121	(0.089)
Older Siblings	-0.054	(0.059)	-0.053	(0.060)	-0.060	(0.060)	-0.058	(0.060)
Young Siblings	-0.106*	(0.064)	-0.104	(0.064)	-0.111*	(0.064)	-0.108*	(0.064)
(ln) Monthly Income	-0.038	(0.058)	-0.039	(0.058)	-0.017	(0.059)	-0.019	(0.059)
Urban	0.026	(0.096)	0.048	(0.097)	0.091	(0.103)	0.106	(0.103)
Lives Both Parents	-0.108	(0.171)	-0.100	(0.172)	-0.075	(0.172)	-0.071	(0.173)
Lives Only Mother	0.076	(0.224)	0.093	(0.225)	0.115	(0.225)	0.127	(0.226)
Father's Educ.: 2yColl	0.035	(0.127)	0.045	(0.127)	0.041	(0.127)	0.049	(0.127)
Father's Educ.: 4yColl	-0.081	(0.078)	-0.077	(0.078)	-0.083	(0.079)	-0.080	(0.079)
Father's Educ.: GS	0.128	(0.134)	0.123	(0.134)	0.138	(0.136)	0.133	(0.137)
% Males	0.311**	(0.123)	0.255**	(0.126)	0.311**	(0.126)	0.260**	(0.128)
% Peer Bullies			0.790**	(0.334)			0.729**	(0.338)
% Violent Fam					-4.191**	(1.673)	-3.818**	(1.682)
% Violent Fam^2					5.338**	(2.117)	4.803**	(2.133)
Non-Cognitive Skills	-0.125**	(0.051)	-0.122**	(0.052)	-0.131**	(0.052)	-0.129**	(0.052)
Cognitive Skills	-0.025	(0.036)	-0.027	(0.036)	-0.029	(0.036)	-0.030	(0.036)
Constant	-1.180***	(0.302)	-1.372***	(0.314)	-0.565	(0.433)	-0.788*	(0.446)
Joint Significance of Instruments								
χ^2					6.387		11.005	
Pr $> \chi^2$					0.041		0.012	
N	2881		2881		2880		2880	

Note: This Table presents the estimated coefficients of different specifications of the equation for bullying (2). Variables "Older Siblings" and "Young Siblings" corresponds to the number of older and younger siblings the respondent has. "Monthly Income" corresponds to the natural logarithm of the monthly income per capita. "Lives Both Parents" and "Lives Only Mother" take the value of one if the respondent lives in a bi-parental household and if the respondent's father is absent from the household, respectively. Father's education attainment has four categories: High school or less (base category), 2yColl (a 2-year college degree), 4yColl (a 4-year college degree) and GS (graduate school). Variable "% Peer Bullies" corresponds to the proportion of peers that report being bullies in the respondent's classroom. "% Peer Violent Fam" contains the proportion of peers in the respondent's classroom that come from a violent family, where a violent family is defined in the data section. "% Males" represents the proportion of male peers in the respondent's classroom. Models in column (3) and (4) include school district controls. Namely, growth in student enrollment between 1999 and 2003, population-adjusted yearly averages of leavers, arrivals, dropouts and per-capita tax revenue. *** p<0.01, ** p<0.05, * p<0.1.

effect remains unchanged across specifications defining the sorting into bullying. Figure 2 illustrate this sorting as a function of unobserved skill. Those identified as victims have a distribution of non-cognitive skills that lie to the left of that of non-victims. Importantly, despite the difference in the skills distributions for victims and non-victims, there is a wide overlap between them. Therefore, the identification of the heterogeneous treatment effects we present later relies on the variation of the latent skills and not on the parametric extrapolation of a locally identified treatment effect (Cooley et al., 2016).

The findings in Table 5 confirm that the characteristics of the classroom to which students are randomly assigned determe the likelihood of being bullied (Sarzosa, 2015). First, having more male peers increases the chances of victimization. A one standard deviation increase in the proportion of boys in the classroom increases the likelihood of being bullied by 14.4%. That is, given the average class size of 31 students, an additional boy in the classroom increases the probability of being victimized by 1.3%. This goes in line with psychological literature that indicates that bullying is more prevalent among boys than among girls (Olweus, 1997; Wolke et al., 2001; Smith et al., 2004; Faris and Felmlee, 2011). The results also indicate that the availability of suppliers of violence within each classroom matters. In fact, all else evaluated at the mean, an additional bully in the classroom at age 14 increases the chances of victimization at age 15 by 3.6%. In the same vein, the marginal effect of increasing the concentration of peers in the classroom that come from violent families is positive and linearly increasing. Thus, the effect of adding a student that comes from a violent family on victimization is larger among classrooms that already have relatively high concentration of this type of students. For instance, adding one of this students to such classroom should, on average, increase the likelihood of being bullied by 2.8%. Consistent with the literature that relates peer effects, conformism and youth delinquency (Patacchini and Zenou, 2012), this suggests the existence of complementarities between peers from violent families in the generation of violence within the classroom.

Figure 2: Non-cognitive Skills (age 14)– Distributions by Bullying Status (age 15)



Note: This Figure presents the marginal distributions of unobserved non-cognitive skills by victimization condition. The distributions are computed using 40,000 simulated observations from the model's estimates.

Table 6 contains the results for equations (3) and (4) across outcomes. Importantly, latent skills have differential effects depending on whether the person was involved in bullying or not.[24] These findings suggest that skills not only influence the likelihood of being involved in bullying, but also they might play a significant role as mediators of the negative consequences associated with this problematic social behavior. Cognitive skills, for example, tend to deter drinking and smoking more among victims of bullying than among non-victims. In the same way, non-cognitive skills tend to reduce stress more among victims than among non-victims. So regardless of whether bullying has large or small consequences on a particular dimension—which is the topic we address next–, skill endowments help cope with these consequences in various ways depending on the outcome.

[24]The figures in Table 6 and the subsequent simulations were obtained from a model where the treatment equation followed specification (4) in Table 5. Our main findings are robust to the specification of the bullying equation. Web Appendix B reports the results from specification (1) where we use no exclusion restrictions (results from specifications (2) and (3) are available from the authors upon request). Figure B.1 shows that the omission of other determinants of bullying at age 15 (exclusion restrictions) generates distinctive sorting patterns by cognitive and non-cognitive skills. This is not surprising as classroom-level determinants of bullying are statistically significant at conventional levels (see Table 5). Importantly, the small differences between the estimated ATEs and TTs in Tables 8 (below) and B.3 suggest that exclusion restrictions (at age 15) are not contributing much to relax the jointly independent assumption of the error terms in the bullying and outcome equations (after controlling for skills). This consistent with our hypothesis that latent cognitive and non-cognitive skills play a critical role in identifying the treatment effects of interest.

Table 6: Outcome Equations (age 18, τ_2) by Bullying Status D (age 15, τ_1)

	(1) Depression		(2) Drinking		(3) Smoking		(4) Life Satisfaction		(5) Feeling Sick		(6) Mental Health Problems	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Non-Cogn Skills	-0.294***	-0.377***	-0.056***	-0.040	-0.044***	0.035	0.104***	0.133***	-0.023***	-0.021	-0.024***	-0.108***
	(0.031)	(0.080)	(0.016)	(0.040)	(0.010)	(0.029)	(0.015)	(0.039)	(0.008)	(0.030)	(0.009)	(0.032)
Cognitive Skills	0.029	0.006	-0.011	-0.066**	-0.032***	-0.134***	0.043***	0.108***	-0.005	-0.014	0.002	-0.007
	(0.022)	(0.060)	(0.011)	(0.031)	(0.007)	(0.022)	(0.011)	(0.030)	(0.006)	(0.022)	(0.007)	(0.024)
Observations	2445		2880		2880		2880		2570		2780	
	(7) College†		(8) Stress: Friends		(9) Stress: Parent		(10) Stress: School		(11) Stress: Total		(12) Stress: Poverty	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Non-Cogn Skills	-0.019	0.040	-0.192***	-0.461***	-0.115***	-0.064	-0.095***	-0.206**	-0.242***	-0.414***	-0.253***	-0.322***
	(0.015)	(0.044)	(0.033)	(0.100)	(0.033)	(0.095)	(0.032)	(0.090)	(0.032)	(0.094)	(0.033)	(0.089)
Cognitive Skills	0.070***	0.091***	0.066***	0.093	0.173***	0.141**	0.296***	0.317***	0.179***	0.213***	0.009	0.079
	(0.011)	(0.033)	(0.023)	(0.073)	(0.024)	(0.070)	(0.023)	(0.067)	(0.023)	(0.068)	(0.023)	(0.066)
Observations	2448		2563		2563		2563		2563		2563	

Note: This Table presents the estimated coefficients of the outcome expressions (3) and (4) across outcomes. "Depression" corresponds to a standardized index of depression symptoms. "Drinking" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. "College" takes the value of 1 if the respondent attends college by age 19. The "Stress" variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. "Stress:Total" aggregates the four triggers of stress. Controls not show: Age in months, gender, number of older and younger siblings, family income, rurality indicator, bi-parental household, and Father's education. See the complete estimates in Tables A.1 and A.2 in the Web Appendix. Columns headed as 1 collect the coefficients for those who were bullied at age 15. Columns headed as 0 collect the coefficients for those who were not bullied at age 15. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † "College" attendance is measured at age 19.

6.3 The Impact of Bullying

To empirically establish that our approach delivers meaningful treatment effects of bullying on different outcomes, we must first assess to what extent our empirical model replicates key features of the data. Thus, we use the results presented in Section 6.1 to simulate moments from the outcome distributions and compare them to actual data. Table 7 displays these data-model comparisons. In particular, while 11.07% of the sample declares being bullied, our model predicts a 11.08%. With respect to the outcomes of interest, we compare the simulated and actual conditional means: $E\left[Y_{0,\tau_2}\left|D_{\tau_1}=0\right.\right]$ and $E\left[Y_{1,\tau_2}\left|D_{\tau_1}=1\right.\right]$. The model is able to closely recreate the observed averages and standard errors by bullying status for the large majority of outcomes.

ATE and TT of Being Bullied. Table 8 presents the ATE and TT estimates of being bullied at age 15 on outcomes at age 18 and older. The findings indicate significant effects of victimization on physical and mental health outcomes. When analyzing ATE, our results indicate that being bullied at age 15 on average causes the incidence of sickness to increase by 6.5 percentage points three years later, which represents an increase of about 93% relative to the baseline status (non-victim). In the same way, on average, the incidence of mental health issues increased by 80% due to victimization..[25] Regarding the stress measures, we find that being bullied on average increases the stress caused by friendships by 23.5% of a standard deviation (SD), the stress caused by the relationship with parents by 16% of a SD and the stress caused by school by 12.3% of a SD. Overall, the results for TT confirm these results also among victims. These findings contrast to the ones reported in the regression analysis, which ignore the endogeneity caused by the selection into treatment and abstract for the measurement error problems affecting test scores. For instance, while we find no overall effect of bullying on depression, life satisfaction and college attendance, the OLS estimates

[25] "Not being in good health" and "Developing mental health issues" represent low-incidence outcomes. Therefore, linear probability models like the ones estimates in each treatment status of the empirical model might run into difficulties. Appendix F presents the results using probit functions in the outcome equations. We confirm that our results from the models using linear outcome equations differ very little from the ones using nonlinear equations.

Table 7: Assessing the Fit of the Model: Conditional Means

	Depression		Smoking		Feeling Sick		Life Satisfaction	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	0.0573	0.0576	0.1307	0.1269	0.0639	0.0644	0.5201	0.4909
	(0.906)	(0.875)	(0.337)	(0.330)	(0.245)	(0.245)	(0.500)	(0.492)
$E[Y_1 \mid D=1]$	0.1431	0.0842	0.1689	0.1746	0.1187	0.1155	0.4764	0.4783
	(0.896)	(0.843)	(0.375)	(0.375)	(0.324)	(0.329)	(0.500)	(0.490)
	College		Mental Health Problems		Stress: Friends		Stress: Parents	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	0.7008	0.6960	0.0874	0.0873	-0.0538	-0.0530	-0.0181	-0.0192
	(0.458)	(0.458)	(0.282)	(0.283)	(0.967)	(0.961)	(0.985)	(0.985)
$E[Y_1 \mid D=1]$	0.6398	0.6275	0.1851	0.1695	0.2928	0.2208	0.1587	0.1351
	(0.481)	(0.489)	(0.389)	(0.384)	(1.137)	(1.084)	(1.033)	(1.053)
	Stress: School		Stress: Poverty		Stress: Total		Drinking	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	-0.0039	-0.0183	-0.0058	-0.0071	-0.0244	-0.0287	0.4940	0.4722
	(0.995)	(0.988)	(0.998)	(0.975)	(0.979)	(0.962)	(0.500)	(0.498)
$E[Y_1 \mid D=1]$	0.1306	0.0701	0.1019	0.0536	0.2313	0.1538	0.4970	0.5187
	(1.008)	(1.013)	(0.991)	(0.964)	(1.049)	(1.010)	(0.499)	(0.509)

Note: The simulated moments (i.e., Model) are calculated using 40,000 observations generated from the models' estimates. The Data columns contain the observed mean at age 18 obtained from the KYPS. "Depression" corresponds to a standardized index of depression symptoms. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Life Satisfied" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "College" takes the value of 1 if the respondent attends college by age 19. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. The "Stress" variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. Standard errors in parentheses.

Table 8: Treatment Effects: Outcomes at Age 18 (τ_2) of Being Bullied at Age 15 (τ_1)

	Depression	Smoking	Drinking	Feeling Sick	Mental Health Problems	Life Satisfaction
ATE	0.0593	0.0241	0.0053	0.0653***	0.0787***	-0.0166
	(0.0627)	(0.0208)	(0.0282)	(0.0216)	(0.0236)	(0.0290)
TTE	0.0472	0.0243	0.0264	0.0524**	0.0820***	-0.0131
	(0.0588)	(0.0208)	(0.0274)	(0.0213)	(0.0243)	(0.0282)

	College	Stress:Friends	Stress:Parent	Stress:School	Stress:Poverty	Stress:Total
ATE	-0.0476	0.2354***	0.1595**	0.1231*	0.0699	0.1988***
	(0.0320)	(0.0756)	(0.0693)	(0.0687)	(0.0670)	(0.0694)
TTE	-0.0377	0.2561***	0.1491**	0.1421**	0.0891	0.2109***
	(0.0309)	(0.0711)	(0.0670)	(0.0640)	(0.0653)	(0.0673)

Note: Standard errors in parenthesis. This Table presents the estimated treatment parameters:

$$ATE = \iint \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \zeta^{NC}, \zeta^{C} \right.\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right)$$

and

$$TT = \iint \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \zeta^{NC}, \zeta^{C}, D_{\tau_1} = 1 \right.\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right) ..$$

The variable Depress corresponds to a standardized index of depression symptoms. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Drinking" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "College" takes the value of 1 if the respondent attends college by age 19. The "Stress" variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. *** p<0.01, ** p<0.05, * p<0.1.

found effectS of -13.4%, -4.1 and -4.8 percentage points, respectively.

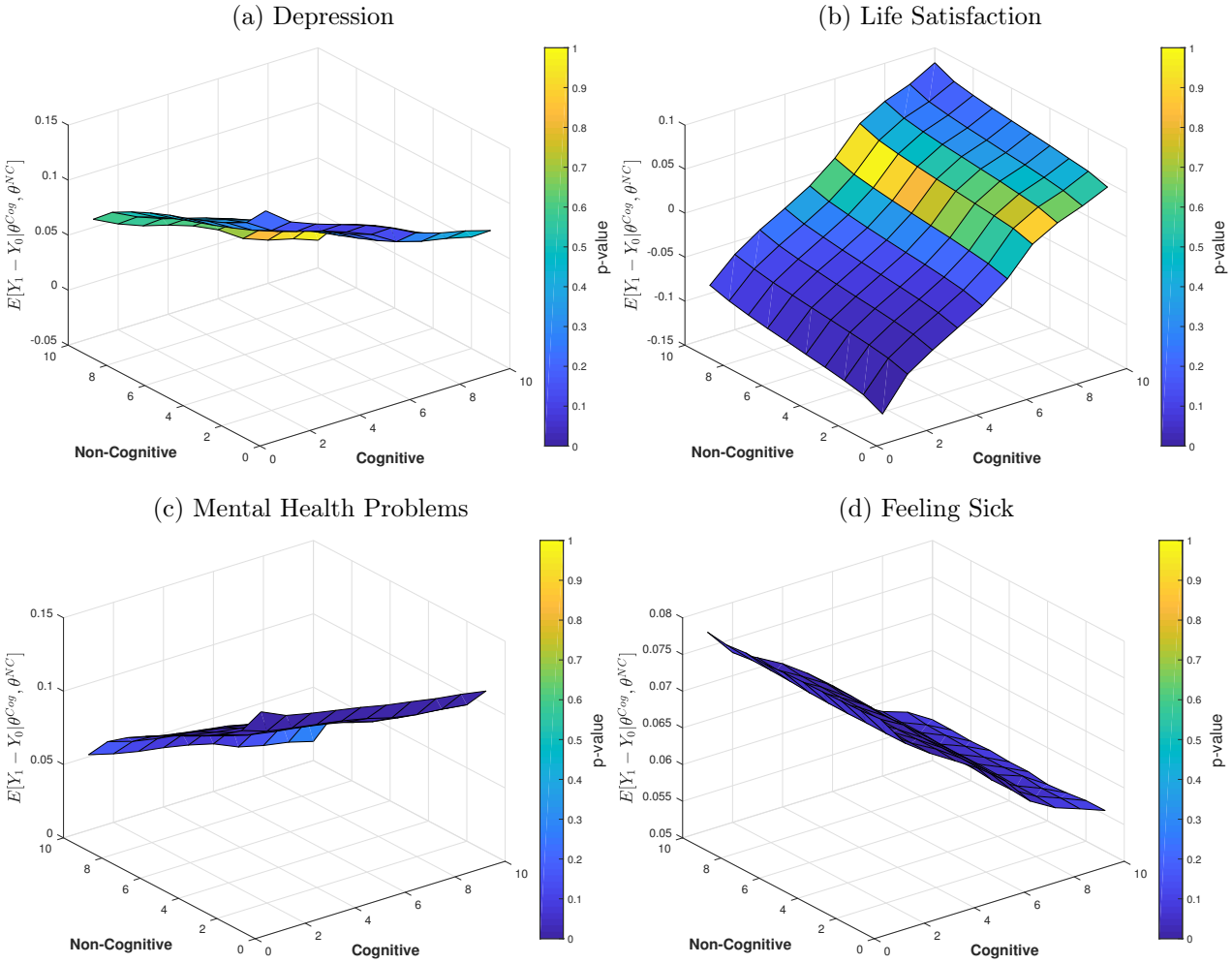
Beyond the overall ATE and TT, we can use our empirical strategy to inquire about these treatment parameters at different regions of the skills space. Thus, we estimate treatment effects conditional on skills, with the intention of assessing about subsets of teenager (endowed with specific cognitive and non-cognitive skills levels) who face impacts even under the absence of significant overall average effects. Given the high correlation between cognitive and non-cognitive skills, these results are best presented in three-dimensional figures displaying the association between skills (x and y-axes) and the outcome of interest (z-axis). To aide exposition, in what follows, we present the results grouping the outcomes into four categories: health (excluding stress), education, take-up of risky behaviors and stress measures. In addition, based on the estimation of pair-wise confidence intervals, we code into the figures the significance levels of testing the absence of an effect due to victimization. Darker colors represent smaller $p-$values.

The analysis confirms the existence of differential effects of victimization depending on the level of skills. In particular, Figures 3 show that individuals who start middle school with low stocks of skills face harsher health consequences of bullying. For instance, even though we found no average effects, 3a demonstrates that student with very low stocks of non-cognitive skills (in the first decile of the distribution) report 11% of a SD higher scores in the depression symptom index. Likewise, Figure 3b shows that victims who had low levels of both skills are up to 13.4 percentage points less likely to be satisfied with how their life is going at age 18 as a result of bullying at age 15.

Similar patterns emerge among outcomes where we found overall significant average treatment effects. For "Mental health problems" or "Felling sick" by age 18, we find stronger effects for students with low levels of both latent skills at age 14. In fact, while we document an average effect of victimization on the likelihood of having mental health problems of 7.8 percentage points, Figure 3c shows that the effect on children with low levels of non-cognitive skills might reach up to 12 percentage points. Another worth-noticing finding from the effect

of bullying has on "Feeling sick", Figure 3d, is that the impact is statistically different from zero even among highly skilled students.

Figure 3: ATE of being bullied at age 15 on Health Outcomes at age 18



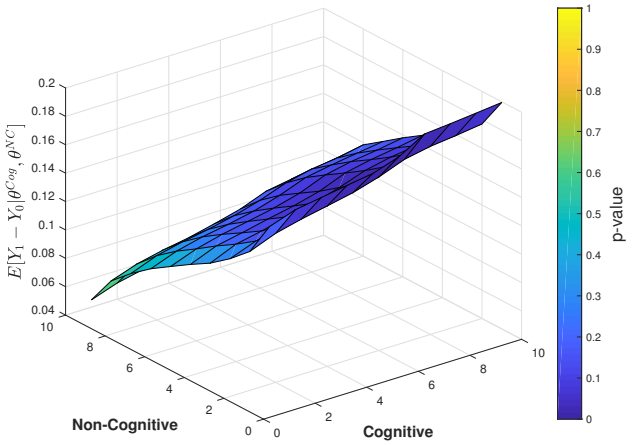
Note: Panels display $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}\right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Depression" is a standardized aggregated index of depression symptoms. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year.

Evidence from the psychological literature suggests that bullying might affect schooling attainment, particularly by fostering a dislike for school that contributes to absenteeism and school drop out (e.g., Smith et al., 2004). By documenting the effect bullying has on college

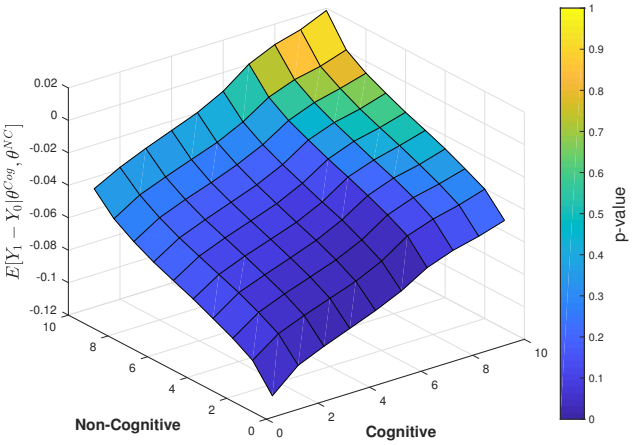
enrollment and stress caused by school, a measure that proxies a dislike for school and its related activities, we shed light on this idea.

Figure 4: ATE of being bullied at age 15 on Educational Outcomes at age 18 and older

(a) Stress: School (Age 18)



(b) College Attendance (Age 19)



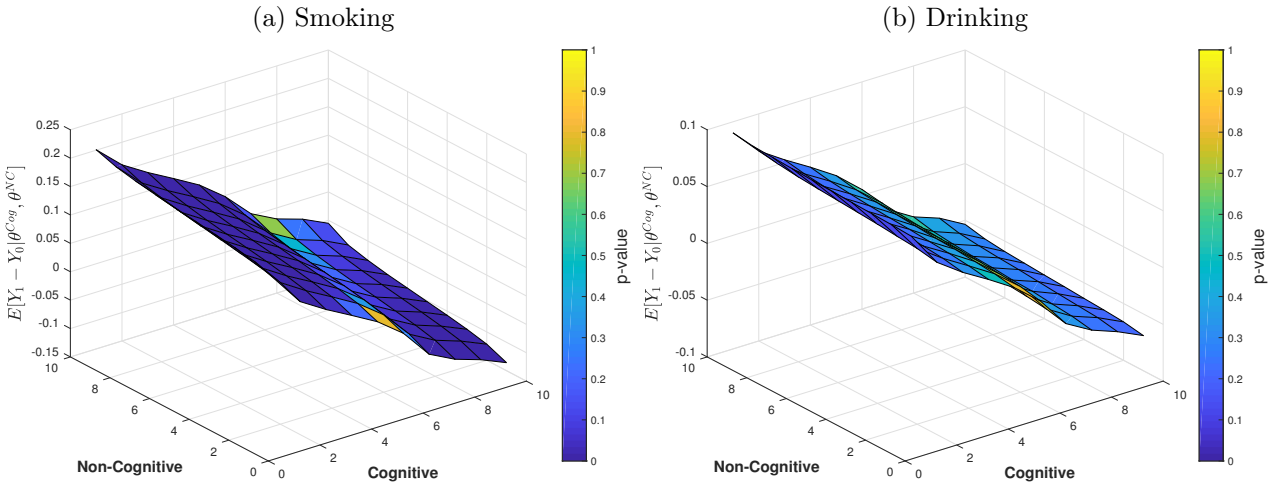
Note: Panels display $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C} \right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Stress: school" is a variable that aggregates stress symptoms triggered by situations related with school. "College Attendance" takes the value of 1 if the respondent attends college by age 19.

Figure 4a indicates that the overall ATE of bullying on stress symptoms triggered by situations related with school (12% of a SD) is driven mainly by the large effect victimization has on students with low levels of non-cognitive skills. In fact, the effect in the first decile of the non-cognitive distribution (14.3% of a SD) is roughly twice larger than that obtained in the tenth decile (7.5% of a SD). The figure also shows an upward gradient between the effect victimization has on stress in school and cognitive skills. Although the *gradient* is not statistically different from zero, the positive relation suggests that smarter individuals may develop a larger distaste for school than those with lower levels of cognitive skills.

All this evidence goes in line with the claim that bullying is a very harmful mechanism through which violence deters learning and schooling achievement, providing a channel through which the findings of Eriksen et al. (2014) on its effect on GPA materialize. Figure 4b complements this result as it shows that bullying is also an important deterrent to tertiary education

enrollment (by age 19). Teenagers that belong to the lower half of the non-cognitive skill distribution face a negative impact of bullying on college enrollment of the order of 5.5 to 9.4 percentage points. This is especially remarkable if we take into account that non-cognitive skills are not statistically significant determinants of college enrollment (see Table C.2 in the Appendix and Espinoza et al., 2018). However, bullying does have an impact among those with low non-cognitive skills. For them, the behavioral problem becomes an obstacle to higher education attainment. This finding also relates to the potential effect of victimization on the stress caused by school. In particular, it is interesting to note the difference the stock of non-cognitive skills makes in palliating the consequences of school bullying on college attendance, even among the smartest students. Victims that start middle school with very high levels of cognitive skills can go from facing no impact to facing a 5.6 percentage points decrease in the likelihood of attending college by age 19 depending on the initial level of non-cognitive skills.

Figure 5: ATE of being bullied (15) on Take-up of Risky Behaviors (18)



Note: Panels display $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C} \right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Drinking' takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year.

Unlike previous outcomes, the effect of bullying on the take-up of risky behaviors, such as smoking and drinking alcoholic beverage, is mainly mediated by cognitive instead of non-

cognitive skills. Figure 5a displays the significant impact of bullying on smoking by age 18 for those who belong to the lower half of the cognitive skill distribution (the estimated impact is about 10.3 percentage points). Interestingly, for those in the first decile bullying increases the likelihood of smoking by 15.4 percentage points. That is, those individuals are more than two times more likely to smoke than the average 18 year-old Korean. On the other hand, we find that bullying victimization *reduces* the likelihood of smoking, given that the victims had cognitive skills in the top 20% of the distribution. In fact, students in the top decile are 8.3 percentage points *less* likely to smoke by age 18 as a result of bullying.[26]

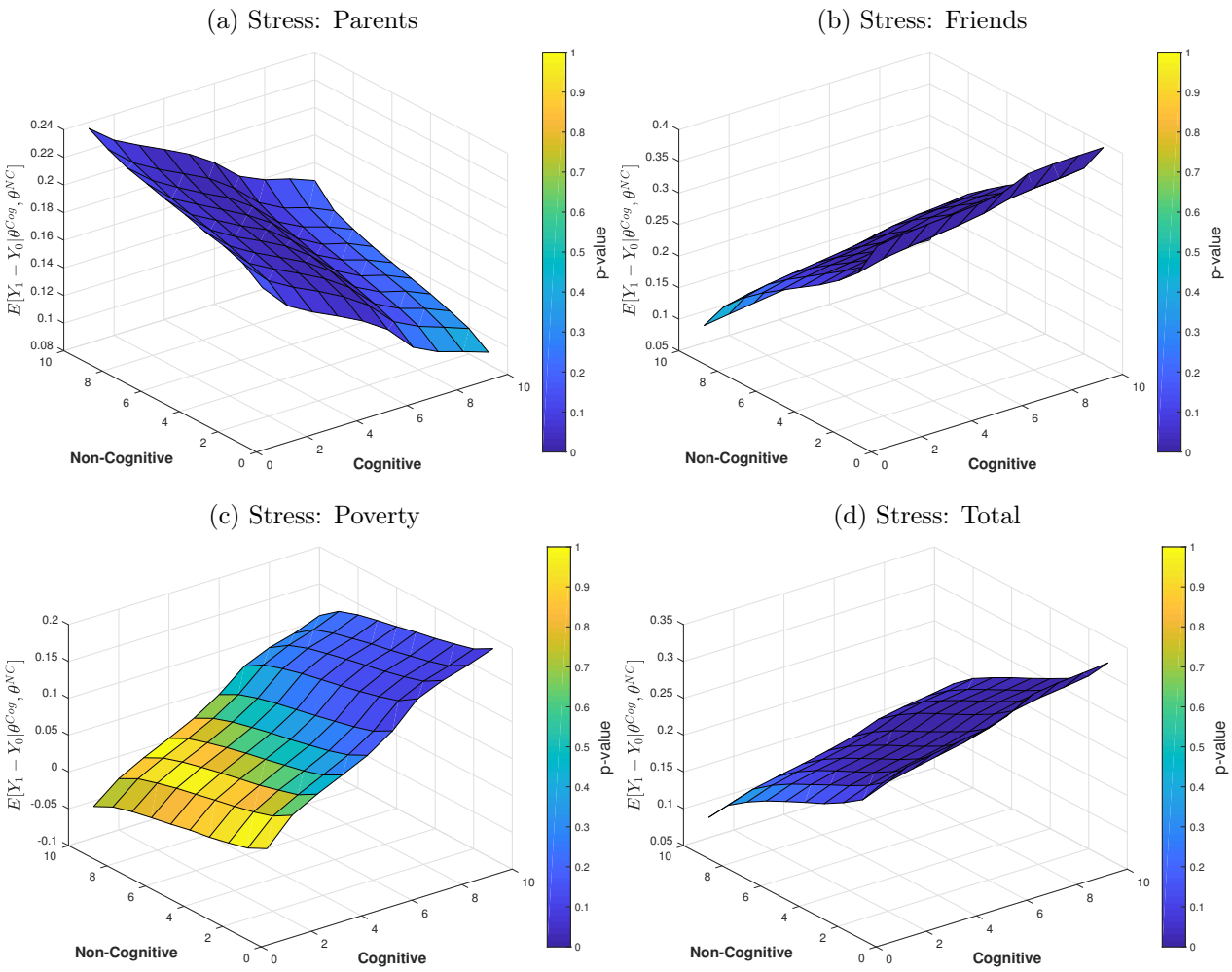
A similar pattern emerges from the analysis of the likelihood of drinking alcohol. Figure 5b shows that while individuals that come from the first decile of the cognitive skill distribution are 8.3 percentage points *more* likely to drink alcohol by age 18 as a result of being victims of bullying at age 15, those that come from the tenth decile are 5.8 percentage points *less* likely to do so. However, the latter effect is not statistically different form zero.

In line with the results on mental health, depression and life satisfaction, we find that being bullied in middle school affects the emotional wellbeing later in life as it leads to greater levels of stress. Figure 6 shows that victimization significantly increases stress due to different causes and for most of the skills space. Panel (a) indicates that the effect of victimization on the stress caused by the relationship with the parents is significantly different from zero regardless of students' stock of skills, with the smallest effects reported among students with high cognitive skills and low non-cognitive skills (9% of a SD). Among students with low cognitive skills and high non-cognitive skills, the effect reaches 24.5% of a SD. Likewise,

[26]The reduction in the incidence of smoking due to bullying for students with high levels of cognitive skills may seem puzzling. One could hypothesize that it may be due to remedial investments by parents, as it is the case for grade retention (Cooley et al., 2016). However, in the case of bullying, parents do not seem to systematically respond with investments (Sarzosa, 2015). In fact, when asked about whether children have been bullied at school, parents and children's answer do not correlate (Holt et al., 2009). In addition, if remedial investment was taking place, we would observe some positive effects in more outcomes, but we do not. We hypothesize that reduction in the incidence of smoking may be due to the negative effect that victimization has on college attendance. Table C.2 in the Appendix shows that cognitive skills increase the likelihood of attending college. Thus, individuals who enroll in college have, on average, higher cognitive skills. In results available upon request, we find that college attendance increases the likelihood of smoking *for students with high levels of cognitive skills*. Thus, given that bullying decreases the changes of going to college, it may be shielding some high skilled people from the effect college attendance has on smoking.

Panel (b) establishes that the effects on the stress caused by friendships are also sizable and significant. However, in this case the magnitude largely depend upon the level of non-cognitive endowments: it is about a third of a SD among those in the bottom third of the non-cognitive distribution, while about 16% of a SD for those in the top third. And when it comes to stress due to economic conditions, Panel (c) shows bullying has a positive and significant effect only for students with very high levels of cognitive skills and low levels of non-cognitive skills. More precisely, among those in the top third of the cognitive and bottom third of the non-cognitive skill distributions the estimated impact is about 16.5% of a SD. The last panel confirm how bullying increases total stress (the accumulation across symptoms) for any combination of cognitive and non-cognitive skills.

Figure 6: ATE of being bullied (15) on Stress (18)



Note: All panels present the $ATE\left(\theta^{NC},\theta^{C}\right)=\mathbb{E}\left[Y_1-Y_0\left|\theta^{NC},\theta^{C}\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Stress: Parents is a variable that aggregates stress symptoms triggered by the relation of the respondent with her parents. Stress: Poverty is a variable that aggregates stress symptoms triggered by situations related with economic difficulties. Friends is a variable that aggregates stress symptoms triggered by situations related with friends and social relations. Stress: Total is a variable that aggregates stress symptoms triggered by situations related with friends, parents, school and poverty.

All in all, these results attest to the fact that cognitive and non-cognitive skills not only affect bullying occurrence, but also, they mediate the extent to which this undesired behavior affects subsequent outcomes. While Figures C.1-C.4 in Web Appendix C confirm this statement using TT instead of ATE, Appendix G explores this even further. It assesses the heterogenous local responses at age 15 to a hypothetical policy change that would drop the number of

bullies by half at age 14. That is, we estimate how much of the average effect of bulling among switchers one year later would not materialize thanks to a policy that would reduce the number of purveyors of violence in the classroom. The findings suggest that reducing the number of bullies in the classrooms at age 14 reduces the average incidence of bullying by 13% at 15. Despite this relatively small change in victimization, we find that among switchers the damage done bullying would greatly be reduced.[27]

6.4 Bullying and Investments in Skills

We have shown that skills are key determinants of bullying and its consequences. However, the findings are silent about the importance of skill investments. By modifying the stock of skills, they could reduce bullying occurrence.

To examine this hypothesis, we re-estimated the bullying model (equation (2)), but this time including variables proxying for parental investments. Formally, the model is augmented to include a vector of skills' investment measures at time τ_0, which includes an index of parental control that measures whether the parents know where the youth is, who she is with and how long she will be there, an index of parental harmony that measures how much time the kid spends with their parents, whether the child considers she is treated with affection by parents, if she believes her parents treat each other well, if her parents talk candidly and frequently with her, and an index of parental abuse that measure whether the household is a violent setting. In addition, we include two measures of school characteristics. The *school quality* measure is an index that aggregates measures of teacher responsiveness and learning conditions. The teacher responsiveness measure is based on the perceptions students have of their teacher, such as whether they think they can talk to their teacher openly and whether they would like to turn out to be like their teacher when they become adults. The

[27] Like in Cooley et al. (2016), given that skills affect the selection into treatment and the size of the effects, the impact of the policy on the marginal student are closer to the counterfactual gain to not being bullied among those who were bullied before the policy change. Interestingly, even in the context of this small change in victimization, we document heterogeneous responses by latent skills and graphically identify the set of complies within the skills domain.

learning conditions index is based on the likelihood of students attending top institutions of higher education after graduating from that particular school, and whether students believe their school allows them to develop their talents and abilities. Finally, *school environment* is measured using information about robbery and criminal activity within or around the school and the presence of litter and garbage within the school or its surroundings.[28]

Table 9: The Model with Investment Controls

	Being Bullied at age 15			
	(1)		(2)	
Variables	Coefficient	Std. Err.	Coefficient	Std. Err.
Non-Cognitive	-0.1290**	(0.052)	-0.0805	(0.056)
Cognitive	0.0300	(0.036)	0.0052	(0.039)
Investment Controls at τ_0				
Parental Control			-0.0219	(0.040)
Parental Harmony			0.0245	(0.041)
Parental Abuse			0.1113***	(0.034)
School Quality			0.0405***	(0.014)
School Environment			0.0166**	(0.007)
Observations	2,880		2,682	

Note: This table presents the estimated coefficients for equation (2). Column (1) is included for completeness as it displays the results in Table 5. Column (2) adds controls. "Parental Control" measures whether the parents know where the youth is, who he is with and how long he will be there, "Parental Harmony" measures how much time the respondent spends with their parents, whether she is treated with affection by them, if her parents treat each other well, and if her parents talk candidly and frequently to her, "Parental Abuse" measures whether the household is a violent setting, "School Quality" measures teacher responsiveness and learning conditions (i.e., how likely are students to attend top institutions of higher education after graduating from that particular school, and whether students believe their school allows them to develop their talents and abilities), and "School Environment" is measured using information about robbery and criminal activity within or around the school and the presence of litter and garbage within the school or its surroundings. In both specifications we controlled for age in months, gender, rurality, the number of older and younger siblings the respondent has, the natural logarithm of the monthly income per capita, whether the respondent lives in a bi-parental household, whether the respondent's father is absent from the household., father's education, the % of peer bullies and the % of peers that come from violent families. *** p<0.01, ** p<0.05, * p<0.1.

Table 9 presents the findings. Column (1) reproduces the original results just for comparison (see Table 5), while (2) displays the results after controlling for investments. The introduction

[28]School quality measures are coded in a reverse scale where high numbers mean less school quality.

of new controls reduces the point estimate of the effect of non-cognitive skills on the likelihood of being bullied. More importantly, however, the results show that less violence-prone parents and better schools negatively correlate with the incidence of bullying. Of course, we do not interpret these results as causal as we do not account for the endogeneity of parental investment, but they do suggest that the inertia caused by low skill levels, particularly non-cognitive traits, in previous periods on higher likelihoods of being involved in bullying can potentially be reversed through the modification of tangible scenarios like the improvement of schools—including teachers—and diminishing aggressive behavior within households.[29] This is consistent with the literature that documents the role of parental investments on skill formation and future outcomes (Cunha and Heckman, 2008).

7 Conclusions

This paper examines the determinants and consequences of bullying at age 15 on subsequent mental and physical health, risky behaviors, and schooling attainment. We base our analysis on the estimation of an empirical model of endogenous bullying and counterfactual outcomes. In this framework, latent cognitive and non-cognitive skills are sources of unobserved heterogeneity. We estimate the model using longitudinal information from South Korea (KYPS).

Our findings show that non-cognitive skills significantly reduce the likelihood of being a victim of bullying. In particular, one standard deviation increase in non-cognitive skills reduces the probability of being bullied by 6,7%. In contrast, we do not find significant effects of cognitive skills on bullying. On the other hand, when analyzing the impact of bullying, we document higher incidence of self-reported depression, sickness, mental health issues and stress, as well as a lower incidence of life satisfaction and college enrollment three years after the event. We also document heterogenous effects across outcomes as function of cognitive and non-cognitive skills. Overall, the magnitudes of the estimated ATE and TT are by no means

[29] These results must be interpreted with caution as parental decisions can be correlated with students' latent skills. The empirical assessment of this possibility is outside the scope of the paper and we leave it for future research.

small, suggesting that bullying represents a heavy burden that needs to be carried for a long time.

Finally, consistent with the recent literature on skill formation, our results suggest that investing in skills development is essential for any policy intended to fight bullying. They not only reduce in general the incidence of bullying, as there will be less people prone to be perpetrators and victims, but also significantly lessen its negative effects.

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Appendix

A The Construction of the Non-cognitive Measures

We construct the locus of control scale as the sum of three questions (Linkert scales):

1. I have confidence in my own decision
2. I believe that I can deal with my problems by myself
3. I am taking full responsibility of my own life

Likewise, for the self-esteem index we use:

1. I think that I have a good character
2. I think that I am a competent person
3. I think that I am a worthy person
4. Sometimes I think that I am a worthless person (the negative of)
5. Sometimes I think that I am a bad person (the negative of)
6. I generally feel that I am a failure in life (the negative of)
7. If I do something wrong, people around me will blame me much (the negative of)
8. If I do something wrong, I will be put to shame by people around me (the negative of)

Finally, we construct a scale capturing the impossibility to carry forward an assigned task to a successful conclusion. We label it "Irresponsibility scale". Interestingly, students with low levels of responsibility tend to favor short-term rewards and that hampers their ability to exert effort for extended period of time in order to achieve longer-term goals. In fact, this ability of exerting effort is often linked with "energetic, conscientious, dutiful, and responsible" people (Duckworth et al., 2007, pg. 1098). Thus, this scale might relate negatively to perseverance and grit, that is, the ability to overcome obstacles and giving proportionally greater value to large future rewards over smaller immediate ones (Duckworth and Seligman, 2005). We construct the irresponsibility score by adding:

1. I jump into exciting things even if I have to take an examination tomorrow
2. I abandon a task once it becomes hard and laborious to do
3. I am apt to enjoy risky activities

B Identification of Latent Skills at age 14 (τ_0)

The identification of the joint distribution of latent cognitive and non-cognitive skills follows the argument in Sarzosa (2015). In what follows, we describe its logic.

Consider the measurement system (5). Suppose that we stack $\mathbf{T}_{\tau_0}$ so that the first three rows are the non-cognitive measures and the last three rows are the academic achievement test scores. If we consider that the first three row represent "pure" non-cognitive measures, $\alpha_{\cdot}^{T_r,C} = 0$ for $r = \{1,2,3\}$. Then, the conditional covariance between any of the tests in the first three rows—call it test A—and one of the tests in the last three rows—call it test B–is given by $COV\left(T^A, T^B \,|\mathbf{X}_T\right) = \alpha^{(A,N)}\alpha^{(B,N)}\sigma^2_{\theta^N} + \alpha^{(A,N)}\alpha^{(B,C)}\sigma_{\theta^N,\theta^C}$, where we drop the time subscript for simplicity. Having two terms adding up is problematic. Carneiro et al. (2003) get rid of the latter by assuming $\theta^C \perp\!\!\!\perp \theta^N$. Instead, our analysis allows for correlated latent skills. Following Sarzosa (2015), we assume $\alpha^{(B,N)} = 0$. That is, non-cognitive skills should not load on at least one test in the bottom three rows of $\mathbf{T}_{\tau_0}$. Then, if we assume T^3 and T^B are the nummeraires for the first and second factor respectively, $COV\left(T^3, T^B \,|\mathbf{X}_T\right) = \sigma_{\theta^C,\theta^N}$. Then, following Carneiro et al. (2003), we use the conditional covariances of test scores in a sequential procedure to secure the identification of all the loadings and variances of the measurement system. Having identified all the loadings and variances, we rely on the argument put forth by Freyberger (2017) and applied by Heckman et al. (2016) to non-parametrically identify $F_{\theta^C_{\tau_0},\theta^N_{\tau_0}}(\cdot,\cdot)$ from the manifest variables $\mathbf{T}_{\tau_0}$.

With respect to the normalizations, in practice we normalize to one the loadings associated with self-esteem (for $D_{\tau_0} = 1$) and class score. We also let class scores to be dedicated measures of cognitive ability. We further impose $\alpha^{T_5,A}_{D_{\tau_0}=1} = \alpha^{T_5,A}_{D_{\tau_0}=0}$ and $\beta^{T_5}_{D_{\tau_0}=0} = \beta^{T_5}_{D_{\tau_0}=1}$ because—in estimations available upon request—we find that they are not statistically different from each other, and such normalizations speed up computation (see Section 5.1).

Table B.1 presents the results from the measurement system. The estimated values for $\beta^T_{D_{\tau_0}=0}$ and $\beta^T_{D_{\tau_0}=1}$ imply that youths with wealthier and more educated parents tend to be more responsible, have higher levels of self-control and are more positive about themselves. These results are consistent with those in Cunha et al. (2006) and Heckman and Masterov (2007). Our estimates also suggest that family composition plays a big role in fostering desirable personality traits. Individuals with younger siblings and those who live with both parents tend to be more responsible. Interestingly, those who live with their mother have substantially higher levels of self-esteem than those who live only with their father. As with the non-cognitive measures, the cognitive scores are higher for individuals coming from wealthier and more educated parents, especially if the mother is present in the family. In addition, the presence of younger (older) siblings is associated with higher (lower) grades. Another notable finding, which is in line with Borghans et al. (2008), is that younger students are less responsible and have less self-control and self-esteem, even within the same year of age.

Table B.1: Estimated Parameters of Measurement System (expression (5)) - Age 14

		Locus Control		Irresponsibility		Self-Esteem		Language - SocStudies		Math - Sci	ClassScore	
	Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	-	$D=0$	$D=1$
Age in Months	0.012	-0.009	-0.010*	0.024**	0.013**	-0.006	-0.016***	-0.007	-0.009**	-0.009**	-0.017***	-0.012***
	(0.007)	(0.011)	(0.006)	(0.010)	(0.006)	(0.011)	(0.005)	(0.007)	(0.004)	(0.004)	(0.006)	(0.003)
Male	0.250***	0.200**	0.140***	-0.081	-0.057	0.319***	0.163***	-0.041	0.028	0.312***	0.008	-0.050**
	(0.052)	(0.079)	(0.040)	(0.076)	(0.040)	(0.078)	(0.039)	(0.054)	(0.028)	(0.032)	(0.043)	(0.022)
Older Siblings	-0.029	0.019	0.018	0.026	-0.016	-0.026	-0.017	-0.109**	-0.024	0.033	0.022	-0.002
	(0.047)	(0.069)	(0.037)	(0.066)	(0.037)	(0.067)	(0.036)	(0.047)	(0.026)	(0.030)	(0.036)	(0.023)
Young siblings	-0.058	-0.057	0.036	-0.054	-0.072*	0.116	-0.014	0.051	0.088***	0.086***	0.047	0.089***
	(0.050)	(0.074)	(0.038)	(0.071)	(0.038)	(0.073)	(0.037)	(0.050)	(0.027)	(0.031)	(0.042)	(0.023)
(ln) Monthly Income	-0.057	0.071	0.076**	-0.142**	-0.088**	0.061	0.002	0.093**	0.171***	0.146***	0.160***	0.114***
	(0.047)	(0.068)	(0.037)	(0.065)	(0.037)	(0.066)	(0.036)	(0.046)	(0.026)	(0.029)	(0.037)	(0.022)
Urban	-0.013	0.052	0.207***	-0.077	-0.090	0.034	0.080	0.274***	0.057	0.068	0.030	-0.028
	(0.079)	(0.115)	(0.059)	(0.111)	(0.059)	(0.113)	(0.057)	(0.078)	(0.041)	(0.046)	(0.060)	(0.032)
Lives BothParents	-0.247*	0.179	0.232**	-0.482***	-0.240**	0.304	0.206*	0.234*	0.374***	0.373***	0.255***	0.216***
	(0.138)	(0.191)	(0.118)	(0.183)	(0.118)	(0.186)	(0.116)	(0.129)	(0.083)	(0.094)	(0.097)	(0.077)
Lives Only Mother	-0.173	0.593**	0.243	-0.591**	-0.144	0.858***	0.232	0.071	0.370***	0.347***	-0.009	0.056
	(0.186)	(0.262)	(0.156)	(0.252)	(0.156)	(0.256)	(0.152)	(0.178)	(0.109)	(0.123)	(0.165)	(0.095)
Father's Educ: 2yColl	0.038	0.275*	0.083	-0.118	-0.153*	0.198	-0.092	0.261**	0.117**	0.196***	0.225***	0.195***
	(0.102)	(0.155)	(0.079)	(0.148)	(0.079)	(0.151)	(0.077)	(0.105)	(0.055)	(0.063)	(0.082)	(0.044)
Father's Educ: 4yColl	-0.006	0.087	0.156***	-0.165*	-0.138***	0.025	0.104**	0.342***	0.312***	0.189***	0.190***	0.261***
	(0.062)	(0.094)	(0.047)	(0.090)	(0.047)	(0.091)	(0.046)	(0.063)	(0.033)	(0.038)	(0.050)	(0.027)
Father's Educ: GS	0.124	0.068	0.325***	-0.054	-0.421***	0.055	0.204**	0.587***	0.426***	0.289***	0.246***	0.340***
	(0.107)	(0.153)	(0.085)	(0.147)	(0.085)	(0.149)	(0.082)	(0.104)	(0.059)	(0.065)	(0.075)	(0.044)
Leavers τ_{-1}	-1.919**											
	(0.866)											
Dropouts τ_{-1}	4.063											
	(2.522)											
Non-Cognitive Skills	-0.041	1.260***	1.151***	-1.215***	-1.192***	1.166***	1	0.749***	0.754***	0.836***		
	(0.193)	(0.142)	(0.090)	(0.144)	(0.096)	(0.171)	■	(0.134)	(0.097)	(0.111)		
Cognitive Skills	-0.038							0.562***	0.549***	0.520***	1	1
	(0.056)							(0.041)	(0.026)	(0.027)	■	■
Constant	-0.415*	-0.552*	-0.834***	1.099***	0.721***	-1.076***	-0.142	-0.823***	-1.271***	-1.280***	-0.966***	-0.709***
	(0.246)	(0.334)	(0.200)	(0.321)	(0.200)	(0.326)	(0.196)	(0.227)	(0.141)	(0.160)	(0.178)	(0.131)
Observations	3096											

Note: "Older Siblings" and "Young Siblings" correspond to the number of older and younger siblings the respondent has. "(ln) Monthly Income" corresponds to the natural logarithm of the monthly income per capita. "Both Parents" takes the value of one if the respondent lives in a biparental household. "Only Mother" takes the value of one if the respondent's father is absent from the household. "Father's Educ: 2yCol" takes the value of one if the highest level of education attained by the respondent's father was a 2-year college degree. "Father's Educ: 4yCol" takes the value of one if the highest level of education attained by the respondent's father was a 4-year college degree. "Father's Educ: GS" takes the value of one if the highest level of education attained by the respondent's father was graduate school. "Leavers" captures the fraction of students that move out the district in 2002 (one year earlier than bullying). "Dropouts" captures the proportion of middle school dropouts in the district in 2002. Columns headed as 1 collect the coefficients for those who were bullied at age 14. Columns headed as 0 collect the coefficients for those who were not bullied at age 14. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

C Test Scores/Measures, Skills and Outcomes without Bullying Considerations

In this section we abstract from bullying and analyze the association between latent skills, their proxies and outcomes. Thus, its objective is two-fold. First, it shows that academic test scores and non-cognitive measures at an early age matter in determining the adult outcomes we use in this paper. To this end it presents results from regressions of the outcomes at age 18 and 19 on the measures and test scores obtained at age 14. Second, it presents the relationship between cognitive and non-cognitive latent skills on outcomes excluding bullying considerations.

Overall, both sets of results show that test scores/measures and cognitive/non-cognitive skills are strong determinants of adult outcomes. These findings are consistent with those in the literature (e.g., Heckman et al. (2006a); OECD (2014)).

C.1 Academic Test Scores, Non-cognitive Measures and Outcomes

Table C.1 shows estimates of OLS regressions of adult outcomes on early test scores. From the table is evident that the abilities measured by the scores are string determinants of later outcomes. In particular, we find that greater scores of irresponsibility by age 14 correlate with higher levels of take-up of risky behaviors like drinking, smoking at age 18. They also correlate with higher levels of mental disorders as measured by incidence of depression and mental health. Locus of control at age 15 correlates with higher levels of life satisfaction and lower levels of stress. Self-esteem is negatively associated with the take-up of risky behaviors, the incidence of mental health issues and stress. Regarding cognitive measures, Table C.1 shows positive relation with college entry, life satisfaction and stress. They also correlate negatively with the take-up of risky behaviors.

C.2 Latent Skills and Outcomes Without Treatment Effect Structure

Table C.2 presents the estimated parameters for the outcome equation:

$$Y_{\tau_2} = \mathbf{X}_Y \beta^Y + \alpha^{Y,A} \theta^A_{\tau_0} + \alpha^{Y,B} \theta^B_{\tau_0} + e^Y_{\tau_2}$$

That is, without the introduction of a treatment variable.

These results indicate that non-cognitive latent skills (age 14) are negatively associated with the likelihood of depression, the incidence of drinking and smoking, the likelihood of being

Table C.1: OLS Regressions of Outcomes on Test Scores

	(1)	(2)	(3)	(4)	(5)	(6)
	Depression	Smoking	Drinking	Feeling Sick	Mental Health Problems	Life Satisfaction
Locus of Control	-0.011	0.010	0.007	-0.003	-0.006	0.024**
	(0.019)	(0.006)	(0.010)	(0.005)	(0.004)	(0.010)
Irresponsability	0.081***	0.036***	0.041***	0.008	0.013***	0.001
	(0.019)	(0.006)	(0.010)	(0.005)	(0.004)	(0.010)
Self-Esteem	-0.185***	-0.009	-0.027***	-0.014***	-0.011**	0.059***
	(0.019)	(0.006)	(0.009)	(0.005)	(0.004)	(0.009)
Language and	0.018	-0.010	0.008	0.008	0.006	0.009
Social Studies	(0.026)	(0.009)	(0.013)	(0.007)	(0.006)	(0.013)
Math and Science	-0.044*	0.003	0.017	0.002	0.006	0.017
	(0.025)	(0.008)	(0.013)	(0.007)	(0.006)	(0.013)
Class Grade	0.033	-0.036***	-0.029**	-0.015*	-0.004	0.042***
	(0.028)	(0.009)	(0.014)	(0.008)	(0.006)	(0.014)
Obs.	2,552	3,097	3,097	2,683	2,683	3,097
	(7)	(8)	(9)	(10)	(11)	(12)
		Stress				
	College	Friends	Parent	School	Poverty	Total
Locus of Control	-0.008	-0.040*	-0.048**	-0.024	-0.033	-0.047**
	(0.010)	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)
Irresponsability	-0.009	0.045**	0.031	-0.008	0.100***	0.057***
	(0.010)	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)
Self-Esteem	-0.015	-0.133***	-0.094***	-0.123***	-0.133***	-0.178***
	(0.010)	(0.021)	(0.020)	(0.020)	(0.020)	(0.020)
Language and	-0.022	-0.003	0.040	0.036	0.012	0.014
Social Studies	(0.014)	(0.029)	(0.028)	(0.027)	(0.028)	(0.028)
Math and Science	0.040***	0.004	0.062**	0.036	0.000	0.033
	(0.013)	(0.028)	(0.027)	(0.027)	(0.027)	(0.027)
Class Grade	0.059***	0.062**	0.103***	0.237***	0.004	0.141***
	(0.014)	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)
Obs.	2,558	2,676	2,676	2,676	2,676	2,676

Note: This table presents the estimated coefficients of the regressing the outcomes of interest in the test scores used to identify skills as latent abilities. Regressions include controls for gender, parental education, household income, number of younger/older siblings, mono/bi-parental household, urbanity indicator, and age in months. "Depression" corresponds to a standardized index of depression symptoms. "Drinking" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

sick, having mental health issues, or feeling stressed about friends and the economic situation at age 18. Furthermore, non-cognitive skills have a positive effect on the likelihood of having a positive perception of life. This is linked with the fact that while non-cognitive skills reduce the likelihood of depression, cognitive skills increase it. Just like happens with the stress variables. However, the reduction on the likelihood of depression is much larger than the increase in the likelihood of depression caused by cognitive skills. We find no effect of cognitive skills on the incidence of drinking alcohol, feeling sick or having mental health issues, while we find that cognitive skills are highly rewarded in the selection into college. Finally, our results indicate that both cognitive and non-cognitive skills reduce the incidence of smoking.

Table C.2: Non-Cognitive and Cognitive Skills (age 14) on Outcomes (18 and 19) – Excluding Bullying Considerations

	(1) Depression	(2) Drinking	(3) Smoking	(4) Life Satisfaction	(5) Feeling Sick	(6) Mental Health Problems
Non-Cogn Skills	-0.306***	-0.051***	-0.035***	0.074***	-0.025***	-0.038***
	(0.029)	(0.014)	(0.010)	(0.015)	(0.008)	(0.009)
Cognitive Skills	0.027	-0.017*	-0.043***	0.066***	-0.006	0.001
	(0.020)	(0.010)	(0.007)	(0.010)	(0.006)	(0.006)
Observations	2446	2881	2881	2881	2571	2781
	(7) College†	(8) Stress: Friends	(9) Stress: Parent	(10) Stress: School	(11) Stress: Total	(12) Stress: Poverty
Non-Cogn Skills	-0.009	-0.229***	-0.113***	-0.111***	-0.267***	-0.262***
	(0.014)	(0.031)	(0.031)	(0.030)	(0.031)	(0.031)
Cognitive Skills	0.072***	0.069***	0.168***	0.299***	0.182***	0.016
	(0.010)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Observations	2449	2564	2564	2564	2564	2564

Note: This Table presents the estimated coefficients of the outcome equations $Y_{\tau_2} = \mathbf{X}_Y\beta^Y + \alpha^{Y,A}\theta^A_{\tau_0} + \alpha^{Y,B}\theta^B_{\tau_0} + e^Y_{\tau_2}$. "Depression" corresponds to a standardized index of depression symptoms. "Drinking" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health Problems" takes a value of 1 if the respondent has been diagnosed with psychological or mental problems. "College" takes the value of 1 if the respondent attends college by age 19. The "Stress" variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. Estimates include controls for gender, parental education, household income, number of younger/older siblings, mono/bi-parental household, urbanity indicator, and age in months. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

† College attendance is measured at age 19.

D Regression Analysis: Instrumental Variables

Table D.1: IV First Stage

	(1)		(2)		(3)	
VARIABLES	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.
% Peer Violent Fam			-1.119**	(0.520)	-1.049**	(0.521)
% Peer Violent Fam^2			1.387**	(0.692)	1.295*	(0.693)
% Peer Bullies	0.179**	(0.083)			0.168**	(0.083)
Observations	3,097		3,097		3,097	
F-test	14.29		7.205		8.784	
Prob > F	0.000		0.007		0.003	

Note: This Table reports the first stage of IV regressions. We only report the coefficients on the instruments. Estimates include controls for gender, parental education, household income, number of younger/older siblings, mono/bi-parental household, urbanity indicator, and age in months. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D.2: IV Results: Bullying at Age 14 on Different Outcomes (18 or 19)

	Depression			Smokinh			Drinking			Feeling Sick		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Bullied (D_{τ_1})	-0.316	-0.590	-0.443	-0.407	-0.547	-0.477	-0.975	0.015	-0.465	-0.546	-0.289	-0.417
	(1.201)	(1.331)	(0.914)	(0.410)	(0.427)	(0.304)	(0.712)	(0.530)	(0.423)	(0.475)	(0.392)	(0.314)
Obs.	2,552	2,552	2,552	3,097	3,097	3,097	3,097	3,097	3,097	2,683	2,683	2,683
Instruments												
Bullies	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y
Troub. Fam.	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y

	Mental Health Prob.			Life Satisfaction			College			Stress: Friends		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Bullied (D_{τ_1})	0.233	-0.049	0.092	-0.541	-0.555	-0.547	0.490	-0.833	-0.132	-0.092	-2.231	-1.138
	(0.296)	(0.272)	(0.199)	(0.595)	(0.575)	(0.426)	(0.531)	(0.620)	(0.360)	(1.364)	(1.884)	(1.116)
Obs.	2,683	2,683	2,683	3,097	3,097	3,097	2,558	2,558	2,558	2,676	2,676	2,676
Instruments												
Bullies	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y
Troub. Fam.	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y

	Stress: Parents			Stress: School			Stress: Poverty			Stress: Total		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Bullied (D_{τ_1})	-1.210	-1.985	-1.584	-2.506	-1.364	-1.916	0.594	-1.275	-0.355	-1.309	-2.468	-1.876
	(1.538)	(1.764)	(1.196)	(1.986)	(1.540)	(1.269)	(1.365)	(1.541)	(0.993)	(1.580)	(1.980)	(1.285)
Obs.	2,676	2,676	2,676	2,676	2,676	2,676	2,676	2,676	2,676	2,676	2,676	2,676
Instruments												
Bullies	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y
Troub. Fam.	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y

Note: This Table reports the second stage of IV regressions. Estimates include controls for gender, parental education, household income, number of younger/older siblings, mono/bi-parental household, urbanity indicator, and age in months. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

E The "Leveling Policy" and Testing the Random Allocation of Students to Classrooms

In 1959 South Korea enacted the Education Act, a law that made full-time education for children from age 8 to 13 (grade 1-6) mandatory, causing the demand for middle school places to skyrocket and unleashing stiff competition for places in prestigious middle schools. In response, in 1969 the government introduced the *Middle School Leveling Policy* aimed at mitigating the burden on elementary school students due to fierce competition that existed for middle school seats. The policy introduced a lottery system for middle school entrance. It started in Seoul in 1969 and became a national policy two years later. As a result, since then all screening procedures have been abolished uniformly across all regions (Korean Ministry of Education, 1998) and middle school enrollment is entirely determined by a lottery directed by the local office of education (Kang, 2007). Although lotteries are supervised at the local level, the procedure is the same throughout the country. A student's residential address associates her to a school district. The school district defines a list of schools to which the student could be assigned. A draw is made electronically or manually. In the electronic case, a local board runs the lottery in the presence of police and parent representatives. In the manual case, students play the lottery on their own (Gyeonggido Office of Education, 2019). The only exception is the case that a district has only one school due to small numbers of students in the area. Any factors such as family background, performance in elementary school, or commute time are not taken into account. The basic structure has not changed since 1969: the biggest change over a half-decade is the introduction of digital draws.

As of 2020, the middle school lottery is considered a fundamental element of Korea's education system. It is carried out thoroughly to the extent that some children in the same family, who usually graduate from the same primary school, are assigned to different middle schools. In other words, within educational districts, the system randomizes the family background of students. This feature of South Korea's schooling system facilitates the examination of classroom behavior during during adolescence.

E.1 Testing the Random Allocation of Students to Classrooms

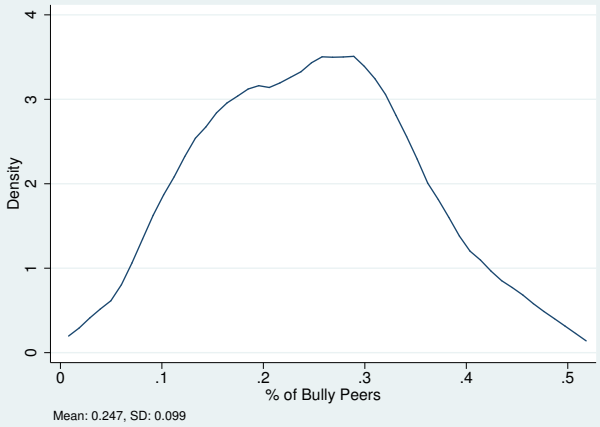
The empirical strategy used in this paper exploits the random allocation of students to classrooms product of the "leveling policy" of 1969. We do so by constructing variables that, while exogenous to students, encapsulate their social interactions and, consequently, affect their chances of being bullied (Sarzosa, 2015). These are the proportion of peers that report being bullies in the class and the proportion of peers in the classroom that come from a violent family. The former uses self-reported bullying, while the latter is obtained after aggregating the Likert scale answers to the following statements: "I always get along well with brothers or sisters", "I frequently see parents verbally abuse each other", "I frequently see one of my parents beat the other one", "I am often verbally abused by parents", and "I

am often severely beaten by parents". We consider as students coming from a violent family those whose aggregate score is above the overall mean.

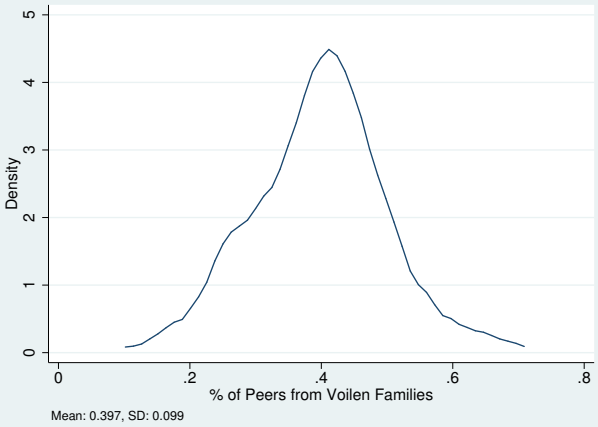
Figure E.1 shows the kernel densities for the assembled variables at the classroom level at age 14. We see there is wide dispersion in both of them, providing a valuable source of variation capturing the proclivity of violence across classrooms. A fourth of the students in the average classroom claimed to be bullies. However, there are classrooms where less than 5% of the students claim to be bullies, while in others half of the students do so. In the same way, in the average classroom at age 14, around 40% of the students come from a violent family. But, while we see some classrooms where less than a fifth of the students come from a violent family, there are others where two-thirds of the students do so.

Figure E.1: Distributions of the Excluded Variables

(a) Fraction of Bullies in the Classroom



(b) Fraction of Peers From Violent Families



Note: Data at the classroom level. % Bully Peers corresponds to the proportion of peers that report being bullies in the respondent's classroom. % of Peers from Violent Families contains the proportion of peers in the respondent's classroom that come from a violent family, where a violent family is defined in Section 3.

The extent to which these variable are able to capture relevant information about the classrooms' social interactions relies on whether students were in fact randomly allocated to classrooms or not. Thus, we must test whether the random allocation in fact happened. Given its sampling scheme, we cannot rely exclusively on the KYPS study to empirically prove that students were randomly allocated to classrooms.[30] However, we take advantage of its school-level data, which contain information on the school location at the city/district (i.e., administrative region) level, to merge the KYPS data with administrative records gathered by the Korean Educational Development Institute (KEDI).

[30]KYPS's sampling scheme collects data for an entire course in a sampled school and does not identify the school district to which is belongs. In South Korea, a school district is defined by (a collection of) administrative regions. For instance, Seoul has 25 administrative districts (*Gu* in Korean) grouped in 11 school districts, where each school district contains 2 to 3 administrative districts.

The KEDI collects detailed information about the universe of educational institutions from kindergarten to high school, including the administrative and educational districts to which they belong. Thus, by combining it with the KYPS through location information, we were able to build a link between administrative and school districts that allowed us to back out the school districts of all KYPS schools and to formally assess whether the randomization was effective.[31] In addition, we exploit KEDI's administrative records to construct variables that can capture the variation of bullying prevalence *across districts*. We also attach regional tax revenue to school districts from publicly available government sources.

Random Assignment: Test results. Enabled by the link with KEDI's administrative dataset we proceed to empirically test for the random allocation of students to classroom. To do so, and in the spirit of Carrell et al. (2018) and Santavirta and Sarzosa (2019), we run a balancing test for whether demographic and socioeconomic characteristics are correlated with the proportion of peers who are bullies or the proportion of peers that come from violent families. We consider different specifications. Table E.1 presents these results. Its Panel A considers separately regressing the demographic and socioeconomic characteristics on the proportion of peers who are bullies and the proportion of peers that come from violent families in the subset of school districts for which we have multiple school in the KYPS-JHS sample. We do so because in that subsample we can control for school district fixed-effects In Panel B, we implement the school district fixed-effect strategy on the entire sample. Finally, in Panel C we run regressions in which we replace the school district fixed-effects with school district-level characteristics obtained from KEDI's administrative dataset. Namely, the yearly fraction of students that move (in) out of the district, the yearly proportion of middle school dropouts, and the 2003 per-capita tax revenue of the school district. This last strategy motivates our empirical strategy for the estimation of non-linear bullying equations (e.g., expression (2)) as we cannot directly use a fixed-effect strategy in that case. Thus, we examine whether we are able to account for the between-district variation in a different way.

Overall, the results provide no evidence of correlations between demographic or socioeconomic characteristics and the proportion of peers who are bullies or the proportion of peers that come from violent families. We cannot find systematic selection of students to particular classrooms on the bases of month of birth, parental income or socioeconomic status. As a consequence, we find strong empirical evidence attesting to the random allocation of students to classrooms. In addition, Panel C confirms that our combination of school district-level characteristics are able to capture the between-district differences that may correlate with violence in schools. This validates the specification of equations (2) and (6).

[31] Given the sparseness of sampled school in Gyeonggi (one of the 12 regions that comprise South Korea), we combined some geographically contiguous school districts so that we had *districts* with more than one school.

Table E.1: Balancing Tests

	Age in Months	Male	Older Siblings	LnMonth Income pc	Lives Both Parents	FatherEdu <Coll
A. School District Fixed-effects: Districts with more than one school						
% Peer Bullies	-0.118	0.147	0.018	-0.312	-0.127	0.245
	(1.095)	(0.130)	(0.143)	(0.235)	(0.091)	(0.220)
N	1,480	1,483	1,483	1,483	1,483	1,483
% Peer Violent Fam	-0.676	-0.111	-0.178	0.003	0.047	0.342
	(1.179)	(0.075)	(0.195)	(0.276)	(0.054)	(0.257)
N	1,961	1,965	1,965	1,965	1,965	1,965
B. School District Fixed-effects: All Districts						
% Peer Bullies	-0.118	0.147	0.018	-0.312	-0.127	0.245
	(1.097)	(0.130)	(0.144)	(0.235)	(0.091)	(0.220)
N	2,410	2,416	2,416	2,416	2,414	2,414
% Peer Violent Fam	-1.005	-0.117	-0.121	0.086	0.076	0.208
	(1.161)	(0.073)	(0.193)	(0.268)	(0.055)	(0.247)
N	3,200	3,208	3,208	3,208	3,208	3,208
C. Controlling for School District Characteristics: Districts with more than one school						
% Peer Bullies	0.524	0.353	0.087	-0.208	-0.068	0.189
	(1.047)	(0.446)	(0.161)	(0.294)	(0.091)	(0.267)
N	1,480	1,483	1,483	1,483	1,483	1,483
% Peer Violent Fam	-0.184	-0.076	-0.193	-0.342	-0.056	0.496
	(1.158)	(0.079)	(0.132)	(0.357)	(0.068)	(0.310)
N	1,961	1,965	1,965	1,965	1,965	1,965

Note: This Table presents regressions between the leave-one-out mean of classroom-level characteristics (i.e., % of bullies and % of violent families) and observable characteristics of the students in wave 1. Lives Both Parents takes the value of 1 if the child live in a biparental household and zero otherwise. FatherEdu<Coll takes the value of 1 of the child's father reports high school or less as the highest education level he completed. To avoid double causality, the regressions using the % of bullies exclude those who claim to be bullies. Regressions using % of violent families include school district fixed-effects of control for school district characteristics. Thus we present the results run in the subsample of school districts with more than one school. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

F Robustness of the Results in Low-mean Outcomes

Relatively few people in the sample develop mental health problems or report not being in good health by age 18. Table 3 shows that only 9.7% of the sample report having mental health issues and only 7% report not being in good health. Such low means can pose difficulties for linear probability models. Especially if we consider that our empirical strategy estimates two linear equations (one for each bullying status) per outcome, thus further splitting the samples. For instance, only 6.2% of the non-victims report not being in good health by age 18. In order to test whether our results my be affected by these low means, we ran an alternate model in which the outcome equations are nonlinear. In particular, we estimate the outcome equations as probit models. Here we present the main findings. The complete set of results is available upon request.

Table F.1 shows that the model with nonlinear outcome equations fits the data very well.

Table F.1: Assessing the Fit of the Model with Nonlinear Outcome Equations

	Sick		Mental Health	
	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	0.0639	0.0637	0.0874	0.0874
	(0.245)	(0.244)	(0.282)	(0.282)
$E[Y_1 \mid D=1]$	0.1187	0.1318	0.1851	0.1627
	(0.324)	(0.337)	(0.389)	(0.368)

Note: The mean simulated outcomes (i.e., Model) were calculated using 40,000 observations generated from the estimated model. The Data columns contain the outcomes' mean at age 18 obtained from the KYPS. Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. Mental Health takes the value of 1 if the respondent has been diagnosed with psychological or mental problems.

Table F.2: Treatment Effects: Outcomes at Age 18 (τ_2) of Being Bullied at Age 15 (τ_1) - Nonlinear Outcome Equations)

	Sick	Mental Health
ATE	0.0811***	0.0717***
	(0.0242)	(0.0270)
TTE	0.0694***	0.0747***
	(0.0208)	(0.0264)

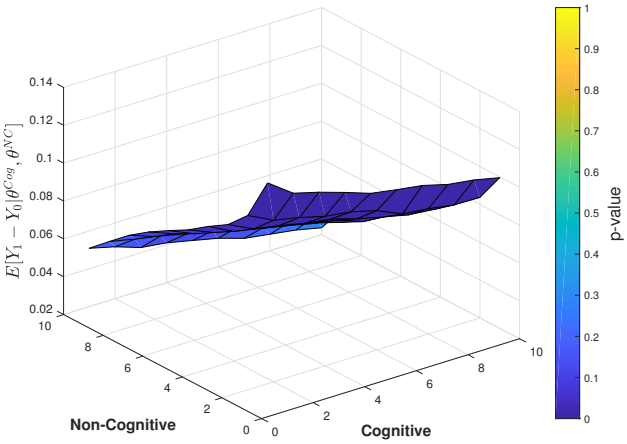
Note: Standard errors in parenthesis. This Table presents the estimated treatment parameters: The variable Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. Mental Health takes the value of 1 if the respondent has been diagnosed with psychological or mental problems by age 18.

Table F.2 and Figures F.1 show the ATE of being bullied at age 15 on the incidence of not being in good health and having mental health issues by age 18 using the nonlinear functions

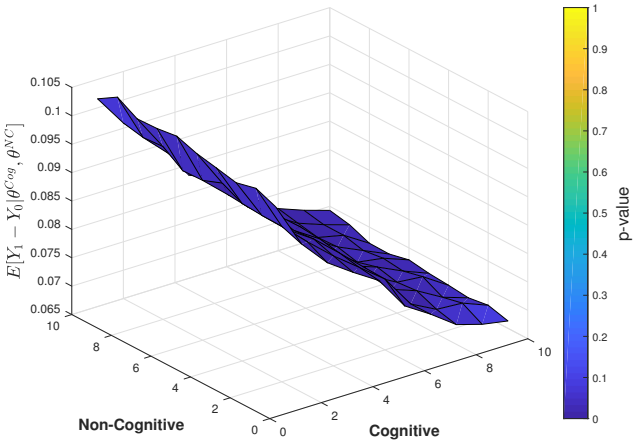
in the outcome equations of the model. If we compare them with Table 8 and Figures 3c and 3d—estimates using linear functions in the outcome equations—we see very little difference. If anything, the effects of bullying estimated using the nonlinear functions on not being in good health are slightly larger. Especially at lower levels of skills. Thus, our results are robust to changes in the functional form of the outcome equations.

Figure F.1: Being bullied at 15 on Health Outcomes at 18 - Nonlinear Outcome Equations

(a) Mental Health Problems



(b) Feeling Sick

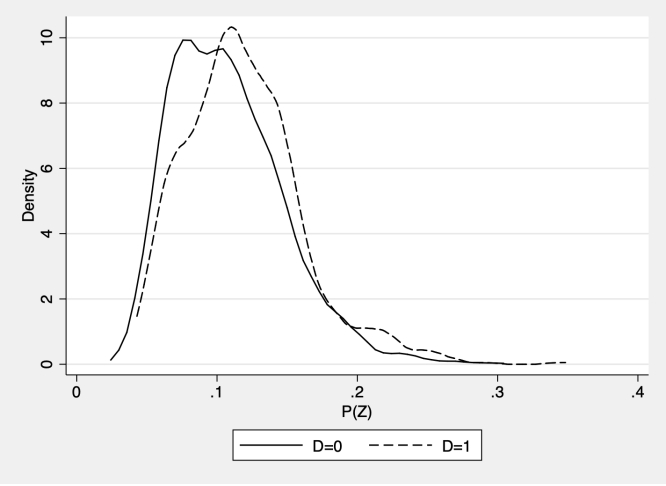


Note: All panels present the $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C} \right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. The variable Mental Health Problems takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. The variable Sick takes the value of 1 if the respondent reports having felt physically ill during the last year.

G Quantifying the Impact of a Policy Change

Our main empirical findings establish wide heterogeneity in treatment effects across latent skill levels. Thus, marginal responses to changes in the incidence of bullying depends on the skills of those induced to change treatment status, and might differ from the average treatment effects. Here we explore this possibility. We take advantage of our model and the wide common support between victims and non-victims along the skill space—allowing us to calculate treatment effects for each level of skills without the need of extrapolation—to explore the marginal responses to a hypothetical policy that would reduce the number of bullies in the student's classroom but in the past. Given the common public stance against bullying, such policies are popular in education institutions around the world. In South Korea in 2012, for instance, in an effort to curb bullying, the government installed 100,000 closed circuit cameras in schools.

Figure G.1: Common Support: Distribution of the Propensity Score by Treatment Status



Note: The Figure depicts the predicted propensity score by victimization condition $\hat{P}(\mathbf{X}_D, \mathbf{Z}_{\tau_0}|D_{\tau_1})$. That is, the predicted probability after estimating a probit of D_{τ_1} on classroom characteristics—% of peer bullies, % peers from violent families, % of male peers—($\mathbf{Z}_{\tau_0}$) and demographic and socioeconomic controls—month of birth, number of siblings, household composition, rurality, household income per capita, father's education—($\mathbf{X}_D$).

We assess the effect of a hypothetical policy that would drop the number of bullies by half at τ_0, reducing the likelihood of victimization at τ_1 ($\tau_0 < \tau_1$).[32] We follow Cooley et al. (2016) and compare the effect of the policy on the 'switchers'—those who where bullied before the policy change ($D^o_{\tau_1} = 1$) but not after it was implemented ($D^n_{\tau_1} = 0$)—to the counterfactual gain to not being bullied among those who were bullied before the policy change (negative of

[32]Despite the fact our model does not seek to develop the dynamic consequences of bullying, this policy change illustrates how the framework can be extended for this purpose. See Sarzosa (2015); Cooley et al. (2016); Heckman et al. (2016) for similar applications in dynamic settings.

the TT, column 2), and the counterfactual gain to not being bullied for students who were not bullied before the policy change (negative of the TUT, column 3).

The policy reduces the average incidence of bullying by only 1.5 percentage points or about 13.6%. This is a relative small change in the likelihood of victimization. However, Table G.1 shows it has relative large consequences on the marginal student. For instance, the average (in terms of skills) switcher would see the effect of being bullied on having mental health problems drop by 8.3pp, and on total stress fall by 20.8% of a SD. Like in Cooley et al. (2016), given that skills affect the selection into treatment and the size of the effects, the effects of the policy on the marginal student are closer to the counterfactual gain to not being bullied among those who were bullied before the policy change.

To further explore heterogeneity by latent skills, we plot the marginal responses for each level of skills. Figures G.2 to G.5 show, despite limited regions of responses (compliers), wide variation in the marginal responses to a reduction in the number of bullies depending on the level of skills.

Table G.1: The Impact of the Policy Change (age 14) on Outcomes (18 and 19)

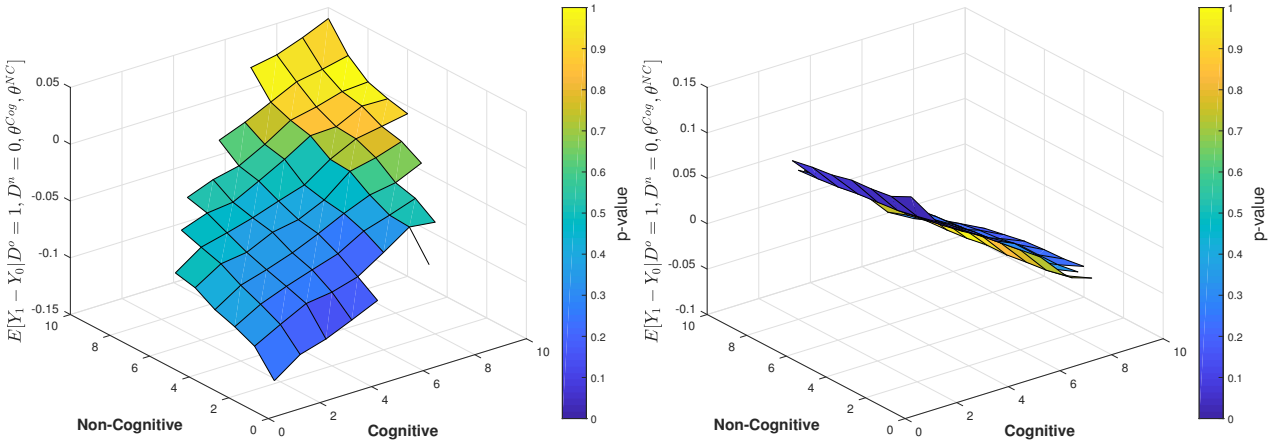
	Gains on those who were:					
	Bullied Before & Not Bullied After the Policy Change (1)		Bullied Before the Policy Change (2)		Not bullied Before the Policy Change (3)	
Outcome	Diff.	Std.Err.	Diff.	Std.Err.	Diff.	Std.Err.
Depression	-0.0475	(0.0588)	-0.0472	(0.0588)	-0.0609	(0.0638)
Smoking	-0.0226	(0.0205)	-0.0243	(0.0208)	-0.0240	(0.0211)
Drinking	-0.0248	(0.0276)	-0.0264	(0.0274)	-0.0027	(0.0287)
Feeling Sick	-0.0545***	(0.0209)	-0.0524**	(0.0213)	-0.0669***	(0.0219)
Mental Health	-0.0830***	(0.0241)	-0.0820***	(0.0243)	-0.0783***	(0.0238)
Life Satisfaction	0.0110	(0.0280)	0.0131	(0.0282)	0.0170	(0.0294)
College	0.0393	(0.0311)	0.0377	(0.0309)	0.0489	(0.0325)
Stress: Friends	-0.2534***	(0.0704)	-0.2561***	(0.0711)	-0.2329***	(0.0771)
Stress: Parents	-0.1483**	(0.0656)	-0.1491**	(0.0670)	-0.1608**	(0.0705)
Stress: School	-0.1402**	(0.0633)	-0.1421**	(0.0640)	-0.1207*	(0.0700)
Stress: Poverty	-0.0852	(0.0632)	-0.0891	(0.0653)	-0.0675	(0.0680)
Stress: Total	-0.2084***	(0.0665)	-0.2109***	(0.0673)	-0.1973***	(0.0705)

Note: This Table estimates the effects of hypothetical policy intervention in which the number of bullies in each classroom is cut by half. Let D^o and D^n denote the bullying status before the policy change (old) and after the policy change (new). Column (1) reports $\iint \mathbb{E}\left[Y_{0,\tau_2} - Y_{1,\tau_2} \middle| D^o_{\tau_1} = 1, D^n_{\tau_1} = 0, \zeta^{NC}, \zeta^{C}\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right)$. Column (2) reports $\iint \mathbb{E}\left[Y_{0,\tau_2} - Y_{1,\tau_2} \middle| D^o_{\tau_1} = 1, \zeta^{NC}, \zeta^{C}\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right)$. That is, the negative of the treatment effect on the untreated. The variable Depress corresponds to a standardized index of depression symptoms. Smoking takes the value of 1 if the respondent smoked a cigarette at least once during the last year. Drinking takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. Mental Health takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Satisfied takes the value of 1 if the respondent reports being happy with the way she is leading her life. The variable inCollege takes the value of 1 if the respondent attends college by age 19. The Stress variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. *** p<0.01, ** p<0.05, * p<0.1.

Figure G.2: Heterogenous Effects among Compliers of the Policy Change – Health Outcomes

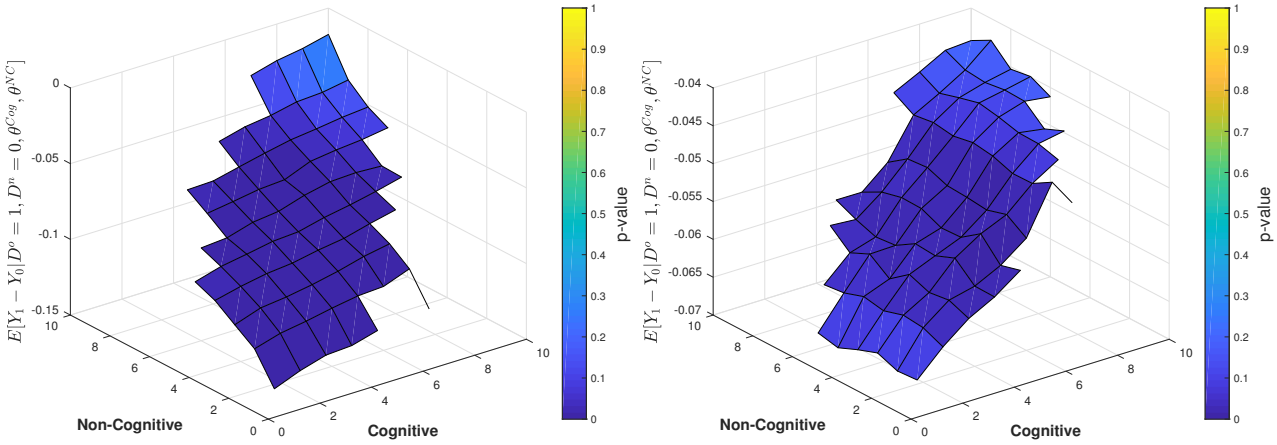
(a) Depression

(b) Life Satisfaction



(c) Mental Health Problems

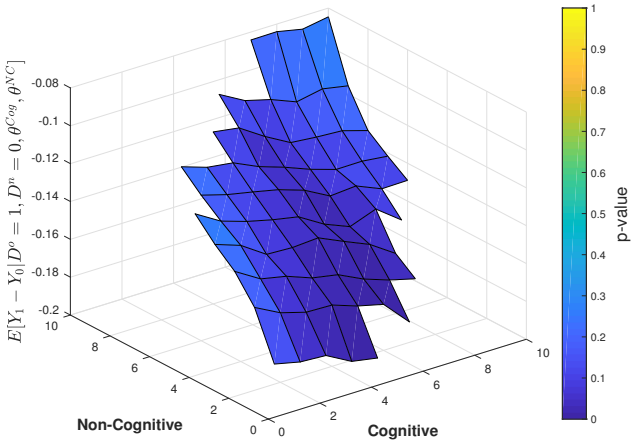
(d) Feeling Sick



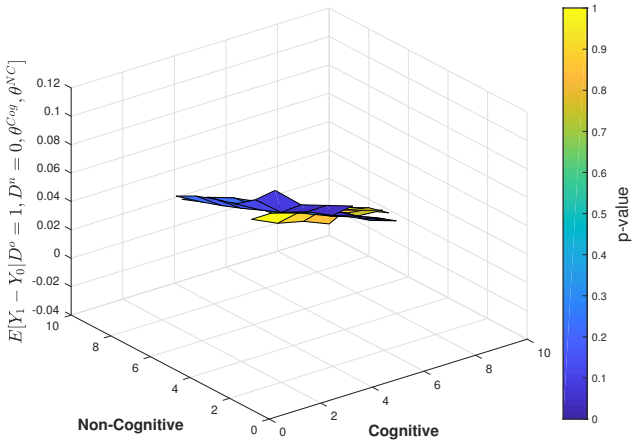
Note: Panels display $\mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D^o_{\tau_1} = 1, D^n_{\tau_1} = 0 \right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Depression" is a standardized aggregated index of depression symptoms. "Mental Health Problems" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Feeling Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year.

Figure G.3: Heterogenous Effects among Compliers of the Policy Change – Educational Outcomes

(a) Stress: School (Age 18)



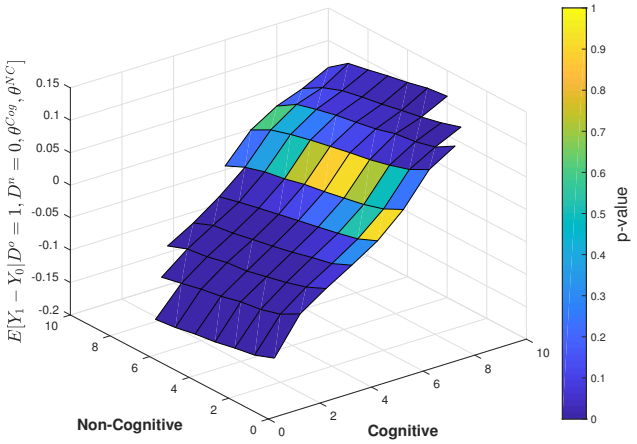
(b) College Attendance (Age 19)



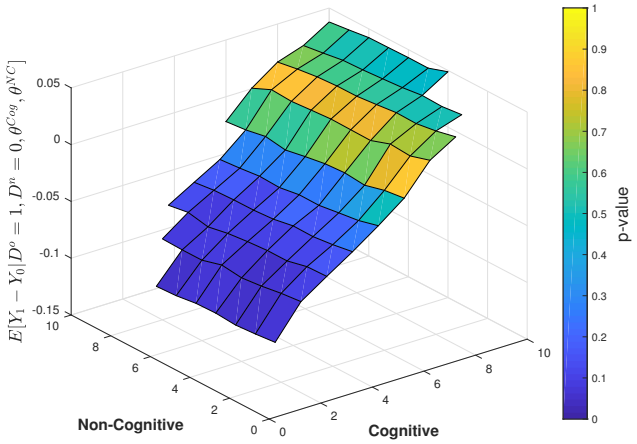
Note: Panels display $\mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D^o_{\tau_1} = 1, D^n_{\tau_1} = 0 \right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Stress: school" is a variable that aggregates stress symptoms triggered by situations related with school. "College Attendance" takes the value of 1 if the respondent attends college by age 19.

Figure G.4: Being bullied (15) on Take-up of Risky Behaviors (18)

(a) Smoking



(b) Drinking

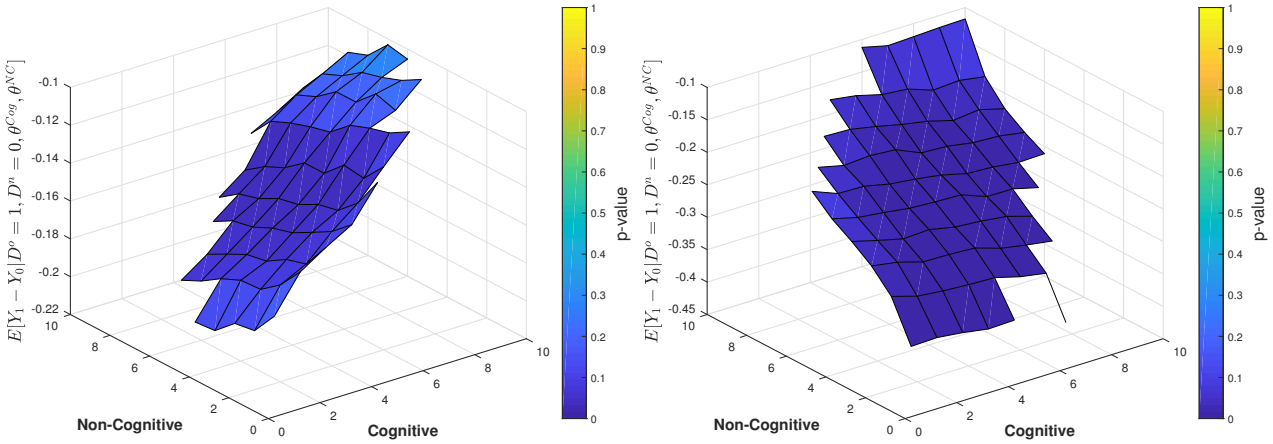


Note: Panels display $\mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D^o_{\tau_1} = 1, D^n_{\tau_1} = 0 \right.\right]$ in the z-axis resulting from 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills, respectively. "Smoking" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. 'Drinking' takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year.

Figure G.5: Being bullied (15) on Stress (18)

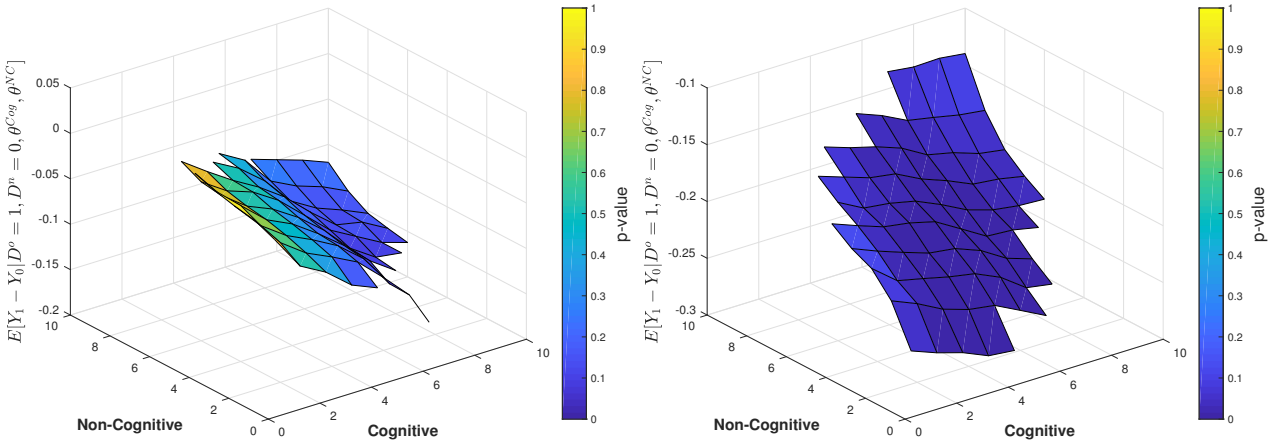
(a) Stress: Parents

(b) Stress: Friends



(c) Stress: Poverty

(d) Stress: Total



Note: All panels present the $\mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^C, D^o_{\tau_1} = 1, D^n_{\tau_1} = 0 \right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Stress: Parents is a variable that aggregates stress symptoms triggered by the relation of the respondent with her parents. Stress: Poverty is a variable that aggregates stress symptoms triggered by situations related with economic difficulties. Friends is a variable that aggregates stress symptoms triggered by situations related with friends and social relations. Stress: Total is a variable that aggregates stress symptoms triggered by situations related with friends, parents, school and poverty.

Web Appendix

A Complete Set of Results for Equations (3) and (4)

Table A.1: Risky Behaviors and Mental and Physical Health Indicators: Outcome Equations (age 18, τ_2) by Bullying Status D (age 15, τ_1)

	(1) Depression		(2) Drink		(3) Smoke		(4) Life Satisfaction		(5) Sick		(6) Mental Health	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Age in Months	-0.002	0.005	-0.002	-0.003	0.003	-0.008	0.002	-0.003	0.000	0.000	0.001	0.001
	(0.005)	(0.015)	(0.003)	(0.008)	(0.002)	(0.006)	(0.003)	(0.008)	(0.001)	(0.006)	(0.002)	(0.007)
Male	-0.205***	-0.352***	0.112***	0.280***	0.121***	0.138***	0.057***	0.127**	-0.021**	-0.043	-0.005	0.023
	(0.039)	(0.109)	(0.020)	(0.058)	(0.013)	(0.042)	(0.020)	(0.056)	(0.010)	(0.041)	(0.012)	(0.046)
Oldersiblings	0.002	-0.086	0.032*	-0.025	0.002	0.037	0.010	0.054	-0.004	-0.024	0.010	-0.047
	(0.036)	(0.092)	(0.019)	(0.048)	(0.012)	(0.035)	(0.019)	(0.047)	(0.010)	(0.034)	(0.011)	(0.038)
Youngsiblings	0.018	-0.085	-0.008	0.043	-0.018	0.038	0.003	0.018	-0.003	0.058	0.008	0.019
	(0.037)	(0.105)	(0.019)	(0.055)	(0.012)	(0.040)	(0.019)	(0.054)	(0.010)	(0.039)	(0.011)	(0.044)
Lnmonthincpc	-0.001	-0.082	-0.013	0.006	0.001	-0.042	0.015	0.080*	-0.010	0.019	0.015	-0.041
	(0.036)	(0.092)	(0.018)	(0.048)	(0.012)	(0.035)	(0.018)	(0.047)	(0.010)	(0.034)	(0.011)	(0.039)
Urban	-0.009	0.014	-0.046	0.032	-0.009	0.058	-0.051*	-0.079	-0.012	-0.019	-0.012	-0.094
	(0.056)	(0.158)	(0.029)	(0.083)	(0.019)	(0.060)	(0.029)	(0.081)	(0.015)	(0.060)	(0.017)	(0.066)
Lives BothParents	-0.322***	-0.331	0.046	-0.051	0.042	-0.003	0.218***	0.032	-0.023	-0.018	-0.055	0.085
	(0.117)	(0.271)	(0.057)	(0.141)	(0.037)	(0.102)	(0.056)	(0.138)	(0.032)	(0.098)	(0.034)	(0.115)
Lives OnlyMother	-0.087	-0.695**	-0.016	0.049	0.103**	0.030	0.191**	0.100	0.058	-0.037	0.012	0.051
	(0.154)	(0.349)	(0.077)	(0.185)	(0.050)	(0.134)	(0.076)	(0.181)	(0.042)	(0.131)	(0.045)	(0.149)
Fathereduc2yColl	-0.066	0.000	-0.016	0.028	-0.017	0.165**	0.131***	-0.006	-0.016	-0.043	0.010	-0.062
	(0.074)	(0.188)	(0.040)	(0.107)	(0.026)	(0.078)	(0.039)	(0.105)	(0.020)	(0.072)	(0.023)	(0.085)
Fathereduc4yColl	-0.026	-0.038	-0.086***	-0.083	-0.036**	0.068	-0.002	-0.016	0.010	0.022	0.002	0.017
	(0.046)	(0.133)	(0.023)	(0.069)	(0.015)	(0.050)	(0.023)	(0.067)	(0.012)	(0.050)	(0.014)	(0.056)
FathereducGS	-0.083	0.135	-0.062	-0.003	-0.041	0.090	0.109**	0.021	0.008	-0.079	-0.012	0.037
	(0.086)	(0.219)	(0.043)	(0.113)	(0.028)	(0.082)	(0.043)	(0.111)	(0.023)	(0.080)	(0.026)	(0.092)
Non-Cogn Skills	-0.294***	-0.377***	-0.056***	-0.040	-0.044***	0.035	0.104***	0.133***	-0.023***	-0.021	-0.024***	-0.108***
	(0.031)	(0.080)	(0.016)	(0.040)	(0.010)	(0.029)	(0.015)	(0.039)	(0.008)	(0.030)	(0.009)	(0.032)
Cognitive Skills	0.029	0.006	-0.011	-0.066**	-0.032***	-0.134***	0.043***	0.108***	-0.005	-0.014	0.002	-0.007
	(0.022)	(0.060)	(0.011)	(0.031)	(0.007)	(0.022)	(0.011)	(0.030)	(0.006)	(0.022)	(0.007)	(0.024)
Constant	0.493**	1.028**	0.506***	0.361	0.032	0.209	0.191**	0.089	0.152***	0.081	0.064	0.336*
	(0.193)	(0.462)	(0.097)	(0.247)	(0.064)	(0.178)	(0.096)	(0.241)	(0.052)	(0.176)	(0.057)	(0.204)
Observations	2445		2880		2880		2880		2570		2780	

Note: This Table presents the estimated coefficients of the outcome equations $Y_{1,\tau_2} = \mathbf{X}_Y\beta^{Y_1} + \alpha^{Y_1,A}\theta^A_{\tau_0} + \alpha^{Y_1,B}\theta^B_{\tau_0} + e^{Y_1}_{\tau_2}$ if $D_{\tau_1} = 1$ and $Y_{0,\tau_2} = \mathbf{X}_Y\beta^{Y_0} + \alpha^{Y_0,A}\theta^A_{\tau_0} + \alpha^{Y_0,B}\theta^B_{\tau_0} + e^{Y_0}_{\tau_2}$ if $D_{\tau_1} = 0$. "Depression" corresponds to a standardized index of depression symptoms. "Drink" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoke" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Oldersiblings corresponds to the number of older siblings the respondent has. Youngsiblings corresponds to the number of younger siblings the respondent has. Lnmonthincpc corresponds to the natural logarithm of the monthly income per capita. Both Parents takes the value of one if the respondent lives in a biparental household. OnlyMother takes the value of one if the respondent's father is absent from the household. Fathereduc2yColl takes the value of one if the highest level of education attained by the respondent's father was a 2-year college degree. Fathereduc4yColl takes the value of one if the highest level of education attained by the respondent's father was a 4-year college degree. FathereducGS takes the value of one if the highest level of education attained by the respondent's father was graduate school. Columns headed as 1 collect the coefficients for those who were bullied at age 15. Columns headed as 0 collect the coefficients for those who were not bullied at age 15. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.2: College Attendance and Stress Levels (age 18, τ_2) Outcome Equations by Bullying Status D (age 15, τ_1)

	(1)		(2)		(3)		(4)		(5)		(6)	
	inCollege†		Stress: Friends		Stress: Parent		Stress: School		Stress: Total		Stress: Poverty	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Age in Months	0.003	-0.002	-0.004	-0.022	0.004	-0.031*	0.003	-0.009	0.004	-0.017	0.005	0.001
	(0.003)	(0.009)	(0.006)	(0.019)	(0.006)	(0.019)	(0.006)	(0.018)	(0.006)	(0.018)	(0.006)	(0.017)
Male	-0.135***	-0.055	0.100**	0.184	0.098**	0.088	-0.175***	-0.011	-0.147***	-0.043	-0.255***	-0.124
	(0.020)	(0.061)	(0.041)	(0.138)	(0.042)	(0.131)	(0.041)	(0.125)	(0.041)	(0.129)	(0.041)	(0.123)
Oldersiblings	-0.002	-0.063	-0.011	0.184	-0.028	0.054	0.059	0.117	-0.011	0.114	-0.021	0.037
	(0.018)	(0.050)	(0.039)	(0.114)	(0.039)	(0.108)	(0.038)	(0.103)	(0.039)	(0.107)	(0.039)	(0.101)
Youngsiblings	0.001	-0.044	0.039	0.072	0.048	0.111	0.052	0.091	0.024	0.081	-0.011	0.014
	(0.018)	(0.058)	(0.039)	(0.131)	(0.040)	(0.124)	(0.039)	(0.119)	(0.039)	(0.123)	(0.040)	(0.116)
Lnmonthincpc	0.020	0.021	-0.005	0.054	0.109***	0.017	0.144***	0.072	0.040	0.049	-0.100***	0.014
	(0.018)	(0.055)	(0.039)	(0.112)	(0.039)	(0.106)	(0.038)	(0.102)	(0.039)	(0.105)	(0.039)	(0.100)
Urban	-0.025	0.057	-0.102*	0.033	0.031	0.183	0.021	0.170	0.018	0.196	0.082	0.324*
	(0.029)	(0.091)	(0.060)	(0.199)	(0.061)	(0.189)	(0.059)	(0.181)	(0.060)	(0.187)	(0.060)	(0.177)
Lives BothParents	0.208***	0.122	-0.239*	-0.874***	-0.175	-0.452	0.166	-0.110	-0.102	-0.508*	-0.078	-0.130
	(0.058)	(0.166)	(0.125)	(0.325)	(0.127)	(0.309)	(0.124)	(0.295)	(0.125)	(0.305)	(0.126)	(0.289)
Lives OnlyMother	0.101	0.063	-0.252	-0.755*	-0.092	-0.863**	0.166	-0.539	-0.080	-0.790*	-0.042	-0.290
	(0.077)	(0.208)	(0.166)	(0.434)	(0.168)	(0.413)	(0.164)	(0.395)	(0.166)	(0.407)	(0.167)	(0.387)
Fathereduc2yColl	0.068*	0.076	0.012	-0.379	0.075	0.120	0.130	-0.004	0.103	-0.061	0.027	-0.103
	(0.039)	(0.113)	(0.080)	(0.239)	(0.081)	(0.228)	(0.079)	(0.218)	(0.080)	(0.225)	(0.081)	(0.213)
Fathereduc4yColl	-0.003	0.070	-0.049	-0.090	0.071	0.098	0.117**	-0.028	-0.006	-0.126	-0.122**	-0.349**
	(0.023)	(0.075)	(0.049)	(0.167)	(0.049)	(0.159)	(0.048)	(0.152)	(0.049)	(0.157)	(0.049)	(0.149)
FathereducGS	-0.038	0.042	0.020	-0.489*	0.049	0.024	0.023	-0.251	-0.123	-0.409	-0.348***	-0.427*
	(0.043)	(0.124)	(0.091)	(0.265)	(0.092)	(0.252)	(0.090)	(0.241)	(0.091)	(0.249)	(0.092)	(0.236)
Non-Cogn Skills	-0.019	0.040	-0.192***	-0.461***	-0.115***	-0.064	-0.095***	-0.206**	-0.242***	-0.414***	-0.253***	-0.322***
	(0.015)	(0.044)	(0.033)	(0.100)	(0.033)	(0.095)	(0.032)	(0.090)	(0.032)	(0.094)	(0.033)	(0.089)
Cognitive Skills	0.070***	0.091***	0.066***	0.093	0.173***	0.141**	0.296***	0.317***	0.179***	0.213***	0.009	0.079
	(0.011)	(0.033)	(0.023)	(0.073)	(0.024)	(0.070)	(0.023)	(0.067)	(0.023)	(0.068)	(0.023)	(0.066)
Constant	0.464***	0.470*	0.267	0.799	-0.478**	0.446	-0.871***	-0.259	-0.095	0.400	0.583***	-0.002
	(0.097)	(0.280)	(0.207)	(0.586)	(0.209)	(0.557)	(0.204)	(0.532)	(0.206)	(0.550)	(0.208)	(0.522)
Observations	2448		2563		2563		2563		2563		2563	

Note: This Table presents the estimated coefficients of the outcome equations $Y_{1,\tau_2} = \mathbf{X}_Y\beta^{Y_1} + \alpha^{Y_1,A}\theta^A_{\tau_0} + \alpha^{Y_1,B}\theta^B_{\tau_0} + e^{Y_1}_{\tau_2}$ if $D_{\tau_1} = 1$ and $Y_{0,\tau_2} = \mathbf{X}_Y\beta^{Y_0} + \alpha^{Y_0,A}\theta^A_{\tau_0} + \alpha^{Y_0,B}\theta^B_{\tau_0} + e^{Y_0}_{\tau_2}$ if $D_{\tau_1} = 0$. Variable inCollege takes the value of 1 if the respondent attends college by age 19. The Stress variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. Older Siblings corresponds to the number of older siblings the respondent has. Young Siblings corresponds to the number of younger siblings the respondent has. Lnmonthincpc corresponds to the natural logarithm of the monthly income per capita. Both Parents takes the value of one if the respondent lives in a biparental household. OnlyMother takes the value of one if the respondent's father is absent from the household. Fathereduc2yColl takes the value of one if the highest level of education attained by the respondent's father was a 2-year college degree. Fathereduc4yColl takes the value of one if the highest level of education attained by the respondent's father was a 4-year college degree. FathereducGS takes the value of one if the highest level of education attained by the respondent's father was graduate school. Columns headed as 1 collect the coefficients for those who were bullied at age 15. Columns headed as 0 collect the coefficients for those who were not bullied at age 15. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

† College attendance is measured at age 19.

B A Model without Exclusion Restrictions (at age 15)

To what extent our main findings are robust to the exclusion restrictions in the model characterizing bullying at age 15 is an empirical question. The following tables shed light on this. They report the results from a model of bullying (15) and outcomes (18/19) restricting the set of variables across equations to be identical. Figure B.1 shows the omission of other determinants of bullying (exclusion restrictions) generates distinctive sorting patterns by cognitive and non-cognitive skills. This is not surprising as classroom-level determinants of bullying are statistically significant at conventional levels (see Table 5 in main text). However, the small differences between many of the estimated ATEs and TTs in Tables 8 (with exclusion restrictions) and B.3 suggest that exclusion restrictions at age 15 are not contributing much to relax the jointly independent assumption of the error terms in the bullying and potential outcome equations (after controlling for latent skills). This is consistent with our hypothesis: latent cognitive and non-cognitive skills play an important role in identifying the treatment effects of interest.

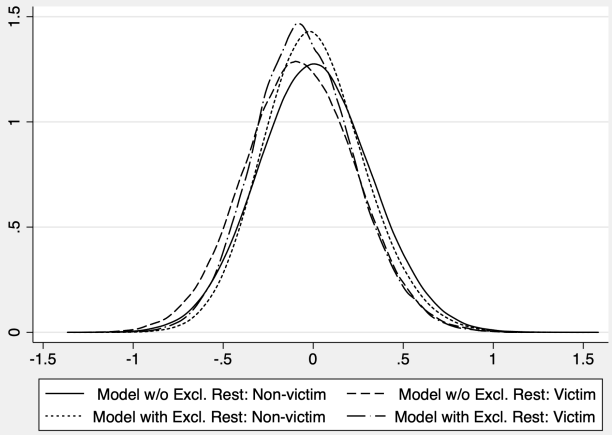
Table B.1: Assesing the Fit of the Model: Conditional Means

	Depression		Smoking		Feeling Sick		Life Satisfaction	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	0.0573	0.0556	0.1307	0.1276	0.0639	0.0647	0.5201	0.4917
	(0.906)	(0.876)	(0.337)	(0.330)	(0.245)	(0.244)	(0.500)	(0.493)
$E[Y_1 \mid D=1]$	0.1431	0.0803	0.1689	0.1727	0.1187	0.1181	0.4764	0.4759
	(0.896)	(0.846)	(0.375)	(0.378)	(0.324)	(0.331)	(0.500)	(0.490)
	College		Mental Health Problems		Stress: Friends		Stress: Parents	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	0.7008	0.6961	0.0874	0.0879	-0.0538	-0.0523	-0.0181	-0.0185
	(0.458)	(0.458)	(0.282)	(0.283)	(0.967)	(0.962)	(0.985)	(0.986)
$E[Y_1 \mid D=1]$	0.6398	0.6261	0.1851	0.1665	0.2928	0.2042	0.1587	0.1200
	(0.481)	(0.493)	(0.389)	(0.385)	(1.137)	(1.087)	(1.033)	(1.054)
	Stress: School		Stress: Poverty		Stress: Total		Drinking	
	Data	Model	Data	Model	Data	Model	Data	Model
$E[Y_0 \mid D=0]$	-0.0039	-0.0179	-0.0058	-0.0068	-0.0244	-0.0284	0.4940	0.4731
	(0.995)	(0.989)	(0.998)	(0.977)	(0.979)	(0.963)	(0.500)	(0.498)
$E[Y_1 \mid D=1]$	0.1306	0.0551	0.1019	0.0416	0.2313	0.1373	0.4970	0.5157
	(1.008)	(1.018)	(0.991)	(0.969)	(1.049)	(1.014)	(0.499)	(0.509)

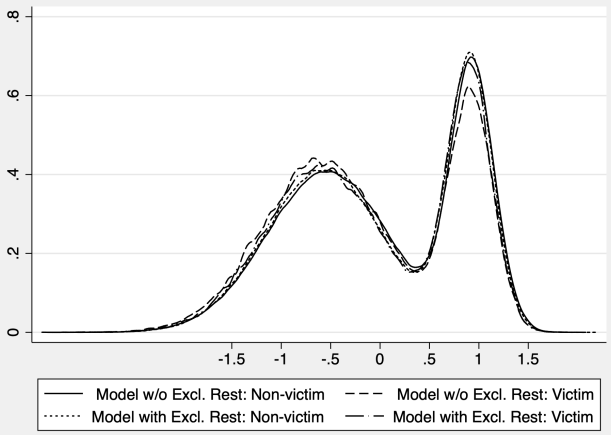
Note: The mean simulated outcomes (i.e., Model) were calculated using 40,000 observations generated from the estimated model. The Data columns contain the outcomes' mean at age 18 obtained from the KYPS. The variable Depression corresponds to a standardized index of depression symptoms. Smoking takes the value of 1 if the respondent smoked a cigarette at least once during the last year. Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. Life Satisfied takes the value of 1 if the respondent reports being happy with the way she is leading her life. Variable College takes the value of 1 if the respondent attends college by age 19. Mental Health takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. The Stress variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. Standard errors in parentheses.

Figure B.1: Skills Sorting into Being a Bullying Victim

(a) Marginal Distribution of Non-Cognitive Skills



(b) Marginal Distribution of Cognitive Skills



Note: Each panel in this Figure presents the marginal distributions of unobserved abilities by victimization condition. The distributions are computed using 40,000 simulated observations from the model's estimates.

Table B.2: Outcome Equations (age 18, τ_2) by Bullying Status D (age 15, τ_1)

	(1) Depression		(2) Drinking		(3) Smoking		(4) Life Satisfaction		(5) Feeling Sick		(6) Mental Health Problems	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Non-Cogn Skills	-0.294***	-0.377***	-0.134***	-0.083	-0.124***	0.124	0.254***	0.365***	-0.048*	-0.084	-0.040**	-0.188**
	(0.031)	(0.080)	(0.050)	(0.135)	(0.033)	(0.094)	(0.050)	(0.131)	(0.026)	(0.101)	(0.020)	(0.087)
Cognitive Skills	0.029	0.006	0.002	-0.061	-0.019*	-0.159***	0.016	0.066*	-0.001	0.008	0.009	0.029
	(0.022)	(0.060)	(0.015)	(0.040)	(0.010)	(0.029)	(0.015)	(0.039)	(0.008)	(0.029)	(0.006)	(0.025)
Observations	2446		2881		2881		2881		2571		2571	
	(7) College†		(8) Stress: Friends		(9) Stress: Parent		(10) Stress: School		(11) Stress: Total		(12) Stress: Poverty	
Bullied	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$	$D=0$	$D=1$
Non-Cogn Skills	-0.047	0.192	-0.488***	-1.110***	-0.288***	-0.047	-0.212**	-0.527*	-0.598***	-0.994***	-0.640***	-0.777***
	(0.049)	(0.144)	(0.103)	(0.342)	(0.103)	(0.317)	(0.101)	(0.300)	(0.102)	(0.313)	(0.104)	(0.298)
Cognitive Skills	0.080***	0.059	0.128***	0.229**	0.220***	0.152*	0.338***	0.391***	0.261***	0.338***	0.087***	0.170**
	(0.015)	(0.042)	(0.032)	(0.098)	(0.032)	(0.092)	(0.031)	(0.088)	(0.032)	(0.091)	(0.032)	(0.086)
Observations	2449		2564		2564		2564		2564		2564	

Note: This Table presents the estimated coefficients of the outcome equations $Y_{1,\tau_2} = \mathbf{X}_Y\beta^{Y_1} + \alpha^{Y_1,A}\theta^A_{\tau_0} + \alpha^{Y_1,B}\theta^B_{\tau_0} + e^{Y_1}_{\tau_2}$ if $D_{\tau_1} = 1$ and $Y_{0,\tau_2} = \mathbf{X}_Y\beta^{Y_0} + \alpha^{Y_0,A}\theta^A_{\tau_0} + \alpha^{Y_0,B}\theta^B_{\tau_0} + e^{Y_0}_{\tau_2}$ if $D_{\tau_1} = 0$. "Depression" corresponds to a standardized index of depression symptoms. "Drink" takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. "Smoke" takes the value of 1 if the respondent smoked a cigarette at least once during the last year. "Life Satisfaction" takes the value of 1 if the respondent reports being happy with the way she is leading her life. "Sick" takes the value of 1 if the respondent reports having felt physically ill during the last year. "Mental Health" takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Variable inCollege takes the value of 1 if the respondent attends college by age 19. The Stress variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. Controls not show: Age in months, gender, number of older and younger siblings, family income, rurality indicator, biparental household, and Father's education. Complete estimates available upon request. Columns headed as 1 collect the coefficients for those who were bullied at age 15. Columns headed as 0 collect the coefficients for those who were not bullied at age 15. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † College attendance is measured at age 19.

Table B.3: Treatment Effects: Outcomes at Age 18 (τ_2) of Being Bullied at Age 15 (τ_1)

	Depre	Smoking	Drinking	Sick	Mental Health	Satisfied
ATE	0.0615	0.0272	0.0059	0.0630***	0.0278	-0.0243
	(0.0639)	(0.0234)	(0.0327)	(0.0227)	(0.0192)	(0.0326)
TTE	0.0522	0.0092	0.0197	0.0522**	0.0386**	-0.0224
	(0.0593)	(0.0234)	(0.0316)	(0.0209)	(0.0168)	(0.0307)

	inCollege	Stress:Friends	Stress:Parent	Stress:School	Stress:Poverty	Stress:Total
ATE	-0.0417	0.2339***	0.1465*	0.0985	0.0615	0.1850**
	(0.0334)	(0.0817)	(0.0748)	(0.0726)	(0.0723)	(0.0768)
TTE	-0.0459	0.2803***	0.1223*	0.1377**	0.0928	0.2180***
	(0.0325)	(0.0720)	(0.0682)	(0.0641)	(0.0647)	(0.0674)

Note: Standard errors in parenthesis. This Table presents the estimated treatment parameters:

$$ATE = \iint \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \zeta^{NC}, \zeta^{C} \right.\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right)$$

and

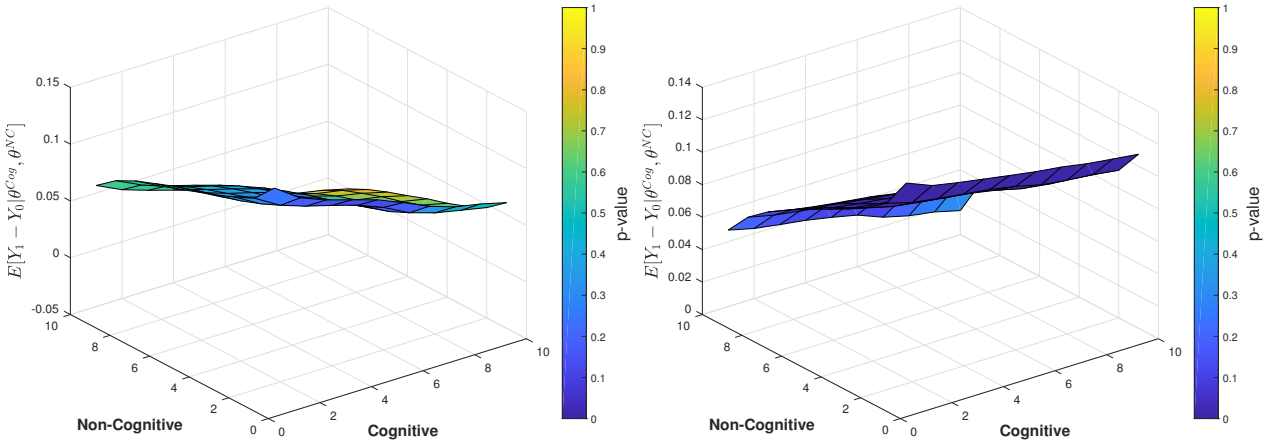
$$TT = \iint \mathbb{E}\left[Y_{1,\tau_2} - Y_{0,\tau_2} \left| \zeta^{NC}, \zeta^{C}, D_{\tau_1} = 1 \right.\right] dF_{\theta^{NC},\theta^{C}}\left(\zeta^{NC}, \zeta^{C}\right)$$

The variable Depress corresponds to a standardized index of depression symptoms. Smoking takes the value of 1 if the respondent smoked a cigarette at least once during the last year. Drinking takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year. Sick takes the value of 1 if the respondent reports having felt physically ill during the last year. Mental Health takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Satisfied takes the value of 1 if the respondent reports being happy with the way she is leading her life. The variable inCollege takes the value of 1 if the respondent attends college by age 19. The Stress variables are standardized indexes that collect stress symptoms triggered by different sources, namely friends, parents, school and poverty. Stress:Total aggregates the four triggers of stress. † College attendance is measured at age 19.

Figure B.2: Being bullied at 15 on Health Outcomes at 18

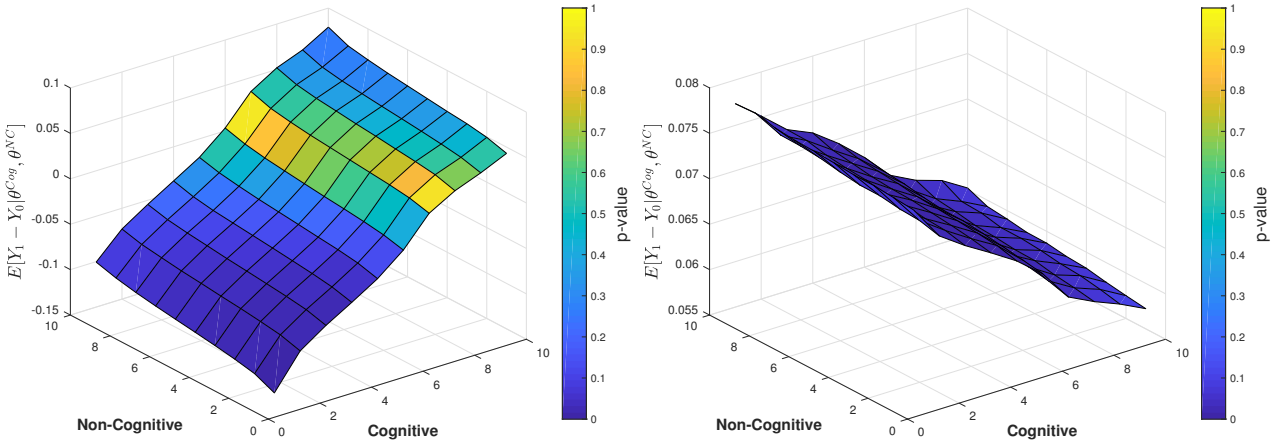
(a) Depresion

(b) Mental Health Problems



(c) Life Satisfaction

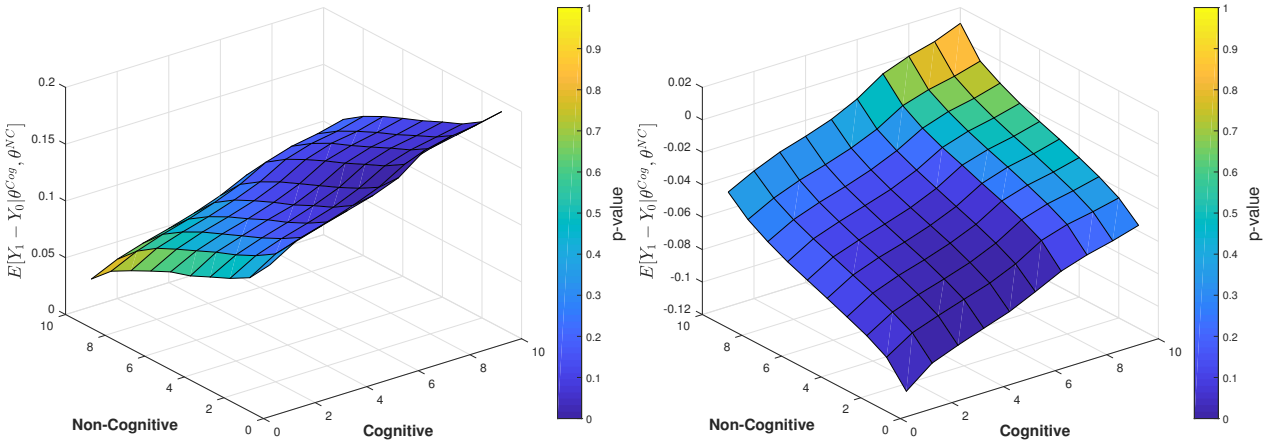
(d) Feeling Sick



Note: All panels present the $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C} \right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. The depression variable is a standardized aggregated index of depression symptoms. The variable Mental Health Problems takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Life Satisfaction takes the value of 1 if the respondent reports being happy with the way she is leading her life. The variable Sick takes the value of 1 if the respondent reports having felt physically ill during the last year.

Figure B.3: Being bullied (15) on Educational Outcomes (18 and 19)

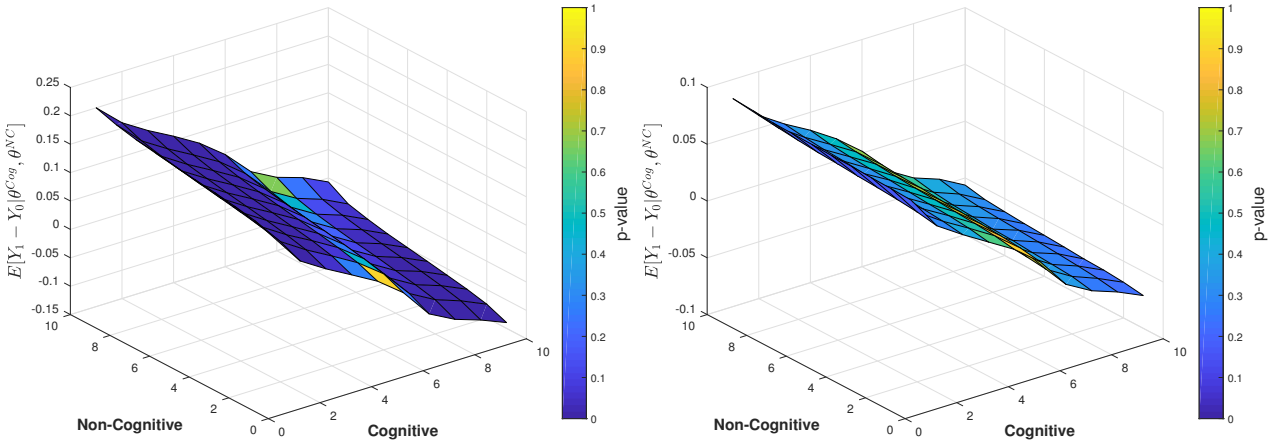
(a) Stress: School (18) (b) College Attendance (19)



Note: Panels present the $ATE\left(\theta^{S}\right)=\mathbb{E}\left[Y_{1}-Y_{0}\left|\theta^{S}\right.\right]$ for $S=\{Non-Cognitive, Cognitive\}$. The y-axes contain the deciles of each dimension of skills. Stress: school is a variable that aggregates stress symptoms triggered by situations related with school. College Attendance takes the value of 1 if the respondent attends college by age 19.

Figure B.4: Being bullied (15) on Take-up of Risky Behaviors (18)

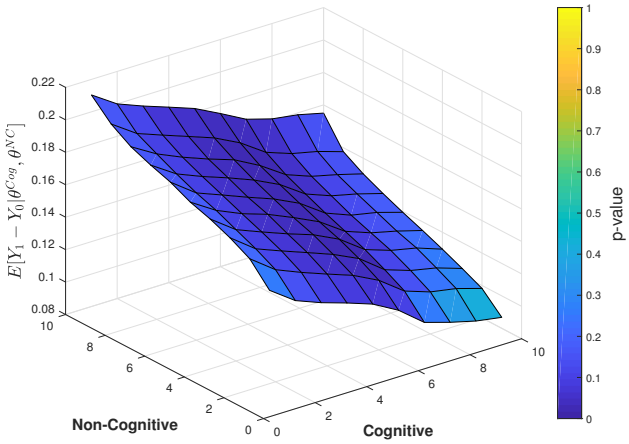
(a) Smoking (b) Drinking Alcohol



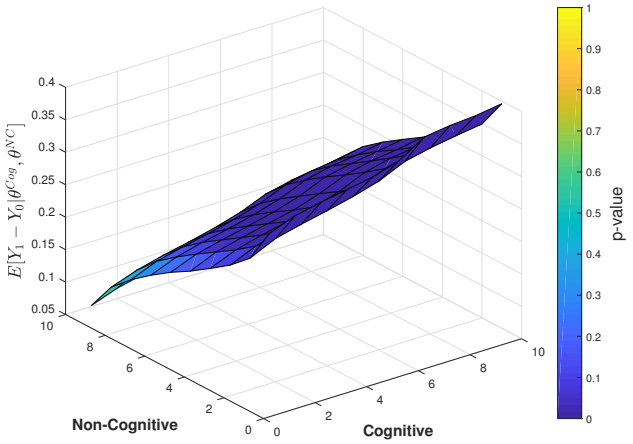
Note: All panels present the $ATE\left(\theta^{NC},\theta^{C}\right)=\mathbb{E}\left[Y_{1}-Y_{0}\left|\theta^{NC},\theta^{C}\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Smoking takes the value of 1 if the respondent smoked a cigarette at least once during the last year. The variable Drinking takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year.

Figure B.5: Being bullied (15) on Stress (18)

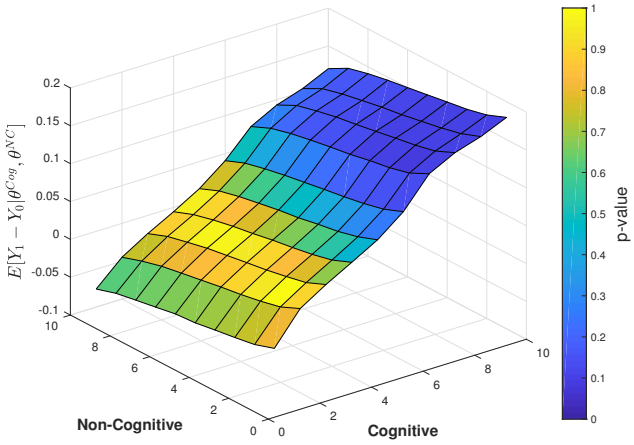
(a) Stresst: Parents



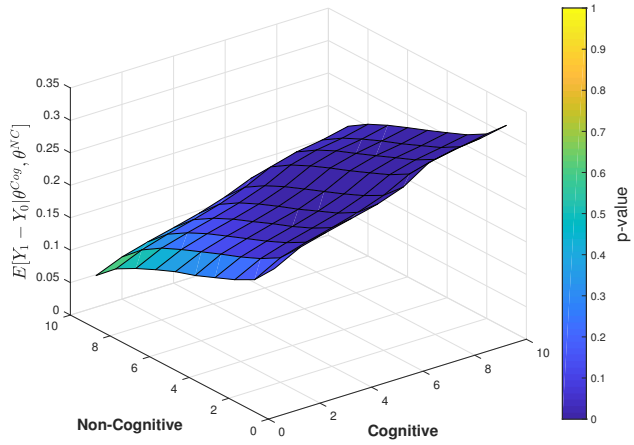
(b) Stress: Friends



(c) Stresst: Poverty



(d) Stress: Total



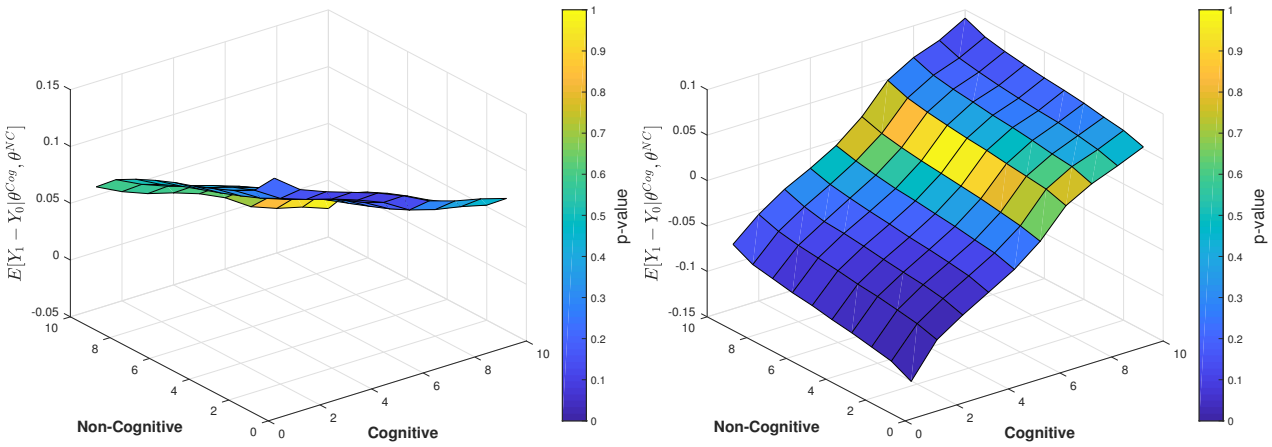
Note: All panels present the $ATE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C} \right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Stress: Parents is a variable that aggregates stress symptoms triggered by the relation of the respondent with her parents. Stress: Poverty is a variable that aggregates stress symptoms triggered by situations related with economic difficulties. Friends is a variable that aggregates stress symptoms triggered by situations related with friends and social relations. Stress: Total is a variable that aggregates stress symptoms triggered by situations related with friends, parents, school and poverty.

C Treatment Effects on the Treated

Figure C.1: Being bullied at 15 on Health Outcomes at 18

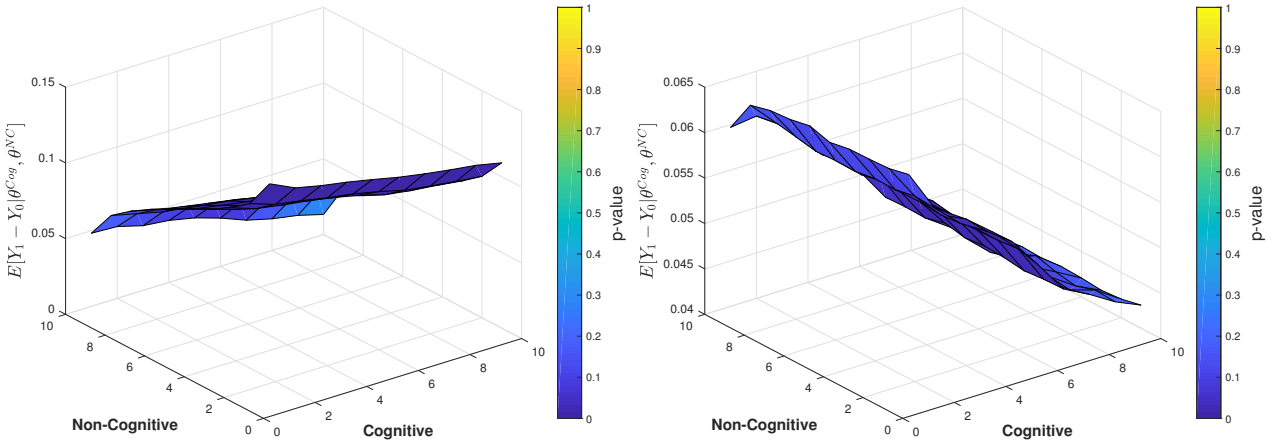
(a) Depresion

(b) Life Satisfaction



(c) Mental Health Problems

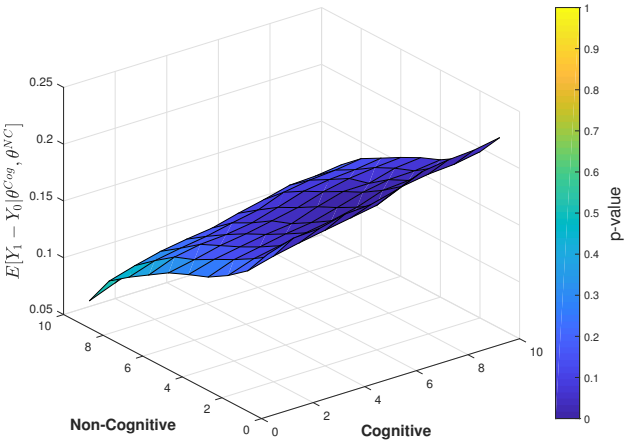
(d) Feeling Sick



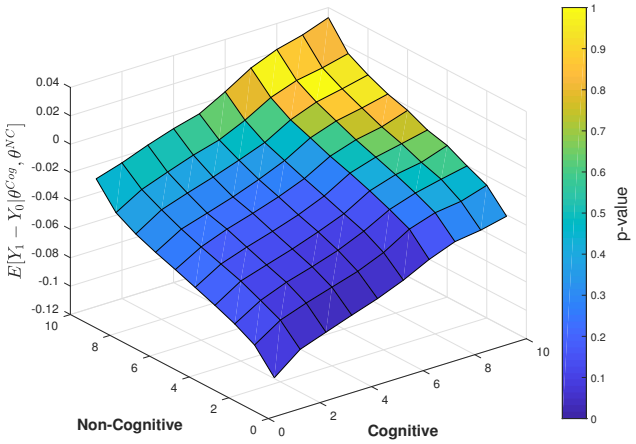
Note: All panels present the $TTE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D_{\tau_0} = 1\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. The depression variable is a standardized aggregated index of depression symptoms. The variable Mental Health Problems takes the value of 1 if the respondent has been diagnosed with psychological or mental problems. Life Satisfaction takes the value of 1 if the respondent reports being happy with the way she is leading her life. The variable Sick takes the value of 1 if the respondent reports having felt physically ill during the last year.

Figure C.2: Being bullied (15) on Educational Outcomes (18 and 19)

(a) Stress: School (18)



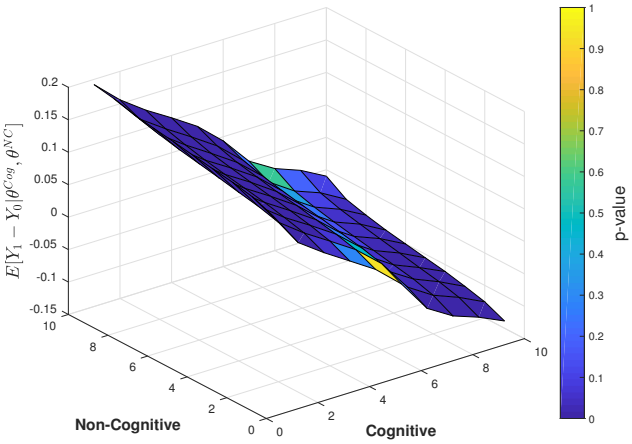
(b) College Attendance (19)



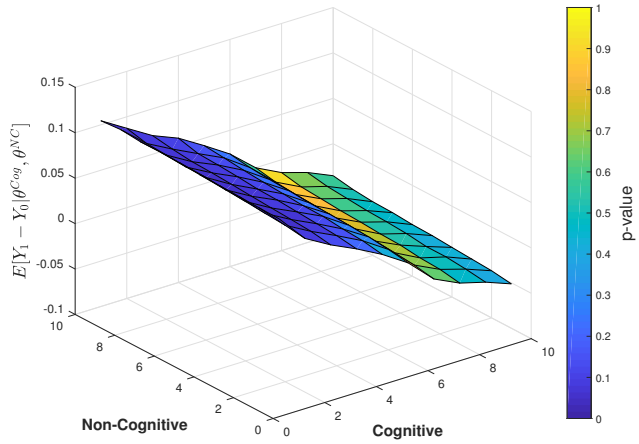
Note: All panels present the $TTE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D_{\tau_0} = 1\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Stress: school is a variable that aggregates stress symptoms triggered by situations related with school. College Attendance takes the value of 1 if the respondent attends college by age 19.

Figure C.3: Being bullied (15) on Take-up of Risky Behaviors (18)

(a) Smoking



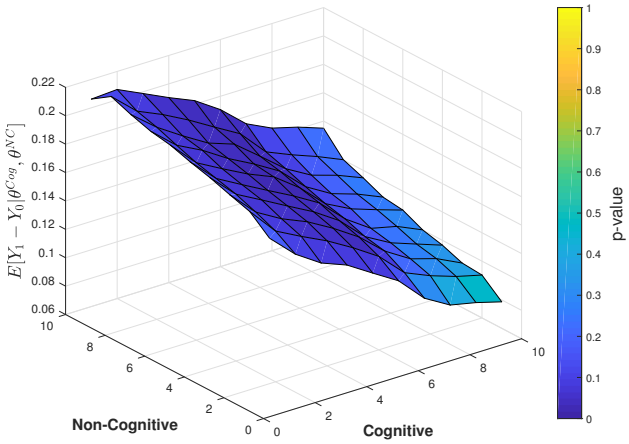
(b) Drinking Alcohol



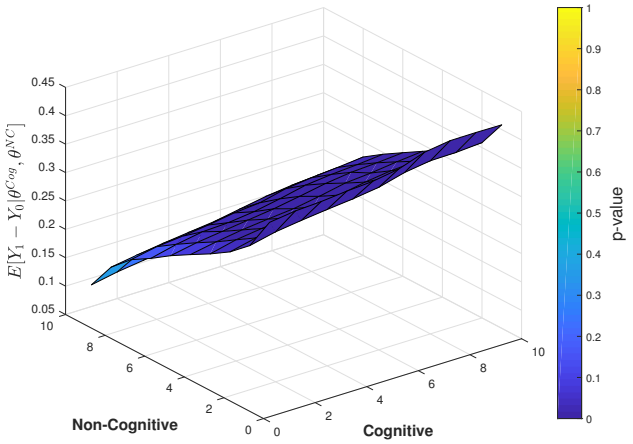
Note: All panels present the $TTE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D_{\tau_0} = 1\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Smoking takes the value of 1 if the respondent smoked a cigarette at least once during the last year. The variable Drinking takes the value of 1 if the respondent drank an alcoholic beverage at least once during the last year.

Figure C.4: Being bullied (15) on Stress (18)

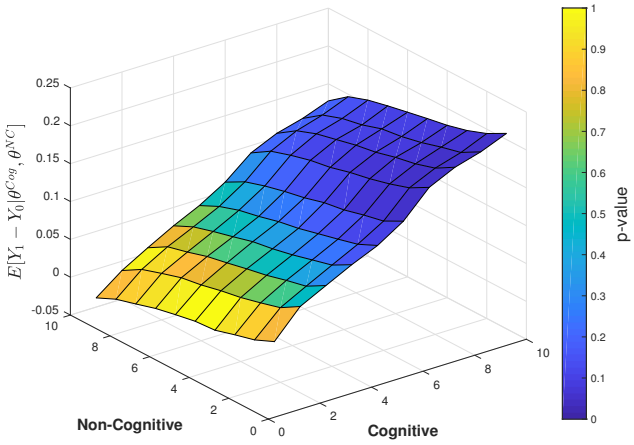
(a) Stresst: Parents



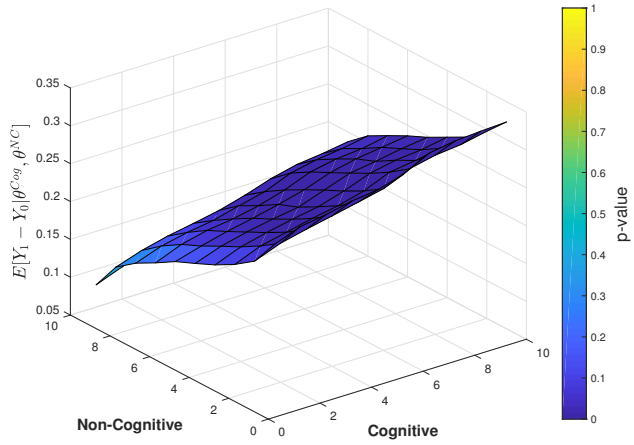
(b) Stress: Friends



(c) Stresst: Poverty



(d) Stress: Total



Note: All panels present the $TTE\left(\theta^{NC}, \theta^{C}\right) = \mathbb{E}\left[Y_1 - Y_0 \left| \theta^{NC}, \theta^{C}, D_{\tau_0} = 1\right.\right]$ in the z-axis product of 40,000 simulations based on the findings of the empirical model. The x-axis and y-axis contain the deciles of non-cognitive and cognitive skills. Stress: Parents is a variable that aggregates stress symptoms triggered by the relation of the respondent with her parents. Stress: Poverty is a variable that aggregates stress symptoms triggered by situations related with economic difficulties. Friends is a variable that aggregates stress symptoms triggered by situations related with friends and social relations. Stress: Total is a variable that aggregates stress symptoms triggered by situations related with friends, parents, school and poverty.