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On Effects of Non-Cognitive Skills, Social Isolation, and Bullying on School Performance

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Introduction

Since the seminal works of Becker (1964) and Mincer (1974) on human capital, research on skills that make individuals economically productive has been one of the most significant strands in the education and labor economic literature. In recent years, economists have emphasized that socially productive skills include not only traditionally-studied cognitive skills, as well as "patterns of thought, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances" (see Roberts, 2009, p.140), known as non-cognitive skills or personality traits (Almlund et al. 2011; Borghans et al., 2008; Heckman et al., 2019). Insufficient investment in some of these skills early in life has long-lasting consequences that are very difficult or costly to revert (Cunha and Heckman, 2007).

In the economic literature, the notion of non-cognitive skills refers to a broad and multidimensional range of work habits (e.g., effort, self-determination, and discipline) and behavioral traits (e.g., self-confidence, sociability, and emotional stability) that are not assessed by conventional tests of cognitive skills (ter Weel, 2008).[1] The contemporary interest in non-cognitive skills appears to be motivated by the observation from the General Educational Development (GED) Program documented in Heckman and Rubinstein (2001) that high school dropouts who successfully complete a GED test, designed to measure proficiency in standard high-school subjects, have lower schooling levels and wages with respect to other high school dropouts after controlling for measured cognitive ability. According to the authors, some unmeasured factor, called by them as non-cognitive skill, accounts for the relatively poor performance of GED recipients compared to other dropouts. Heckman and Rubinstein (2001) argued that the GED is a "mixed signal" that attracts dropouts with higher cognitive skills but lower levels of unspecified non-cognitive skills that affect schooling choices and are valued in the labor market.

Over the past two decades, economists have increasingly begun to consider specific measures of non-cognitive skills to explain heterogeneity in educational and labor market outcomes. For example, several studies have linked the measure of locus of control to subsequent educational achievement (e.g., Cebi, 2007; Coleman and DeLeire, 2003; Piatek and Pinger, 2016); others have analyzed the role of both the locus of control and self-esteem in predicting educational and labor market outcomes (e.g., Heckman et al., 2006; Waddell, 2006); some researchers have studied the effects of Big Five Traits (e.g., Borghans et al., 2008; Humphries and Kosse, 2017) and others have explored the role of social skills' measures in predicting important socio-economic outcomes (Carneiro et al., 2003; Kosse et al., 2020; Kuhn and Weinberg, 2005).

Despite this empirical evidence on the fundamental importance of non-cognitive skills and significant advances in understanding the relationship between certain non-cognitive skills' measures and educational

[1] Cognitive skills are generally measured by language and mathematical composites or by aptitude and ability tests (see, for example, Almlund et al. (2011), ter Weel (2008)).

attainment, the debate over the nature of the relationship is still far from being conclusive. Little is known about which skills matter most for individual and collective success and how these skills should be formed in the school setting where these non-cognitive abilities have been shown to be relatively malleable (Heckman and Kautz, 2012).

This thesis aims to provide a new evidence on the relationship between some measures of non-cognitive abilities, which have received a considerable attention in the economic and psychological literature, and educational outcomes, with a focus on Italian school setting.

In the economics of education literature, within the non-cognitive dimension, students' behavior at school attract particular attention. The literature suggests that measures of childhood behavior at school are related to educational success, antisocial and criminal behaviors in adulthood, and labor market outcomes (e.g., Bertrand and Pan, 2013; Heckman et al., 2013; Papageorge et al., 2019; Segal, 2008, 2013; Spengler et al., 2018).

In recent years, an enduring wave of interest has arisen among educators and policymakers about the role that particularly undesired social behavior of students at school, namely bullying, might play in explaining educational and other socio-economic outcomes. Bullying exhibited by some children toward their peers in the school setting refers to a series of behaviors aimed at other classmates in order to cause harm intentionally, at the physical, psychological, verbal, or relational level (Olweus, 1993). From an economic point of view, such aggressive behavior may be very costly, not only in terms of immediate individual welfare but also in terms of medium and long run consequences.

Notably, unlike research on school bullying in psychology and sociology that has developed rapidly since the 1970s,[2] the economic literature for a long time has mostly stayed away from research efforts aimed at understanding this problematic behavior and its impact on educational attainment and other significant life outcomes. Economic research on the impact of school bullying are extremely limited and can be found, for instance, in Ammermueller (2012), Bracco et al. (2022), Brown and Taylor (2008), Delprato et al. (2017), Eriksen et al. (2014), Gorman et al. (2021), Le et al. (2005), Oliveira et al. (2018), Ponzo (2013), Sarzosa and Urzúa (2021). These studies provide evidence that bullying at school adversely affects schooling attainment, further education, and employment prospects. However, the effects of students' bullying behavior on primary-school teachers' grading practices and the consequences of exposure to bullying on cognitive skill formation process for victimized schoolchildren during middle and high school have not yet been addressed in the economic literature. This thesis tries to fill this gap.

The empirical analysis performed in this thesis is based on large scale observational data provided by

[2] See, for example, Bandura (1973), Bjorkqvist et al. (1992), Carlson et al. (1989), Kanetsuna and Smith (2002), Olweus (1978, 1993, 1997, 1999, 2010), Rigby and Slee (1991), Rigby (1996), Roland (1989), Smith and Brain (2000), Wolke et al. (2001).

the Italian National Institute for the Evaluation of the Educational System (INVALSI henceforth). We had access to data collected by INVALSI for the cohort of Italian students who in 2013/14 were in the 5th grade and for whom there is also available data on test scores obtained three and five years later (in the school years 2016/2017 and 2018/19) when they were attending the 8th and 10th grade in secondary school. This cohort of students is specifically appropriate for our analysis due to the following reasons. First, thanks to the mandatory INVALSI assessment program conducted in May 2014, for these students we have information on their cognitive and non-cognitive abilities, as well as detailed information on their bullying-related attitudes and victimization status, as measured at the end of the 5th grade (at age 10-11). Second, for these students we are also able to observe their cognitive abilities as measured at the end of the 8th and 10th grades, as proxied by standardized test score results in literacy and numeracy obtained three and five years later (this is not possible for other cohorts of students as the panel dimension was introduced in the INVALSI dataset only recently).

The thesis is organized as follows. In Chapter 1, we study the role of pupils' academic motivation, self-efficacy, and social isolation among classmates in late childhood on their subsequent school performance. The psychological traits we study have received a considerable attention both in the psychological and economic literature - see, for example, Caprara et al. (2008), Duckworth and Seligman (2005), Duckworth and Schoon (2010), Filippin and Paccagnella (2012), Heckman et al. (2006), Piatek and Pinger (2016), Steinmayr et al. (2019). Previous literature has shown that non-cognitive skills tend to be quite stable after childhood (see, for example, Cobb-Clark and Schurer, 2012, 2013) and we use information on pupils' psychological traits collected well before the test scores in order to minimize reverse causality problem. In particular, using a very rich panel dataset INVALSI, we estimate how standardized test scores in literacy and numeracy obtained in the 8th and 10th grades are affected by students' non-cognitive skills as measured when attending primary school, controlling for their ex-ante cognitive abilities as proxied by standardized tests scores achieved in the 5th grade. The contribution of this research to increasing the body of knowledge about the non-cognitive determinants of school performance is that it shows that pupils' intrinsic motivation, high self-efficacy, and positive social interactions with own classmates are important for understanding individual educational outcomes.

In Chapter 2, we investigate whether pupils' bullying behavior towards schoolmates at primary school affects teachers' grading practices of cognitive performance in literacy and numeracy. Using census data on the whole population of Italian children attending the 5th grade in the school year 2013/14, we measure the extent to which teachers' judgments may vary for students with different in-school behavioral characteristics. Our empirical strategy is based on the contrast between teacher-assigned scores and standardized test scores taken in the national external evaluation program that covers the same area during the same school year.

In Chapter 3, we explore the consequences of experiencing school bullying victimization in primary

school on children's subsequent educational attainment. Using ordinary least squares with school fixed effects and matching estimators, we quantify the impact of exposure to bullying in the 5th grade of primary school on educational outcomes, including standardized test scores and teacher-assigned marks in literacy and numeracy, achieved in the 8th and 10th grades of secondary school. Recent convincing evidence (e.g., Brown and Taylor, 2008; Eriksen et al., 2014; Gorman et al., 2021; Sarzosa and Urzúa, 2021) on the impact of school bullying victimization suggests that the exposure to bullying has negative future educational and labor-market consequences. However, the question of whether exposure to bullying in primary school affects formation of cognitive ability in middle and high school has not been directly addressed.

Taken together, the chapters of this thesis seek to provide evidence on the extent to which non-cognitive skills, social interactions, and bullying at school can play in affecting schooling outcomes in Italy.

The obtained results are collected and discussed in Conclusion.

Chapter 1

Non-Cognitive Skills and Social Isolation in Primary School: An Investigation of Their Impact on School Performance in Italy

Abstract

We investigate whether students' non-cognitive skills affect their educational outcomes. To minimize reverse causality problems, we rely on a very rich panel dataset INVALSI, providing information for a cohort of Italian students on school performance, demographic characteristics, and on a number of non-cognitive skills. For these pupils, we estimate how standardized test scores in literacy and numeracy obtained in the 8^{th} and 10^{th} grades are affected by their non-cognitive skills as measured when attending primary school, controlling for their ex-ante cognitive abilities as proxied by standardized test scores achieved in the 5^{th} grade. We find that higher levels of scales measuring student academic motivation and regulatory self-efficacy positively affect performance in literacy and numeracy, as measured by both national standardized tests scores and marks assigned by teachers. We also exploit the student's Social Isolation within Classroom scale. We find that higher levels of student social isolation in primary school have a statistically significant negative effect on school outcomes obtained when attending secondary school. Results are robust to different specifications including controls for ex-ante student cognitive abilities, class size, and a number of student and school characteristics.

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***Keywords**: Education; Cognitive Skills; Non-Cognitive Skills; Motivation; Self-efficacy; Social Isolation.*

1.1. Introduction

Even if there is a general agreement on the crucial role played by education for the development and progress of any society, still little is known on which are the skills that matter most for individual and collective success and how these skills should be developed. As recently recalled by Andreas Schleicher, OECD, "to succeed with converting education into better jobs and lives, we need to better understand skills that drive outcomes and ensure that the right skill mix is being learned over the lifecycle and help economies to make good use of those skills".[3]

In popular usage, skills are subdivided in cognitive and non-cognitive. Cognitive abilities may be defined as a "mental capability that … involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Gottfredson, 1997, p. 13).[4] Non-cognitive skills are instead generally defined as the "patterns of thought, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances" (Roberts, 2009, p. 140), which can also involve intellect, but more indirectly and less consciously than cognitive skills (Borghans et al., 2008).[5]

Over the past two decades, economists have increasingly begun to consider non-cognitive skills to explain heterogeneity in educational and labour market outcomes between individuals.[6] A number of papers has provided empirical evidence on the importance of non-cognitive skills other than general intelligence for educational choices and success in school - see, e.g., Almlund et al. (2011), Barón and Cobb-Clark (2010), Borghans et al. (2008), Carneiro et al. (2007), Coleman and DeLeire (2003), Cebi (2007), Heckman et al. (2006), Heckman et al. (2013), Humphries and Kosse (2017), Mendolia and Walker (2014), Piatek and Pinger (2016), Silles (2010), West et al. (2016).

The set of non-cognitive skills considered in this literature is quite large and includes locus of control, self-esteem, Big Five personality traits (i.e., openness to experience, conscientiousness, extraversion, agreeableness, neuroticism), social skills, economic preferences (such as time and risk preferences). Nonetheless, many of these studies have focused primarily on students in the later years of secondary school and present compelling evidence on correlations between certain measures of non-cognitive skills and

[3] OECD's Andreas Schleicher on skills and jobs posted 10th Sep 2020 in People Matters. https://www.peoplematters.in/article/skilling/oecds-andreas-schleicher-on-skills-and-jobs-26931

[4] European Commission Glossary defines cognition as "having to do with the ability to think and reason; this includes the ability to concentrate, remember things, process information, learn, speak, and understand".

[5] The concept of '*non-cognitive skills*' was introduced by sociologists Bowles and Gintis (1976) as a catch-all phrase for skills not captured by assessments of cognitive ability, a construct that can be reliably measured by standardized achievement test scores such as literacy and numeracy, which some psychologists assume are good measures of intelligence (see, for example, Nisbett, 2009).

[6] In the economic literature, some researchers refer to non-cognitive skills, some refer to non-cognitive abilities, while others refer to personality traits or socio-emotional skills when discuss a whole set of unobserved constructs to differentiate individuals. Throughout this paper we use the term '*non-cognitive skills*'.

educational attainment rather than on understanding the causal relationship.

In this chapter, using census data on a cohort of primary school children, provided by the Italian National Institute for the Evaluation of the Educational System (INVALSI henceforth), we analyze how motivation, self-efficacy, and social isolation in primary school predict educational outcomes in secondary school. The data at hand allow us to handle reverse causality problems: we follow the same cohort of students within their educational path and consider the impact of non-cognitive skills as measured in the 5th grade on educational outcomes obtained three and five years later (in the 8th and 10th grade).

The psychological traits we study have received a considerable attention both in the psychological and economic literature (see, e.g., Caprara et al., 2008; Duckworth and Seligman, 2005; Duckworth and Schoon, 2010; Heckman et al., 2006; Piatek and Pinger, 2016; Steinmayr et al., 2019). As regards motivation, i.e., the process in which "goal-directed activity is instigated and sustained" (see Pintrich and Schunk, 1996, p. 4), we refer to the Self-Determination Theory (SDT henceforth) proposed by Deci and Ryan (1985, 2000).[7] According to the SDT there are two types of motivation: intrinsic motivation (also known as self-determined, or autonomous motivation), and extrinsic motivation (also called controlled motivation). The SDT proposes three major types of extrinsic motivation, namely, external regulation, introjected regulation, and identified regulation. Individuals who are externally regulated undertake an activity in order to obtain positive results, as for example a tangible reward, or to avoid negative consequences. The second type of the external motivation is introjected regulation, in which the individual considers relevant the maintenance or improvement of her/his self-esteem and the avoidance of a sense of guilt. When individuals have identified regulation, they attribute a value to the behavior, and they feel that the activity is important and belongs to them. The highest level of self-determined motivation is intrinsic regulation; individuals who are intrinsically regulated engage in an activity for the pleasure, interest, and satisfaction derived from the participation itself.[8]

The second measure of non-cognitive skills that we can construct is a measure of self-efficacy, i.e., "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (see Bandura, 1995, p.2).[9] Students with a robust sense of efficacy in their self-regulatory capabilities believe they can manage their time effectively, organize their work, minimize distractions, set

[7] Apart from the Self-Determination Theory (Deci and Ryan, 1985), in the literature there are several other theories explaining the concept of motivation: the Achievement Goal Theory (Dweck and Leggett, 1988; Ames, 1992), the Attribution Theory (Weiner, 1979), Expectancy-Value Theory (Eccles et al., 1983), and the Locus of Control Theory (Rotter, 1966).

[8] A review of the literature on the intrinsic/extrinsic motivation (see Vallerand, 1997) reveals that extrinsic motivation is associated with poorer well-being and less optimal functioning for children and adolescents compared to intrinsic motivation, which is positively related to psychological well-being and positive adjustment.

[9] Since Bandura (1977) introduced the concept of '*self-efficacy*' in the psychology literature, researchers have studied its role in varied domains, including education, business, careers, health, and well-being. According to Bandura's Social Cognitive Theory (Bandura, 2001) perceived self-efficacy plays a pivotal role in the process of self-management.

goals for themselves, monitor their comprehension, and maintain an effective work environment.[10] In the literature on personality psychology, self-efficacy is one of the six lower-level facets of Conscientiousness that is one of the Big Five personality traits (Borghans et al., 2008; Almlund et al., 2011).

The measurement of social isolation among classmates is based on the appraisal of various kinds of social contacts, which include fleeting or superficial social interactions, such as just having a chat with someone, as well as friendship. This construct explores behaviors that are malleable and can be directly influenced by teachers in the classroom, and even indirectly when students are not at school, by assigning homework or activities to be done together with other students. Peer relationship has important implications for adjustment to school and well-being (see Ryan and Deci, 2017).

In order to estimate the impact of non-cognitive skills on school performance and to handle reverse causality problems, we exploit a recent feature of the INVALSI, which allows us to follow the same cohort of students within their educational path. At this aim we focus on the cohort of Italian students who in 2013/14 were in the 5th grade and for whom there is also available data on test scores obtained three and five years later (in the school years 2016/2017 and 2018/19) when they were attending the 8th and 10th grade in secondary school. Thanks to the data at hand, we are able to measure both intrinsic and extrinsic academic motivation (also often referred to as self-regulation and locus of control), as well as students' beliefs in self-efficacy toward learning, and their social isolation among classmates. All measures of non-cognitive skills used in this study closely correspond to those used by educational psychologists in an independent literature on school engagement.

We present evidence that pupils' educational outcomes achieved in secondary school are affected by their non-cognitive skills as measured when attending their last year in primary school (the 5th grade). We find that, even after controlling for ex-ante cognitive skills as proxied by standardized test scores achieved in the 5th grade, academic motivation, regulatory self-efficacy, and social isolation are significantly associated with student educational outcomes obtained in the last year of lower secondary school (three years later). In particular, pupils with extrinsic motivation or with low levels of self-efficacy, or who reported fewer social contacts among classmates seem less likely to have good performance in literacy and numeracy test scores. These effects hold true when we control for ex-ante student cognitive abilities, class size and for a number of student and school characteristics.

The contribution of our study to the literature is fourfold. First, despite the large evidence documenting

[10] In the psychology literature, studies on the relationship between self-efficacy and academic performance showed mixed results. According to the studies supporting for Social-Cognitive Theory in an educational environment that self-efficacy expectations increase efforts and task persistence (Bandura, 1991). On the other hand, several studies introduced another view on self-efficacy effects. Their approach relies on Control Theory (Powers, 1973). The self-efficacy expectation is one component of the preparedness perception. Consequently, high levels of self-efficacy might not always be beneficial for educational attainment. As the student believes that he or she is sufficiently prepared to pass the exams, his or her high self-efficacy level would lead to overconfidence and lower academic performance (Furnham et al., 2003).

the correlation between non-cognitive skills and measures of educational success, the debate over the nature of the relationship is still far from being conclusive. Previous research examining the way in which non-cognitive skills affect student achievement and learning decisions report mixed results. This is mainly due to the fact that many studies suffer from reverse causality and endogeneity issues. The present paper is instead able to control for reverse causality by using information on personality traits collected well before educational outcomes. In addition, data at hand allow us to control not only for a rich set of demographic and family background characteristics, class size, and a number of school characteristics, but also for pupils' ex-ante cognitive skills.

Second, while much of the existing literature on the impact of non-cognitive skills on educational outcomes is based on non-representative samples, we provide evidence based on a large-scale longitudinal study considering the whole population of Italian pupils attending the 5^{th} grade in the 2013/14 school year. This allows to solve selection biases that might derive from specific samples and to strengthen to external validity of our results.

Third, while the existing empirical studies mostly analyse the impact of adolescents' measures of non-cognitive skills on their educational attainment, including completion of secondary school, high school GPA, years of schooling, and college attendance (see, e.g., Barón and Cobb-Clark, 2010; Cebi, 2007; Humphries and Kosse, 2017), in our study we provide evidence on the effects of non-cognitive skills on test scores and grades by focusing on children attending primary school. Compared to secondary school, primary school is the more sensitive and the more critical period in the formation of skills, when cognitive and non-cognitive skills are highly malleable (see Kautz et al., 2014).

Fourth, whereas most of the studies focus on the role of one specific non-cognitive skill, such as locus of control (see, for example, Barón and Cobb-Clark, 2010; Cebi, 2007; Coleman and DeLeire, 2003; Piatek and Pinger, 2016) or social skills (see Carneiro et al., 2007), we analyse the simultaneous role of three measures of non-cognitive skills: motivation, self-efficacy, and social interactions.

The remaining part of the Chapter 1 is structured as follows. In Section 1.2 we review the related literature. Section 1.3 provides a description of the institutional setting of Italian schools and presents the data. In Section 1.4 we discuss the empirical approach. In Section 1.5 we analyze the effects of non-cognitive skills on school performance. Section 1.6 investigates heterogeneity while Section 1.7 concludes the Chapter 1.

1.2. Related Literature

Even though the study of non-cognitive skills originated as an attempt to understand why some more cognitively able individuals perform well in school and in later life while others do not, the relationship between non-cognitive skills and education has not received as much attention from economists as the effects

of non-cognitive skills on earnings and/or employment.[11]

In the literature on economics of education there exists a number of studies that focus on the effects of non-cognitive skills on school performance and attainment.[12] Table 1.1 provides a short summary of these papers, which are closely related to our study and examine the relationship between students' non-cognitive skills and their educational outcomes.

One of the first studies providing evidence on the importance of non-cognitive skills for individual and economic success is due to Heckman and Rubinstein (2001). The authors analyse the performance of Graduate Equivalence Diplomas (GED) recipients and concludes that GED recipients are as smart as high school graduates who go on to college, but they have much lower non-cognitive skills. Further evidence can be found in Heckman et al. (2006) who, using data from the National Longitudinal Survey of Youth (NLSY79), examine the effects of cognitive and non-cognitive skills on schooling attainment, wages, and participation in a range of adolescent risky behaviours.[13] Their findings reveal that non-cognitive skills strongly influence schooling decisions and affect wages, given schooling decisions; for a variety of dimensions of behaviour, a change in non-cognitive skills from the lowest to the highest level has an effect on behaviour comparable to or greater than a corresponding change in cognitive skills.

Coleman and DeLeire (2003) present an economic model of how adolescents' locus of control might affect their human capital investments. The authors, based on the National Educational Longitudinal Study (NELS), estimate the effects of 8th-graders' internal-external locus of control on high school completion and college attendance. Even when controlling for test scores, parents' education, parenting behavior, and family structure, their results show that adolescents' locus of control influences educations decisions.[14] On the other hand, Cebi (2007) using a different dataset - National Longitudinal Survey of Youth (NLSY) - to test the predictions of Coleman DeLeire's model, finds little evidence of positive effects of internal locus of control

[11] We do not discuss here in depth the impact of non-cognitive skills on higher education achievement and labor market outcomes. Bowles et al. (2001), Caliendo et al. (2014), Cobb-Clark and Tan (2011), Fletcher (2013), Heckman et al. (2006), Heinek and Anger (2010), Mueller and Plug (2006) provide evidence on the effects of non-cognitive skills on earnings and/or employment. See also Almlund et al. (2011), Farrington et al. (2012), Gutman and Schoon (2013), Heckman et al. (2019) for an overview of the literature on the effects of non-cognitive skills that we neglect.

[12] Previous extensive research in psychology and education finds that non-cognitive skills (primarily motivation, persistence, socio-emotional regulation, self-efficacy, and self-esteem) are strongly predictive of grades in school, and other measures of educational success (see, for example, Bandura et al., 2001; Caprara et al., 2011; Conard, 2006; Duckworth and Seligman, 2005; Pajares & Schunk, 2001; Wolfe and Johnson, 1995). However, most of these studies use small samples that are not representative and focus on correlation between non-cognitive skills and educational attainment rather than on understanding the causal relationship.

[13] In their analysis, the cognitive skill measure represents the average over the ASVAB scores (arithmetic reasoning, word knowledge, paragraph comprehension, mathematical knowledge, and coding speed), while the non-cognitive measure is computed as the average of the Rosenberg Self-Esteem Scale and Rotter Locus of Control Scale.

[14] Coleman and DeLeire (2003) find that a one-standard deviation increase in 8th-grade locus of control (becoming more internal) is estimated to lead to 1.4% increase in the probability of graduating from high school while the estimated marginal effect of locus of control on the second measure of educational attainment in the most extensive specification - four-year college attendance – is not statistically different from zero.

on educational attainment for a teenage sample of 10th and 11th graders in 1979. Her estimation results from probit model suggest that teenagers' locus of control is not a significant determinant of educational outcomes once cognitive ability is controlled for.

In a similar vein, Barón and Cobb-Clark (2010) examine the relationship between young people's locus of control over their lives and their investments in education. Using data from the Youth in Focus (YIF) Project, in which 18-year-old Australians were interviewed about their experiences in school, educational achievement and future study plans, the authors find that young people with a more internal locus of control have a higher probability of finishing secondary school and, conditional on completion, meeting the requirements to obtain a university entrance rank. Those individuals with an internal locus of control who obtain a university entrance rank achieve higher rankings than do their peers who have a more external locus of control.

Mendolia and Walker (2014) use data for a cohort of English children born in 1990 and followed for seven years (starting in 2004) to study the effects of locus of control, self-esteem, and work-ethics (measured at age 15) on high school performance - specifically on test scores in English and Mathematics at age 16, and on subject choices and subsequent performance at age 17-18. Using ordinary least squares as well as propensity score matching techniques, the authors find that non-cognitive skills influence study choices and performance in test scores - particularly in Mathematics and Science. Their estimation results show that pupils with external locus of control or with low levels of self-esteem seem less likely to have good performance in test scores at age 16 and to pursue further studies at 17-18.

West et al. (2016) exploiting cross-sectional data from a sample of 8th grade students attending public schools in the city of Boston, find that, at the student level, scales measuring conscientiousness, self-control, grit, and growth mindset are positively correlated with attendance, behavior, math and English language arts test-score gains between the 4th and 8th grade. However, the positive student level relationships between these self-reported measures of non-cognitive skills and improvements in academic achievement dissipate when the measures are aggregated to the school level.

In more recent work, Humphries and Kosse (2017), using data from the youth survey of the German Socio-Economic Panel (GSOEP), evaluate the role of non-cognitive skills in determining educational success measured by high school GPA and show that cognition and conscientiousness are positively correlated with GPA, while risk preference and agreeableness are negatively correlated.

The studies mentioned above present compelling evidence that school performance is related to a range of non-cognitive skills, including locus of control, self-esteem, conscientiousness, agreeableness, risk preference, self-control, and the ability to work with others. Most of these studies have focused primarily on the effects of non-cognitive skills measured in later years of secondary school on later educational outcomes, while studies that explore the role of non-cognitive skills on school performance with a focus on primary

school-age children are scant.

Even though non-cognitive skills have become important components in the economics of education literature, there is little consensus among researchers on which skills are matter most for school success, how they can be reliably measured, how those skills are related among them, and their malleability in school settings.

Table 1.1. Previous Findings on The Effects of Non-Cognitive Skills on School Performance

Author(s)	Data	Main Variable(s)	Method	Control variables	Findings
J. D. Barón and D. Cobb-Clark (2010)	YIF (sample N=2,065; AU)	*Outcomes:* completion of secondary school, obtaining a university entrance rank *Non-cognitive skills:* locus of control (at age 18, in the 12th grade)	Probit	Gender, indigenous indicator, family structure at 14 years old, socio-economic background, parental education, parents' investments in children's education.	A one SD increase in internal locus of control is associated with a 4.5%. increase in the probability of secondary school completion. A one SD increase in internal locus of control is associated with a 2.9% increase in the probability of obtaining a university entrance rank.
L. Borghans, A.L. Duckworth, J. Heckman, and B. ter Weel (2008)	From meta-analysis and reviews in the psychology literature	*Outcomes:* years of education, college grades *Non-cognitive skills:* Big Five Traits	Correlation analysis	None	Conscientiousness and openness to experience are the best predictors for years of education and college grades.
P. Carneiro, C. Crawford, and A. Goodman (2007)	NCDS (sample N=10,723; GB).	*Outcomes:* schooling at age 16, higher education degree at age 42. *Non-cognitive skills:* social skills at age 11	Probit	Gender, ethnicity, early/health development, family structure, home environment, parental education, socio-economic status, local area variables, cognitive ability.	A one SD increase in social adjustment score at age 11 increases the probability to stay at school post-16 by 4.3% and the probability of having a degree by 2.2%.
M. Cebi (2007)	NLSY (sample N=1,737; US)	*Outcomes:* high school graduation, college attendance *Non-cognitive skills:* locus of control (10th and 11th graders at age 15-22)	Probit	Gender, race, ethnicity, age, region, parental education family structure, residence in an SMSA and in an urban area, cognitive ability.	Locus of control does not predict educational attainment.
M. Coleman and T. DeLeire (2003)	NELS1988 (sample N= 13,720; US)	*Outcomes*: high school graduation, four-year college attendance. *Non-cognitive skills:* locus of control in grade 8	Probit	Gender, race, ethnicity, parent' s education, parenting behaviour, family structure, urban, rural region, cognitive ability.	A one SD increase in teenager's locus of control results in a 1% to 2% increase in the probability of completing high school.

J. Heckman, J. Stixrud, and S. Urzúa (2006)	NLSY79	*Outcomes:* Schooling decisions *Non-cognitive skills:* locus of control, self-esteem at age 14-22	Multinomial Probit	Gender, race, family background characteristics, cohort dummies, region, cognitive ability.	Locus of control and self-esteem affect years of schooling.
J.E. Humphries and F. Kosse (2017)	GSOEP (sample N=1,333; DE).	*Outcomes:* high school GPA (at age 17) *Non-cognitive skills*: Big-5, risk and time preferences, locus of control, engagement behaviour, social behaviour, risky behaviour (at age 17)	OLS	Gender, urban status, residence in Eastern Germany, cognitive ability.	Cognition and conscientiousness are positively correlated with GPA, while risk preference and agreeableness are negatively correlated.
S. Mendolia and I. Walker (2014)	LSYPY & NPD (sample N=5,500; GB)	*Outcomes*: test scores in 11th and 13th grades (at age 16 and 18) in different subjects. *Non-cognitive skills*: locus of control, self-esteem and attitudes to work (in 9th grade, at age 14-15)	PSM, OLS, Probit,	Gender, at-birth characteristics, ethnic background, family background, parental education, employment status, family income, youths' mental health.	Students with external locus of control, low self-esteem, and low levels of work ethics are less likely to have good performance in test scores at age 16 and to pursue further studies at 17–18, especially in mathematics or science.
R. Piatek and P. Pinger (2016)	GSOEP A combined sample of 1901 youths and 1606 adults ($N_{females}$=1,532; N_{males}=1,584; DE)	*Outcomes:* educational decisions *Non-cognitive skill:* locus of control at the age of 17	Monte Carlo experiment	Gender, family background, parental education, socio-economic status, parental investment, region, city size, cognitive ability.	An increase of locus of control by one SD results in a 5% difference in the probability of obtaining an upper secondary school certificate.
M. A. Silles (2010)	NCDC (sample N=8646; GB)	*Outcomes:* test-scores in math at age 16 *Non-cognitive skills:* social maladjustment at age 11	OLS	Gender, birth weight, family size, birth order, parental education, socio-economic status, spells of illness at age 16, cognitive ability, school type	Passive and non-passive aggression are associated with worth test scores in math.
M. West, M. A. Kraft, A.S. Finn, R.E. Martin, et al. (2016)	Sample of 8th-grade students attending 32 public schools in the city of Boston (N=1,368; US)	*Outcomes:* test-score gains in math and English language arts between 4th grade and 8th grade *Non-cognitive skills:* conscientiousness, self-control, grit, and growth mindset (in 8th grade)	Correlation analysis	None	At the student level, conscientiousness, self-control, grit, and growth mindset are positively correlated with attendance behavior, and test-score gains; conscientiousness, self-control, and grit are unrelated to test-score gains at the school level.

1.3. Institutional Background, Data and Measures

Education in Italy is compulsory from ages 6 to 16 and consists of three main stages before tertiary education: primary school, lower secondary, and upper secondary school. Before entering primary schools, pupils can attend daycare (from age 0 to 2) and kindergarten (from age 3 to 5); these stages are not mandatory. At the compulsory stages, schools are organized into single or multi-unit institutions, sharing the principal and several administrative services.

Primary school lasts five years (grades 1 to 5, from age 6 to 10). After completion of the last year of primary school (grade 5), pupils enter lower secondary school directly.[15] Secondary education lasts eight years and it is divided into stages: a three-year lower secondary school (grades 6 to 8, from age 11 to 13) and a five-year high school program (grades 9 to 13, from age 14 to 18). The lower secondary school, also known as middle school, is compulsory for all students with a more subject-oriented curriculum where students are taught by subject specialists. At the end of the third year of lower secondary school, pupils have to pass a final exam to access higher secondary school. The first two years of higher secondary school are compulsory, while the other three years are voluntary. There are three types of higher secondary school: lyceum, technical college, and vocational college. Students are free to choose what type of higher secondary school to attend. Lyceum, technical and vocational colleges have the same duration (5 years), but vary greatly in curriculum, program complexity and prestige.

The quality assurance process at primary and secondary level is implemented by the National Institute for the Evaluation of the Educational System (INVALSI), a government agency placed under the control of the Ministry of Education, which every year carries out a testing of student attainment through national standardized tests in literacy and numeracy. The evaluation covers the entire population of students attending the 2nd and 5th grade (primary school), the 8th grade (lower secondary school), as well as the 10th and 13th graders (in upper secondary school).[16] The INVALSI also submits questionnaires to students in order to investigate other elements useful for the evaluation of the system.

In this study, to investigate the impact of non-cognitive skills on school performance and to handle reverse causality problems, we exploit a recent feature of the data provided by INVALSI, which allows us to follow the same cohort of students within the educational path. We focus on a cohort of primary school

[15] The allocation of students in classes in primary and lower secondary schools is decided following a mix of rules and discretion established by the Law no.81 of 20 March 2009 (Decreto de Presidente della Repubblica 81/2009). The Italian law stipulates that primary school classes cannot be composed by less than 15 and more than 27 students, with the exception of schools in mountain areas and small islands where the minimum number if pupils is retained at 10. The lower secondary school classes are subject to a minimum size of 18 and a maximum of 28 students, with the exception of school in highlands and small islands where the minimum number of pupils was retained at 10.

[16] All Italian students attending the last year of upper secondary school (grade 13) take the INVALSI standardized tests starting in the school year 2018/19.

students who in 2013/14 school year were in the 5th grade and for whom there are also available data on INVALSI test scores and teachers' marks obtained 3 and 5 years later in the school years 2016/2017 and 2018/19 when they were attending the lower and upper secondary school.[17] For these students we have detailed information about their non-cognitive and cognitive skills, as measured at the end of the 5th grade, and information on their cognitive skills as measured after 3 and 5 years (at the end of the 8th and 10th grade). In fact, 5th-graders, on the same day of one of the two standardized tests, are also required to complete a survey asking them a number of questions that allow us to build some of indicators of their non-cognitive skills.

More precisely, thanks to the data collected by INVALSI through the Student Questionnaire in 2013/14 school year that we have at hand, we are able to consider in our analysis the effects of intrinsic-extrinsic motivation, self-efficacy, and social isolation. Our measure of student's motivation is based on the Academic Motivation Scale, an 18-item self-reported instrument which has been included in the Student Questionnaire INVALSI.[18] The scale allowing us to measure students' intrinsic and extrinsic motivation,[19] included two questions about why students do their school's work: 1) "Why do you try to do well in school?", and 2) "Why do you do your homework?". Each question is followed by several responses that represent the four regulatory styles considered in the scale: external regulation (5 items),[20] introjected regulation (5 items),[21] identified regulation (4 items),[22] and intrinsic motivation (4 items).[23] The responses to each item are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true). First, we calculate the subscale score for each of the four subscales by averaging the items that make up that subscale. Very true is scored 4; sort of true is scored 3; not very true is scored 2; and not at all true is scored 1. A high score in the subscale will indicate a high level of endorsement of that regulatory style. Then, using the individual subscale scores, we construct

[17] In the 2016/17 school year, the INVALSI literacy and numeracy tests were proposed to eighth graders in June 2017, while in the 2013/14 fifth graders took the INVALSI tests in May 2014.
[18] Validation of this scale in an Italian sample is presented in Alivernini et al. (2008, 2017). The original format of the scale (32 items) was developed for students in late elementary and middle school by Ryan and Connell (1989).
[19] The types of motivation with their regulatory styles are presented in Figure A1.1 in the Appendix 1.
[20] The subscale reflecting *external regulation* consists of five items: 1) "I try to do well in school because that's what I'm supposed to do"; 2) "I try to do well in school because I will get in trouble if I don't do well"; 3) "I try to do well in school because I might get a reward if I do well"; 4) " I do my homework because I'll get in trouble if I don't"; 5) "I do my homework because that's what I'm supposed to do".
[21] To assess students' *introjected regulation* was administered a set of five items: 1) "I try to do well in school because the teacher will think that I'm a good student if I do it do well"; 2) "I try to do well in school because I'll feel really bad about myself if I don't do well"; 3) "I try to do well in school because I will feel really proud of myself if I do well; 4) "I do my homework because I want the teacher to think I'm a good student"; 5) "I do my homework because I will feel bad about myself if I don't do it".
[22] The *identified regulation* subscale consists of four items 1) "I try to do well in school because it's important to me to understand better new things"; 2) "I try to do well in school because it's important to me to try to do well in school"; 3) "I do my homework because I want to understand the subject"; 4) "I do my homework because it's important to me to do my homework".
[23] The items associated with the *intrinsic motivation* are: 1) "I try to do well in school because I enjoy doing my schoolwork well"; 2) "I try to do well in school because it's fun"; 3) "I do my homework because it's fun; 4) "I do my homework because I enjoy doing my homework".

the *Motivation* measure as proxied by the *Relative Autonomy Index* (RAI) proposed by Ryan and Deci (2000), which is a single score obtained by applying a weighting to each subscale and then summing the weighted scores. To form the RAI, the external subscale is weighted -2, the introjected subscale is weighted -1, the identified subscale is weighted +1, and the intrinsic subscale is weighted +2. In this way the final measure of *Motivation* allows us to have an indicator of a student's overall motivational orientation with higher positive scores representing more intrinsic regulation and negative scores representing more extrinsic regulation.

To measure self-efficacy, we consider a set of four questions that are derived from the Perceived Efficacy Scale for Self-Regulated Learning (Bandura, 1990), validated on Italian samples (Bandura et al., 1996).[24] Answers were given on a 4-point Likert-type scale, where 1 corresponds to "not able to do it at all" and 4 corresponds to "able to do it at all". Each student's self-efficacy score is calculated as the average of their responses. A higher score of a *Self-Efficacy* measure represents a higher level of perceived self-efficacy for self-regulated learning, which helps a student use their own resources to plan, control and analyze the execution of tasks, activities and the preparation of learning products. Students with high self-efficacy use more cognitive strategies that are useful when it comes to learning, organizing their time and regulating their own efforts; students that demonstrate a weak sense of self-efficacy may avoid certain tasks and have difficulty in paying attention, planning and persistence on learning activities.

Finally, we consider a 5-item Student's Social Isolation within Classroom (SIWC) scale.[25] For each item students evaluate the number of their classmates with whom they have a social relationship on a scale consisting of five possible answers ("none", "few", "some", "many" or "all") coded with values ranging from 1 to 5. After reverse coding, we calculated each student's mean response across these five items. Social isolation within the classroom scores, were then calculated as their mean response across items presented in the scale. In this way the lowest possible score indicates social contacts between the respondent and the whole class, while the highest possible score indicates the absence of any social contacts.

The student-level Pearson correlations among the full set of measures of non-cognitive abilities and social isolation are presented in Table 1.2. Given that intrinsic regulation, identified regulation, and self-efficacy are closely related constructs (see, for example, Gist and Mitchell, 1992), it is unsurprising that they are highly interrelated, with correlations ranging from .41 to .46. Social isolation, with the exception of external regulation, is negatively and significantly correlated with each of these non-cognitive qualities, ranging from -.20 (self-efficacy) to -.11 (introjected regulation).

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[24] This is the list of questions: "1) How well can you finish your homework in time?; 2) How well can you study when there are other interesting things to do?; 3) How well can you focus on your schoolwork a without distraction?; 4) How well can you remember information presented in class?".

[25] The scale found to be reliable in Alivernini and Manganelli (2016) and Cavicchiolo et al. (2019). This is the list of questions: "1) How many of your classmates do you "have chat" with?; 2) How many of your classmates speak with you?; 3) How many of your classmates do you get on well with? 4) How many of your classmates would you help if they were in some kind of trouble?; 5) How many of your classmates do you consider as your "friends?".

Table 1.2. Correlation Matrix of Non-Cognitive Skills and Social Isolation

	Motivation	*Self-Efficacy*	*Social Isolation*	*External Regulation*	*Introjected Regulation*	*Identified Regulation*	*Intrinsic Regulation*
Motivation	1.000						
Self-Efficacy	0.268***	1.000					
Social Isolation	-0.117***	-0.203***	1.000				
External Regulation	-0.693***	0.047***	0.020***	1.000			
Introjected Regulation	-0.211***	0.289***	-0.114***	0.386***	1.000		
Identified Regulation	0.411***	0.408***	-0.179***	0.016***	0.341***	1.000	
Intrinsic Regulation	0.669***	0.436***	-0.149***	0.005**	0.330***	0.462***	1.000

Note: Sample restricted to students with complete data on each non-cognitive indicator (total N = 377689, 183887 boys and 193802 girls). $^{+}p< 0.10$, $^{*}p< 0.05$, $^{**}p< 0.01$, $^{***}p< 0.001$.

As regards students' cognitive skills, the INVALSI standardized tests aim at assessing students' proficiency in reading comprehension and mathematics. Both tests are written, the type of tasks that students have to complete includes multiple-choice and open-ended questions with a correction grid. For the 5th and 8th grade students we observe both the percentage of correct answers (*Literacy Score* and *Numeracy Score*) and the scores computed by applying the IRT Rasch model in order to account for different difficulties of single items (*Rasch Literacy Score* and *Rasch Numeracy Score*; these scores are standardized to a have a mean of 200 and a standard deviation of 40). Concerning students' standardized test scores achieved in the 10th grade, we have only information on their Rasch test score results in literacy and numeracy. [26] In addition, we observe marks assigned by math and Italian language teachers (*Teacher Mark Literacy* and *Teacher Mark Numeracy*). Marks assigned by teachers range from 0 to 10, where 6 is a passing grade.[27] Differently from INVALSI tests, that are identical across Italian schools and are given in the same manner to all test takers, marks assigned by teachers are based on a standard that each teacher autonomously sets. Whereas the INVALSI test scores are comparable across schools and students, this is not the case for teachers' marks. The INVALSI tests are graded in the same manner for everyone, while teachers' marks are non-blind marks and might be affected by the student behavior, class size, and class composition.

The dataset INVALSI provides information on a number of children and parents characteristics (gender, immigration status, attendance of pre-primary school, parents' education and working status, a comprehensive indicator of students' socio-economic status (*ESCS Index*))[28], on whether the student is

[26] As regards standardized test score results taken in the 10th grade (in the school year 2018/19), the data provided by the Institute INVALSI does not include information on the fraction of correct answers.
[27] Data collected by INVALSI allows the distinction between written marks and oral marks assigned by math and Italian language teachers at the end of the fall semester. Due to the large percentage of missing values in written teacher-assigned marks (80.66% and 80.71% for literacy and numeracy, respectively), we only consider oral marks in our analysis.
[28] ESCS is an index for the Economic, Social and Cultural Status of the student family. The *ESCS Index* is computed by INVALSI following an OECD's standard taking into account parents' occupations and education, along with variables

younger or older than a regular student (we build a dummy variable for students who went to school one year before the suggested age, *Early Enrolled*, and a dummy variable for students who entered the school one year after or repeated one or more years, *Late Enrolled)* and on whether he or she follows a full or part-time schedule (we build a dummy variable *Full time* for those students whose schedule is organized in entire days instead that only in the morning).

As regards school organization, we know the number of students enrolled in each class at the beginning of the school year, *Class Size*, and we also calculated the share of females in each class, *Share Females*. In addition, we also have information on the region and province in which the school is located.

Initially, we limit our analytical sample to students who participated in the 2013/14 and 2016/17 waves and who completed the Student Questionnaire ending up with a sample of 418,331 pupils. After list wise deletion of missing data, data from 377,689 school-aged children (183,887 boys and 193,802 girls) were accepted for analysis. Then, to investigate the effects of non-cognitive skills on educational outcomes obtained in upper secondary school (in the 10th grade), we keep in our sample only those students for whom we observe the INVALSI test scores obtained 5 years later, in the school year 2018/19.[29]

Descriptive statistics for the large census-based cohort of pupils followed for 3 years, starting in the school year 2013/14 when students attended the last year of primary school (grade 5) are reported in Panel (a) of Table 1.3, while in Panel (b) are reported descriptive statistics for students followed for 5 years.

Table 1.4 presents the descriptive statistics of students' intrinsic and extrinsic academic motivation with their regulatory styles, self-efficacy, and social isolation among classmates, broken down by gender and by the socio-economic background.[30] As it can be seen from the table, with respect to male students, female students are more intrinsically regulated and have higher scores on scales measuring their academic motivation and regulatory self-efficacy but lower on social isolation. Descriptive statistics also suggest that students from less well-off families are more socially isolated among classmates and have lower scores of motivation and self-efficacy, with respect to students who come from more advantaged backgrounds. The non-cognitive skills density distributions in the pooled sample and in the split samples are also presented graphically in Figures A1.2 and A1.3 (presented in the Appendix 1). Using a set of nonparametric Wilcoxon rank-sum tests, the null hypothesis that the scales measuring academic motivation, self-efficacy, and social isolation are equal in distribution between the samples of boys and girls is rejected for all the domains (p-

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that measure home possession goods (see Campodifiori et al., 2010 for details).

[29] We apply a sample restriction criterion to ensure that all measures of cognitive and non-cognitive abilities are based on the same set of individuals. First, we include only 5th-grade students who took INVALSI test in 2013/14 and completed all three scales measuring student's intrinsic/extrinsic academic motivation, self-efficacy, and social isolation. Second, we include only students for whom we observe INVALSI test score results obtained 3 years later, in the school year 2016/17. Third, we keep in our sample only those students for whom we have information on the INVALSI test scores obtained in 2018/19 school year.

[30] We split the sample by *ESCS Index* above/below median within schools.

value = .000). The Wilcoxon test gives also evidence against the null hypothesis of identical distributions for motivation, self-efficacy, and isolation between the samples of students from more and less well-off families.

Table 1.3. Sample Descriptive Statistics

	Panel (a) Whole sample in the school year 2016/17 Grade 8			Panel (b) Whole sample in the school year 2018/19 Grade 10		
	Mean	SD	Obs	Mean	SD	Obs
Outcome Measures:						
Literacy Score	69.013	16.138	377,689			
Numeracy Score	57.604	19.552	377,689			
Rasch Literacy Score	208.482	39.137	377,689	208.035	38.177	301,232
Rasch Numeracy Score	207.700	39.616	377,689	208.022	39.135	301,232
Teacher Mark Literacy	7.150	1.170	317,205	6.559	1.067	274,549
Teacher Mark Numeracy	6.975	1.375	315,955	6.235	1.405	272,009
Non-Cognitive Skills' Measures:						
Motivation in 5th Grade	1.041	2.356	377,689	1.111	2.374	301,232
Self-Efficacy in 5th Grade	3.131	0.529	377,689	3.148	0.519	301,232
Social Isolation in 5th Grade	1.919	0.671	377,689	1.901	0.661	301,232
External Regulation in 5th Grade	2.493	0.701	377,689	2.471	0.705	301,232
Introjected Regulation in 5th Grade	2.964	0.639	377,689	2.967	0.639	301,232
Identified Regulation in 5th Grade	3.597	0.483	377,689	3.607	0.475	301,232
Intrinsic Regulation in 5th Grade	2.697	0.785	377,689	2.707	0.783	301,232
Students' characteristics:						
Female	0.513	0.500	377,689	0.527	0.499	301,232
ESCS Index	0.124	0.984	377,419	0.125	0.977	291,423
Age	13.927	0.328	377,607	15.917	0.321	301,232
Pre-Primary School	0.854	0.331	377,689	0.858	0.328	301,232
Father's years of study	11.577	3.548	310,389	12.627	3.698	261,120
Mother's years of study	12.150	3.534	315,113	13.200	3.641	268,820
Immigrant	0.068	0.252	370,487	0.073	0.259	286,847
Early Enrolled	0.013	0.115	377,689	0.014	0.119	301,232
Late Enrolled	0.017	0.128	377,689	0.011	0.106	301,232
Southern Regions	0.377	0.485	377,689	0.383	0.486	301,232
***Schools' characteristics**:*						
Full time	0.125	0.331	377,689	0.047	0.212	301,232
Class Size	21.853	3.777	377,689	20.799	4.618	301,232
Share Females	0.463	0.108	377,689	0.509	0.277	301,232
Students' Cognitive Skills (measured in the 5th Grade):						
Literacy Score in 5th Grade	67.082	16.605	377,689	71.249	15.157	301,232
Rasch Literacy Score in 5th Grade	214.052	40.378	377,689	213.622	37.930	301,232
Numeracy Score in 5th Grade	69.087	16.589	377,689	59.937	19.064	301,232
Rasch Numeracy Score in 5th Grade	216.540	43.764	377,689	212.281	39.122	301,232

Notes: As regards standardized test score results taken in the 10th grade (in the school year 2018/19), the data INVALSI that we have at hand does not include information on the fraction of correct answers in the Literacy and Numeracy tests.
Source: Author's calculations based on data from INVALSI (waves 2013/14, 16/17, and 18/19).

Table 1.4. Descriptive Statistics of Non-cognitive Skills and Social Isolation: by Gender and Socio-Economic Status

	Panel (a): Cohort of primary students followed for three years								**Panel (b)**: Cohort of primary students followed for five years							
By gender:	**Boys N = 183887**				**Girls N = 193802**				**Boys N = 142387**				**Girls N = 158845**			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Motivation	0.583	2.313	-8.75	9	1.477	2.314	-7.95	9	0.638	2.337	-7.80	9	1.535	2.326	-7.95	9
Self-Efficacy	3.101	0.541	1	4	3.159	0.517	1	4	3.121	0.529	1	4	3.172	0.509	1	4
Social Isolation	1.962	0.678	1	5	1.879	0.663	1	5	1.948	0.669	1	5	1.859	0.650	1	5
External Regulation	2.582	0.681	1	4	2.409	0.710	1	4	2.564	0.686	1	4	2.387	0.712	1	4
Introjected Regulation	2.925	0.649	1	4	3.000	0.627	1	4	2.930	0.649	1	4	3.000	0.628	1	4
Identified Regulation	3.535	0.523	1	4	3.655	0.434	1	4	3.548	0.514	1	4	3.661	0.430	1	4
Intrinsic Regulation	2.568	0.806	1	4	2.820	0.745	1	4	2.575	0.805	1	4	2.825	0.743	1	4
By socio-economic status:	**High SES N = 186686**				**Low SES N = 191003**				**High SES N = 155550**				**Low SES N = 145682**			
Motivation	1.137	2.399	-8.75	9	0.942	2.307	-7.80	9	1.086	2.393	-7.95	9	1.138	2.353	-7.80	9
Self-Efficacy	3.167	0.515	1	4	3.094	0.542	1	4	3.150	0.519	1	4	3.146	0.519	1	4
Social Isolation	1.874	0.649	1	5	1.966	0.691	1	5	1.885	0.652	1	5	1.919	0.669	1	5
External Regulation	2.462	0.711	1	4	2.525	0.690	1	4	2.463	0.706	1	4	2.480	0.704	1	4
Introjected Regulation	2.971	0.640	1	4	2.956	0.638	1	4	2.965	0.640	1	4	2.970	0.638	1	4
Identified Regulation	3.611	0.475	1	4	3.583	0.492	1	4	3.600	0.481	1	4	3.616	0.469	1	4
Intrinsic Regulation	2.711	0.786	1	4	2.683	0.785	1	4	2.688	0.787	1	4	2.726	0.778	1	4

Source: Author's calculations based on data from INVALSI (waves 2013/14, 16/17, and 18/19)

1.4. The Empirical Strategy

The objective of the present study is to investigate whether pupils' non-cognitive skills in primary school affect their educational outcomes. In order to estimate the impact of non-cognitive skills on school performance and to minimise a reverse causality problem,[31] we exploit a recent feature of the Italian national assessment program run by INVALSI (since the school year 2009/10) that allows us to follow the same cohort of all Italian school-age children within their educational path. We focus on a cohort of pupils who in 2013/14 school year were attending the 5th grade (the last year of primary school). This cohort of students is specifically appropriate for our analysis for a number of reasons. First, thanks to the mandatory INVALSI assessment program conducted in May 2014, for these students we have information on their cognitive and non-cognitive abilities as measured at the end of the 5th grade. Second, for these students we are also able to observe their cognitive abilities as measured at the end of the 8th and 10th grades, as proxied by standardized test score results in literacy and numeracy obtained three and five years later (this is not possible for other cohorts of students as the panel dimension was introduced in the INVALSI dataset only recently).

Thus, focusing on the cohort of Italian primary school students who in 2013/14 school year were in the 5th grade, we are able to investigate how test scores and teachers' marks in literacy and numeracy achieved in lower and upper secondary school are affected by pupils' motivation, self-efficacy, and social interactions among classmates as measured when attending primary school. Using information on non-cognitive skills collected well before educational outcomes allows us to control for reverse causality problem. Similar strategy has been adopted by Heckman et al. (2006), who use locus of control and self-esteem measurements in the National Longitudinal Survey of Youth (NLSY) taken at age 14-22 to explain later outcomes.

In addition, thanks to the census data provided by INVALSI, we are able to control not only for a rich set of demographic and family background characteristics, class size and a number of school characteristics, but also for pupils' ex-ante cognitive skills (standardised test scores obtained in the 5th grade).

We investigate whether non-cognitive skills measured when students attending the primary school (grade 5) affect their performance in literacy and numeracy in lower secondary school (grade 8) and upper secondary school (10 grade), controlling for their ex-ante cognitive skills as proxied by test scores achieved early. We model cognitive ability $Y_{ij(t+n)}$ of student i in class j in year $t+n$ (where n is the number of years that the student i is followed within educational path) in Equation 1.

[31] The problem of reverse causality has been discussed and analyzed in studies conducted by Borghans et al. (2008), Hansen et al. (2004), Heckman and Kautz (2012), Piatek and Pinger (2016).

$$Y_{ij(t+n)} = \alpha + \beta_1 Motivation_{ijt} + \beta_2 Self\text{-}Efficacy_{ijt} + \beta_3 Social\ Isolation_{ijt} + \\ + \beta_4 Cognitive\ Ability_{ijt} + \gamma X_{ij} + \delta_k + \varepsilon_{ij} \quad (1)$$

Where in Equation (1) $Y_{ij(t+n)}$ is the outcome variable of interest at time *t+n* (alternatively the 8th or the 10th grade *Test Score*, *Rasch Test Score* or *Teacher Mark* of student *i* in class *j* in literacy and numeracy in the school year 2016/17 or 2018/19); $Motivation_{ijt}$ is the self-reported measure of academic motivation of student *i* in class *j* at time *t* (grade 5, in the school year 2013/14), as proxied by the *Relative Autonomy Index*; $Self\text{-}Efficacy_{ijt}$ is the self-reported measure of self-efficacy of student *i* in class *j* toward learning at time *t* (grade 5, in the school year 2013/14); $Social\ Isolation_{ijt}$ is the self-reported measure of social contacts between the student *i* and his/her classmates in class *j* at time *t* when attending the last year of primary school (grade 5, in the school year 2013/14); $Cognitive\ Ability_{ijt}$ is the ex-ante measure of cognitive skills of student *i* enrolled in class *j* at time *t* as proxied by the INVALSI test score results in literacy or numeracy obtained in the school year 2013/14; X_{ij} is a vector of individual and school characteristics (including gender, *ESCS Index*, immigrant status, pre-primary school attendance, *Early Enrolled*, *Late Enrolled*, *Full Time*, *Class Size, Share Females*); δ_k are primary school fixed effects and ε_{ij} is a random error term. We include primary school fixed effects since secondary school is a choice that could itself depend on student's non-cognitive skills, and, as a result, secondary school fixed effects could be a bad control (an outcome of the treatment of interest).

All specifications are run separately for literacy and numeracy student outcomes. The choice of control variables is motivated by the literature related to children's human capital production function (see Cunha and Heckman, 2007; Harris and Sass, 2011; Todd and Wolpin, 2003, 2007). We estimate ordinary least squares (OLS) regressions with primary school fixed effects and report the results in the next section. Table A1.1 (presented in the Appendix 1) provides a list of variables considered in the empirical analysis.

1.5. The Impact of Pupils' Non-Cognitive Skills and Social Isolation on School Performance

In this section, we analyze the role of non-cognitive skills on school performance. Initially we present OLS estimates of the impact of motivation (as proxied by the *Relative Autonomy Index*), self-efficacy, and social isolation on standardized test scores and teachers' marks obtained in the 8th grade (last year of lower secondary school), and then we focus our attention on standardized test scores and marks obtained in the 10th grade (the 2nd year of upper secondary school). About inference, standard errors are robust to heteroskedasticity and are

allowed for clustering at the class level. In all specifications, we control for primary school fixed effects.[32] To facilitate reading of results, all measures of cognitive as well as non-cognitive skills and social isolation are standardized to have a zero mean and a standard deviation equal to one.

1.5.1. The Impact of Pupils' Primary-School Non-Cognitive Skills and Social Isolation on Eight-Grade Test Scores and Teachers' Evaluations

We begin our analysis using students' performance in standardized test scores as outcome variable. Initially we focus on student performance in literacy test and then we turn our attention to their performance in numeracy.

In Table 1.5 we report OLS estimates when considering as dependent variable student performance in literacy test in the 8th grade. In the first four specifications of Table 1.5 our dependent variable is the fraction of correct answers in the literacy test, *Literacy Score,* while in regressions reported in columns (5-8) we consider as dependent variable the *Rasch Literacy Score*. Column (1) reports the estimated effects from a baseline regression without controls. The subsequent columns present the results from the estimation of specifications in which we cumulatively add the following controls: (2) literacy test score observed in the 5th grade; (3) class size and share of girls; (4) individual and family background characteristics (including gender, *ESCS Index*, immigrant status, pre-primary school attendance, *Early Enrolled*, *Late Enrolled*, *Full Time*). In our discussion, we will focus on the OLS estimation results from specification (4), as this is our preferred specification.

We find that motivation and self-efficacy exhibit positive and statistically significant coefficients. Specifically, estimates reported in column (4) in Table 1.5 show that one standard deviation increase in academic motivation is associated with an increase of 3 percent of a standard deviation in literacy test score, while one standard deviation increase in self-efficacy raises 2.3 percent of a standard deviation literacy performance. Social isolation exhibits negative and statistically significant impact on literacy test score; the size of this coefficient implies that one standard deviation decrease in the social isolation within classroom score is associated with an increase of 3.2 percent of a standard deviation in literacy test score. Similar results are found in specifications where we consider as outcome variable the Rasch literacy score, which also takes into account the different degree of difficulty of questions.

The effects of control variables are consistent with the findings presented in the existing literature. Females tend to perform better in literacy than males. Student with a better socio-economic background obtain higher test results compared to students who are from more disadvantaged families. Late enrolled students

[32] The results reported in Section 1.5 remain qualitatively equivalent when we include primary classroom fixed effects instead of primary school fixed effects.

obtain worse test results. In addition, students with Italian parents perform better than students whose parents were born abroad.

Table 1.5. The Impact of Students' Motivation, Self-efficacy, and Social Isolation on Performance in Literacy Test in Grade 8

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Literacy Score in 8th Grade*				Dependent variable: *Rasch Literacy Score in 8th Grade*			
Motivation in 5th Grade	0.109***	0.048***	0.046***	0.030***	0.118***	0.056***	0.054***	0.038***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Self-efficacy in 5th Grade	0.046***	0.029***	0.029***	0.023***	0.051***	0.034***	0.034***	0.028***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Social Isolation in 5th Grade	-0.108***	-0.042***	-0.042***	-0.032***	-0.100***	-0.038***	-0.037***	-0.027***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Literacy Score in 5th Grade		0.617***	0.615***	0.578***				
		(0.002)	(0.002)	(0.002)				
Rasch Literacy Score in 5th Grade						0.609***	0.607***	0.569***
						(0.002)	(0.002)	(0.002)
Class Size			0.010***	0.008***			0.010***	0.008***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.335***	0.127***			0.340***	0.132***
			(0.021)	(0.021)			(0.022)	(0.022)
Female				0.205***				0.204***
				(0.003)				(0.003)
Pre-Primary School				0.013**				0.012*
				(0.006)				(0.007)
Early Enrolled				0.085***				0.092***
				(0.012)				(0.013)
Late Enrolled				-0.176***				-0.157***
				(0.012)				(0.011)
Full time				0.048***				0.049***
				(0.008)				(0.008)
ESCS Index				0.126***				0.130***
				(0.002)				(0.002)
Immigrant				-0.109***				-0.105***
				(0.006)				(0.005)
Observations	377689	377689	377689	370228	377689	377689	377689	370228
Adjusted R^2	0.101	0.415	0.417	0.440	0.103	0.401	0.403	0.426

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Literacy test score results and self-reported measures of non-cognitive skills and social isolation are standardized to have mean zero and unit variance in the study sample. See Table A1 in Appendix 1 for the full variables' description. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

In Table 1.6 we report results obtained when considering as dependent variable students' performance in numeracy standardized test obtained in lower secondary school (grade 8). Similarly to Table 1.5, in specifications (1-4) we consider as outcome variable the number of correct answers in numeracy test – *Numeracy Score*, while specifications (5-8) consider the *Rasch Numeracy Score*.

Table 1.6. The Impact of Students' Motivation, Self-efficacy, and Social Isolation on Performance in Numeracy Test in Grade 8

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Numeracy Score in 8th Grade*				Dependent variable: *Rasch Numeracy Score in 8th Grade*			
Motivation in 5th Grade	0.064***	0.025***	0.025***	0.034***	0.067***	0.027***	0.027***	0.037***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Self-efficacy in 5th Grade	0.034***	0.018***	0.018***	0.011***	0.037***	0.018***	0.018***	0.011***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Social Isolation in 5th Grade	-0.058***	-0.012***	-0.012***	-0.006***	-0.053***	-0.012***	-0.012***	-0.006***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Numeracy Score in 5th Grade		0.620***	0.619***	0.588***				
		(0.002)	(0.002)	(0.002)				
Rasch Numeracy Score in 5th Grade						0.618***	0.616***	0.583***
						(0.002)	(0.002)	(0.003)
Class Size			0.008***	0.006***			0.009***	0.006***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			-0.022	0.054**			-0.010	0.070***
			(0.024)	(0.024)			(0.024)	(0.024)
Female				-0.097***				-0.103***
				(0.003)				(0.003)
Pre-Primary School				0.022***				0.025***
				(0.007)				(0.007)
Early Enrolled				0.119***				0.122***
				(0.012)				(0.013)
Late Enrolled				-0.151***				-0.157***
				(0.011)				(0.011)
Full time				0.074***				0.072***
				(0.008)				(0.008)
ESCS Index				0.124***				0.131***
				(0.002)				(0.002)
Immigrant				-0.089***				-0.095***
				(0.005)				(0.005)
Observations	377689	377689	377689	370228	377689	377689	377689	370228
Adjusted R^2	0.102	0.410	0.410	0.427	0.099	0.388	0.388	0.406

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Numeracy test score results and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

It can be seen from Table 1.6 that in our sample of 370,228 pupils, across all specifications, measures of academic motivation, self-efficacy, and social isolation exhibit statistically significant coefficients at the 1% level. In specification (4), where all control variables are included in the estimation at the same time, regression results show that one standard deviation increase in *Motivation* is associated with an increase of 3.4 percent of a standard deviation in *Numeracy Score* and a one standard deviation increase in *Self-Efficacy* raises 1.1 percent of a standard deviation *Numeracy Score*. As regards the impact of social isolation among classmates in primary school on numeracy standardized test scores achieved in the middle school, estimates

indicate that a one standard deviation increase in *Social Isolation* score is associated with a reduction of 0.6 percent of a standard deviation in *Numeracy Score.*

Results reported in Tables 1.5 and 1.6 show that students' academic motivation, self-efficacy and isolation among classmates (measured in the 5th grade) have a statistically significant impact on their standardized test score results in literacy and numeracy (obtained in the 8th grade). Our findings suggest that higher scores on academic motivation (that means having more intrinsic regulation) and self-efficacy positively affect literacy and numeracy test scores, while social isolation negatively affects school performance. The estimated effect of *Social Isolation* – presented in Table 1.5 – appear to be more intensive with respect to those presented in Table 1.6. Our findings are consistent with previous literature from psychology. For example, Vallejo and Marón (2020) discuss findings from various studies and inform that social isolation causes discomfort that leads to a decrease in academic performance and particularly in reading comprehension. Our results also suggest that *Self-Efficacy* has a stronger positive impact on literacy score, with respect to numeracy one. According to specifications where we include a full set of controls, the estimated effect of *Motivation* - presented in Table 1.5 - remain qualitatively unchanged with respect to those presented in Table 1.6.

In Table 1.7 we replicate the same specifications that we have estimated in the previous analysis but considering as outcome variables the marks assigned by teachers in literacy (columns 1-4) and numeracy (columns 5-8), respectively. In particular, the findings suggest that a one standard deviation increase in *Motivation* is associated with an increase of 6.2 (6.6) percent of a standard deviation in *Teacher Mark Literacy* (Numeracy); one standard deviation increase in *Self-Efficacy* score is associated with an increase of 7.7(6.8) percent of a standard deviation in *Teacher Mark Literacy* (*Numeracy*); one standard deviation increase in social isolation is associated with a decrease of 1.2 (0.4) percent of a standard deviation in Literacy(Numeracy) mark. These regression results suggest that, with respect to standardized test scores, marks assigned by math and Italian language teachers appear to be more affected by students' self-efficacy and academic motivation.

From Tables presented in Section 1.5.1, we see that higher positive levels of academic motivation (as proxied by the *Relative Autonomy Index*) that represent more intrinsic (or autonomous) self-regulation and higher levels of self-efficacy positively affect student educational outcomes obtained in middle school, while higher scores on student's social isolation among classmates negatively affect school performance. Estimated coefficients on motivation, self-efficacy, and social isolation scores are substantially robust to the inclusion of the control variables, primary school or classroom fixed effects, to alternative measures of student performance in literacy and numeracy.

Table 1.7. The Impact of Students' Motivation, Self-efficacy, and Social Isolation on Marks Assigned by Teachers in Grade 8

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Teacher Mark Literacy in 8th Grade*				Dependent variable: *Teacher Mark Numeracy in 8th Grade*			
Motivation in 5th Grade	0.144***	0.094***	0.093***	0.062***	0.119***	0.088***	0.087***	0.066***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Self-efficacy in 5th Grade	0.100***	0.086***	0.085***	0.077***	0.090***	0.077***	0.077***	0.068***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Social Isolation in 5th Grade	-0.080***	-0.026***	-0.026***	-0.012***	-0.057***	-0.019***	-0.019***	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Literacy Score in 5th Grade		0.508***	0.506***	0.458***				
		(0.002)	(0.002)	(0.002)				
Numeracy Score in 5th Grade						0.500***	0.500***	0.476***
						(0.002)	(0.002)	(0.002)
Class Size			0.009***	0.007***			0.006***	0.003***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.223***	-0.124***			0.228***	0.004
			(0.025)	(0.025)			(0.024)	(0.024)
Female				0.347***				0.211***
				(0.003)				(0.003)
Pre-Primary School				0.006				0.020***
				(0.007)				(0.007)
Early Enrolled				0.098***				0.135***
				(0.013)				(0.013)
Late Enrolled				-0.052***				-0.104***
				(0.013)				(0.013)
Full time				0.049***				0.026***
				(0.010)				(0.009)
ESCS Index				0.174***				0.170***
				(0.002)				(0.002)
Immigrant				-0.124***				-0.141***
				(0.006)				(0.007)
Observations	317205	317205	317205	311416	315955	315955	315955	310189
Adjusted R^2	0.118	0.331	0.333	0.383	0.088	0.289	0.289	0.325

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Marks assigned by math and Italian language teachers and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

1.5.2. The Impact of Pupils' Primary-School Non-Cognitive Skills and Social Isolation on Tenth-Grade Test Scores and Teachers' Evaluations

In this section, we analyze the role of pupils' non-cognitive skills and social isolation among classmates, as measured in the last year of primary school (in grade 5, at age 10-11), on their performance in upper secondary school (in grade 10, at age 15-16), at the stage before tertiary education. The results from the estimation of the effects of motivation, self-efficacy, and social isolation on educational outcomes by subject are presented

in Tables 1.8 and 1.9.

Table 1.8 reports the estimation results of an OLS model with primary school fixed effects in which we consider as dependent variable Rasch test score in literacy (columns 1-4) and numeracy (columns 5-8).

Table 1.8. The Impact of Students' Motivation, Self-efficacy, and Social Isolation on Performance in Literacy and Numeracy Tests achieved in High School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Rasch Literacy Score in 10th Grade*				Dependent variable: *Rasch Numeracy Score in 10th Grade*			
Motivation in 5th Grade	0.125***	0.066***	0.055***	0.051***	0.070***	0.036***	0.047***	0.052***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Self-efficacy in 5th Grade	0.037***	0.026***	0.023***	0.020***	0.040***	0.025***	0.024***	0.020***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Social Isolation in 5th Grade	-0.047***	0.002	0.007***	0.016***	-0.021***	0.009***	0.008***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Rasch Literacy Score in 5th Grade		0.556***	0.536***	0.507***				
		(0.002)	(0.002)	(0.002)				
Rasch Numeracy Score in 5th Grade						0.545***	0.522***	0.492***
						(0.002)	(0.002)	(0.002)
Class Size			0.021***	0.017***			0.024***	0.021***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.303***	0.217***			-0.415***	-0.377***
			(0.009)	(0.009)			(0.010)	(0.010)
Female				0.082***				-0.070***
				(0.004)				(0.004)
Pre-Primary School				0.019***				0.026***
				(0.006)				(0.006)
Early Enrolled				0.113***				0.163***
				(0.013)				(0.014)
Late Enrolled				-0.116***				-0.132***
				(0.015)				(0.015)
Full time				-0.131***				-0.166***
				(0.013)				(0.013)
ESCS Index				0.107***				0.111***
				(0.002)				(0.002)
Immigrant				-0.120***				-0.123***
				(0.006)				(0.006)
Observations	301232	301232	301232	285286	301232	301232	301232	285286
Adjusted R^2	0.107	0.357	0.372	0.387	0.142	0.367	0.389	0.408

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Test scores and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

It can be seen from Table 1.8 that, across all specifications, *Motivation* and *Self-efficacy* exhibit positive and statistically significant coefficients. Our results indicate that a one standard deviation increase in motivation is associated with an increase of 5.1 (5.2) percent of a standard deviation in Rasch literacy (numeracy) score and a one standard deviation increase in self-efficacy raises 2 percent of a standard deviation

in literacy and numeracy Rasch score. These results are consistent with those reported from OLS estimation in Section 1.5.1. As regards the impact of social isolation on standardized test scores achieved in the 10th grade, our baseline regression results without controls (see columns 1 and 5 in the table) indicate that isolation among classmates in primary school (in grade 5) has a statistically significant negative impact (at the 1% level) on literacy and numeracy test scores obtained in upper secondary school (in grade 10). However, the effect is not robust to the inclusion of the control variables.

We then look at the relationship between pupils' motivation, self-efficacy, and social isolation in late childhood and their later educational outcomes by considering as measures of school performance both the *Teacher Mark Literacy* and *Teacher Mark Numeracy*.

In Table 1.9 we replicate the same specifications that we have estimated in the previous analysis but considering as outcome variables the marks assigned by teachers in literacy (columns 1-4) and numeracy (columns 5-8). The estimates presented in Table 1.9 suggest that pupils' motivation and self-efficacy (measured in the 5th grade) have a statistically significant impact (at the 1% level) on teachers' evaluations in upper secondary school. We find that a one standard deviation increase in academic motivation score (becoming more intrinsically regulated) corresponds to an increase of *Teacher Mark Literacy* (*Numeracy*) by 5.3 (5.5) percent of its standard deviation, and a one standard deviation increase in self-efficacy score raises 6.7 (5.1) percent of a standard deviation in *Teacher Mark Literacy* (*Numeracy*).

The estimated effects of non-cognitive skills in the 10th grade regressions - presented in this section – are, though, smaller than the effects that we found in the 8th grade regressions reported in Section 1.5.1. One possible explanation for the smaller estimated effects of non-cognitive skills on the 10th-grade achievement is the potential self-selection sampling bias. As was mentioned in Section 1.3, data on non-cognitive tests for the 2013/14 5th grade students have been merged to data on educational outcomes of 8th grade students in 2016/17 and 10th grade students in 2018/19. This means that grade repeaters between grades 5-8 in the first regression (presented in Section 1.5.1) and 5-10 in the second one (reported in Section 1.5.2) are excluded from the estimation sample. Yet, academic motivation, self-efficacy and isolation within classroom may have a role in determining students' grade retention and progress. In order to explore this, we run a simple regression for being merged or not. Results from Appendix Table A1.2 suggest that motivation and self-efficacy have a statistically significant negative effect on grade retention, while isolation among classmates has a positive significant effect on grade retention. The results from Appendix A1.2 are consistent with our expectations and with previous literature on education. Probably due to these significant effects of non-cognitive skills on grade repetition, estimates obtained within the sample of regular students should deliver a lower bound of the effects on achievement that we would see if we could measure achievements for all students. This is consistent with the smaller effects estimated in the 10th grade regressions, where roughly 20% of the sample is lost.

Table 1.9. The Impact of Students' Primary-School Motivation, Self-efficacy, and Social Isolation on Marks Assigned by Teachers in High School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Teacher Mark Literacy in 10th Grade*				Dependent variable: *Teacher Mark Numeracy in 10th Grade*			
Motivation in 5th Grade	0.120***	0.084***	0.073***	0.053***	0.102***	0.085***	0.072***	0.055***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Self-efficacy in 5th Grade	0.073***	0.066***	0.065***	0.067***	0.058***	0.051***	0.050***	0.051***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Social Isolation in 5th Grade	-0.041***	-0.011***	-0.008***	0.003	-0.008***	0.007***	0.011***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Rasch Literacy Score in 5th Grade		0.335***	0.325***	0.308***				
		(0.002)	(0.002)	(0.002)				
Rasch Numeracy Score in 5th Grade						0.280***	0.290***	0.289***
						(0.002)	(0.002)	(0.002)
Class Size			0.003***	0.002**			-0.001	-0.002***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.368***	0.026**			0.384***	0.110***
			(0.011)	(0.012)			(0.010)	(0.011)
Female				0.339***				0.266***
				(0.005)				(0.005)
Pre-Primary School				0.029***				0.024***
				(0.007)				(0.007)
Early Enrolled				0.093***				0.121***
				(0.016)				(0.016)
Late Enrolled				-0.006				-0.058***
				(0.018)				(0.020)
Full time				-0.045*				0.008
				(0.023)				(0.020)
ESCS Index				0.071***				0.048***
				(0.002)				(0.002)
Immigrant				-0.154***				-0.152***
				(0.008)				(0.008)
Observations	274549	274549	274549	260405	272009	272009	272009	257977
Adjusted R^2	0.076	0.166	0.177	0.199	0.055	0.115	0.125	0.139

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Educational outcomes and measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

1.6. Heterogeneity Analysis of the Effects of Pupils' Non-Cognitive Skills and Social Isolation on School Performance

In this section, we explore whether the effects are heterogeneous according to students' gender and to the socio-economic environment in which they live.

Previous findings in related research report mixed results. For example, Lundberg (2013) examines the effects of cognitive ability and non-cognitive skills on college graduation in a cohort of young Americans, and

how the returns to these traits vary by family background. His findings suggest that conscientiousness has no significant impact on the education of disadvantaged men, while openness to experience is an important correlate of college graduation only for less-advantaged men and women. Barón and Cobb-Clark (2010), based on data from a cohort of Australian youths, analyze the link between young people's sense of control over their life and their investments in education. They provide evidence on the positive effect of a more internal locus of control on high school graduation and university attendance, however they do not find any significant relationship between family welfare history and young people's locus of control. Mendolia and Walker (2014), using data on cohort of English young people, explore the link between non-cognitive skills (i.e., locus of control, self-esteem, and work ethics) at age 15 on high school performance. The authors show that the effect of non-cognitive skills is particularly strong for the cognitive outcomes for children who come from disadvantaged socio-economic backgrounds, while the effect on advantaged children is limited. Corazzini et al. (2021), using data from a cohort of Italian students, explore whether the effect of the Big Five traits on university performance is gender-dependent. Their findings suggest that the effects of personality traits on GPA are not heterogeneous between males and females.

As discussed in Section 1.3, gender differences emerge in the density distribution of non-cognitive skills' scores between girls and boys. Table 1.10 reports split sample estimates of Equation (1) for gender. In all regressions reported in the table we control for cognitive ability, individual characteristics, family background, class size, share of girls, school organization, and primary school fixed effects. Our results suggest that a more intrinsic motivation and a higher level of self-efficacy in the 5th grade have a statistically significant positive impact on the 8th and 10th grade performance in literacy and numeracy (observed 3 and 5 years later) both for boys and girls. However, the effect of non-cognitive skills varies across gender. We find that the positive effect of higher levels of self-efficacy on educational achievement is larger for boys, while a more intrinsic academic motivation has a more positive impact on test scores and teachers' mark in literacy and numeracy for girls. The negative effects of social isolation among classmates are larger and more significant for girls than for boys.

In Table 1.11 we split the results by socio-economic status (we consider the ESCS Index above/below median within schools). The positive effect of motivation and self-efficacy is found for both socio-economic groups, but it is stronger for students who come from high socio-economic backgrounds. The negative significant effect of social isolation among classmates on school performance is found for both socio-economic groups, but it is stronger for students from more disadvantaged families.

The regression results from Tables 1.10 and 1.11 suggest that the effects of students' beliefs in self-efficacy toward learning, academic motivation, and social isolation among classmates on school performance are heterogeneous according to students' gender and to the socio-economic environment in which they live.

Table 1.10. Effect of Motivation, Self-Efficacy, and Social Isolation in Late Childhood on Later Performance: by Gender

Dependent variable:	(1) *Literacy Score in 8th Grade*	(2) *Rasch Literacy Score in 8th Grade*	(3) *Numeracy Score in 8th Grade*	(4) *Rasch Numeracy Score in 8th Grade*	(5) *Teacher Mark Literacy in 8th Grade*	(6) *Teacher Mark Numeracy in 8th Grade*	(7) *Rasch Literacy Score in 10th Grade*	(8) *Rasch Numeracy Score in 10th Grade*	(9) *Teacher Mark Literacy In 10th Grade*	(10) *Teacher Mark Numeracy in 10th Grade*
Boys										
Motivation in 5th Grade	0.021***	0.028***	0.024***	0.028***	0.059***	0.059***	0.045***	0.044***	0.051***	0.053***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Self-Efficacy in 5th Grade	0.031***	0.035***	0.013***	0.013***	0.079***	0.070***	0.027***	0.023***	0.063***	0.049***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Social Isolation in 5th Grade	-0.024***	-0.019***	-0.001	0.001	0.000	0.005**	0.026***	0.026***	-0.005*	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	180313	180313	180313	180313	151780	151185	133368	133368	139309	137976
Adjusted R^2	0.425	0.412	0.447	0.429	0.343	0.322	0.378	0.408	0.178	0.126
Girls										
Motivation in 5th Grade	0.038***	0.047***	0.046***	0.048***	0.064***	0.072***	0.056***	0.057***	0.051***	0.053***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Self-Efficacy in 5th Grade	0.014***	0.021***	0.008***	0.008***	0.074***	0.065***	0.011***	0.014***	0.063***	0.049***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Social Isolation in 5th Grade	-0.040***	-0.035***	-0.013***	-0.014***	-0.024***	-0.013***	0.005**	0.006***	-0.005*	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	189915	189915	189915	189915	159636	159004	151918	151918	139309	137976
Adjusted R^2	0.432	0.416	0.407	0.382	0.370	0.323	0.389	0.412	0.178	0.126

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for prior performance in literacy or numeracy, individual characteristics, family background, class size, share of females and school organization, and primary school fixed effects. All measures of school performance and non-cognitive skills' measures are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table 1.11. Effect of Motivation, Self-Efficacy, and Social Isolation in Late Childhood on Later Performance: by Socio-Economic Status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	*Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Literacy In 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
High Socio-Economic Status										
Motivation in 5th Grade	0.036***	0.045***	0.040***	0.044***	0.066***	0.068***	0.051***	0.050***	0.052***	0.053***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Self-Efficacy in 5th Grade	0.028***	0.035***	0.019***	0.020***	0.087***	0.078***	0.020***	0.019***	0.070***	0.053***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Social Isolation in 5th Grade	-0.023***	-0.020***	-0.005***	-0.003	-0.008***	-0.005**	0.018***	0.018***	0.004	0.020***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	189471	189471	189471	189471	159293	158642	143070	143070	130627	129404
Adjusted R^2	0.424	0.406	0.418	0.397	0.361	0.302	0.395	0.414	0.207	0.148
Low Socio-Economic Status										
Motivation in 5th Grade	0.025***	0.031***	0.029***	0.031***	0.060***	0.065***	0.049***	0.049***	0.052***	0.056***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Self-Efficacy in 5th Grade	0.025***	0.028***	0.010***	0.009***	0.075***	0.066***	0.016***	0.017***	0.062***	0.048***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Social Isolation in 5th Grade	-0.042***	-0.036***	-0.011***	-0.012***	-0.020***	-0.008***	0.013***	0.014***	0.001	0.023***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	181016	181016	181016	181016	152326	151749	142216	142216	129778	128573
Adjusted R^2	0.410	0.398	0.395	0.373	0.339	0.282	0.387	0.411	0.188	0.129

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school performance in literacy or numeracy, individual characteristics, family background, class size, share of girls, school organization, and primary school fixed effects. All measures of school performance and non-cognitive skills' measures are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent le

1.7. Concluding Remarks

The present study has highlighted the effects of pupils' primary-school intrinsic-extrinsic motivation, self-efficacy toward learning, and social isolation among classmates on their performance in secondary school. We used census data on a cohort of primary school children, provided by the Italian National Institute for the Evaluation of the Educational System (INVALSI), which is a rich source of information on their cognitive and non-cognitive skills in different moment of their educational career. To deal with simultaneity bias and reverse causality problems by combining early-life measures of non-cognitive skill with later-school outcomes, we exploited a recent feature of the INVALSI, allowing us to follow the same cohort of children within their educational path. We focused on a cohort of Italian students who in 2013/14 were in their last year of primary school (in the 5th grade) and for whom were also available data on test score results obtained three and five years later (in the school years 2016/2017 and 2018/19) when they were attending the 8th and 10th grade of secondary school.

Our analysis is performed using ordinary least squares with primary school fixed effects. We estimated how middle and high-school test scores and teachers' marks in literacy and numeracy were affected by non-cognitive skills measured when attending primary school, taking into account prior cognitive ability. Our findings suggest that a more intrinsic academic motivation and higher levels of self-efficacy have a statistically significant positive impact on student performance in literacy and numeracy, as measured by both national standardized tests scores and marks assigned by teachers, while higher scores on social isolation within classroom have a statistically significant negative impact on school performance in lower secondary school. These effects hold true when we control for class size and for a number of students' characteristics.

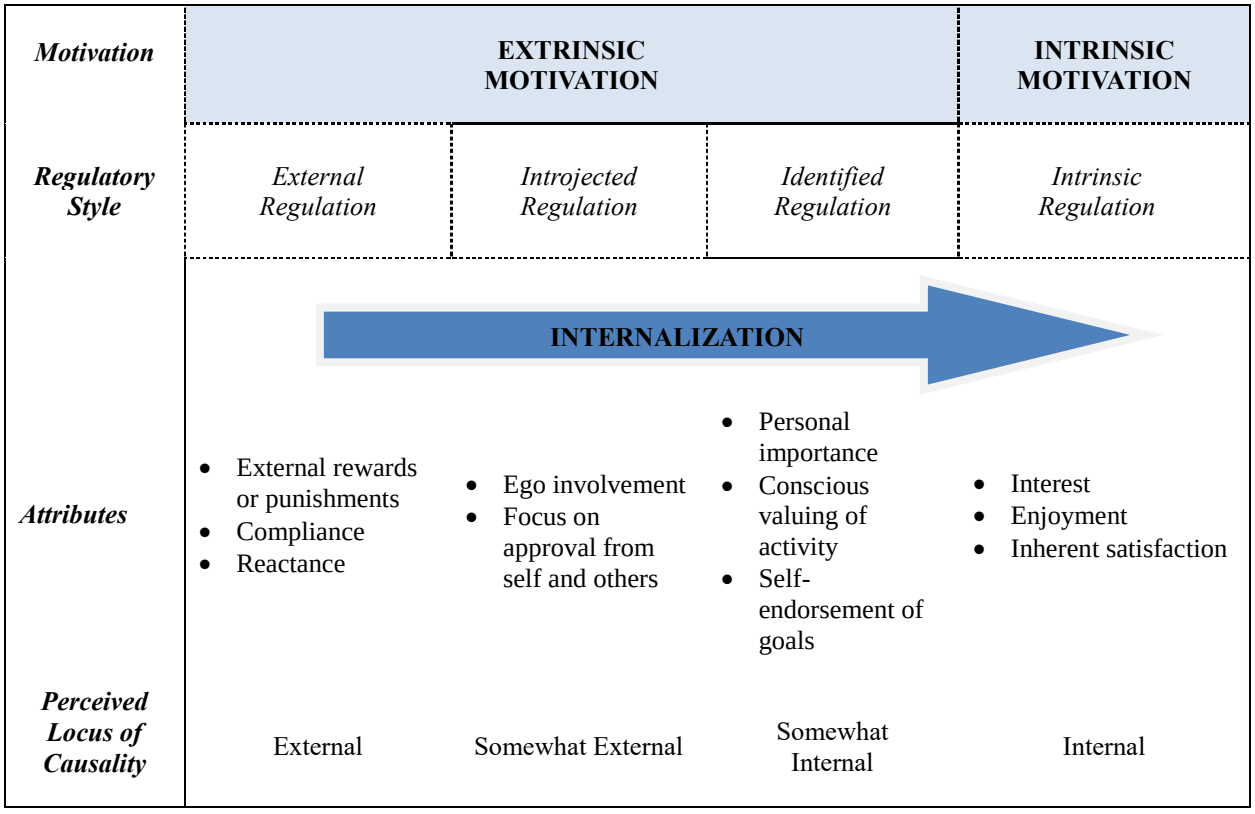
Of interest in this study is the empirical evidence that, thanks to the large census-based longitudinal cohort study, has led to the recognition of the relevance of academic motivation, self-efficacy, and positive social interactions in the classroom in explaining heterogeneity in school outcomes. Our study is linked to a strand of literature that attempts to establish a definite pattern regarding the relationship between individuals' non-cognitive skills and their schooling outcomes. The literature provides evidence for the importance of school performance and educational decisions for later life outcomes (see, for example, Heckman et al. 2018).

Cognitive and non-cognitive skills are widely considered as a focus for analytical research and a core object for policy intervention. We hope that our results could be useful for those interested in the effects of educational policies mediated by non-cognitive skills, such as academic motivation (intrinsic and extrinsic), perceived self-efficacy for self-regulated learning, and social interactions in the classroom. We are well aware that knowledge about children's specific non-cognitive skills that drive school success and learning decisions

(especially in middle school)[33] could help policy makers in designing and implementing educational public policies directed towards improving student achievement and preventing students from dropping out of school[34]; it could also lead to more early targeted interventions aimed at influencing the formation of non-cognitive skills in early years of primary school.

Appendix 1

Figure A1.1. Intrinsic and Extrinsic Motivation with Their Regulatory Styles



Source: Adapted from the Center for Self-Determination Theory (SDT).

[33] Middle school is a critical step in the educational pathway as suggested by the fact that the process of dropping out begins at this stage, when habits that predict whether student graduates are formed (Middle School Moment, 2012). At this stage, adolescents become more vulnerable to gangs, criminal activity, drugs and substance abuse.

[34] The problem of school dropouts in Italy is one of the hottest issues in the EU education policy, because Italy is still well above the Europe 2020 figures, which aim to reduce the quota to 10%. For instance, in 2020 Italy had an early school leaving rate of 13.1 percent (EU 10.2) with higher dropout rates in southern regions such as Sicily (19.4 percent), Campania (17.3 percent) and Calabria (16.6 percent) than in the rest of the country (Eurostat, 2021). These numbers are associated with the high level of youth unemployment in Italy. Recent data reveal that the unemployment rate among individuals aged 24 to 35 who either held the elementary school certificate or had no education in Italy was 32.6% in 2020, while some 21% of young people with a middle school degree was unemployed (Statistica 2021).

Academic Motivation – Questions in Student Questionnaire INVALSI 2013/14

Why do I try to do well in school?

1. Because that's what I'm supposed to do.
2. Because the teacher will think that I'm a good student if I do it do well.
3. Because it's important to me to understand better new things.
4. Because I enjoy doing my schoolwork well.
5. Because I will get in trouble if I don't do well.
6. Because I will feel really bad about myself if I don't do well.
7. Because it's important to me to try to do well in school.
8. Because I will feel really proud of myself if I do well.
9. Because I might get a reward if I do well.
10. Because it's fun.

Why do I do my homework?

11. Because I want the teacher to think I'm a good student.
12. Because I'll get in trouble if I don't.
13. Because it's fun.
14. Because I will feel bad about myself if I don't do it.
15. Because I want to understand the subject.
16. Because that's what I'm supposed to do.
17. Because I enjoy doing my homework
18. Because it's important to me to do my homework.

Possible answers: *very true*, *sort of true*, *not very true*, *not at all true.*

Student's Regulatory Self-Efficacy Beliefs - Questions in Student Questionnaire INVALSI 2013/14

1) How well can you finish your homework in time?
2) How well can you study when there are other interesting things to do?
3) How well can you focus on your schoolwork a without distraction?
4) How well can you remember information presented in class?

Possible answers were given on a 4-point Likert-type scale, from 1, *not able to do it at all,* to 4*, able to do it at all.*

Student's Social Isolation Within Classroom - Questions in Student Questionnaire INVALSI 2013/14

1) How many of your classmates do you "have chat" with?
2) How many of your classmates speak with you?
3) How many of your classmates do you get on well with?
4) How many of your classmates would you help if they were in some kind of trouble?
5) How many of your classmates do you consider as your "friends?

Possible answers: *none*, *few*, *some*, *many*, *all* (coded with values ranging from 1 to 5).

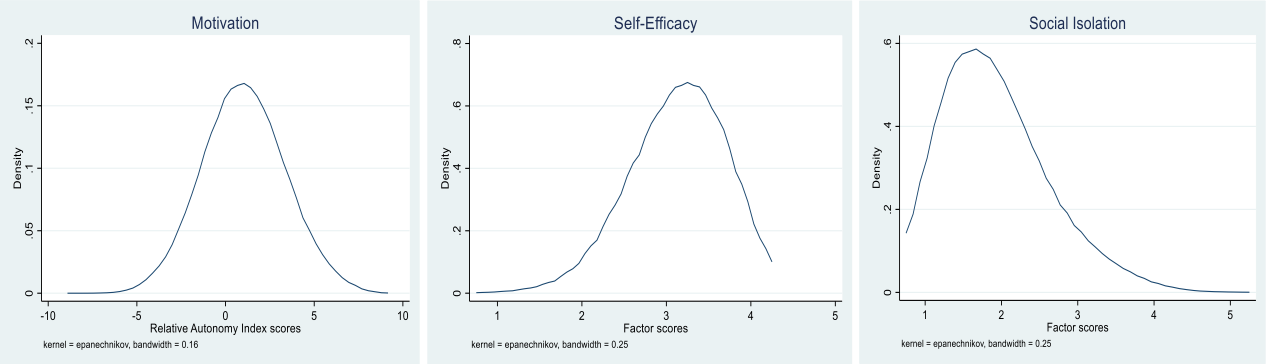
In Table A1.1 is reported a complete description of the variables used in the econometric analysis performed in Chapter 1.

Table A1.1. Variable Description

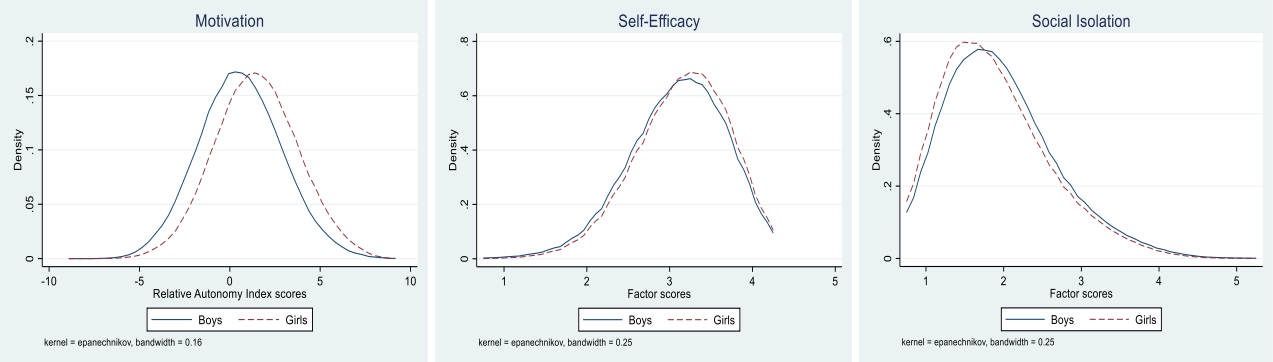
Cognitive skills:	
Literacy Score	Fraction of correct answers in the INVALSI standardized literacy test
Rasch Literacy Score	Score computed by the INVALSI applying the IRT Rasch model to students' answers in the test, in order to account for different difficulties of single items
Numeracy Score	Fraction of correct answers in INVALSI standardized numeracy test
Rasch Numeracy Score	Score computed by the INVALSI applying the IRT Rasch model to students' answers in the test, in order to account for different difficulties of single items
Teacher Mark Literacy	Oral mark assigned by Italian language teacher
Teacher Mark Numeracy	Oral mark assigned by math teacher
Non-cognitive skills:	
External Regulation	Score calculated as the average of student's responses on the items that make up the External Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Introjected Regulation	Score calculated by averaging the student's responses on the items that make up the Introjected Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Identified Regulation	Score calculated by averaging the student's answers on items that make up the Identified Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Intrinsic Motivation	Score calculated by averaging the student's responses on items that make up the Intrinsic Motivation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Motivation (as proxied by the Relative Autonomy Index)	Score obtained by applying a weighting to the External Regulation, Introjected Regulation, Identified Regulation, and Intrinsic Motivation Subscales. Then we summed the weighted scores. To form the RAI, the following formula is used: 2 × Intrinsic + Identified - Introjected - 2 × External motivation. High positive scores indicate greater intrinsic or self-determined motivation, and low negative scores indicate more extrinsic or controlled regulation.
Self-efficacy	Score obtained as the average of responses on the items that make up the Perceived Efficacy Subscale for Self-Regulated Learning. Answers are on a 4-point Likert-type scale, where 1 corresponds to "not able to do it at all" and 4 corresponds to "able to do it at all". A higher score represents a higher level of self-efficacy.
Social Isolation	Score calculated as mean response across items that make up the Student's Social Isolation Within Classroom (SIWC) scale. The lowest possible score indicates social contacts between the respondent and the whole class, while the highest possible score indicates the absence of any social contacts.
Students' socio-demographic characteristics:	
ESCS Index	Index of social, economic and cultural status of the student's family
Female	Dummy variable equals to 1 if the observation refers to female
Age	Student's age (number of years)
PrePrimary School	Pre-primary school attendance (dummy variable equals to 1 for students who went to the pre-primary school)
Immigrant	Dummy variable equals to 1 if the observation refers to first or second-generation immigrant student
Early Enrolled	Dummy variable equals to 1 for students who is younger than regular students
Late Enrolled	Dummy variable equals to 1 for students who is older than regular students
School organization and characteristics:	
Full time	Dummy variable equals to 1 if the student's schedule is organized in entire days (8 am -4 pm)
Class Size	Number of students in class at the beginning of the school year
Share Females	Share of girls in class at the beginning of the school year

Figure A1.2. Density Distribution of Non-cognitive Abilities and Social Isolation in the Cohort of Primary Students Followed for 3 years - from Grade 5 to Grade 8

A. Density distribution of Motivation, Self-Efficacy, and Social Isolation in the pooled sample

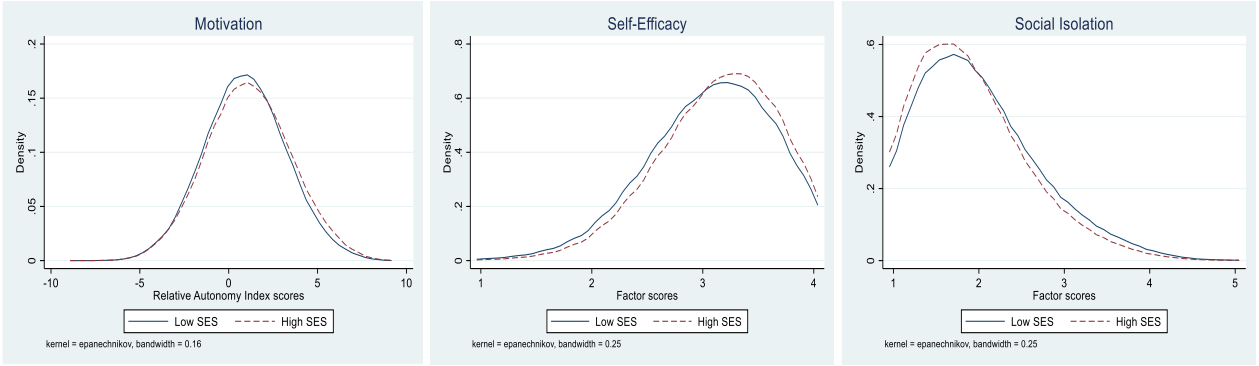


B. Density distribution of Motivation, Self-Efficacy, and Social Isolation by gender



Note: Using a set of nonparametric Wilcoxon rank-sum tests, the null hypothesis that the scales measuring academic motivation, self-efficacy, and social isolation are equal in distribution between the samples of boys and girls is rejected for all the domains (p-value = 0.000).

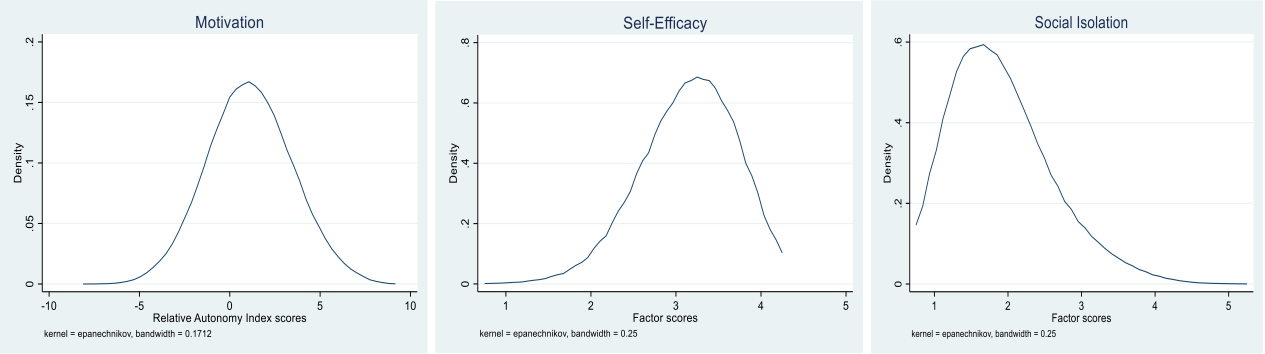
C. Density distribution of Motivation, Self-Efficacy, and Social Isolation by socio-economic status



Note: Using a set of nonparametric Wilcoxon rank-sum tests, the null hypothesis that the scales measuring academic motivation, self-efficacy, and social isolation are equal in distribution between the samples of students from more and less well-off families is rejected for all the domains (p-value = 0.000).

Figure A1.3. Density Distribution of Non-cognitive Abilities and Social Isolation in the Cohort of Primary Students Followed for 5 years - from Grade 5 to Grade 10

A. Density distribution of Motivation, Self-Efficacy, and Social Isolation in the pooled sample



B. Density distribution of Motivation, Self-Efficacy, and Social Isolation by gender

Note: Using a set of nonparametric Wilcoxon rank-sum tests, the null hypothesis that the scales measuring academic motivation, self-efficacy, and social isolation are equal in distribution between the samples of boys and girls is rejected for all the domains (p-value = 0.000).

C. Density distribution of Motivation, Self-Efficacy, and Social Isolation by socio-economic status

Note: Using a set of nonparametric Wilcoxon rank-sum tests, the null hypothesis that the scales measuring academic motivation, self-efficacy, and social isolation are equal in distribution between the samples of students from more and less well-off families is rejected for all the domains (p-value = 0.000 for Motivation and Social Isolation; p-value = 0.0104 for Self-Efficacy).

Table A1.2. The Determinants of Grade Retention

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Grade Retention 5-8*				Dependent variable: *Grade Retention 5-10*			
Motivation in 5th Grade	-0.004***	0.001*	0.001*	0.000	-0.018***	-0.008***	-0.008***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Self-efficacy in 5th Grade	-0.011***	-0.009***	-0.009***	-0.008***	-0.025***	-0.022***	-0.022***	-0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Social Isolation in 5th Grade	0.017***	0.009***	0.009***	0.005***	0.027***	0.012***	0.013***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Rasch Literacy Score in 5th Grade		-0.034***	-0.033***	-0.021***		-0.082***	-0.081***	-0.057***
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Rasch Numeracy Score in 5th Grade		-0.013***	-0.014***	-0.014***		-0.038***	-0.038***	-0.040***
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Class Size			-0.001***	-0.001***			-0.003***	-0.002***
			(0.000)	(0.000)			(0.000)	(0.000)
Share Females			-0.027***	-0.004			-0.043***	0.004
			(0.004)	(0.004)			(0.008)	(0.007)
Female				-0.022***				-0.049***
				(0.001)				(0.001)
Pre-Primary School				-0.012***				-0.014***
				(0.001)				(0.002)
Early Enrolled				0.034***				0.004
				(0.006)				(0.007)
Late Enrolled				0.071***				0.136***
				(0.004)				(0.006)
Full time				0.004***				0.022***
				(0.001)				(0.002)
ESCS Index				-0.018***				-0.061***
				(0.001)				(0.001)
Immigrant				0.101***				0.162***
				(0.002)				(0.003)
Chi squared	2764.61	6638.16	6849.40	14670.50	4912.21	14615.65	15049.94	30340.07
	p=0.000	*p*=0.000	*p*=0.000	*p*=0.000	*p*=0.000	*p*=0.000	*p*=0.000	*p*=0.000
Pseudo R squared	0.0130	0.0604	0.0617	0.1066	0.0122	0.0713	0.0725	0.1125
Observations	420,988	412,062	412,062	411,225	420,988	412,062	412,062	411,225

Notes: Marginal effects of Probit estimates (evaluated at the mean values of the explanatory variables in the sample). Standard errors (reported in parentheses) are corrected for heteroskedasticity and adjusted for potential clustering at the class level. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table A1.3. The Impact of Non-Cognitive Skills and Social Isolation on Marks Assigned by Teachers in Grade 8 (with Controls for 5th and 8th Grade Test Scores)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Teacher Mark Literacy in 8th Grade*				Dependent variable: *Teacher Mark Numeracy in 8th Grade*			
Motivation in 5th Grade	0.071***	0.063***	0.063***	0.043***	0.078***	0.073***	0.072***	0.047***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Self-efficacy in 5th Grade	0.068***	0.069***	0.068***	0.065***	0.068***	0.066***	0.066***	0.060***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Social Isolation in 5th Grade	-0.019***	-0.009***	-0.009***	-0.001	-0.024***	-0.017***	-0.016***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rasch Literacy Score in 8th Grade	0.619***	0.513***	0.512***	0.473***				
	(0.002)	(0.002)	(0.002)	(0.002)				
Rasch Literacy Score in 5th Grade		0.195***	0.195***	0.187***				
		(0.002)	(0.002)	(0.002)				
Rasch Numeracy Score in 8th Grade					0.614***	0.520***	0.520***	0.509***
					(0.002)	(0.002)	(0.002)	(0.002)
Rasch Numeracy Score in 5th Grade						0.181***	0.181***	0.180***
						(0.002)	(0.002)	(0.002)
Class Size			0.005***	0.003***			0.002***	0.000
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.056**	-0.179***			0.242***	-0.022
			(0.024)	(0.024)			(0.023)	(0.023)
Female				0.252***				0.262***
				(0.003)				(0.003)
Pre-Primary School				0.005				0.010
				(0.007)				(0.007)
Early Enrolled				0.059***				0.077***
				(0.012)				(0.012)
Late Enrolled				0.009				-0.036***
				(0.011)				(0.012)
Full time				0.021**				-0.015
				(0.009)				(0.009)
ESCS Index				0.113***				0.109***
				(0.002)				(0.002)
Immigrant				-0.084***				-0.101***
				(0.006)				(0.006)
Observations	317205	317205	317205	311416	315955	315955	315955	310189
Adjusted R^2	0.462	0.483	0.483	0.506	0.426	0.443	0.444	0.470

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Educational outcomes and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table A1.4. The Impact of Non-Cognitive Skills and Social Isolation on Marks Assigned by Teachers in Grade 10 (with Controls for 5th and 10th Grade Test Scores)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: *Teacher Mark Literacy in 10th Grade*				Dependent variable: *Teacher Mark Numeracy in 10th Grade*			
Motivation in 5th Grade	0.069***	0.063***	0.056***	0.037***	0.075***	0.073***	0.054***	0.034***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Self-efficacy in 5th Grade	0.058***	0.058***	0.058***	0.060***	0.042***	0.042***	0.040***	0.043***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Social Isolation in 5th Grade	-0.022***	-0.012***	-0.010***	-0.003	-0.001	0.003*	0.008***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Rasch Literacy Score in 10th Grade	0.408***	0.331***	0.323***	0.319***				
	(0.003)	(0.003)	(0.003)	(0.003)				
Rasch Literacy Score in 5th Grade		0.151***	0.152***	0.146***				
		(0.003)	(0.003)	(0.003)				
Rasch Numeracy Score in 10th Grade					0.398***	0.356***	0.388***	0.403***
					(0.003)	(0.003)	(0.003)	(0.003)
Rasch Numeracy Score in 5th Grade						0.085***	0.087***	0.091***
						(0.003)	(0.003)	(0.003)
Class Size			-0.003***	-0.004***			-0.010***	-0.011***
			(0.001)	(0.001)			(0.001)	(0.001)
Share Females			0.272***	-0.042***			0.550***	0.267***
			(0.012)	(0.012)			(0.010)	(0.012)
Female				0.313***				0.293***
				(0.004)				(0.004)
Pre-Primary School				0.024***				0.014**
				(0.007)				(0.007)
Early Enrolled				0.061***				0.058***
				(0.015)				(0.014)
Late Enrolled				0.033*				-0.001
				(0.018)				(0.019)
Full time				-0.002				0.081***
				(0.023)				(0.020)
ESCS Index				0.037***				0.005**
				(0.002)				(0.002)
Immigrant				-0.117***				-0.105***
				(0.007)				(0.008)
Observations	274549	274549	274549	260405	272009	272009	272009	257977
Adjusted R^2	0.223	0.236	0.241	0.258	0.190	0.194	0.217	0.232

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. In all regressions we control for primary school fixed effects. Educational outcomes and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Chapter 2

Does Bullying Behavior in Primary School Affect Teachers' Grading Practices?

Abstract

We explore whether students' school violent behavior towards classmates influences teachers' assessment practices. Evidence is drawn from census data on the whole population of Italian children attending the 5th grade in the school year 2013/14. Our empirical model is based on the contrast between teacher-assigned scores and standardized test scores taken in the national external evaluation program that covers the same area during the same school year. The pattern of results suggests that primary-school teachers are not neutral to students' bullying behavior at school when assessing their cognitive abilities in literacy and numeracy.

***JEL classification**: I21; I24; I28.*

***Keywords**: Bullying Behavior; Students' Performance; Teachers' Assessment; Grading Bias.*

2.1. Introduction

In the entire world, bullying is considered the most predominant form of aggression found in all schools at all grade levels that undermines the quality of education for all learners (UNESCO, 2019). There exist numerous definitions of bullying. The majority of them categorize bullying as a subset of aggressive behavior that involves an intention to hurt another person repeatedly and over time (Olweus 1993,1997; Rigby, 1996; Rivers and Smith, 1994). This negative intentional behavior, characterized by an imbalance of power between the interacting parties, can be manifested through direct psychical and verbal aggression, and indirect aggression (Olweus, 1997).[35]

In recent years, economists have contributed to the growing body of knowledge regarding school bullying in a variety of ways. For instance, Le et al. (2005), using an Australian sample of twins, find that childhood behavior disorders are positively associated with dropping-out from school and unemployment. Brown and Taylor (2008) use British cohort data and show that being bullied (and being a bully) is associated with lower educational attainment and, as a result, with lower wages later in life. Eriksen et al. (2014) use Danish administrative data and show that school bullying victimization has large detrimental effects on students' educational attainment. Gorman et al. (2021), using data on a cohort of English adolescents, find that the experiencing bullying victimization in secondary school has negative consequences on victims' academic outcomes, mental health, unemployment, and income. Sarzosa and Urzúa (2021), using longitudinal data from South Korea, document that exposure to bullying has a significant negative impact on tertiary education enrollment, physical and mental health outcomes. Bracco et al. (2022), using census data on 5th-grade Italian students, demonstrate that highly active anti-immigration politics increase the victimization of immigrant children and that being a victim of bullying is associated with markedly lower test score performance.

Unfortunately, even though educators and policymakers have a vested interest in the development and implementation of anti-bullying programs for decades, economic research on bullying behavior remains in its infancy. Despite the prevalence of this undesired social behavior and its high associated costs, still little is known in practice about the determinants and consequences of bullying.[36]

In this chapter, we study whether pupils' bullying behavior at school affect teachers' assessment of their cognitive performance.[37] Teachers' evaluations of students' cognitive skills are central to school

[35] Direct physical aggression involves tangible behaviors such as hitting, pushing, and kicking. Direct verbal aggression includes name-calling and threats. The least identified and most difficult to prove is indirect aggression. It involves such behavior as spreading rumors and telling tales. Direct aggression is explicitly exhibited from the aggressor to the victim whereas indirect aggression involves a third party (Olweus, 1995; Rivers and Smith, 1994).

[36] The literature suggests that the behavior patterns involved in bully/victims' problems are fairly stable over time (see, for example, Olweus, 1997).

[37] Research in psychology and sociology has shown that students who bully others experience school problems. This

decisions, including instructional planning, screening, placement, referrals, and communication with parents. Textbooks on assessment and grading advise teachers to base their evaluations on students' achievement of the main educational goals in the classroom (e.g., Brookhart, 2004; Linn & Miller, 2005).[38] However, teachers might take student characteristics other than achievement into account and sanction students' bullying behavior towards schoolmates when assessing their performance and knowledge.[39] The literature suggests that this grading behavior may be socially desirable if it induces a student to behave better, generating private benefits to the pupil and positive externalities to peers (Figlio, 2007; Golsteyn et al., 2021). On the other hand, grade retention and inaccurate test scores might be an incentive to reduce students' effort (Mechtenberg, 2009) and interest in a subject (Bonesrønning, 2008; Marsh and Craven, 1997), and to contribute to greater behavioral difficulties. The study conducted by Johnson et al. (2008) reveals that 95% of the school administrators judged this practice, however, as unethical.

In the literature on economics of education there exist a number of papers in which researchers compare non-blindly- and blindly-assigned scores in order to investigate teachers' grading practices. One strand of this recent literature on teacher discrimination in grading investigates whether there are systematic differences in teachers' grading between boys and girls. One of the first studies addressing this issue is Lavy (2008) who, based on data from matriculation exams in Israel, finds a negative bias in teachers' assessment for male students. Similar results are found by Breda and Ly (2015), Cornwell et al. (2013), Di Liberto et al. (2021), Hinnerich et al. (2011), Terrier (2020) who document that teachers favour girls in their evaluations.

Another strand of the literature on teachers' discrimination in grading has addressed whether ethnic minority pupils are subject to low teachers' expectations (see Alesina et al., 2018; Botelho et al., 2015; Burgess and Greaves, 2013; Hanna and Linden, 2012). Their findings show the presence of a negative bias in teachers' grading practices for ethnic minorities. For instance, Burgess and Greaves (2013) use English National Pupils Database and show that there are enduring and quantitatively significant differences in teachers' assessments of pupils from different ethnic groups. The authors show that, relative to white pupils, black Caribbean and black African pupils are under-assessed, whereas Indian, Chinese, and mixed white and Asian pupils are over-assessed. Botelho et al. (2015), based on administrative data from the state of São Paulo, document that blacks have lower teacher-assigned math grades than their white classmates in the 8th-grade. Alesina et al. (2018) use Italian administrative data and show that middle school teachers give lower grades to immigrant students

literature has documented that bullies are more likely to be academically disengaged (Graham et al., 2006); that they do not consider themselves academically competent (Ma et al., 2009); and they are more likely to perform poorly, skip learning activities and drop out (Kokko et al., 2006; Jankauskiene et al., 2008).

[38] According to Brookhart (2004), teacher-assigned marks should primarily function as information for students and parents about students' course achievement.

[39] Research in psychology documents that teachers assign less favorable grades for similar achievement when they perceive a student's behavior to be inappropriate (see, for example, Zimmermann et al. (2013)) or when a student displays little interest or effort (Hochweber et al. (2014)).

compared to natives who have the same performance on standardized blindly-graded tests. De Benedetto and De Paola (2022) analyze how changes in the geographic concentration of immigrants affect teachers' assessment of students' performance and show that an increase in the share of immigrants in the local population negatively affects the way immigrant students are evaluated by their teachers in non-blindly-graded tests compared to their peers. Besides ethnic and gender indicators, behavior at school is another relevant student's characteristic available to teachers during in-class interactions that may impact their judgment when grading (Ferman and Fontes, 2021).[40]

The current study is closely related to this recent literature on teacher discrimination in grading and evaluates whether pupils' undesired social behaviors in primary school such as bullying affect teachers' assessment practices. In the economic literature, studies examining teachers' grading biases toward pupils' behavior are limited. As far as we know, the only paper looking at the students' attitudes in the classroom is the recent study Ferman and Fontes (2021) who use administrative data on middle- and high-school students in Brazilian private schools. Their empirical strategy is based on the contrast between teacher-assigned and blindly-assigned scores on achievement tests that are high-stakes and cover the same material. Using detailed data on student classroom behavior and holding constant the performance on exams graded blindly, the authors provide evidence that teachers inflate test scores of better-behaved students and deduct points from worse-behaved ones.

Similar to Ferman and Fontes (2021), we propose teachers' assessment practices as a potential mediator for gaps in attainment between students with different school-related behavioral characteristics. We examine this proposal by testing whether students' problematic behaviors at school affect teachers' grading practices, with a focus on Italian primary school setting.

Our analysis is based on a large-scale observational data considering the whole population of Italian primary-school students attending the 5th grade in the school year 2013/14. The data, provided by the Italian National Institute for the Evaluation of the Educational System (INVALSI henceforth) are very rich and contain information on students' behavioral characteristics, non-cognitive skills, socio-economic background, and their performance in terms of both standardized test scores and marks assigned by math and Italian language teachers. Thanks to the detailed information on students' behavior at school, blind and non-blind scores that cover the same area during the same school year, we analyze whether primary-school teachers are biased in favour of better-behaved in-classroom students in their evaluations. At this aim, we employ an econometric model that compares teacher-assigned marks in literacy and numeracy and standardized test score results taken by 5th-graders in the national external evaluation program managed by a government agency, INVALSI, during the school year, assuming that the latter are free from school behavior bias.

[40] In the psychology literature, it has been shown that students' behavior at school predicts important life outcomes above and beyond measures of cognitive and non-cognitive skills (see, for example, Spengler et al., 2018).

Our evidence reveals that students' undesired social behavior at school directly affects teachers' evaluations of their cognitive performance. We find that children who bully their peers are graded less favourably than better-behaved children – not bullies - in both literacy and numeracy. The estimated bias against bullying-behaved students in the 5th grade is 9.7% of a standard deviation in literacy and 15.5% of a standard deviation in numeracy. These results are robust to the inclusion of other confounders that may lead to grading bias (i.e., gender, socio-economic status, immigrant status), to the inclusion of school fixed effects, and to alternative measures of student performance in blindly-graded tests.

Our findings are related to several strands of literature. First, our findings showing that being a school bully is associated with markedly lower performance in literacy and numeracy contribute to the growing body of economic research on the impact of bullying, which still provides limited knowledge on the dimension and potential consequences of this undesired social attitudes. Second, the evidence presented here contributes to the literature by showing the presence of teachers' grading bias against more problematic-behaved primary schoolchildren in two core subjects: literacy and numeracy. As teacher judgments in terms of grades, proficiency assessments, and recommending placement in ability groups can have important consequences for a child's future educational path (Carlana, 2019; Lavy and Sand, 2018), and, through this channel, on their further labour market and lifetime outcomes, the results of our research seem to be particularly relevant. As was already said, evidence is drawn from a census data provided by a government agency INVALSI that cover almost all Italian 5th graders attending the public and private primary school in the school year 2013/14 and this reduces the possibility of selection problems.

The remaining part of Chapter 2 is organized as follows. Section 2.2 describes the institutional setting, the data and introduces the used measures of bullying behavior and school performance assessed blindly and not blindly. Section 2.3 discusses the empirical approach and presents the main findings. Section 2.4 contains heterogeneity analysis and robustness checks, and, finally, Section 2.5 is dedicated to conclusions.

2.2. Institutional Background and Data

This section presents the institutional context within which we perform our analysis and provides a detailed discussion of data source.

In Italy, education is compulsory from ages 6 to 16 and consists of three main stages before tertiary education: primary school, lower secondary and upper secondary school. Before entering primary schools, pupils can attend daycare (from age 0 to 2) and kindergarten (from age 3 to 5); these stages are not mandatory. At the compulsory stages, schools are organized into single or multi-unit institutions, sharing the principal and several administrative services. Primary school lasts five years (grades 1 to 5, from age 6 to 10). After completion of the last year of primary school, pupils enter lower secondary school directly. Secondary

education lasts eight years and it is divided into stages: a three-year lower secondary school (grades 6 to 8, from age 11 to 13) and a five-year upper secondary school (grades 9 to 13, from age 14 to 18). The lower secondary school, also known as middle school, is compulsory for all students with a more subject-oriented curriculum where students are taught by subject specialists. Up to lower secondary school, the educational curriculum is the same for all pupils and the subjects studied are the same. At the end of the third year of lower secondary school, pupils have to pass a final exam to access higher secondary school. The first two years of higher secondary school are compulsory, while the other three years are voluntary. There are three types of higher secondary school: lyceum, technical college, and vocational college. Students are free to choose what type of higher secondary school to attend. Lyceum, technical, and vocational colleges have the same duration (5 years), but vary greatly in curriculum, program complexity, and prestige.

The quality assurance process at primary and secondary level is implemented by the National Institute for the Evaluation of the Educational System (Istituto Nazionale per la Valutazione del Sistema Educativo di Istruzione e di Formazione, called INVALSI), a government agency placed under the control of the Ministry of Education, which every year carries out a testing of student attainment through national standardized tests in literacy and numeracy. The INVALSI also submits questionnaires to students in order to investigate other elements useful for the evaluation of the system.

We now describe the school setting for students from primary school. Teachers in Italian primary schools are generalists. They are required to have obtained a Master degree in primary education sciences and they have to teach an identical nation-wide curriculum, defined for each grade. This implies that primary schoolchildren are taught the same curriculum by teachers with similar qualifications. The compulsory subjects taught during the 5 years of primary school are: Italian, English, history, geography, mathematics, sciences, technology, music, arts, sports education, civic education. Primary-school teachers assess pupils daily through oral examinations, written tests, home assignments, working in group, etc. The student's overall assessment takes place at the end of each term plus a final assessment at the end of the school year.[41] Periodic and annual evaluation of pupils focuses on of the learning process, their behavior, and their overall leaning outcomes. More specifically, the periodic and final evaluation of pupils' learning outcomes in each subject is expressed in numerical marks out of ten (from 1 to 10, where 6 is the passing grade). Conduct is evaluated through a report assessment, which may be analytical or a summary, subject to the Teachers' Council decision. At the end of each term and at the end of the school year, pupils receive a personal assessment document which includes their marks in numbers and letters for each subject, as well as a report of their behavior.

The number of teachers per class varies according to the different timetable models.[42] In fact, the

[41] For pupils' evaluation purposes, the school year can be divided into two or three terms (periods of three or four months, as decided by the Teachers' Council of each school).

[42] The minimum timetable varies according to the organization of time chosen by families and available at school: 24

classes adopting the weekly school timetable of 24, 27 or 30 hours usually have only one teacher, who may be supported by English language and Catholic religious studies teachers. Conversely, two teachers work – although not at the same time – in classes with a weekly timetable of 40 hours. Lessons are usually held from Monday to Friday, but some schools offer a six-day week with lessons on Saturday.

The allocation of students in classes in primary schools is decided following a mix of rules and discretion established by the Law no.81 of 20 March 2009 (Decreto de Presidente della Repubblica 81/2009). The Italian law stipulates that primary school classes cannot be composed by less than 15 and more than 27 students, with the exception of schools in mountain areas and small islands where the minimum number if pupils is retained at 10.

As regards bullying at school, it can represent a violation of the fundamental principles of the Italian Constitution that gives to the State the task of promoting and encouraging the full development of the human person pursuant to the following principles: equality (art. 3), freedom of education (art. 33), the right to education (art. 34). The national guidelines state the necessity to develop policies and programs to prevent school bullying at the national level. At this aim, the guidelines invited schools to work for prevention school bullying at the national level and provided financial resources for teachers' training and established a team of experts within a network of schools.

Central to our analysis are census data drawn from the National Program from the Assessment of Education run by INVALSI, as was mentioned above, the Italian government agency that carries out yearly testing of student attainment through national standardized tests in literacy and numeracy. The evaluation covers the entire population of students attending the 2nd and the 5th grade (primary school), the 8th grade (lower secondary school), as well as the 10th and 13th graders (in upper secondary school).[43] For each grade, approximately 400,000 students sit the assessment every year, over the two different days (for the two subjects), at the end of the school year.

Important for our purposes, data provided by INVALSI contain information on blindly-graded test scores that are collected through standardized assessments, as well as on scores assigned by teachers in non-blindly graded tests in two main subjects: literacy and numeracy. The data include also detailed information on individual and family background characteristics which come from school administrative records. In addition to these rich data, the dataset INVALSI includes a range of individual-level information on family, school and context characteristics collected through a Student Questionnaire, administered on the same day as one of the two tests.[44]

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hours, 27 hours up to 30 hours and 40 hours.

[43] All Italian students attending the last year of upper secondary school (grade 13) take the INVALSI standardized tests starting in the school year 2018/19.

[44] Students anonymously completed the questionnaire.

In our study, we focus on primary schoolchildren for several reasons. First, according to the literature on skill formation, primary school is a critical and sensitive period for the formation not only of children's cognitive skills, but also of certain behaviors, feelings, and attitudes, knows as non-cognitive skills (Almlund et al., 2011; Kautz et al. 2014). Particularly important from policy perspective, these skills are malleable and can be influenced by teaching quality, school and home environment, and educational interventions (Alan et al., 2019; Jackson et al., 2020; Heckman et al., 2013). Second, in the Italian education system, as in other countries, the prevalence of bullying behavior in primary school is higher than at other stages - including lower and upper secondary schools.[45] We further restrict our analysis to students attending the 5th grade as the survey providing information on students' school-related behavioral attitudes, family background, and school context (including the bullying questions) was not given to 2nd graders.

Data are from the wave 2013/14 and for which the Student Questionnaire INVALSI contains the following four items which offer a description of the child's behaviour aimed at hurting others physically, verbally or through indirect aggression: 1) "This school year how often have you bullied/hassled other students at school by teasing them?"; 2) "This school year how often have you bullied/hassled other students at school by insulting them?"; 3) "This school year how often have you bullied/hassled other students at school by isolating them?"; 4) "This school year, how often have you bullied/hassled other students at school by hitting them?". The first two questions refer to verbal bullying, the third to psychological bullying, and the last to physical bullying. For each of these questions 5th-graders had to choose the following answers: 1 (never), 2 (now and then), 3 (weekly), and 4 (daily). The last two possible answers fit the generally accepted definition of frequent bullying that states that "a student is being bullied or victimized when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students" (see Olweus, 1993, p. 9).

Table A2.1 in the Appendix 2 reports the responses to the four questionnaire items. The data collected in the survey indicate that 28,112 fifth-graders (7.33% of the total of 383,591 students) were involved in frequent bullying situations as bullies that occurred about once a week or more frequently. It implies that approximately one student out of fourteen bullied other students regularly during their 5th year of primary school. There are many more boys than girls who bully others; the percentage of boys who reported having bullied other schoolmates is 10.77 (n = 20,464 out of the total of 190,066 boys) while the percentage of girls is 3.95 (n = 7,648 out of the total of 193,525 girls).

Using this information on students' school bullying-related attitudes, we generate dummy variable,

[45] According to the Italian 2018 HBSC Surveillance report, 16.2% of 11 years-old students declared to have experienced victimization at least once in the last two months, among 13-years old students the percentage is of 13.9%, and at 15 years old the figure is 8.9%. The trends are the same in Europe and North America, where students aged 15 years are less likely to be bullied (23.7%) than those aged 13 years (29.6%) and 11 years (32.6%) (HBSC).

Bullying Behavior, if a student has bullied others at school weekly or daily in at least one of the four ways (*Teasing*, *Insulting*, *Isolating*, and *Hitting*). In Table A2.2 in the Appendix 2 we report the correlations between these measures of bullying. It can be seen from the table that the incidence if bullying is highly correlated across the different categories. For instance, the correlation between the two different types of verbal frequent bullying (teasing and insulting) is equal to 0.452, p-value=0.000; the correlation between verbal and psychological bullying (insulting and isolating) is 0.321, p-value=0.000, while for verbal and physical (isolating and hitting) is 0.363, p-value=0.000. Similar high correlations are found also for the other measures of bullying.

From the data provided by INVALSI, we gather information on both teachers' assessments (non-blind scores) and national standardized test scores (blind scores) in two main primary school program subjects: literacy and numeracy. The data distinguish between oral teacher-assigned grade and written teacher-assigned grade. Due to the large percentage of missing values in written grades (80.66% and 80.71% for literacy and numeracy, respectively), we only consider oral grades (*Teacher Score Literacy* and *Teacher Score Numeracy*) in our analysis. Teacher-assigned grades are based on the overall student's performance during the first term of the school year 2013/14 and can range from 1 to 10, where 6 is the passing grade.

As regards students' performance in standardized tests, we have information on test scores that are computed by INVALSI, applying the Item Response Theory (IRT) Rasch model to students' answers in the test, in order to account for different difficulties of single items (*Rasch Literacy Score* and *Rasch Numeracy Score*).[46] The INVALSI literacy test aims at assessing students' proficiency in reading comprehension that involves grammatical, lexical, and pragmatic competences. The INVALSI numeracy test evaluates students' knowledge and level of proficiency in specific math contents such as geometry and algebra. Both tests are written, the type of tasks that students have to complete includes multiple-choice and open-ended questions with a correction grid.

Since the data come from the national assessment tests which are common to all schools, the performance of students attending the same grade are by construction comparable across schools in different geographical areas of the country.

Differently from INVALSI tests, that are identical across Italian schools and are given in the same manner to all test takers, grades assigned by teachers are based on a standard that each teacher autonomously sets. Whereas the INVALSI test scores are comparable across schools and students, this is not the case for teachers' marks. The INVALSI tests are graded in the same manner for everyone, while teachers' marks are non-blind marks and might be affected by student behavior.

Apart from measures of bullying and student performance, the INVALSI dataset also allows us to build

[46] These scores are standardized to have a mean of 200 and a standard deviation of 40.

some measures of non-cognitive skills. Relying on the rich survey data collected by INVALSI at the end of the school year 2013/14, we were able to carefully consider in our analysis possible confounders such as students' motivation and self-efficacy. Non-cognitive skills are increasingly considered to be as central as cognitive skills in explaining academic outcomes (see, for example, Almlund et al. (2011)). Our first non-cognitive skill measure is based on the Academic Motivation Scale, an 18-item self-reported instrument which has been included in the INVALSI Student Questionnaire.[47] The scale allowing us to measure students' intrinsic and extrinsic motivation, included two questions about why students do their school's work: 1) "Why do you try to do well in school?", and 2) "Why do you do your homework?". Each question is followed by several responses that represent the four regulatory styles considered in the scale: external regulation (5 items)[48], introjected regulation (5 items)[49], identified regulation (4 items)[50], and intrinsic motivation (4 items)[51]. The responses to each item are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true). First, we calculate the subscale score for each of the four subscales by averaging the items that make up that subscale. Very true is scored 4, sort of true is scored 3, not very true is scored 2, and not at all true is scored 1. A high score in the subscale will indicate a high level of endorsement of that regulatory style. Then, using the individual subscale scores, we construct the *Motivation* measure as proxied by the Relative Autonomy Index (RAI) proposed by Ryan and Deci (2000), which is a single score obtained by applying a weighting to each subscale and then summing the weighted scores.[52] In this way the final measure of *Motivation* (as proxied by the RAI index*)* allows us to have an indicator of a student's overall motivational orientation with higher positive scores representing more intrinsic regulation and negative scores representing more extrinsic regulation.

In addition, the data provided by INVALSI allow us to construct a measure of student self-efficacy. To

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[47] Validation of this scale in an Italian sample is presented in Alivernini et al. (2008, 2017). The original format of the scale (32 items) was developed for students in late elementary and middle school by Ryan and Connell (1989).

[48] The subscale reflecting *external regulation* consists of five items: 1) "I try to do well in school because that's what I'm supposed to do"; 2) "I try to do well in school because I will get in trouble if I don't do well"; 3) "I try to do well in school because I might get a reward if I do well"; 4) " I do my homework because I'll get in trouble if I don't"; 5) "I do my homework because that's what I'm supposed to do".

[49] To assess students' *introjected regulation* was administered a set of five items: 1) "I try to do well in school because the teacher will think that I'm a good student if I do it do well"; 2) "I try to do well in school because I'll feel really bad about myself if I don't do well"; 3) "I try to do well in school because I will feel really proud of myself if I do well; 4) "I do my homework because I want the teacher to think I'm a good student"; 5) "I do my homework because I will feel bad about myself if I don't do it".

[50] The *identified regulation* subscale consists of four items 1) "I try to do well in school because it's important to me to understand better new things"; 2) "I try to do well in school because it's important to me to try to do well in school"; 3) "I do my homework because I want to understand the subject"; 4) "I do my homework because it's important to me to do my homework".

[51] The items associated with the *intrinsic motivation* are: 1) "I try to do well in school because I enjoy doing my schoolwork well"; 2) "I try to do well in school because it's fun"; 3) "I do my homework because it's fun; 4) "I do my homework because I enjoy doing my homework".

[52] To form the RAI, the external subscale is weighted -2, the introjected subscale is weighted -1, the identified subscale is weighted +1, and the intrinsic subscale is weighted +2.

this end, we consider a set of four questions that are derived from the Perceived Efficacy Scale for Self-Regulated Learning (Bandura, 1990), validated on Italian samples (Bandura et al., 1996).[53] Answers were given on a 4-point Likert-type scale, where one corresponds to "not able to do it at all" and four corresponds to "able to do it at all". Each student's self-efficacy score is calculated as the average of their responses. A higher score of a *Self-Efficacy* measure represents a higher level of perceived self-efficacy for self-regulated learning, which helps a student use their own resources to plan, control and analyze the execution of tasks, activities and the preparation of learning products. Students with high self-efficacy use more cognitive strategies that are useful when it comes to learning, organizing their time and regulating their own efforts; students that demonstrate a weak sense of self-efficacy may avoid certain tasks and have difficulty in paying attention, planning and persistence on learning activities.

The data at hand also provide information on a number of pupils' and parents' characteristics (gender, age, origin of birth, immigrant status, attendance of pre-primary school, parents' education and working status, a comprehensive indicator of students' socio-economic status (*ESCS Index*))[54], on whether the student is younger or older than a regular student (we build a dummy variable for students who went to school one year before the suggested age, *Early Enrolled*, and a dummy variable for students who entered the school one year after or repeated one or more years, *Late Enrolled)* and on whether he or she follows a full or part-time schedule (we build a dummy variable *Full time* for those students whose schedule is organized in entire days instead of that only in the morning). As regards school organization, we know the number of students in each class, *Class Size*, and the number of classes per school*, School Size*. In addition, we have information on province and region in which the school is located.

As previously mentioned, we focus our attention on all Italian primary schoolchildren enrolled in the 5th grade in the 2013/14 school year. Then, we limit our analytical sample to students who participated in the National Assessment Program managed by INVALSI and who completed also the Student Questionnaire ending up with a sample of 413,306 pupils. After list wise deletion of missing data, the data of 383,591 Italian primary schoolchildren (190,066 boys and 193,525 girls) from grade 5 in 26,410 classrooms and 6,468 schools were accepted for analysis.

[53] This is the list of questions: "1) How well can you finish your homework in time?; 2) How well can you study when there are other interesting things to do?; 3) How well can you focus on your schoolwork a without distraction?; 4) How well can you remember information presented in class?".

[54] ESCS is an index for the Economic, Social and Cultural Status of the student family, computed by INVALSI following an OECD's standard taking into account parents' occupations and education, along with variables that measure home possession goods (see Campodifiori et al., 2010 for details).

Table 2.1. Sample Descriptive Statistics

	Mean	St. Dev.	Obs.	Min	Max
Outcome measures:					
Rasch Literacy Score	211.982	41.255	383,591	-15.797	380.938
Rasch Numeracy Score	214.687	44.323	383,591	-7.143	361.389
Teacher Literacy Score	7.805	1.090	383,591	1	10
Teacher Numeracy Score	7.885	1.138	383,591	1	10
Bullying Behavior Measures:					
Bullying Behavior	0.073	0.261	383,591	0	1
Bullying Behavior, Teasing	0.032	0.177	383,591	0	1
Bullying Behavior, Insulting	0.028	0.164	383,591	0	1
Bullying Behavior, Isolating	0.033	0.178	383,591	0	1
Bullying Behavior, Hitting	0.023	0.150	383,591	0	1
Non-Cognitive Skills' Measures:					
Motivation	1.024	2.348	383,591	-8.750	9.000
Self-Efficacy	3.124	0.536	383,591	1	4
External Regulation	2.501	0.699	383,591	1	4
Introjected Regulation	2.960	0.640	383,591	1	4
Identified Regulation	3.591	0.490	383,591	1	4
Intrinsic Regulation	2.698	0.787	383,591	1	4
Students' Characteristics:					
Female	0.505	0.500	383,591	0	1
Age	10.936	0.342	383,558	9	14
Regularly Enrolled	0.964	0.187	383,591	0	1
Early Enrolled	0.013	0.115	383,591	0	1
Late Enrolled	0.023	0.150	383,591	0	1
Pre-Primary School	0.886	0.318	383,591	0	1
ESCS Index	0.092	0.996	383,401	-3.017	2.537
Immigrant	0.091	0.288	383,167	0	1
Mother's years of study	11.955	3.569	315,043	5	18
Father's years of study	11.411	3.561	310,305	5	18
Full time	0.316	0.465	383,591	0	1
Class Size	20.416	4.288	383,591	1	35
School Size	5.300	1.980	383,591	1	13
Southern Regions	0.379	0.485	383,591	0	1

Note: This table reports summary statistics for our data. Observations refer to the number of students attending the last year of their primary school (grade 5).
Source: Author's calculations based on data from INVALSI (wave 2013/14).

Table 2.1 reports the summary statistics. Males are 49.5 percent. The share of foreign students in the sample is 9.1 percent. The average 5th-grade class size is 20 pupils.[55] Students' parents' education is around 12 years. Pupils who went to school one year before the suggested age are 1.3 percent of the sample (n =

[55] About 25 percent of 5th-graders are in classes with more than 24 pupils.

5,131). Students who entered one year after or repeated one or more years are 2.3 percent of the sample (n = 8,787). The share of pupils whose schedule is organized in entire day (8 a.m. - 4 p.m. usually) instead of that only in the morning is 31.6 percent. Almost 38 percent of students are from the Southern Italian regions.

Sample average INVALSI test score result in literacy obtained at the end of the 5th grade is 212; its sample average in numeracy is 214. The average teachers-assigned literacy and numeracy scores are 8 over 10. We rely on information on blindly-graded national standardized tests as a proxy for students' cognitive skills. Figures A2.1 and A2.2, reported in the Appendix 2, plot binned scatterplots describing the mean relationship between the blind and blind score in literacy and numeracy. It can be seen from Figure A2.1, that *Rasch Literacy Score* (blind score) and *Teacher Literacy Score* (non-blind score) are significantly correlated. We can observe that a one standard deviation increase in the blind scores is associated with increased teacher-assigned literacy scores of 0.67 standard deviation. Similar high correlation is found for the association between the blind and non-blind numeracy scores (see Figure A2.2); one standard deviation increase in *Rasch Numeracy Score* is associated with increased *Teacher Numeracy Score* of 0.72 standard deviation.

2.3. Estimating Teachers' Grading Biases Based on Student Behavior at School

The purpose of the present study is to investigate whether students' problematic behavior at school affects teachers' grading practices, with a focus on Italian primary school setting. To do this, we exploit the presence in our dataset of the detailed information on students' school bullying-related attitudes, as well as the availability of both teachers' assessment (non-blind scores) and standardized test results (blind scores) in two core subjects of the primary school curriculum: literacy and numeracy.

2.3.1. Methodology

To measure the extent to which teachers' judgments may vary for students with different school behavioral characteristics, we exploit the data pooled over the two types of scores (one blind and the other non-blind in the two subjects) and estimate the following score equation model:

$$Score_{ijsh} = \alpha + \gamma Bullying\ Behavior_{ijh} + \delta Non - Blind\ Score_{ijsh} + \beta(Bullying\ Behavior_{ijh} \times Non - Blind\ Score_{ijsh}) + \phi X'_{ijh} + \theta_k + \varepsilon_{ijsh} \quad (1)$$

where $Score_{ijsh}$ is a score of student i in class j in subject s (in literacy or numeracy) in school h in the blind test, *Rasch Score*, or the teacher's grading procedure, *Teacher Score*; $Bullying\ Behavior_{ijh}$ is the dummy variable equal to 1 if the student i bullies repeatedly (weekly or daily) other students at school h; and

$Non-Blind\ Score_{ijsh}$ is the dummy identifying the teacher-assigned score for student *i* in class *j* in subject *s* in school *h.* The coefficient α is the average score obtained by non-bullies on the national standardized INVALSI test in subject *s* - literacy or numeracy. The coefficients for $Bullying\ Behavior$ and $Non-Blind\ Score$, γ and δ, identify the effects of being a bully at school and a non-blind scoring procedure, respectively, on the test score. The parameter of interest is that pertaining to the interaction of $Bullying\ Behavior$ and $Non-Blind\ Score$, β, which measures the average difference between the non-blind scores of bad-behaved students and those of good-behaved students, given the respective difference in the blind score. In this way, we can interpret β as a measure of a potential primary-school teacher bias based on a student in-school behavior; if negative, the bias is toward bad-behaved students and if positive, good-behaved students. Since $Bullying\ Behavior$ at school, unlike the student's gender or ethnicity, cannot be viewed as exogeneous to the model determining the outcome $Score_{ijsh}$, therefore, we cannot interpret β as a causal effect. X' is a vector of individual controls that includes gender, socio-economic status, immigrant status, early/late enrolment, pre-primary school attendance, and measures of non-cognitive abilities such as academic motivation and self-efficacy; θ_k are school fixed effects (in alternative models we use school-level controls),[56] while ε_{ijsh} is a random error term.

In the following section we present estimated parameters for Equation (1) for two subjects: literacy and numeracy.

2.3.2. Empirical Results

In this section, we report our main results. Table 2.2 presents the estimated parameters for Equation (2) in *Literacy*, while in Table 2.3 we present the corresponding analysis for *Numeracy.* In each subject, the dataset is a stacked file including the teacher-assigned scores (non-blind) and standardized test scores (blind). All test scores were standardized to a distribution with zero mean a unit standard deviation. This procedure was applied within subjects to each test separately. We build up the specification gradually. Column (1) includes the results of our most parsimonious specification. In column (2) we include as controls only *Female*, socio-economic status (as proxied by the *ESCS Index*), pre-primary school attendance*,* immigrant status, early/late primary school enrolment. In column (3) we additionally include controls for student's academic motivation and regulatory self-efficacy. Column (4) includes school-level characteristics (*Class Size*, *School Size*, school organization, and the region in which the school is located) while in column (5) we include school fixed effects. The inclusion of the school fixed effects allows us to control for unobserved factors that are shared by

[56] We consider school fixed effects instead of classroom fixed effects because the latter may be endogenous if bullies are systematically placed in specific classes (smaller ones, those with less disruptive students) by teachers or headmasters to monitor their behavior.

all individuals within the same school - for example, the school principal management practices and the disciplinary regime at the school.

Table 2.2. Teachers' Grading Bias in Literacy

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*
Bullying Behavior × Non-Blind Score	-0.097***	-0.097***	-0.097***	-0.097***	-0.097***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Bullying Behavior	-0.385***	-0.266***	-0.208***	-0.203***	-0.190***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Non-Blind Score	0.010***	0.011***	0.011***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Female		0.185***	0.150***	0.149***	0.150***
		(0.002)	(0.002)	(0.002)	(0.002)
ESCS Index		0.260***	0.253***	0.250***	0.251***
		(0.001)	(0.001)	(0.001)	(0.001)
Immigrant		-0.359***	-0.370***	-0.378***	-0.386***
		(0.004)	(0.004)	(0.004)	(0.004)
Pre-Primary School		0.019***	0.026***	0.023***	0.139***
		(0.004)	(0.004)	(0.004)	(0.008)
Early Enrolled		0.066***	0.046***	0.059***	0.014
		(0.010)	(0.010)	(0.010)	(0.009)
Late Enrolled		-0.376***	-0.380***	-0.378***	-0.342***
		(0.008)	(0.008)	(0.008)	(0.008)
Motivation			0.084***	0.085***	0.083***
			(0.001)	(0.001)	(0.001)
Self-efficacy			0.062***	0.063***	0.063***
			(0.001)	(0.001)	(0.001)
Full time				-0.023***	-0.032***
				(0.002)	(0.004)
Class Size				0.005***	0.004***
				(0.000)	(0.000)
School Size				0.006***	0.000
				(0.001)	(.)
Southern Regions				-0.029***	0.000
				(0.002)	(.)
Constant	0.028***	-0.074***	-0.064***	-0.170***	-0.242***
	(0.002)	(0.004)	(0.004)	(0.007)	(0.010)
Observations	767182	765954	765954	765954	765954
Adjusted R^2	0.013	0.115	0.128	0.129	0.198
School Fixed Effects	No	No	No	No	Yes

Notes: OLS estimates. Standard errors corrected for heteroskedasticity are reported in parentheses. All measures of school performance and measures of students' non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. See Table A2.3 in Appendix 2 for the full variables' description. The number of observations is twice the number of students, since the dataset is stacked; for each student there are two observations, one for the teacher-assigned score and one for the INVALSI Rasch literacy score.

Table 2.3. Teachers' Grading Bias in Numeracy

Dependent Variable:	(1) *Numeracy Score*	(2) *Numeracy Score*	(3) *Numeracy Score*	(4) *Numeracy Score*	(5) *Numeracy Score*
Bullying Behavior × Non-Blind Score	-0.155***	-0.155***	-0.155***	-0.155***	-0.155***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Bullying Behavior	-0.251***	-0.206***	-0.149***	-0.148***	-0.137***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Non-Blind Score	0.014***	0.014***	0.014***	0.014***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Female		-0.067***	-0.101***	-0.101***	-0.100***
		(0.002)	(0.002)	(0.002)	(0.002)
ESCS Index		0.228***	0.221***	0.221***	0.226***
		(0.001)	(0.001)	(0.001)	(0.001)
Immigrant		-0.258***	-0.268***	-0.266***	-0.264***
		(0.004)	(0.004)	(0.004)	(0.004)
Pre-Primary School		0.030***	0.036***	0.038***	0.126***
		(0.004)	(0.004)	(0.004)	(0.008)
Early Enrolled		0.099***	0.080***	0.080***	0.023**
		(0.010)	(0.010)	(0.010)	(0.010)
Late Enrolled		-0.285***	-0.289***	-0.288***	-0.261***
		(0.008)	(0.008)	(0.008)	(0.008)
Motivation			0.080***	0.080***	0.077***
			(0.001)	(0.001)	(0.001)
Self-efficacy			0.062***	0.061***	0.061***
			(0.001)	(0.001)	(0.001)
Full time				-0.014***	-0.004
				(0.002)	(0.004)
Class Size				0.003***	0.003***
				(0.000)	(0.000)
School Size				0.005***	0.000
				(0.001)	(.)
Southern Regions				0.003	0.000
				(0.003)	(.)
Constant	0.018***	0.031***	0.040***	-0.054***	-0.110***
	(0.002)	(0.004)	(0.004)	(0.008)	(0.010)
Observations	767182	765954	765954	765954	765954
Adjusted R^2	0.008	0.077	0.089	0.089	0.174
School Fixed Effects	No	No	No	No	Yes

Notes: OLS estimates. Standard errors corrected for heteroskedasticity are reported in parentheses. All measures of school performance and measures of students' non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. See Table A2.3 in Appendix 2 for the full variables' description. The number of observations is twice the number of students, since the dataset is stacked; for each student there are two observations, one for the teacher-assigned score and one for the INVALSI Rasch numeracy score.

In all specifications reported in Tables 2.2 and 2.3, the coefficient on the *Bullying Behavior* dummy variable is negative and statistically significant at the 1% level for both subjects (literacy and numeracy). This implies that, on average, children who bully others at school have a lower achievement on literacy and numeracy standardized tests with respect to students who are not perpetrators of bullying. We find that children who repeatedly and intentionally injure or discomfort other students have disadvantages in literacy of 19% and in numeracy of 14% of a standard deviation of the blind score distribution (see column (5)). These results are in line with previous findings reported by Brown and Taylor (2008) and Le et al. (2005) who document that being a bully at school or having behavior disorder problems have largest negative impact on the educational attainment.

It can be seen from Tables 2.2 and 2.3 that the mean differences between the (non-blind) teachers' scores and the (blind) standardized test scores are very small, positive and statistically significant (at the 1% level) for both subjects.

The main parameter of interest is the estimated coefficient on the interaction between the bullying behavior indicator for students who are bullies at school and the non-blind teaching score indicator. These estimates are negative and statistically different from zero (at the 1% level) in all specifications reported in Tables 2.2 and 2.3.

In summary, these results suggest that teachers' scores widen an already existing bully - non-bully achievement difference in literacy and numeracy. The evidence from the two subjects is similar but not identical. Bullying behavior bias coefficients are greater for numeracy than those estimated for literacy; our regression analysis suggests that the estimated teacher's bias based on school behavior (in grade 5) is 9.7% of a SD in literacy and 15.5% of a SD in numeracy. These results are robust to the inclusion of a rich set of covariates and school fixed effects.

In the following section we examine whether these effects are heterogeneous according to students' gender, non-cognitive skills, to the socio-economic environment in which they live and check the robustness of the basic results.

2.4. Heterogeneity and Robustness Checks

The evidence presented in the literature on teachers' grading bias convincingly suggests a bias against boys with respect to girls (e.g., Cornwell et al., 2013; Di Liberto et al., 2021; Lavy, 2008). For instance, in the Italian context, the study by Di Liberto et al. (2021), using census data for all Italian students attending the 5th and 6th grades, reveals that since primary school, boys are graded less favourably than girls in literacy and numeracy. In particular, the authors document that the teachers' bias against primary-school boys is 19% of a

SD in literacy and 12% of a SD in numeracy. Boys are also known to have more attention and behavioral difficulties than girls (e.g., Beamen et al. 2006; Rosen and Nofziger, 2019) and to outperform girls in mathematics (e.g., Contini et al., 2017).

We re-estimate Equation (1) separately for girls and for boys. Results are reported in Table 2.4. It can be seen from the table that, our main parameter of interest, the estimated coefficient of the interaction term *Bullying Behavior* × *Non-Blind Score*, is negative and statistically significant at the 1% level both for boys and for girls in two core primary school subjects: literac*y* and numeracy. However, the results suggest that teachers' grading bias in literacy is smaller against female bullies than against male bullies, while the estimated bias against male bullies is smaller in numeracy.

We next replicate the analysis by separating the sample for socio-economic background (below and above the median). The results reported in Table 2.5. demonstrate large difference in the effect across socio-economic and cultural status. We find that teachers' grading bias coefficients are greater for perpetrators of bullying from less well-off families.

We also perform the analysis for two subsamples of fifth-graders that share the same level of academic motivation and belief in their self-regulatory capabilities to manage their time effectively, organize their work and minimize distractions. Results are reported in Table 2.6, with Panel (A) for students having a more extrinsic academic motivation and a weak sense of efficacy in their self-regulatory skills, and a Panel (B) including those students who reported to have a more intrinsic motivation and a robust sense of regulatory self-efficacy. The regression results show that the coefficient on the interaction term *Bullying Behavior* × *Non-Blind Score* is negative and statistically significant at the 1% level in all specifications reported in the table for both groups of students. However, the teachers' grading bias against worse-behaved students is higher for students with higher levels of non-cognitive skills.

The results reported in Sections 2.3 and 2.4 remain similar if instead of using scores computed by INVALSI applying the IRT Rasch model to students' answers in the test, in order to account for different difficulties of single items, we use fractions of correct answers in INVALSI literacy and numeracy test.

Taken together, these results reinforce the point that primary-school teachers consider students' behavior at school when assessing their cognitive abilities in two main subjects: literacy and numeracy.

Table 2.4. Heterogeneous Effects on Teachers' Grading Bias in Literacy e Numeracy: by Gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*
Panel (A): **Girls**										
Bullying Behavior × *Non-Blind Score*	-0.061***	-0.062***	-0.062***	-0.062***	-0.062***	-0.131***	-0.132***	-0.132***	-0.132***	-0.132***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)	(0.017)	(0.016)
Bullying Behavior	-0.346***	-0.273***	-0.211***	-0.206***	-0.187***	-0.252***	-0.192***	-0.129***	-0.132***	-0.116***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)
Non-Blind Score	0.054***	0.054***	0.054***	0.054***	0.054***	0.072***	0.072***	0.072***	0.072***	0.072***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	387050	386458	386458	386458	386458	387050	386458	386458	386458	386458
Adjusted R^2	0.006	0.100	0.116	0.117	0.192	0.005	0.071	0.087	0.088	0.184
Panel (B): **Boys**										
Bullying Behavior × *Non-Blind Score*	-0.079***	-0.079***	-0.079***	-0.079***	-0.079***	-0.122***	-0.122***	-0.122***	-0.122***	-0.122***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)
Bullying Behavior	-0.354***	-0.279***	-0.223***	-0.218***	-0.209***	-0.297***	-0.232***	-0.179***	-0.173***	-0.163***
	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Non-Blind Score	-0.037***	-0.037***	-0.037***	-0.037***	-0.037***	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	380132	379496	379496	379496	379496	380132	379496	379496	379496	379496
Adjusted R^2	0.015	0.112	0.124	0.125	0.196	0.013	0.083	0.093	0.093	0.175
Individual Characteristics	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Family Background	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Non-Cognitive Skills	No	No	No	Yes	Yes	No	No	No	Yes	Yes
School Fixed Effects	No	No	No	No	Yes	No	No	No	No	Yes

Notes: OLS estimates. Standard errors corrected for heteroskedasticity are reported in parentheses. All measures of school performance are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. See Table A2.3 in Appendix 2 for the full variables' description. The number of observations is twice the number of students, since the dataset is stacked; for each student there are two observations, one for the teacher-assigned score and one for the INVALSI Rasch score.

Table 2.5. Heterogeneous Effects on Teachers' Grading Bias in Literacy e Numeracy: by Socio-Economic Background

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*
Panel (A): **Low SES**										
Bullying Behavior × *Non-Blind Score*	-0.111***	-0.111***	-0.111***	-0.111***	-0.111***	-0.174***	-0.175***	-0.175***	-0.175***	-0.175***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)
Bullying Behavior	-0.401***	-0.341***	-0.287***	-0.271***	-0.249***	-0.259***	-0.265***	-0.211***	-0.202***	-0.184***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Non-Blind Score	-0.048***	-0.047***	-0.047***	-0.047***	-0.047***	-0.067***	-0.067***	-0.067***	-0.067***	-0.067***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	396622	396038	396038	396038	396038	396622	396038	396038	396038	396038
Adjusted R^2	0.017	0.051	0.062	0.065	0.148	0.011	0.026	0.037	0.038	0.134
Panel (B): **High SES**										
Bullying Behavior × *Non-Blind Score*	-0.053***	-0.054***	-0.054***	-0.054***	-0.054***	-0.094***	-0.094***	-0.094***	-0.094***	-0.094***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
Bullying Behavior	-0.292***	-0.236***	-0.162***	-0.156***	-0.148***	-0.183***	-0.194***	-0.124***	-0.120***	-0.112***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
Non-Blind Score	0.071***	0.071***	0.071***	0.071***	0.071***	0.099***	0.099***	0.099***	0.099***	0.099***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	370560	370296	370296	370296	370296	370560	370296	370296	370296	370296
Adjusted R^2	0.008	0.034	0.055	0.056	0.134	0.006	0.018	0.036	0.037	0.131
Individual Characteristics	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Family Background	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Non-Cognitive Skills	No	No	No	Yes	Yes	No	No	No	Yes	Yes
School Fixed Effects	No	No	No	No	Yes	No	No	No	No	Yes

Notes: OLS estimates. Standard errors corrected for heteroskedasticity are reported in parentheses. All measures of school performance are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. See Table A2.3 in Appendix 2 for the full variables' description. The number of observations is twice the number of students, since the dataset is stacked; for each student there are two observations, one for the teacher-assigned score and one for the INVALSI Rasch score.

Table 2.6. Heterogeneous Effects on Teachers' Grading Bias in Literacy e Numeracy: by Non-Cognitive Skills

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Literacy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*	*Numeracy Score*
Panel (A): **More Extrinsic Academic Motivation and Low Self-Efficacy**										
Bullying Behavior × *Non-Blind Score*	-0.071***	-0.073***	-0.073***	-0.073***	-0.073***	-0.106***	-0.107***	-0.107***	-0.107***	-0.107***
	(0.014)	(0.013)	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)	(0.013)	(0.013)	(0.012)
Bullying Behavior	-0.275***	-0.185***	-0.185***	-0.180***	-0.164***	-0.172***	-0.145***	-0.145***	-0.142***	-0.127***
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Non-Blind Score	-0.039***	-0.038***	-0.038***	-0.038***	-0.038***	-0.025***	-0.024***	-0.024***	-0.024***	-0.024***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	212076	211748	211748	211748	211748	212076	211748	211748	211748	211748
Adjusted R^2	0.012	0.105	0.105	0.106	0.181	0.006	0.071	0.071	0.071	0.158
Panel (B): **More Intrinsic Academic Motivation And High Self-Efficacy**										
Bullying Behavior × *Non-Blind Score*	-0.107***	-0.104***	-0.104***	-0.104***	-0.104***	-0.222***	-0.221***	-0.221***	-0.221***	-0.221***
	(0.031)	(0.028)	(0.028)	(0.028)	(0.027)	(0.030)	(0.029)	(0.029)	(0.029)	(0.027)
Bullying Behavior	-0.480***	-0.347***	-0.347***	-0.344***	-0.318***	-0.305***	-0.246***	-0.246***	-0.247***	-0.219***
	(0.022)	(0.021)	(0.021)	(0.021)	(0.020)	(0.022)	(0.021)	(0.021)	(0.021)	(0.019)
Non-Blind Score	0.058***	0.059***	0.059***	0.059***	0.059***	0.058***	0.059***	0.059***	0.059***	0.059***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	162342	162100	162100	162100	162100	162342	162100	162100	162100	162100
Adjusted R^2	0.010	0.118	0.118	0.119	0.204	0.007	0.082	0.082	0.082	0.189
Individual Characteristics	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Family Background	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
School Fixed Effects	No	No	No	No	Yes	No	No	No	No	Yes

Notes: OLS estimates. Standard errors corrected for heteroskedasticity are reported in parentheses. All measures of school performance are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. See Table A2.3 in Appendix 2 for the full variables' description. The number of observations is twice the number of students, since the dataset is stacked; for each student there are two observations, one for the teacher-assigned score and one for the INVALSI Rasch score.

2.5. Concluding Remarks

In this chapter, we explored whether students' school bullying behavior towards classmates influences teachers' grading practices.

Within pupils' cognitive and non-cognitive skills, measures of childhood and adolescent behavior at school attract a particular attention in the economics of education literature (e.g., Heckman et al., 2013; Papageorge et al., 2019). In recent years, a wave of interest has arisen in the role that students' bullying behavior at school might play in explaining educational achievements and other significant life outcomes (e.g., Brown and Taylor, 2008; Eriksen et al., 2014; Gorman et al., 2021; Sarzosa and Urzúa, 2021). Bullying exhibited by some children toward their peers in the school setting refers to a series of behaviors aimed at other classmates in order to cause harm intentionally, at the physical, psychological, verbal, or relational level.

The present study aimed to shed light on this relevant problematic social behavior and to estimate the extent to which primary-school teachers' judgments might systematically vary for students with different bullying-related attitudes. Our study uses data from the Italian national learning assessment program INVALSI, involving the 5th grade Italian students, that allow us to compare the teacher-assigned scores (non-blind scores) and the standardized test scores (blind scores) that fifth-graders received in the same area during the same school year, assuming that the latter are free from teachers' bias based on student behavior. Using ordinary least squares with school fixed effects, we detect that teachers are not neutral to students' behavior when assessing their cognitive ability in numeracy and literacy. The pattern of results suggests that primary schoolchildren who frequently bully their schoolmates are graded less favourably in literacy and numeracy with respect to children who are not engaged in school bullying. We find that the primary-school teachers' assessment bias against bullies in the 5th grade is 9.7% of a standard deviation in literacy and 15.5% of a standard deviation in numeracy. These results are robust to the inclusion of other confounders that may lead to grading bias (i.e., gender, socio-economic status, immigrant status), to the inclusion of school fixed effects, and to alternative measures of student performance in blindly-graded tests.

The regression analysis of the heterogeneous effects suggests that teachers' evaluation bias is smaller against female bullies with respect to male bullies in literacy, while the estimated bias in numeracy is smaller against male bullies compared to female bullies. Moreover, we find that teachers' grading bias coefficients are higher for perpetrators of bullying from less well-off families.

Clearly, students' in-school behavioral characteristics cannot be viewed as exogeneous to educational attainment. Therefore, the estimation results reported in this chapter have been interpreted as associations rather than causal effects.

In conclusion, let us mention that in recent years, certain countries (e.g., Norway, the United States) implemented the reforms aimed at improving their school assessment systems, by making it more standardized

and fair. One of the measures proposed by these reforms was the complete separation between achievement assessment and behavior. The empirical evidence presented here go against the objectives sought by these reforms suggesting that teachers are not neutral to positive (negative) behavioral characteristics in assessing students' cognitive abilities. We hope that our results could be useful for those interested in designing and evaluating technologies to reduce grading biases.

Appendix 2

Table A2.1. Frequency of Different Types of Bullying in Primary School (in grade 5, at age 10)

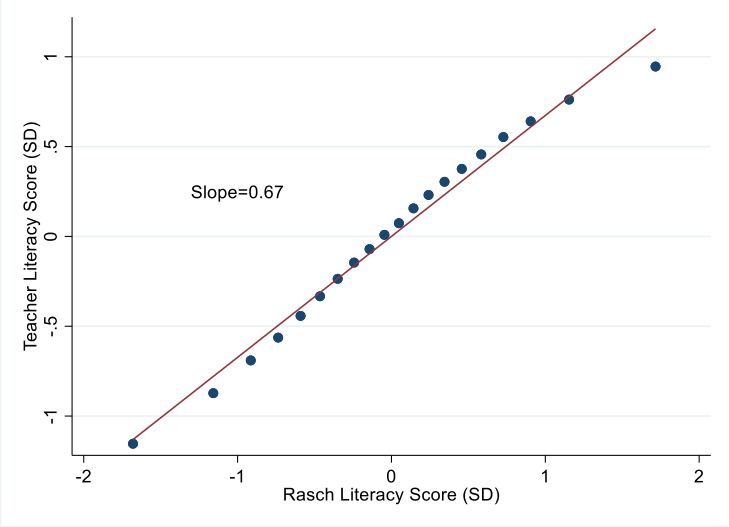
	Verbal Bullying: *Teasing*			Verbal Bullying: *Insulting*			Psychological Bullying: *Isolating*			Physical Bullying: *Hitting*		
	All	**Boys**	**Girls**	**All**	**Boys**	**Girls**	**All**	**Boys**	**Girls**	**All**	**Boys**	**Girls**
Never	48.50	39.62	57.22	67.10	58.70	75.34	59.14	57.35	60.89	83.19	74.82	91.40
Sometimes	48.26	55.45	41.21	30.15	37.02	23.40	37.60	37.92	37.29	14.51	21.65	7.49
Every week	1.68	2.57	0.81	1.66	2.59	0.75	1.84	2.70	1.00	1.26	1.98	0.56
Every day	1.55	2.36	0.76	1.09	1.69	0.51	1.42	2.03	0.82	1.04	1.54	0.55
Observations	383,591	190,066	193,525	383,591	190,066	193,525	383,591	190,066	193,525	383,591	190,066	193,525

Table A2.2. Correlation Matrix for Different Measures of Bullying

	Bullying Behavior	Bullying Behavior: *Teasing*	Bullying Behavior: *Insulting*	Bullying Behavior: *Isolating*	Bullying Behavior: *Hitting*
Whole sample					
Bullying Behavior	1.000				
Bullying Behavior: Teasing	0.650	1.000			
Bullying Behavior: Insulting	0.599	0.452	1.000		
Bullying Behavior: Isolating	0.653	0.302	0.321	1.000	
Bullying Behavior: Hitting	0.546	0.268	0.363	0.277	1.000
Boys					
Bullying Behavior	1.000				
Bullying Behavior: Teasing	0.656	1.000			
Bullying Behavior: Insulting	0.609	0.465	1.000		
Bullying Behavior: Isolating	0.642	0.311	0.328	1.000	
Bullying Behavior: Hitting	0.550	0.279	0.370	0.289	1.000
Girls					
Bullying Behavior	1.000				
Bullying Behavior: Teasing	0.622	1.000			
Bullying Behavior: Insulting	0.557	0.393	1.000		
Bullying Behavior: Isolating	0.671	0.256	0.282	1.000	
Bullying Behavior: Hitting	0.521	0.214	0.320	0.229	1.000

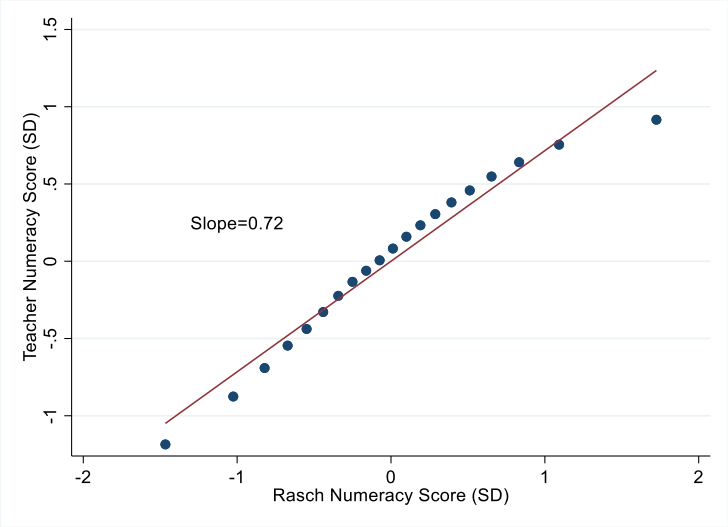
Notes: All the reported correlation rates are statistically significant at the 1 percent level.

Figure A2.1. Association Between the Blind and Non-Blind Literacy Scores



Note: This figure plots binned scatterplots describing the mean relationship between the scores assigned by Italian language teachers and standardized literacy scores graded blindly. All scores are standardized (the mean equals zero and the variance equals one).

Figure A2.2. Association Between the Blind and Non-Blind Numeracy Scores



Note: This figure plots binned scatterplots describing the mean relationship between the scores assigned by math teachers and standardized numeracy test scores. All scores are standardized (the mean equals zero and the variance equals one).

In Table A2.3 is reported a complete description of the variables used in the econometric analysis performed in Chapter 2.

Table A2.3. Variable Description

Outcome Measures:	
Rasch Literacy Score *Rasch Numeracy Score*	Scores computed by INVALSI applying the IRT Rasch model to students' answers in the national standardized literacy/numeracy test, in order to account for different difficulties of single items in the test. These scores are obtained at the end of the school year.
Teacher Score Literacy *Teacher Score Numeracy*	Oral marks assigned by Italian language/math teachers at the end of the first term of the school year.
Bullying Behavior Measures:	
Bullying Behavior	Binary variable equal to one if a child has bullied others weekly or daily in at least one of the four ways (teasing, insulting, isolating, and hitting) during his or her 5th year of primary school.
Bullying Behavior: Teasing	Binary variable equal to one if a child has bullied others by teasing them weekly or daily.
Bullying Behavior: Insulting	Binary variable equal to one if a child has bullied others by insulting them weekly or daily.
Bullying Behavior: Isolating	Binary variable equal to one if a child has bullied others by isolating them weekly or daily.
Bullying Behavior: Hitting	Binary variable equal to one if a child has bullied others by hitting them weekly or daily.
Non-cognitive skills' Measures:	
External Regulation	Score calculated as the average of student's responses on the items that make up the External Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Introjected Regulation	Score calculated by averaging the student's responses on the items that make up the Introjected Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Identified Regulation	Score calculated by averaging the student's answers on items that make up the Identified Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Intrinsic Motivation	Score calculated by averaging the student's responses on items that make up the Intrinsic Motivation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Motivation (as proxied by Relative Autonomy Index)	Score obtained by applying a weighting to the External Regulation, Introjected Regulation, Identified Regulation, and Intrinsic Motivation Subscales. Then we summed the weighted scores. To form the RAI, the following formula is used: 2 × Intrinsic + Identified - Introjected - 2 × External motivation. High positive scores indicate greater intrinsic or self-determined motivation, and low negative scores indicate more extrinsic or controlled regulation.
Self-efficacy	Score obtained as the average of responses on the items that make up the Perceived Efficacy Subscale for Self-Regulated Learning. Answers are on a 4-point Likert-type scale, where 1 corresponds to "not able to do it at all" and 4 corresponds to "able to do it at all". A higher score represents a higher level of self-efficacy.
Students' socio-demographic characteristics:	
ESCS Index	Index of social, economic and cultural status of the student's family.
Female	Dummy variable equals to 1 if the observation refers to female.
Age	Student's age (number of years).
Pre-Primary School	Pre-primary school attendance (dummy variable equals to 1 for students who went to the pre-primary school).
Immigrant	Dummy variable equals to 1 if the observation refers to first or second-generation immigrant student.
Early Enrolled	Dummy variable equals to 1 for students who is younger than a regular student.
Late Enrolled	Dummy variable equals to 1 for students who is older than a regular student.
School organization and characteristics:	
Full time	Dummy variable equals to 1 if the student's schedule is organized in entire day (8 am -4 pm).
Class Size	Average number of students in class
School Size	Number of classes

Chapter 3

On Effects of Exposure to Bullying in Primary School on Later Educational Outcomes

Abstract

The current study explores the consequences of experiencing school bullying victimization in primary school on children's subsequent educational attainment. For this purpose, census data on the whole population of Italian children attending the 5th grade in the school year 2013/14 are used. The data contain information on psychological and physical bullying - including teasing, insulting, exclusion, and hitting - and their frequency. Using ordinary least squares and matching estimators, we quantify the impact of exposure to bullying in the 5th grade of primary school on educational outcomes, including standardized test scores and teacher-assigned marks in literacy and numeracy, achieved in the 8th and 10th grades of secondary school. The pattern of results suggests that being bullied in primary school has a considerable negative effect on victims' performance not only 3 but also 5 years after the exposure to bullying. Our findings reveal that any form of bulling (physical, verbal or indirect through social exclusion), as well as its intensity, matters for cognitive skill formation process of victimized children.

***JEL classification**: I21; I24; I28.*

***Keywords**: Education; Bullying Victimization; School Performance; Non-cognitive Skills; Propensity Score Matching.*

3.1. Introduction

In this study, we analyze the effect of bullying victimization on school performance. Despite a keen interest among educators and policymakers, the phenomenon of school bulling has not been studied sufficiently well in the economic literature. Bullying can be defined as repeated negative actions executed by a more powerful person or a group of persons against someone who cannot effectively resist (Olweus, 1993). Power may arise from superior strength, maturity, peer status or peer support. Bullying can be physical in nature, verbal, or indirect – through social aggression and exclusion; the existence of an asymmetric power relationship among subjects involved bonds these different forms of bullying (Olweus, 2010).

Bullying in school settings is a serious global problem effecting high percentages of children: almost one in three students has been bullied by their peers at school at least once in the last month (UNESCO, 2019).[57] Available international evidence indicates that bullying can be found, up to different extents, in all schools, and it is common throughout different cultures. Bullying occurs at all grade levels, although most frequently during primary school (OECD, 2019; EC 2021 Education and Training Monitor).[58] A global meta-analysis reveals that between 70% and 80% of all boys and girls aged 8-11 years had experienced bullying from a classmate in the past year. However, this percentage decreased to 50% among those aged 12-17 years (Devries et al., 2018).[59] In this scenario, ensuring that all schoolchildren have access to safe, inclusive, health-promoting learning environments is a strategic priority in The Global Education 2030 Agenda (UNESCO 2019).

As in other countries, bullying is a cause of concern also in Italy, the country we examine in this study. According to the Italian 2018 HBSC Surveillance report, 16.2% of 11 years-old students declared to have experienced victimization at least once in the last two months, among 13-years old students the percentage is of 13.9%, and at 15 years old the figure is 8.9%.[60] Another national research shows that, more than half of all

[57] According to the UNESCO definition, "bullying is characterized as aggressive behavior that involves unwanted, negative actions, is repeated over time, and an imbalance of power or strength between the perpetrator or perpetrators and the victim" (UNESCO, 2019, p. 14); for a student to be considered a victim of bullying, aggressions should occur at least once or twice a month or more.

[58] There are, however, considerable regional differences in students' reported exposure to bullying. Using international self-report data (mainly the GSHS and the HBSC, supplemented by PIRLS and PISA data), the UNESCO 2019 study suggests that the proportion of pupils reporting that they have been bullied is highest in sub-Saharan Africa (48.2%), North Africa (42.7%) and the Middle Est (41.1%) and lowest in Europe (25%), the Caribbean (25%), and Central America (22.8%). Psychological bullying is reported more frequently in Europe and North America, while physical bullying is the most common type of bullying reported in other regions.

[59] The trends are the same in Europe and North America, where students aged 15 years are less likely to be bullied (23.7%) than those aged 13 years (29.6%) and 11 years (32.6%) (HBSC). TIMSS data show a similar trend, with the prevalence of being bullied decreasing from 43% among those aged 10 years to 36% among those aged 14 years.

[60] In terms of trend with data reference period from 2002 to 2018, based on the HBSC data, Italy has seen a decline in bullying over time (26.9% in 2002, 15.6% in 2014, and 13% in 2018).

Italian students aged 11-17 experience bullying at least a few times a year, while two in ten children (19.8%) report having been bullied two or more times in a month (ISTAT, 2015).

Bullying among schoolchildren as a social phenomenon has been studied in psychology and sociology literature since the 1970.[61] This literature highlighted that school bullying can be devastating for the victims. It has found that frequently bullied students report a range of psychological, psychosomatic, and behavioural problems – including anxiety, depression, low self-esteem, loneliness and sadness, suicidal ideation, and suicide attempts (Kim et al., 2009; Kochel et al., 2012; Livingston et al., 2019). It has also been documented that this aggressive behavior is more frequent among boys than girls (Boulton and Underwood,1992; Perry et al. 1988) and that the size of the class or the school is not significant determinant of the likelihood of bullying occurrence in the class or the school (Olweus, 1993, 1997). It has been shown that bullying victims have less attention in the classroom, are more likely to miss lessons, avoid school activities, and drop out of school (Smith et al., 2004).

From an economic point of view, school bullying may be extremely costly, not only in terms of immediate individual welfare but also in terms of medium and long run consequences; it is reasonable to expect that this undesired behavior among schoolchildren might adversely affect schooling attainment, further education, and employment prospects.[62] Notably, unlike psychology and sociology, economic research has not paid enough attention to bullying.[63] Only a handful of papers in economics analyze the phenomenon of school bullying and its consequences on socio-economic outcomes. [64] These studies did not however focus specifically on the effects of exposure to bullying in primary school on cognitive skill formation during middle and high school.[65]

The aim of this study is to explore the extent to which the experiencing psychological and/or physical school bullying victimization may influence subsequent educational achievements. Our empirical analysis is carried out using census data on a cohort of 365,404 primary schoolchildren, provided by the National Institute

[61] See, for example, Bandura (1973), Bjorkqvist et al. (1992), Carlson et al. (1989), Kanetsuna and Smith (2002), Olweus (1978), Olweus (1999), Rigby and Slee (1991), Rigby (1996), Roland (1989), Smith and Brain (2000), Wolke et al. (2001).

[62] Gutman and Feinstein (2008) using data from the Avon Longitudinal Study of Parents and Children (ALSPAC) found that children's individual experiences of bullying, victimization, and friendships are key factors affecting their well-being.

[63] According to Sarzosa and Urzúa (2021), it can be attributed to at least two reasons. First, the lack of representative information about bullying in both cross-sectional and longitudinal studies; and second, the fact that the selection into this behavioral phenomenon is complex and non-random, reducing the chances of reliable identification strategies.

[64] Research on the effects of school bullying in the economic literature can be found in Ammermueller (2012), Brown and Taylor (2008), Delprato et al. (2017), Eriksen et al. (2014), Gorman et al. (2021), Oliveira et al. (2018), Ponzo (2013), Sarzosa and Urzúa (2021).

[65] In this study, we follow the literature and define cognitive skills as a "mental capability that… involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Gottfredson, 1997, p. 13), and non-cognitive skills as "the patterns of thought, feelings, and behaviors that reflect the tendency to respond in certain ways in certain circumstances" (Roberts, 2009, p.140).

for the Evaluation of the Education System (INVALSI), which enables us to relate a child's experience of bullying when in 5th grade (at age 10) to his/her subsequent educational attainment observed during various stages of adolescence (at age 13 and 15).

Using both parametric estimators (ordinary least squares with school fixed effects) and non-parametric matching estimators, we quantify the impact of exposure to bullying in the 5th grade of primary school on schooling outcomes, including standardized test scores and teacher-assigned marks in literacy and numeracy, achieved in the 8th and 10th grades of secondary school. Our empirical findings suggest that school bullying victimization has an adverse effect on students' subsequent performance.

The phenomenon of school bullying victimization is an important and complex issue; longitudinal research on the degree of its influence on the formation of students' cognitive skills in the economic literature are extremely limited. Our study provides new robust evidence on the consequences of experiencing bullying victimization in primary school on later school performance observed in lower and upper secondary school. Using information on bullying status collected well before the educational outcomes allows to control for potential reverse causality arising from school bullying victimization affecting performance and performance affecting bullying. We provide evidence on the medium-term impact of being bullied at age 10 on educational attainment, based on a large-scale longitudinal study considering the whole population of Italian children attending the 5th grade in the school year 2013/14. This allows us to solve selection biases that might derive from specific samples and to strengthen to external validity of our results.

The remainder of the Chapter 3 unfolds as follows. Section 3.2 surveys the economics literature analysing bullying victimization and its consequences. Section 3.3 discusses the institutional context, the available data, and measures. Section 3.4 explores the determinants of school bullying victimization. In Section 3.5 we present and discuss results from regression analyses of the impact of school bullying victimization on later educational outcomes. Section 3.6 investigates heterogeneity. Section 3.7 reports the empirical results obtained with matching estimators while Section 3.8 concludes.

3.2. The State of the Art

Despite the keen public attention devoted to the widespread phenomenon of school bullying, we are not well aware about the dimension and consequences of this undesired social behavior. Even though research in education and psychology on school bullying has developed rapidly since the 1970s, the economic literature for a long time has mostly stayed away from research efforts aimed at understanding this behavior and its impact on educational and other socio-economic outcomes.[66]

[66] In contrast to the psychological and sociological literature, economists have only recently begun to pay attention to this behavioral phenomenon among schoolchildren. In particular, the empirical evidence in economics trying to figure

In the literature on economics of education there exists a number of studies that have examined the relationship between school bullying victimization and student performance by applying cross-sectional analysis. For instance, Ponzo (2013) uses Italian data from the Progress in International Reading Literacy Study (2006-PIRLS) and the Trends in International Mathematics and Science Study (2007-TIMSS) to analyse the impact of bullying on performance for students enrolled at the 4th and 8th grades. In main analysis, being bullied is defined as a binary variable indicating whether at least one form of school bullying act (psychological or physical) occurred to the child within the prior month. The author finds that victimization has a negative impact on student performance at both the 4th and 8th grade. Propensity score matching results show that, at grade 4 (at age 9), bullied children achieve between 9.5 and 12.7 points less in literacy score, about 9 points less in math score and 11 points less in science score with respect to students that do not experience any act of bullying. In a similar vein, Oliveira et al. (2018), apply the ordinary least squares and matching methods to a sample of almost 4,000 6th-graders (at age 11) attending public elementary schools in Recife, Brazil, to measure the impact of bullying victimization on math scores. The authors base their analysis on the suffering of bullying reported by the students and observe that this phenomenon has a significant negative impact on performance in mathematics of the order of 4.3 to 7.4 percentage points. Delprato et al. (2017) examine the impact of exposure to bullying on learning and non-cognitive outcomes for 6th-grade students in 15 Latin America countries using data from the Third Regional Comparative and Explanatory Study (TERCE) learning survey. Using PSM method, the authors find that bullied students achieve between 9.6 and 18.4 points less in math than their non-bullied peers whilst in reading between 5.8 and 19.4 lower scores, a 0.07-0.22 reduction in the standard deviation of test scores.

Few studies explore the consequences of school bullying victimization using longitudinal information on children or teenagers. In comparison with cross-sectional analysis, the longitudinal studies afford better scope in dealing with reverse causality issue and allow for a more credible identification of the effect of bullying. One of the first studies examining the medium and long-term consequences of being bullied at school is due to Brown and Taylor (2008). Using data from the UK National Child Development Study (NCDS), the authors estimate ordered probit and linear regression models to examine the relationship between bullying and educational attainment and wages. Using information pertaining to experiences of bullying at school reported by the mother of each student, they construct two three-point indices to measure the extent of bullying at ages 7 and 11 - where higher score corresponds to frequent bullying. Their results reveal that being a victim

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out which are the effects produced by being bullied at school on educational achievement and other socio-economic outcomes can be found in Ammermueller (2012), Brown and Taylor (2008), Delprato et al. (2017), Eriksen et al. (2014), Gorman et al. (2021), Oliveira et al. (2018), Ponzo (2013), Sarzosa and Urzúa (2021). This literature generally accepts Daniel Olweus's definition of bullying, which states that "a student is being bullied or victimized when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students" (Olweus, 1993, p. 9). However, the ways in which the experience of bullying is measured in this literature varies greatly (Gorman et al., 2021).

of school bullying (and being a bully) is associated with reduced educational attainment and earnings later in life. In particular, it increases the likelihood of failing high school exams by 1.7 percentage points, while a one-point change in their bullying index at age 7 (or 11) decreases earnings by approximately 3.1 (or 2.8) percentage points.

Ammermueller (2012), using longitudinal data from the British NCDS and the cross-sectional data from the Trends in International Mathematics and Science Study (TIMSS) for 11 EU countries, analyses the determinants of being a victim of school bullying and its effect on student performance. Based on TIMSS data, the author estimates linear regression models and finds that being stolen from and being hurt (reported by students enrolled at the 4th and 8th grades) is negatively associated with contemporaneously measured math scores. Based on the NCDS data, the least squares estimation results suggest that being bullied at age 11 is associated with a reduced performance in reading test scores at age 16, even after controlling for prior achievement and prior victimization (the magnitude of the effect of around 10% of a standard deviation). For boys the effects are smaller and less significant while they are relatively larger and more significant for girls. The author also finds that the level of educational attainment at age 33 is affected while there is no direct link to earnings when controlling for education, non-cognitive skills, and appearance.

A very recent study of Gorman et al. (2021), using data on a cohort of adolescents from the Longitudinal Study of Young People in England (LSYPE), explores the consequences of experiencing bullying in junior high school (at the age of 13-14) on high-stakes examinations at the end of compulsory schooling (at age 16) and other later life outcomes, such as receiving a university degree, income, unemployment, mental health index (at age 25). In their analysis they focus on three definitions of bullying – a binary variable, *Any Bullying*, indicating whether the student has been bullied, of any type or frequency, at any point over three waves of data; a continuous variable, *Bullying Factor*, constructed via a factor analysis capturing the variation in the type and frequency of bullying; and a multivalued categorical treatment which allows the effects to differ by type and intensity. Across various identification strategies (least squares, matching, and inverse probability weighting) and various measures of bullying, the authors find that being bullied in school year 9 has adverse effects on high stakes outcomes (-5%), income (-4%), unemployment (3%), and mental ill-health (of about one third of a standard deviation).

There are a few studies that address the issue of causality. By implementing an instrumental variable strategy, Eriksen et al. (2014) deal with the endogeneity of bullying. Using detailed administrative data on children born in Aarhus, a region of Denmark during 1990-92, they instrument parent-teacher reported victim status at ages 10-12 with the proportion of classmates whose parents have a criminal conviction or have served time in prison. In identifying bullying, the authors exploit the parent and teacher questionnaires conducted in 2001 (only parents) and 2002 and define a child as a victim of bullying if either the teacher or the parents replied that the child is being bullied “to a small extent”, “to some extent”, or “to large extent” in the 2001

survey or “somewhat true” or “certainly true” in the 2002 surveys. Their findings confirm that being a bullied in primary school significantly reduces 9th grade GPA at age 16; the effects tend to increase with the severity of bullying. Their reported OLS results with classroom fixed effects and full lists of controls suggest that exposure to bullying is associated with a reduced 9th-grade GPA of -13.9 % of a standard deviation, the reported IV results are almost an order of magnitude larger.

Sarzosa and Urzúa (2021) use a structural model with latent cognitive and non-cognitive skills to estimate average treatment effects of being bullied at age 15 on academic achievement (using college attendance by age 19) and other life outcomes, such as risky behaviors, health and stress measures (all by age 18). The authors apply their method to longitudinal data from Korean Youth Panel Survey (KYPS), where bullying is self-reported – students are considered to be victims if they have been severely teased or bantered, threatened, collectively harassed, severally beaten or robbed, and zero otherwise. Their findings show that while cognitive skills do not play a role in deterring or motivating the undesired behavior, non-cognitive skills - including locus of control, self-esteem, and irresponsibility - significantly reduce the likelihood of being a victim of bullying in high school (by 6.7% of a SD). Analysing the impact of bullying, the authors 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 3 years after the event. In particular, 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.

The studies discussed above are summarized and compared in Table 3.1. For each study, the table shows the authors of the study, data source, sample size, outcome variables of interest, bullying victimization measures, empirical methods, control variables, and obtained results.

Table 3.1. Previous Findings on the Effects of School Bullying Victimization on Educational and Other Life Outcomes

Author(s)	Data	Main Variable(s)	Method	Control variables	Findings
A. Ammer-mueller (2012)	TIMSS 2003 (11 EU countries); NCDS 1958 birth cohort (sample N=3876, UK)	*Outcomes:* TIMSS: math scores at grade 4/8; NCDS: reading score at age 11/16; educational degree, earnings at age 33. *Bullying measures:* TIMSS: dummy variable 'being stolen' and 'being hurt (reported by student); NCDS: being bullied at all or not at all at age 7 and 11(elicited from mother).	Ordered probit, OLS	TIMSS: Child's characteristics (gender, age, parent born abroad, specking another language at home, home environment), teacher's characteristics (experience, gender), school-level variables (hours taught per day, environment, location). NCDS: Child's characteristics (gender, appearance, prior test scores, non-cognitive skills), family background (parents' origin, interest in their child's education, free meals), school characteristics (e.g., type of school, pupil-teacher ratio, local authority, environment), prior bullying.	TIMSS: being stolen from is associated with a decrease of the test score of 0.19 (0.13) SDs at grade 4(8), while the values from being hurt are 0.08 and 0.11 SDs. NCDS: being bullied at age 11 is associated with a reduction of the reading test score of 0.07 SD at age16; it has negative impact on highest educational degree and earnings (20% of the SD).
S. Brown and K. Taylor (2008)	NCDS (sample N=8,477; GB) *Data Year*: 1958	*Outcomes:* number of GCSEs at age 16, degree/none at age 23, wages at ages 23, 33 and 42. *Bullying measures:* three-point index of the level of bullying experienced at ages 7 and 11 (elicited from the mother).	Ordered Probit, OLS	Child's physical characteristics, number of schools attended, whether child is in care or attends special classes, family background characteristics, family difficulties during childhood, private room/none, school quality, cognitive and non-cognitive abilities.	Being bullied at school increases the likelihood of failing high school exams by 1.7 p.p; a one-point change in bullying index at age 7 (or 11) decreases earnings by approximately 3.1 (or 2.8) p.p.
M. Delprato, K. Akyeam-pong, and M. Dunne (2017)	TERCE (15 Latin America countries) Data Year: 2013	*Outcomes:* math and reading test scores in grade 6, non-cognitive skills at grade 6. *Bullying measures:* binary treatment – any bullying, physical and psychological bullying (measured in 6th grade).	OLS, PSM, QTEs	Child's characteristics (gender, age, whether repeated a grade, study conditions attended pre-primary, study conditions at home,), family background (socio-economic and cultural status, index of control and study supervision), school (type, infrastructure, number of students) and principal/head master and teacher characteristics (years of experience, qualifications)	For the whole sample, OLS with school FE results suggest a 0.05-0.10 reduction in the SDs of test scores while the ATT's estimates show a reduction of 11% in the SD of learnings scores.
T. L.M. Eriksen, H.S. Nielsen, and M. Simonsen (2014)	Denmark-administrative data (sample N=4,255) *Data Year*: 2001	*Outcomes:* 9th grade-level GPA in Math and Danish language at age 16. *Bullying measures:* teacher's and parent's perception whether the child was a victim of bullying at ages 10-12.	OLS, IV using the proportion of peers from troubled homes in one's classroom.	Child's physical characteristics and early health outcomes, gender, ethnicity, number of older/younger siblings, number of moves, mental/ behavioral disorder, psychosocial factors, parents' socio-economic background (including criminal records and health status), classroom information.	Exposure to bullying is associated with a reduced 9th-grade GPA of more than 10% of a SD.

F. R. Oliveira, T. A. de Menezes, G. Irffi, and G. R. Oliveira (2018)	6th-graders attending public schools in Recife, Brazil (sample N=4,191) *Data Year:* 2013	*Outcomes:* Mathematics scores in Prova Brazil test (grade 6) at age 11-12 *Bullying measures:* binary variable that assumes the value 1 if the student claims to have suffered bullying and 0, otherwise.	OLS, PSM, IPW, IPWR	Child's characteristics (gender, age, race, BMI, non-cognitive skills, presence of any disease), family background (level of education, per capita income, the presence of those responsible in the student's school life, family scholarship/ none), teacher's characteristics (age, gender. experience), school's characteristics (class size, drop-out levels, absence, share of girls per class).	The impact of bullying on the math score is about 4.3 - 7.4 p.p.
M. Ponzo (2013)	Italian data from 2006-PIRLS	*Outcomes*: literacy score in grade 4 (at age 9), math and science scores in grade 4 and 8 (at age 9 and 13). *Bullying measures:* Binary treatment variable indicating whether at least one form of bullying act occurred to the child within the prior month (reported by student).	OLS, PSM	Gender, age, language spoken a home, family background characteristics (origin of birth, years of education, economic situation), city size, geographical residence, total school enrolment, share of students from disadvantaged families.	The magnitude of the effect of being bullied at school on educa-tional achievement is about 9-13 points (according to the specification).
M. Sarzosa and S.Urzúa (2021)	S. Korea KYPS (sample N=3,449) *Data Year:* (2003)	*Outcomes:* college attendance by age 19; mental health, stress, depression, feeling sick, life satisfaction, drinking and smoking by age 18. *Bullying measures:* binary bullying victimization variable (reported by students – at age 14 or 15)	LIML structural estimation ,OLS	Age in months, gender, number of older and younger siblings, family income, rurality indicator, bi-parental household, and father's education.	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 SD.
E. Gorman, C. Harmon, S.Mendolia, A. Staneva, and I. Walker (2021)	LSYPE (sample N=7,569; GB) *Data Year*: 1989/1990 birth cohort	*Outcomes:* 5+ GCSE, points of best 3 A-levels, any A-level at age 16; university degree/none, income, unemployment, mental health at age 25. *Bullying measures:* 1) binary variable indicating whether the child has experienced any bullying across the three waves; 2) a measure of cumulative bullying intensity; 3) multivalued discreate treatment (reported by child and parent)	OLS, PSM, IPWRA	Child characteristics (gender, age, ethnicity, month of birth, GOR, English being a second language, early test scores KS2), family background characteristics (parental age, education, health, income, marital status), school characteristics (school type).	Bullying, whether at high or low intensity, has significant adverse effect on high-stakes outcomes (between 3.5 -7.1 p.p.) and unemployment by 3 p.p.

3.3. Institutional Background and Data

This section presents the institutional context within which we perform our analysis and provides a detailed discussion of data source along with the measures of school bullying victimization, the outcome variables of interest, and the conditioning set.

Education in Italy is compulsory from ages 6 to 16 and consists of three main stages before tertiary education: primary school, lower secondary and upper secondary school. Before entering primary schools, pupils can attend daycare (from age 0 to 2) and kindergarten (from age 3 to 5); these stages are not mandatory. At the compulsory stages, schools are organized into single or multi-unit institutions, sharing the principal and several administrative services. Primary school lasts five years (grades 1 to 5, from age 6 to 10). After completion of the last year of primary school, pupils enter lower secondary school directly.[67] Secondary education lasts eight years and it is divided into stages: a three-year lower secondary school (grades 6 to 8, from age 11 to 13) and a five-year high school program (grades 9 to 13, from age 14 to 18). The lower secondary school, also known as middle school, is compulsory for all students with a more subject-oriented curriculum where students are taught by subject specialists. At the end of the 3rd year of lower secondary school, pupils have to pass a final exam to access higher secondary school. The first two years of higher secondary school are compulsory, while the other three years are voluntary. There are three types of higher secondary school: lyceum, technical college, and vocational college. Students are free to choose what type of higher secondary school to attend. Lyceum, technical, and vocational colleges have the same duration (5 years), but vary greatly in curriculum, program complexity, and prestige.

The quality assurance process at primary and secondary level is implemented by the National Institute for the Evaluation of the Educational System (Istituto Nazionale per la Valutazione del Sistema Educativo di Istruzione e di Formazione, called INVALSI), a government agency placed under the control of the Ministry of Education, which every year carries out a testing of student attainment through national standardized tests in literacy and numeracy. The INVALSI also submits questionnaires to students in order to investigate other elements useful for the evaluation of the system.

Bullying can represent a violation of the fundamental principles of the Italian Constitution that gives to the State the task of promoting and encouraging the full development of the human person pursuant to the following principles: equality (art. 3), freedom of education (art. 33), the right to education (art. 34). Over the

[67] The allocation of students in classes in primary and lower secondary schools is decided following a mix of rules and discretion established by the Law no.81 of 20 March 2009 (Decreto de Presidente della Repubblica 81/2009). The Italian law stipulates that primary school classes cannot be composed by less than 15 and more than 27 students, with the exception of schools in mountain areas and small islands where the minimum number if pupils is retained at 10. The lower secondary school classes are subject to a minimum size of 18 and a maximum of 28 students, with the exception of school in highlands and small islands where the minimum number of pupils was retained at 10.

past two decades anti-bullying policy has become a topic of discussion and several initiatives have been taken in Italy. An important measure was the 285 Law, approved in 1997 and labelled: "Regulation for promoting rights and Opportunity in Childhood and Adolescence", that provided the creation of a National Funding for Childhood and Adolescence and a series of initiatives aimed at ameliorating the quality of life of children and adolescents, contrasting poverty and violence. Another important measure took place in 2007 when the Italian Ministry of Education launched a national campaign by issuing a directive called "General guidelines and national actions to prevent and contrast bullying" ("Linee di indirizzo generali ed azioni a livello nazionale per la prevenzione e la lotta al bullismo" - the Ministerial Directive n.16/2007).[68] This document stated the necessity to develop policies and programs to prevent school bullying at the national level. The guidelines invited schools to work for prevention and provided financial resources for teachers' training and established a team of experts within a network of schools.

To investigate the effect of school bullying on students' cognitive skill formation process we rely on census data provided by INVALSI. Since the school year 2009/10, the INVALSI standardized tests are compulsory for all Italian schools and students, both public and private, attending the 2nd and the 5th grade (primary school), the 8th grade (lower secondary school), as well as the 10th and 13th graders (in upper secondary school). [69] For each grade, approximately 400,000 students sit the assessment every school year, over two different days (for the two different subjects), during the first week starting in May. In recent years, INVALSI has introduced a panel dimension that allows us to link student's data across grades through an encoded student number (to ensure anonymity). We exploit this feature that allows us to follow the same cohort of students within their educational path.

In our study, we use a very rich dataset covering the universe of the cohort of Italian students enrolled in the 5th-year of primary school (grade 5, at age 10) in the school year 2013/14 and followed from grade 5 across grade 8 and grade 10. The dataset at hand for these students contains detailed information on their cognitive and non-cognitive skills, sociodemographic and family background characteristics, as well as the incidence of school bullying victimization – where bullying is self-reported at age 10-11. In fact, fifth-graders, on the same day of one of the two INVALSI tests, were required to complete a survey asking them a series of questions on whether students had been bullied at school during the current school year. For this students' cohort, relying on census data collected by INVALSI through different moments of their educational career,

[68] Beyond the governmental initiatives, since 2008 other institutions such as the Italian State Police and national associations (e.g., the Italian Pediatric Society, the National Association of Italian Municipalities (ANCI), Italy's Telefono Azzurro) have contributed to raise awareness about the phenomenon of this aggressive behavior. In recent years there has been an increasing number of interventions disseminated throughout the country. Evidence on school-based anti-bullying interventions implemented in Italy can be found, for example, in Costantino et al. (2019), Nocentini and Menesini (2016), Palladino et al. (2016).

[69] All Italian students attending the last year of upper secondary school (grade 13) take the INVALSI standardized tests starting in the school year 2018/19.

provides a unique opportunity to explore whether school bullying victimization at primary school age is related to later school performance. We focus on a cohort of primary school-age children for several reasons. First, according to the literature on skill formation, primary school is a critical and sensitive period for the formation of children's cognitive and non-cognitive abilities.[70] Second, the prevalence of bullying in primary school is higher than at other stages - including lower and upper secondary schools.

In identifying school bullying victimization, we exploit the Victimization Scale that has been included in the Student Questionnaire[71] developed and administered by INVALSI to all Italian primary 5th-grade students who took part in the National Assessment Program at the end of the school year 2013/14. Each student supplies a rating of the extent to which he or she has been a victim of bullying during that school year. The scale concerning victimization consists of four items, assessing the frequency of being teased, insulted, excluded from others, and hit: 1) "This school year how often have you been teased by other pupils at school?; 2) "This school year how often have you been insulted by other pupils at school?"; 3) "This school year how often have you been excluded or isolated from group by other pupils at school?"; 4) "This school year how often have you been hit by other pupils at school?".[72] The possible answers were as follows: 1 (never), 2 (now and then), 3 (weekly), and 4 (daily). Table A3.1 in the Appendix 3 reports the responses to the four questionnaire items. Verbal bullying is the most widespread type of bullying, especially teasing, with more than 55% of students reported being bullied at school sometimes within the school year. Approximately 37% of fifth-graders experienced indirect bullying - through social isolation and exclusion by their schoolmates; almost 14% of students have reported being hit at least once in the school year.

We propose and compute three bullying victimization measures. The first is a binary variable, *Any Bullying Act*, equal to one if a child has experienced any type of bullying act, and zero otherwise. Notice that most of the existing quantitative literature uses just one binary variable to define bullying - see, for example, Ammermuller (2012), Delprato et al. (2017), Oliveira et al. (2018) - and this simple binary treatment, *Any Bullying Act*, provides a baseline specification that is comparable with previous studies. Second, based on the Victimization Scale, we construct the index of exposure to bullying, *Victimization Score*, by taking the mean item score across the four types of bullying (i.e., teasing, insulting, exclusion, and physical threats/violence).[73] Higher scores reflect more school bullying victimization at age 10: direct (physical or verbal in nature) and indirect (exclusion). Possible score range is 0 to 3 points. Not bullied is scored 0, bullied but not frequently is

[70] See, for example, Borghans et al. (2008), Kautz et al. (2014).
[71] All the participating students completed the anonymous questionnaires in class during the first part of an ordinary school day. Thanks to a student identifier, we linked the data collected through the questionnaire to the same students' administrative data. We drop observations where we notice no information about victimization, as well as observations with no information on non-cognitive skills - including academic motivation and self-efficacy.
[72] The first two questions refer to verbal bullying, which we distinguish as teasing and insulting. The third question is related to indirect or relational bullying – through social exclusion and isolation, and the last to physical bullying.

scored 1, bullied every week is scored 2, and bullied every day is scored 3. The third definition of the treatment is a binary variable, *Frequent Victimization*, equal to one if a child has been bullied weekly or daily in at least one of the four ways (teasing, insulting, social isolation, and hitting) during his or her 5th year of primary school. In Table A3.2 in the Appendix 3 we report the correlations between these alternative measures of school bullying victimization. It can be seen from the table that all of these measures are correlated to each other; however, the stronger correlation we observe between *Victimization Score* and *Frequent Victimization*.

Thanks to the data provided by INVALSI, we are able to analyse the impact of primary school bullying on several educational outcomes, observed three and five years later. In particular, we observe pupils' test score results in literacy and numeracy standardized tests administrated by INVALSI at the end of lower secondary school (grade 8) in the school year 2016/17 and at the end of the second year of upper secondary school (grade 10) in the school year 2018/19. These scores are computed by INVALSI, applying the Item Response Theory (IRT) Rasch model to students' answers in the test, in order to account for different difficulties of single items (*Rasch Literacy Score* and *Rasch Numeracy Score*).[74] Since the data come from the national assessment tests which are common to all schools, the performance of students attending the same grade are by construction comparable across schools in different geographical areas of the country.

In addition to standardized test score results, the data provided by INVALSI, for this students' cohort, allow us to observe the marks assigned by math and Italian language teachers at the end of the first term of the 8th and 10th grade (*Teacher Mark Literacy* and *Teacher Mark Numeracy*).[75] Marks assigned by teachers based on the overall student's performance during the term.[76] Teacher assessments and INVALSI test scores are positively correlated but there are some relevant differences.[77] Differently from INVALSI tests, that are identical across Italian schools and are given in the same manner to all test takers, marks assigned by teachers are based on a standard that each teacher autonomously sets. Whereas the INVALSI test scores are comparable across schools and students, this is not the case for teachers' marks. The INVALSI tests are graded in the same manner for everyone, while teachers' marks are non-blind marks and might be affected by the student behavior and class composition.

Apart from measures of bullying and cognitive skills, the INVALSI dataset also allows us to build some measures of non-cognitive skills. Relying on the rich survey data collected by INVALSI at the end of

[74] These scores are standardized to have a mean of 200 and a standard deviation of 40.
[75] Data provided by the Institute INVALSI allow the distinction between written marks and oral marks. In our analysis, we have considered oral marks, but results do not change qualitatively if we consider the written marks or the average value of written and oral marks. The correlation between 8th-grade (written and oral mark is 0.9699 and 0.9727 for literacy and numeracy respectively (p-value 0.000).
[76] Teacher-assigned marks can range from 4 to 10, where 6 is the passing grade.
[77] We have established that the correlation between *Rasch Literacy Score* and *Teacher Mark Literacy* is 0.63 (0.42) in grade 8 (10), while the correlation between *Rasch Numeracy Score* and *Teacher Mark Numeracy* is 0.61 (0.4) in grade 8 (10).

the school year 2013/14, we were able to carefully consider in our analysis possible confounders such as students' non-cognitive skills. Non-cognitive skills are increasingly considered to be as central as cognitive skills in explaining academic outcomes (see, for example, Almlund et al. (2011)). Our first non-cognitive skill measure is based on the Academic Motivation Scale, an 18-item self-reported instrument which has been included in the INVALSI Student Questionnaire.[78] The scale allowing us to measure students' intrinsic and extrinsic motivation, included two questions about why students do their school's work: 1) "Why do you try to do well in school?", and 2) "Why do you do your homework?". Each question is followed by several responses that represent the four regulatory styles considered in the scale: external regulation (5 items)[79], introjected regulation (5 items)[80], identified regulation (4 items)[81], and intrinsic motivation (4 items)[82]. The responses to each item are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true). First, we calculate the subscale score for each of the four subscales by averaging the items that make up that subscale. Very true is scored 4, sort of true is scored 3, not very true is scored 2, and not at all true is scored 1. A high score in the subscale will indicate a high level of endorsement of that regulatory style. Then, using the individual subscale scores, we construct the *Motivation* measure as proxied by the Relative Autonomy Index (RAI) proposed by Ryan and Deci (2000), which is a single score obtained by applying a weighting to each subscale and then summing the weighted scores.[83] In this way the final measure of *Motivation* allows us to have an indicator of a student's overall motivational orientation with higher positive scores representing more intrinsic regulation and negative scores representing more extrinsic regulation.

In addition, the data provided by INVALSI allow us to construct a measure of student self-efficacy. To this end, we consider a set of four questions that are derived from the Perceived Efficacy Scale for Self-

[78] Validation of this scale in an Italian sample is presented in Alivernini et al. (2008, 2017). The original format of the scale (32 items) was developed for students in late elementary and middle school by Ryan and Connell (1989).

[79] The subscale reflecting *external regulation* consists of five items: 1) "I try to do well in school because that's what I'm supposed to do"; 2) "I try to do well in school because I will get in trouble if I don't do well"; 3) "I try to do well in school because I might get a reward if I do well"; 4) " I do my homework because I'll get in trouble if I don't"; 5) "I do my homework because that's what I'm supposed to do".

[80] To assess students' *introjected regulation* was administered a set of five items: 1) "I try to do well in school because the teacher will think that I'm a good student if I do it do well"; 2) "I try to do well in school because I'll feel really bad about myself if I don't do well"; 3) "I try to do well in school because I will feel really proud of myself if I do well; 4) "I do my homework because I want the teacher to think I'm a good student"; 5) "I do my homework because I will feel bad about myself if I don't do it".

[81] The *identified regulation* subscale consists of four items 1) "I try to do well in school because it's important to me to understand better new things"; 2) "I try to do well in school because it's important to me to try to do well in school"; 3) "I do my homework because I want to understand the subject"; 4) "I do my homework because it's important to me to do my homework".

[82] The items associated with the *intrinsic motivation* are: 1) "I try to do well in school because I enjoy doing my schoolwork well"; 2) "I try to do well in school because it's fun"; 3) "I do my homework because it's fun; 4) "I do my homework because I enjoy doing my homework".

[83] To form the RAI, the external subscale is weighted -2, the introjected subscale is weighted -1, the identified subscale is weighted +1, and the intrinsic subscale is weighted +2.

Regulated Learning (Bandura, 1990), validated on Italian samples (Bandura et al., 1996).[84] Answers were given on a 4-point Likert-type scale, where one corresponds to "not able to do it at all" and four corresponds to "able to do it at all". Each student's self-efficacy score is calculated as the average of their responses. A higher score of a *Self-Efficacy* measure represents a higher level of perceived self-efficacy for self-regulated learning, which helps a student use their own resources to plan, control and analyze the execution of tasks, activities and the preparation of learning products. Students with high self-efficacy use more cognitive strategies that are useful when it comes to learning, organizing their time and regulating their own efforts; students that demonstrate a weak sense of self-efficacy may avoid certain tasks and have difficulty in paying attention, planning and persistence on learning activities.

The data at hand also provide information on a number of pupils' and parents' characteristics (gender, age, origin of birth, immigrant status, attendance of pre-primary school, parents' education and working status, a comprehensive indicator of students' socioeconomic status (*ESCS Index*))[85], on whether the student is younger or older than a regular student (we build a dummy variable for students who went to school one year before the suggested age, *Early Enrolled*, and a dummy variable for students who entered the school one year after or repeated one or more years, *Late Enrolled)* and on whether he or she follows a full or part-time schedule (we build a dummy variable *Full time* for those students whose schedule is organized in entire days instead of that only in the morning). As regards school organization, we know the number of students in each class, *Class Size*, and the number of classes per school*, School Size*. In addition, we have information on the province and region in which the school is located.

Initially, we limit our analytical sample to students who participated in the 2013/14 and 2016/17 waves and who completed the INVALSI student questionnaire ending up with a sample of 418,331 pupils. After list wise deletion of missing data, data from 365,404 school-aged children (177,007 boys and 188,397 girls) were accepted for analysis. Then, to investigate the impact of being bullied at primary school age on educational outcomes obtained in the 10th grade, we keep in our sample only those students for whom we observe the INVALSI test score results obtained 5 years later, in the school year 2018/19.[86]

Descriptive statistics for the census-based cohort of pupils followed for 3 years, starting in the school

[84] This is the list of questions: "1) How well can you finish your homework in time?; 2) How well can you study when there are other interesting things to do?; 3) How well can you focus on your schoolwork a without distraction?; 4) How well can you remember information presented in class?".

[85] ESCS is an index for the Economic, Social and Cultural Status of the student family, computed by INVALSI following an OECD's standard taking into account parents' occupations and education, along with variables that measure home possession goods (see Campodifiori et al., 2010 for details).

[86] We apply a sample restriction criterion to ensure that all measures of school bullying victimization, cognitive and non-cognitive abilities are based on the same set of individuals. First, we include only 5th-grade students who took INVALSI test in 2013/14 and completed all three scales measuring student's bullying victimization score, intrinsic/extrinsic academic motivation, self-efficacy. Second, we include only students for whom we observe INVALSI test score results obtained 3 years later, in the school year 2016/17. Third, we keep in our sample only those students for whom we have information on the INVALSI test scores obtained in 2018/19 school year.

year 2013/14 when students attended the last year of primary school (grade 5) are reported in Panel (a) of Table 3.2, while in Panel (b) are reported descriptive statistics for students followed for 5 years.

As it can be seen from Panel (a) of Table 3.2, *Any Bullying Act* takes on a value of 0.795, implying that about 80% of students in our sample has experienced any form of school bulling act (physical, verbal or indirect through social exclusion) during their 5th-year of primary school. Percentage of students who reported being exposed to frequent bullying victimization occurring about once a week or more frequently during the whole school year 2013/14 is 19.2% (*n* for boys = 39,441; *n* for girls = 30,775) of the total of 365,404 students. It is apparent that bullying is considerable problem in Italian primary school, a problem that affects a very large number of students. The average frequency of self-reported victimization among the 5th-grade students during the school year 2013/14 is 0.59.

Sample average INVALSI test score result in literacy obtained at the end of the 8th grade is 209; its sample average in numeracy is 208. The average literacy and numeracy marks at the 8th grade are 7 over 10. Males are 48.4 percent. The share of foreign students in the sample is 6.8 percent. The average 8th-grade class size is 22 pupils.[87] Students' parents' education is around 12 years. Pupils who went to school one year before the suggested age are 1.3 percent of the sample (*n* = 4,902). Students who entered one year after or repeated one or more years are 1.7 percent of the sample (*n* = 6,041). The share of pupils whose schedule is organized in entire days (8 a.m. - 4 p.m. usually) instead of that only in the morning is 12.5 percent. Almost 38 percent of students are from the Southern Italian regions.

[87] About 25 percent of 8th-graders are in classes with more than 24 pupils.

Table 3.2. Sample Descriptive Statistics

	Panel (a)			Panel (b)		
	Whole sample in the school year 2016/17 Grade 8			Whole sample in the school year 2018/19 Grade 10		
	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.
Female	0.516	0.500	365,404	0.528	0.499	297,946
Age	13.927	0.328	365,323	15.917	0.321	297,946
Early Enrolled	0.013	0.115	365,404	0.014	0.119	297,946
Late Enrolled	0.017	0.128	365,404	0.011	0.106	297,946
Regularly Enrolled	0.970	0.171	365,404	0.985	0.119	297,946
Pre-Primary School	0.854	0.331	365,404	0.858	0.328	297,946
ESCS Index	0.128	0.983	365,244	0.126	0.977	288,312
Immigrant	0.068	0.251	358,494	0.072	0.259	283,809
Mother's years of study	12.158	3.534	304,986	13.202	3.640	265,996
Father's years of study	11.583	3.548	300,410	12.629	3.698	258,396
Full time	0.125	0.331	365,404	0.047	0.211	297,946
Class Size	21.857	3.777	365,404	23.957	0.926	297,946
School Size	6.044	2.755	365,404	5.303	3.473	297,946
Southern regions	0.377	0.485	365,404	0.383	0.486	297,946
Outcome Measures:						
Rasch Literacy Score	208.786	39.089	365,404	208.127	38.157	297,946
Rasch Numeracy Score	207.975	39.605	365,404	208.129	39.125	297,946
Teacher Mark Literacy	7.158	1.169	306,892	6.562	1.066	271,551
Teacher Mark Numeracy	6.984	1.375	305,685	6.238	1.405	269,038
Bullying Measures:						
Any Bullying Act in 5th Grade	0.795	0.404	365,404	0.789	0.408	297,946
Victimization Score in 5th Grade	0.587	0.541	365,404	0.570	0.528	297,946
Frequent Victimization in 5th Grade	0.192	0.394	365,404	0.182	0.386	297,946
Students' Cognitive Skills (measured in the 5th Grade):						
Rasch Literacy Score in 5th Grade	214.430	40.291	365,404	218.285	39.338	297,946
Rasch Numeracy Score in 5th Grade	216.896	43.765	365,404	220.470	43.321	297,946
Students' Non-Cognitive Skills (measured in the 5th Grade):						
Motivation in 5th Grade	1.050	2.357	365,404	1.115	2.374	297,946
Self-Efficacy in 5th Grade	3.133	0.528	365,404	3.149	0.519	297,946
External Regulation in 5th Grade	2.491	0.701	365,404	2.470	0.705	297,946
Introjected Regulation in 5th Grade	2.964	0.639	365,404	2.967	0.639	297,946
Identified Regulation in 5th Grade	3.598	0.482	365,404	3.608	0.474	297,946
Intrinsic Regulation in 5th Grade	2.698	0.785	365,404	2.707	0.783	297,946

Source: Authors' calculations based on data from INVALSI (waves 2013/14, 16/17, and 18/19).

3.4. The Determinants of Bullying Victimization at Primary School Age

The literature suggests that certain individual child's characteristics, as well as the quality of the family and the school environment, can influence the bullying status at school.[88] At this aim, in this section, we first explore determinants of school bullying victimization. Our analysis is carried out using census data on a whole population of Italian school-age children attending the 5th grade in Italian schools (both public and private) in the school year 2013/14.[89] As we describe below, for this cohort of pupils, we have detailed information on their victimization status at school (reported by children at the end of the 5th grade, at age 10-11), as well as information on their cognitive and non-cognitive skills, family background, and school characteristics.

3.4.1. Methodology

We model an individual's experiences of school bullying victimization by specifying an ordered probit model as follows:

$$Bullied_{ijht}^{T} = \beta_0 + \gamma X'_{ijht} + \varepsilon_{ijh} \quad (1)$$

where in Equation (1), $Bullied_{ijht}$ represents a three-point victimization index measuring the extent of bullying of student *i* at class *j* at primary school *h* at time *t (*grade 5, in the school year 2013/14*); T* denotes the form of school bullying (alternatively *Teasing*, *Insulting*, *Exclusion* or *Hitting*). The vector X'_{ijht} contains explanatory variables which may influence the type and the level of bullying experienced by the child and includes individual, family and school characteristics. In the vector X'_{ijht} we also include measures of student's cognitive skills, as proxied by the literacy and numeracy standardized test scores achieved in 5th grade, as well as measures of non-cognitive skills - academic motivation and self-efficacy.

3.4.2. Results

The results from the estimation of the Equation (1) are presented in Table 3.3, where the marginal effects associated with the probability of being bullied at least once a week are shown.

Individual characteristics associated with a higher probability of being bullied frequently at age 10 are: being a boy, being a child of immigrants, being an early enrolled, having a less well-off family or poorly educated parents, having lower levels of achievement, being a student with schedule organized in entire day instead that only in the morning, having more extrinsic academic motivation and a week sense of perceived

[88] See, for example, Brown and Taylor (2008), Vignoles and Meschi (2010).
[89] In Italy about 94% of primary school students attend public school.

efficacy for self-regulated learning. In particular, our findings indicate that a one standard deviation (SD) increase in *Motivation* that is proxied by the Relative Autonomy Index (RAI) - where a higher numerical score signifies more intrinsic or autonomous self-regulation - decreases the probability of being frequently insulted by 1.2%; a one SD increase in the *Self-Efficacy* score decreases the probability of being frequently teased by 1.4%.[90]

The findings are consistent with the previous studies (Brown and Taylor, 2008; Eriksen et al., 2014; Mühlenweg, 2010; Oliveira et al., 2018; Ponzo, 2013; Vignoles and Meschi, 2010;) that explore the determinants of school bullying. In fact, in the economics literature, Ponzo (2013) using Italian data from 2006-PIRLS and 2007-TIMSS documents that students who are males, immigrant and coming from a low socio-economic background (parents with low educational attainment and earning low incomes) are more likely to being bullied at school. Brown and Taylor (2008) find that being a boy, unattractive physical appearance, personality traits, and number of schools attended are strong predictors of being bullied at age 11, while the study conducted by Eriksen et al. (2014) documents that individual characteristics such as poor early mental health, indicators of hyperactive behavior, and physical appearance are important drivers of victimization. The findings of Oliveira et al. (2018) suggest that black, younger, less emotionally stable students with high BMI are more likely to report being bullied at age 11. The estimation results of Vignoles and Meschi (2010) reveal that pupils who report to have special educational needs and more unauthorised absence at age 14 are more likely to report a higher degree of bullying at age 16, and the pupil's own prior academic achievement does not appear to cause them to be more or less likely to be bullied at age 16. Not only in the socio-economic but also in the psychological literature (see, for example, the study of Wolke et al., 2001) it has been shown that low socioeconomic status correlates positively with victimization and that ethnic background/skin color is an important predictor.

[90] Our calculation was based on the mean sample characteristics. The 1.2% effect was derived by multiplying the marginal effect of *Motivation*, -0.012, by the standard deviation of the *Motivation*, unit standard deviation; the 1.4% effect was derived by multiplying the marginal effect of *Self-Efficacy*, -0.014, by the standard deviation of the *Self-Efficacy* measure, unit standard deviation.

Table 3.3. The Determinants of School Bullying Victimization in Primary School

	(1)	(2)	(3)	(4)
	ME for Frequent Verbal Victimization *Teasing in 5th Grade*	ME for Frequent Verbal Victimization *Insulting in 5th Grade*	ME for Frequent Social Manipulation *Exclusion in 5th Grade*	ME for Frequent Physical Victimization *Hitting in 5th Grade*
Female	-0.027***	-0.035***	0.013***	-0.025***
	(0.001)	(0.001)	(0.001)	(0.000)
Pre-Primary School	-0.000	-0.003*	0.000	0.000
	(0.002)	(0.001)	(0.001)	(0.001)
Immigrant	0.013***	0.018***	0.012***	0.001*
	(0.002)	(0.001)	(0.001)	(0.001)
Early Enrolled	0.016***	0.013***	0.012***	0.004***
	(0.004)	(0.003)	(0.003)	(0.001)
Late Enrolled	-0.005	-0.003	-0.001	-0.004***
	(0.003)	(0.002)	(0.000)	(0.001)
ESCS Index	-0.004***	-0.002***	-0.003***	0.000*
	(0.001)	(0.000)	(0.000)	(0.000)
Southern Regions	-0.013***	0.018***	-0.009***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.000)
Motivation in 5th Grade	-0.010***	-0.012***	-0.004***	-0.004***
	(0.001)	(0.000)	(0.000)	(0.000)
Self-Efficacy in 5th Grade	-0.014***	-0.011***	-0.010***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Rasch Literacy Score in 5th Grade	-0.009***	-0.011***	-0.011***	-0.007***
	(0.001)	(0.001)	(0.000)	(0.000)
Rasch Numeracy Score in 5th Grade	-0.009***	-0.007***	-0.006***	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Full Time in 5th Grade	0.026***	0.018***	0.011***	0.007***
	(0.001)	(0.001)	(0.001)	(0.000)
Class Size in 5th Grade	-0.001***	-0.000***	0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
School Size in 5th Grade	-0.001***	-0.001***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Chi squared (14)	5161.08, *p*=0.000	8827.52, *p*=0.000	5825.16, *p*=0.000	13980.63, *p*=0.000
Pseudo R squared	0.0101	0.0157	0.0115	0.0444
Observations	361,070	361,070	361,070	361,070

Notes: Marginal effects of ordered probit estimates (evaluated at the mean values of the explanatory variables in the sample). ME denotes marginal effects. Standard errors (reported in parentheses) are corrected for heteroskedasticity and adjusted for potential clustering at the class level. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

3.5. The Impact of Primary School Bullying Victimization on Later Educational Outcomes: Regression Analysis

In this section, to evaluate the effects of bullying victimization on later school performance, we apply an ordinary least square (OLS) estimator with school fixed effects and cluster errors at the classroom level, controlling for a number of individual and family background, and school organization characteristics.[91]

3.5.1. Methodology

Following the literature (Brown and Taylor, 2008; Eriksen et al., 2014; Gorman et al., 2021; Sarzosa and Urzúa, 2021), we posit the following regression model:

$$Y_{ijh(t+n)} = \beta Bullied_{ijht} + \gamma X'_{ijh} + \delta_k + \varepsilon_{ijh} \quad (2)$$

where in Equation (2) $Y_{ijh(t+n)}$ denotes the outcome variable of interest measured in the 8th or 10th grade (alternatively *Rasch Test Score* or *Teacher Mark* of student *i* in class *j* in school *h* in literacy and numeracy at time $t+n$, where the 8th grade corresponds to n=3 and the 10th grade to n=5); $Bullied_{ijht}$ represents the school bullying victimization variable measured at time t when attended the last year of primary school (grade 5 in the school year 2013/14), which may be a scalar or a vector, for student *i* in class *j* attending school *h*; X'_{ijh} is a vector of individual- and school-level characteristics (e.g., gender, family-social background, immigrant status, pre-primary school attendance, prior academic performance, academic motivation, self-efficacy, enrolment, school organization, class size); δ_k is a school fixed effect while ε_{ijh} is a random error term.

In this specification, the coefficients on the $Bullied_{ijht}$ indicators, β, are the parameters of interest. Notice that students reported their bullying victimization status when they were at the end of their final year of primary school (grade 5). This implies that we interpret our parameters of interest, β, as the effect of being bullied in the 5th grade in primary school.[92] The plausibility of the conditional independence assumption required for a causal interpretation depends on the relationship between the outcomes $Y_{ijh(t+n)}$ and the covariates X'_{ijh}. In our empirical analysis, we use three sets of covariates, each including school fixed effects. The inclusion of the school fixed effects allows us to account for unobserved time-invariant school characterises, which may affect both bullying at school and students' performance. The first conditioning set (specification (1)) includes gender, immigrant status, pre-primary school attendance, economic and social

[91] The OLS results reported in Sections 3.5 and 3.6 remain qualitatively equivalent when we use classroom fixed effects instead of school fixed effects.

[92] School bullying victimization could have started earlier on, and it may continue afterwards. Unfortunately, for this cohort of fifth-graders, there are no other available data on their victimization status collected before and after the school year 2013/14.

cultural status (*ESCS Index*), enrolment, class size, and school organization. The specification (2), includes controls for ex-ante measures of cognitive skills as proxied by test score results in the INVALSI tests achieved early. The specification (3) also includes controls for student's non-cognitive skills such as academic motivation and self-efficacy measured in the 5th grade.

3.5.2. The Impact of Primary School Bullying on Eighth Grade Students' Performance

In this section, we present results of the impact of bullying victimization in primary school on students' performance observed in the 8th grade, three years later. We first explore the effects of a being a victim of *Any Bullying Act* at school, and then we assess the impact of *Victimization Score* and *Frequent Victimization.* In all specifications, standard errors are robust to heteroskedasticity and adjusted for potential clustering at the classroom level. To facilitate reading of results, all measures of students' performance as well as measure of bullying victimization (*Victimization Score*)[93] are standardized to have a zero mean and a standard deviation equal to one. In this section, we report results for boys and girls pooled, with a gender control included.

Results from OLS estimations for the *Any Bullying Act* are shown in Table 3.4. We consider as dependent variables, respectively, test scores and marks in literacy and numeracy. For each outcome variable of interest, we report three specifications. The first specification includes as covariates the child's gender, origin of birth, pre-primary school attendance, economic and social cultural status, enrolment, and school's organization; specification (2) adds controls for prior school performance, and, then, specification (3) includes also control for child's motivation and self-efficacy. The first six columns of the table show the impact of bullying on performance in literacy while columns (7-12) report results for the effect on numeracy test scores and marks.

[93] The bullying measure, *Victimization Score*, is standardized to have a mean of zero and a standard deviation of one, in order to interpret the OLS results in terms of a standard deviation of the bullying intensity at school.

Table 3.4. The Impact of Any Bullying Act in Primary School on Students' Performance in Middle School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*
Any Bullying Act in 5th Grade	-0.112***	-0.053***	-0.043***	-0.125***	-0.077***	-0.057***	-0.080***	-0.026***	-0.020***	-0.118***	-0.073***	-0.054***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Rasch Literacy Score in 5th Grade		0.534***	0.527***		0.433***	0.421***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 5th Grade								0.520***	0.516***		0.430***	0.419***
								(0.003)	(0.003)		(0.002)	(0.002)
Motivation in 5th Grade			0.040***			0.061***			0.039***			0.066***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			0.033***			0.081***			0.014***			0.068***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	0.015***	0.011***	0.010***	0.015***	0.011***	0.011***	0.012***	0.008***	0.008***	0.010***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.304***	0.232***	0.214***	0.438***	0.380***	0.350***	-0.170***	-0.096***	-0.113***	0.176***	0.236***	0.202***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Pre- Primary School	0.064***	0.036***	0.037***	0.068***	0.044***	0.046***	0.064***	0.042***	0.043***	0.076***	0.057***	0.059***
	(0.008)	(0.007)	(0.007)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Early Enrolled	0.083***	0.054***	0.053***	0.093***	0.072***	0.073***	0.116***	0.076***	0.075***	0.136***	0.105***	0.106***
	(0.014)	(0.014)	(0.013)	(0.015)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)
Late Enrolled	-0.344***	-0.173***	-0.175***	-0.216***	-0.078***	-0.079***	-0.289***	-0.177***	-0.180***	-0.218***	-0.129***	-0.131***
	(0.014)	(0.012)	(0.011)	(0.014)	(0.013)	(0.013)	(0.014)	(0.011)	(0.011)	(0.015)	(0.014)	(0.013)
Full time	0.076***	0.065***	0.065***	0.060***	0.050***	0.050***	0.105***	0.091***	0.090***	0.044***	0.031***	0.030***
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
ESCS Index	0.250***	0.137***	0.133***	0.281***	0.189***	0.180***	0.230***	0.138***	0.135***	0.266***	0.190***	0.181***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.261***	-0.107***	-0.121***	-0.245***	-0.121***	-0.148***	-0.172***	-0.094***	-0.104***	-0.202***	-0.137***	-0.162***
	(0.007)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.005)	(0.006)	(0.008)	(0.007)	(0.007)
Observations	358337	358337	358337	301418	301418	301418	358337	358337	358337	300233	300233	300233
Adjusted R^2	0.176	0.413	0.416	0.211	0.368	0.379	0.167	0.390	0.392	0.145	0.298	0.308

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. School fixed effects are included in all specifications. Measures of school performance and measures of students' non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

It can be seen from Table 3.4 that in our sample of 358,337 pupils, across all specifications, *Any Bullying Act* exerts a statistically significant negative impact (at the 1% level) on students' performance in literacy and numeracy at the 8th grade. According to column (1), the effect of bullying on *Rasch Literacy Score* is about of -11.2 % of a SD. By adding the controls for measures of pupils' cognitive and non-cognitive abilities (in specifications (2) and (3)), the estimated coefficient on bullying is reduced in absolute terms, decreases to about 4.3%.

In columns (4-6), we investigate the effect of bullying on students' performance, considering as outcome variables the marks assigned by teachers in literacy. In specification (1), where we do not control for measures of cognitive and non-cognitive skills (column 4), we find that pupils who have reported to being bullied during the final year of primary school have 12.5% of a SD lower scores in the marks assigned by Italian language teachers in the 8th grade. When we add controls for literacy test scores achieved at the end of the 5th grade (column 5), results suggest that *Any Bullying Act* is related to a decrease in the *Teacher Mark Literacy* by 7.7% of its SD.

In columns (7-12) of the table we report results obtained when considering as dependent variable student cognitive skills in numeracy. In columns (7-9) we consider as outcome variable the *Rasch Numeracy Score*, while specifications reported in columns (10-12) consider *Teacher Mark Numeracy*. Results reported in column (7) show that pupils experiencing any bullying at school obtain about 3.2 points less in numeracy test (or - 8% of its SD). As regards teachers' assessments, bullying at school leads to a reduction of 5.4-11.8% SDs in the teacher-assigned marks (according to specifications).

The effects of control variables can be summarized as follows: girls tend to perform better than boys as regards literacy. Pupils with intrinsic (or more autonomous) academic motivation and higher levels of regulatory self-efficacy perform better in school with respect to student with a weaker sense of self-efficacy and more extrinsic academic motivation. Pupils with a better socio-economic background obtain better results compared to students who are from more disadvantaged families. Students who are *Late Enrolled* (or older) than a regular student obtain worse test scores and teacher-assigned marks in literacy and numeracy. Native students perform much better than immigrant ones.

Table 3.5 shows the results from the estimation of Equation (2) using the second measure of bullying, *Victimization Score*. The effects of bullying using this measure exhibit a pattern similar to the findings obtained in Table 4. Across all specifications reported in Table 3.5, *Victimization Score in 5th Grade,* is negatively associated (at the 1% level) with the 8th-grade performance even after accounting for either full controls from specification (3). In particular, our results indicate that a one SD increase in intensity of exposure to bullying at school (at age 10) corresponds to a reduction of *Rasch Literacy (Numeracy) Score* by 9.6% (6.8%) of the SD (see, columns 1and 7) and reduces *Teacher Mark Literacy (Numeracy)* by 10.4% (9.7%) of the SD (see, columns 4 and 10).

Table 3.5. The Impact of Primary School Bullying Victimization on Students' Performance in Middle School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*
Victimization Score in 5th Grade	-0.096***	-0.045***	-0.041***	-0.104***	-0.062***	-0.052***	-0.068***	-0.023***	-0.020***	-0.097***	-0.061***	-0.051***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Rasch Literacy Score in 5th Grade		0.530***	0.524***		0.428***	0.417***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 5th Grade								0.519***	0.514***		0.425***	0.416***
								(0.003)	(0.003)		(0.002)	(0.002)
Motivation in 5th Grade			0.038***			0.059***			0.038***			0.064***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			0.032***			0.079***			0.013***			0.066***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	0.014***	0.010***	0.010***	0.014***	0.011***	0.011***	0.011***	0.008***	0.008***	0.009***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.290***	0.226***	0.209***	0.423***	0.372***	0.344***	-0.179***	-0.100***	-0.116***	0.162***	0.227***	0.195***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Pre- Primary School	0.062***	0.036***	0.036***	0.067***	0.043***	0.045***	0.063***	0.042***	0.042***	0.075***	0.057***	0.058***
	(0.008)	(0.007)	(0.007)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Early Enrolled	0.088***	0.056***	0.056***	0.099***	0.076***	0.076***	0.119***	0.077***	0.076***	0.142***	0.108***	0.109***
	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)
Late Enrolled	-0.341***	-0.173***	-0.175***	-0.212***	-0.077***	-0.079***	-0.287***	-0.177***	-0.180***	-0.214***	-0.128***	-0.130***
	(0.014)	(0.011)	(0.011)	(0.014)	(0.013)	(0.013)	(0.014)	(0.011)	(0.011)	(0.015)	(0.014)	(0.013)
Full time	0.079***	0.066***	0.066***	0.061***	0.052***	0.051***	0.107***	0.091***	0.091***	0.045***	0.032***	0.031***
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
ESCS Index	0.247***	0.137***	0.133***	0.278***	0.188***	0.179***	0.228***	0.138***	0.135***	0.263***	0.189***	0.180***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.256***	-0.105***	-0.119***	-0.239***	-0.119***	-0.146***	-0.168***	-0.093***	-0.103***	-0.197***	-0.135***	-0.159***
	(0.007)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)
Observations	358337	358337	358337	301418	301418	301418	358337	358337	358337	300233	300233	300233
Adjusted R^2	0.183	0.415	0.418	0.219	0.370	0.382	0.171	0.391	0.392	0.152	0.300	0.310

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. *Victimization Score,* measures of school performance, and measures of students' non-cognitive skills are standardized to have mean zero and unit variance in the study sample. School fixed effects are included in all specifications. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table 3.6 presents results from OLS estimates of the association of *Frequent Victimization* in the 5th grade with the 8th grade test scores and marks in literacy (columns 1-6) and numeracy (columns 7-12). We see that victims of school bullying at age 10 perform significantly worse in middle school in terms of the 8th grade test scores and marks in literacy and numeracy (observed at age 13) than non-victims peers. It can be seen from Table 3.6 that the size of the negative estimated effect of *Frequent Victimization* at school on further academic achievement is strengthened than the impact of other measures of bullying - *Any Bullying Act* or *Victimization Score*. Based on the first conditioning set, our regression models in Table 3.6 reveal that being a victim of school bullying in the 5th grade is associated with a reduced 8th-grade literacy (numeracy) test score of 15.6% (8.8%) of a SD and with a reduced 8th-grade teacher mark in literacy and numeracy of more than 16 % of the SDs.

In all specifications reported in Tables 3.4-3.6, the estimated coefficients on the $Bullied_{ijht}$ indicators, β, are statistically significant at the 1% level even when all covariates from specification (3) are included in the regression models. These findings suggest that primary school bullying victimization negatively affects performance in literacy and numeracy in lower secondary school.

Table 3.6. The Impact of Being a Victim of Bullying in Primary School on Performance in Middle School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*
Frequent Victimization in 5th Grade	-0.156***	-0.072***	-0.063***	-0.180***	-0.111***	-0.092***	-0.088***	-0.015***	-0.009***	-0.166***	-0.104***	-0.087***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Rasch Literacy Score in 5th Grade		0.533***	0.527***		0.431***	0.420***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 5th Grade								0.521***	0.516***		0.429***	0.418***
								(0.003)	(0.003)		(0.002)	(0.002)
Motivation in 5th Grade			0.039***			0.060***			0.039***			0.066***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			0.033***			0.080***			0.014***			0.067***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	0.015***	0.011***	0.010***	0.014***	0.011***	0.011***	0.012***	0.008***	0.008***	0.009***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.296***	0.228***	0.211***	0.430***	0.375***	0.346***	-0.173***	-0.097***	-0.113***	0.169***	0.231***	0.198***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Pre- Primary School	0.062***	0.035***	0.036***	0.066***	0.043***	0.045***	0.063***	0.042***	0.042***	0.075***	0.057***	0.058***
	(0.008)	(0.007)	(0.007)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Early Enrolled	0.083***	0.054***	0.054***	0.095***	0.073***	0.074***	0.116***	0.076***	0.075***	0.137***	0.106***	0.106***
	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)
Late Enrolled	-0.339***	-0.171***	-0.174***	-0.210***	-0.075***	-0.077***	-0.286***	-0.177***	-0.179***	-0.213***	-0.126***	-0.128***
	(0.014)	(0.011)	(0.011)	(0.014)	(0.013)	(0.013)	(0.014)	(0.011)	(0.011)	(0.015)	(0.014)	(0.013)
Full time	0.076***	0.065***	0.065***	0.059***	0.050***	0.050***	0.105***	0.090***	0.090***	0.043***	0.031***	0.030***
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
ESCS Index	0.250***	0.137***	0.133***	0.280***	0.189***	0.180***	0.230***	0.138***	0.135***	0.266***	0.190***	0.181***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.260***	-0.107***	-0.121***	-0.244***	-0.121***	-0.148***	-0.172***	-0.094***	-0.104***	-0.201***	-0.137***	-0.161***
	(0.007)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)
Observations	358337	358337	358337	301418	301418	301418	358337	358337	358337	300233	300233	300233
Adjusted R^2	0.178	0.414	0.417	0.213	0.369	0.380	0.168	0.390	0.392	0.147	0.298	0.309

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. School fixed effects are included in all specifications. Measures of school performance and measures of students' non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

3.5.3. The Impact of Primary School Bullying on Tenth Grade Students' Performance

In this section, we present results from OLS estimates of the association of being bullied in the 5th grade (at age 10) with four outcomes of school performance observed in the 10th grade (at age 15-16): standardized test scores and teacher-assigned marks in literacy and numeracy. We perform a regression analysis similar to the analysis conducted in the previous section, as well as now we use census data on fifth-graders that we can follow within educational path for 5 years, starting from the school year 2013/14 when students attended the final year of their primary school (grade 5) up to the 2nd year of their high school (grade 10) of the 2018/19 school year.

In Table 3.7, as in the OLS analysis performed above, we first report estimates on consequences of *Any Bullying Act* in the 5th grade. The first six columns in the table show the impact on performance in literacy while columns (7-12) report the impact of bullying on numeracy. For each outcome, we gradually expand the conditioning set. Estimates in the table reveal that *Any Bullying Act* has an adverse effect on students' performance both in literacy and numeracy observed at the 10th grade. In particular, regression results from specification (1), where we control for a standard set of control variables (e.g., gender, family background characteristics, pre-primary school attendance, immigrant status, enrolment, class size, school organization) indicate that *Any Bullying Act* has a negative statistically impact (at the 1% level) on the 10th-grade teacher assessments (of the order of 5.4 to 7.5% of a SD) and test scores (around -3.5% of a SD).

A similar pattern emerges from the analysis of the impact of *Victimization Score.* Results shown in Table 3.8 suggest that a one SD increase in *Victimization Score* in the 5th Grade reduces on average the 10th-grade students' performance in literacy (numeracy) test score by 3.6% (2.8%) of a SD and teacher mark literacy (numeracy) by 5.8% (4.7%) of a SD.

The findings in Table 3.9 confirm that being a victim of bullying in primary school has negative effects on literacy and numeracy outcomes achieved in upper secondary school. Our results suggest that *Frequent Victimization* in the 5th grade reduces the 10th-grade victim's performance in terms of *Teacher Mark Literacy* by 9.2% of a SD, *Teacher Mark Numeracy* by 8.9% of a SD, *Rasch Literacy Score* by 4.1% of a SD, and *Rasch Numeracy Score* by 2.4% of a SD (according to specification (1)).

Through OLS regressions reported in this section, we find that being bullied at school is associated with a lower educational achievement. Our results are robust to different specifications including controls for prior performance, non-cognitive skills, class size, and for a number of family and school characteristics.

In the next section, we will examine whether these effects are heterogeneous according to students' gender and to the socio-economic environment in which they live.

Table 3.7. The Impact of Any Bullying Act in Primary School on Students' Performance in High School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Any Bullying Act in 5th Grade	-0.036***	0.004	0.008**	-0.075***	-0.041***	-0.027***	-0.033***	-0.006**	-0.001	-0.054***	-0.032***	-0.019***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Rasch Literacy Score in 8th Grade		0.482***	0.478***		0.400***	0.393***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 8th Grade								0.505***	0.502***		0.410***	0.405***
								(0.002)	(0.002)		(0.002)	(0.002)
Motivation in 5th Grade			0.041***			0.045***			0.035***			0.045***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			-0.004***			0.055***			0.004***			0.047***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	-0.001	0.001	0.001	-0.001	0.001	0.001	-0.014***	-0.009***	-0.009***	-0.001	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Female	0.160***	0.057***	0.043***	0.382***	0.296***	0.277***	-0.206***	-0.096***	-0.109***	0.245***	0.335***	0.314***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Pre- Primary School	0.013***	0.010***	0.010***	0.021***	0.020***	0.019***	0.011***	0.002	0.002	0.018***	0.011**	0.011**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Early Enrolled	0.041***	0.038***	0.037***	0.037**	0.035**	0.036**	0.104***	0.076***	0.075***	0.088***	0.068***	0.069***
	(0.014)	(0.012)	(0.012)	(0.016)	(0.015)	(0.015)	(0.013)	(0.012)	(0.012)	(0.016)	(0.014)	(0.014)
Late Enrolled	-0.168***	-0.084***	-0.090***	-0.060***	0.010	0.003	-0.116***	-0.051***	-0.056***	-0.083***	-0.026	-0.032*
	(0.016)	(0.013)	(0.013)	(0.019)	(0.017)	(0.017)	(0.016)	(0.012)	(0.012)	(0.020)	(0.019)	(0.019)
Full time	-0.140***	-0.091***	-0.092***	-0.018	0.021	0.023	-0.127***	-0.093***	-0.092***	-0.029	-0.002	0.001
	(0.032)	(0.024)	(0.024)	(0.042)	(0.038)	(0.038)	(0.033)	(0.024)	(0.024)	(0.036)	(0.033)	(0.033)
ESCS Index	0.101***	0.049***	0.049***	0.092***	0.049***	0.047***	0.084***	0.038***	0.037***	0.066***	0.029***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.228***	-0.116***	-0.121***	-0.221***	-0.127***	-0.141***	-0.169***	-0.084***	-0.090***	-0.182***	-0.115***	-0.127***
	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
Observations	282267	282267	282267	257641	257641	257641	282267	282267	282267	255239	255239	255239
Adjusted R^2	0.293	0.474	0.476	0.155	0.275	0.281	0.356	0.559	0.561	0.093	0.223	0.228

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. School fixed effects are included in all specifications. Measures of school performance and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table 3.8. The Impact of Primary School Bullying Victimization on Students' Performance in High School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Victimization Score in 5th Grade	-0.036***	-0.005***	-0.003*	-0.058***	-0.032***	-0.025***	-0.028***	-0.008***	-0.006***	-0.047***	-0.031***	-0.024***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Rasch Literacy Score in 8th Grade		0.481***	0.478***		0.398***	0.392***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 8th Grade								0.505***	0.502***		0.409***	0.405***
								(0.002)	(0.002)		(0.002)	(0.002)
Motivation in 5th Grade			0.040***			0.044***			0.034***			0.044***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			-0.004***			0.054***			0.004***			0.046***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	-0.001	0.001	0.001	-0.001	0.001	0.001	-0.014***	-0.009***	-0.009***	-0.001	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Female	0.155***	0.056***	0.043***	0.374***	0.292***	0.274***	-0.210***	-0.097***	-0.110***	0.239***	0.331***	0.310***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Pre- Primary School	0.012***	0.010***	0.010***	0.021***	0.019***	0.019***	0.011**	0.002	0.002	0.018***	0.011**	0.011**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Early Enrolled	0.044***	0.039***	0.038***	0.040**	0.037**	0.038***	0.106***	0.076***	0.076***	0.091***	0.071***	0.071***
	(0.014)	(0.012)	(0.012)	(0.016)	(0.015)	(0.015)	(0.013)	(0.012)	(0.012)	(0.016)	(0.014)	(0.014)
Late Enrolled	-0.168***	-0.084***	-0.090***	-0.061***	0.009	0.003	-0.117***	-0.051***	-0.056***	-0.083***	-0.026	-0.032*
	(0.016)	(0.013)	(0.013)	(0.019)	(0.017)	(0.017)	(0.016)	(0.012)	(0.012)	(0.020)	(0.019)	(0.019)
Full time	-0.139***	-0.091***	-0.091***	-0.018	0.021	0.023	-0.126***	-0.092***	-0.092***	-0.029	-0.002	0.001
	(0.032)	(0.024)	(0.024)	(0.042)	(0.038)	(0.038)	(0.033)	(0.024)	(0.024)	(0.035)	(0.033)	(0.033)
ESCS Index	0.101***	0.049***	0.049***	0.091***	0.049***	0.047***	0.084***	0.038***	0.037***	0.066***	0.029***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.226***	-0.115***	-0.121***	-0.217***	-0.126***	-0.139***	-0.168***	-0.084***	-0.089***	-0.179***	-0.113***	-0.125***
	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
Observations	282267	282267	282267	257641	257641	257641	282267	282267	282267	255239	255239	255239
Adjusted R^2	0.294	0.474	0.476	0.157	0.276	0.282	0.356	0.559	0.561	0.095	0.224	0.229

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. *Victimization Score,* measures of school performance, and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. School fixed effects are included in all specifications. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

Table 3.9. The Impact of Being a Victim of Bullying in Primary School on Performance in High School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Frequent Victimization in 5th Grade	-0.041***	0.004	0.008**	-0.092***	-0.054***	-0.042***	-0.024***	-0.008**	-0.003	-0.079***	-0.066***	-0.054***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)
Rasch Literacy Score in 8th Grade		0.482***	0.478***		0.400***	0.393***						
		(0.002)	(0.002)		(0.002)	(0.002)						
Rasch Numeracy Score in 8th Grade								0.505***	0.502***		0.410***	0.405***
								(0.002)	(0.002)		(0.002)	(0.002)
Motivation in 5th Grade			0.041***			0.045***			0.035***			0.045***
			(0.001)			(0.002)			(0.001)			(0.002)
Self-efficacy in 5th Grade			-0.004***			0.055***			0.004***			0.046***
			(0.001)			(0.002)			(0.001)			(0.002)
Class Size	-0.001	0.001	0.001	-0.001	0.001	0.001	-0.014***	-0.009***	-0.009***	-0.001	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Female	0.158***	0.057***	0.043***	0.378***	0.294***	0.275***	-0.207***	-0.096***	-0.109***	0.242***	0.332***	0.311***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Pre- Primary School	0.013***	0.010***	0.010***	0.021***	0.020***	0.019***	0.011***	0.002	0.002	0.018***	0.011**	0.011**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Early Enrolled	0.042***	0.038***	0.037***	0.037**	0.035**	0.036**	0.104***	0.076***	0.075***	0.088***	0.069***	0.070***
	(0.014)	(0.012)	(0.012)	(0.016)	(0.015)	(0.015)	(0.013)	(0.012)	(0.012)	(0.016)	(0.014)	(0.014)
Late Enrolled	-0.168***	-0.084***	-0.090***	-0.060***	0.010	0.003	-0.117***	-0.051***	-0.056***	-0.083***	-0.026	-0.032*
	(0.016)	(0.013)	(0.013)	(0.019)	(0.017)	(0.017)	(0.016)	(0.012)	(0.012)	(0.020)	(0.019)	(0.019)
Full time	-0.140***	-0.091***	-0.092***	-0.018	0.021	0.024	-0.127***	-0.093***	-0.092***	-0.029	-0.002	0.001
	(0.032)	(0.024)	(0.024)	(0.042)	(0.038)	(0.038)	(0.033)	(0.024)	(0.024)	(0.035)	(0.033)	(0.033)
ESCS Index	0.101***	0.049***	0.049***	0.092***	0.049***	0.047***	0.084***	0.038***	0.037***	0.066***	0.029***	0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Immigrant	-0.228***	-0.116***	-0.122***	-0.220***	-0.127***	-0.141***	-0.169***	-0.084***	-0.090***	-0.182***	-0.114***	-0.126***
	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
Observations	282267	282267	282267	257641	257641	257641	282267	282267	282267	255239	255239	255239
Adjusted R^2	0.293	0.474	0.476	0.155	0.276	0.281	0.356	0.559	0.561	0.093	0.224	0.228

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. School fixed effects are included in all specifications. Measures of school performance and self-reported measures of non-cognitive skills are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level.

3.6. The Impact of School Bullying Victimization on Educational Outcomes: Heterogeneous Effects

In this section, we present heterogeneity of results by gender and by socio-economic and cultural status.

3.6.1. Gender Heterogeneity

Previous findings on gender differences in school bullying victimization effects are mixed. For example, Delprato et al. (2017), using data from the TERCE learning survey on students attending the 6th grade, find that bullying effects on math and read test scores are similar by gender. Ammermueller (2012), based on the data from the British NCDS, using ordinary least squares, finds that being bullied at school at age 11 is associated with a reduced performance in reading test scores at age 16, even after controlling for prior achievement and prior victimization (the magnitude of the effect of around 10% of a SD). However, for boys the effects are smaller and less significant while they are relatively larger and more significant for girls.

Now we explore whether the relationship between bullying and school performance varies by gender. At this aim, using OLS regression models with school fixed effects, we estimate Equation (2) for boys and girls' samples separately and test whether the effects of bullying on learning differ by gender.

In Table 3.10, we present estimates for the impact of the indicators of bullying victimization on performance in the 8th grade, while the impact on performance in the 10th grade is reported in Table 3.11. Similarly to the regression analysis performed in Section 3.5, we consider as dependent variables, respectively, pupils' test scores and marks in literacy and numeracy achieved in the 8th and the 10th grades. For each outcome variable of interest, we report three specifications. Specification (1) includes as covariates the child's origin of birth, pre-primary school attendance, economic and social cultural status, enrolment, and school's organization; specification (2) adds controls for prior standardized test score result in literacy or numeracy, and, then, specification (3) includes also controls for child's academic motivation and self-efficacy measured in the 5th grade. The first six columns of the tables show the impact of bullying on performance in literacy while columns (7-12) report results for the effect on numeracy test scores and marks for boys and girls separately. In all specifications, standard errors are robust to heteroskedasticity and adjusted for potential clustering at the class level. To facilitate reading of results, all measures of students' performance as well as bullying measure, *Victimization Score,* are standardized to have a zero mean and a standard deviation equal to one.

Results reported in Tables 3.10 and 3.11 show that being bullied at school in the 5th grade has a statistically significant negative impact on the 8th and the 10th grade performance in literacy and numeracy (observed 3 and 5 years later) both for boys and girls. However, the effect is larger for girls with respect to boys.

Table 3.10. The Impact of Being Bullied in Primary School on Performance in Medium School. Heterogeneous Effects by Gender

Dependent variable:	(1) *Rasch Literacy Score in 8th Grade*	(2) *Rasch Literacy Score in 8th Grade*	(3) *Rasch Literacy Score in 8th Grade*	(4) *Teacher Mark Literacy in 8th Grade*	(5) *Teacher Mark Literacy in 8th Grade*	(6) *Teacher Mark Literacy in 8th Grade*	(7) *Rasch Numeracy Score in 8th Grade*	(8) *Rasch Numeracy Score in 8th Grade*	(9) *Rasch Numeracy Score in 8th Grade*	(10) *Teacher Mark Numeracy in 8th Grade*	(11) *Teacher Mark Numeracy in 8th Grade*	(12) *Teacher Mark Numeracy in 8th Grade*
Boys												
Any Bullying Act in 5th Grade	**-0.110*****	**-0.049*****	**-0.040*****	**-0.114*****	**-0.065*****	**-0.047*****	**-0.065*****	**-0.011****	**-0.006**	**-0.098*****	**-0.054*****	**-0.037*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	173661	173661	173661	146214	146214	146214	173661	173661	173661	145642	145642	145642
Adjusted R^2	0.156	0.400	0.403	0.168	0.328	0.340	0.159	0.410	0.411	0.135	0.300	0.310
Girls												
Any Bullying Act in 5th Grade	**-0.112*****	**-0.055*****	**-0.044*****	**-0.134*****	**-0.088*****	**-0.066*****	**-0.090*****	**-0.040*****	**-0.031*****	**-0.136*****	**-0.092*****	**-0.071*****
Standard Error	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	184676	184676	184676	155204	155204	155204	184676	184676	184676	154591	154591	154591
Adjusted R^2	0.162	0.401	0.405	0.186	0.353	0.364	0.174	0.369	0.372	0.148	0.291	0.302
Gender diff. p-value	0.598	0.169	0.249	0.025	0.002	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Boys												
Victimization Score in 5th Grade	**-0.092*****	**-0.042*****	**-0.038*****	**-0.094*****	**-0.053*****	**-0.045*****	**-0.061*****	**-0.016*****	**-0.014*****	**-0.085*****	**-0.049*****	**-0.041*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	173661	173661	173661	146214	146214	146214	173661	173661	173661	145642	145642	145642
Adjusted R^2	0.164	0.402	0.405	0.176	0.330	0.342	0.162	0.410	0.411	0.142	0.302	0.311
Girls												
Victimization Score in 5th Grade	**-0.101*****	**-0.049*****	**-0.043*****	**-0.115*****	**-0.073*****	**-0.062*****	**-0.075*****	**-0.031*****	**-0.027*****	**-0.113*****	**-0.075*****	**-0.065*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Observations	184676	184676	184676	155204	155204	155204	184676	184676	184676	154591	154591	154591
Adjusted R^2	0.168	0.403	0.406	0.195	0.356	0.367	0.177	0.369	0.372	0.156	0.295	0.305
Gender diff. p-value	0.004	0.003	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Boys												
Frequent Victimization in 5th Grade	**-0.169*****	**-0.076*****	**-0.068*****	**-0.178*****	**-0.103*****	**-0.085*****	**-0.090*****	**-0.012*****	**-0.007**	**-0.154*****	**-0.090*****	**-0.074*****
Standard Error	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Observations	173661	173661	173661	146214	146214	146214	173661	173661	173661	145642	145642	145642
Adjusted R^2	0.159	0.401	0.404	0.172	0.329	0.341	0.160	0.410	0.411	0.138	0.301	0.310
Girls												
Frequent Victimization in 5th Grade	**-0.141*****	**-0.068*****	**-0.058*****	**-0.182*****	**-0.123*****	**-0.103*****	**-0.084*****	**-0.018*****	**-0.010***	**-0.182*****	**-0.124*****	**-0.105*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)
Observations	184676	184676	184676	155204	155204	155204	184676	184676	184676	154591	154591	154591
Adjusted R^2	0.162	0.401	0.405	0.188	0.353	0.365	0.173	0.368	0.371	0.149	0.292	0.303
Gender diff. p-value	0.001	0.351	0.261	0.430	0.000	0.001	0.326	0.606	0.527	0.000	0.000	0.000

Notes: OLS estimates. We estimate the Equation (2). Results from specification (1) are reported in columns 1,4,7,10; from specification (2) are shown in columns 2,5,8,11, and covariates from specification (3) are included in columns 3,6,9,12. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. Measure of exposure to bullying, *Victimization Score,* and measures of school performance are standardized to have a mean of zero and a standard deviation of one in the study sample. School fixed effects are included in all specifications. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. Gender diff.: the p-value from a test for differences in the effect between the boys and girls subgroup.

Table 3.11. The Impact of Being Bullied in Primary School on Performance in High School. Heterogeneous Effects by Gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Boys												
Any Bullying Act in 5th Grade	**-0.025*****	**0.018*****	**0.022*****	**-0.064*****	**-0.027*****	**-0.014****	**-0.014****	**0.011****	**0.015*****	**-0.036*****	**-0.015****	**-0.002**
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Observations	131854	131854	131854	119710	119710	119710	131854	131854	131854	118630	118630	118630
Adjusted R^2	0.294	0.467	0.468	0.120	0.243	0.250	0.366	0.570	0.571	0.076	0.212	0.217
Girls												
Any Bullying Act in 5th Grade	**-0.045*****	**-0.008***	**-0.004**	**-0.086*****	**-0.054*****	**-0.040*****	**-0.049*****	**-0.021*****	**-0.016*****	**-0.073*****	**-0.050*****	**-0.037*****
Standard Error	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Observations	150413	150413	150413	137931	137931	137931	150413	150413	150413	136609	136609	136609
Adjusted R^2	0.281	0.472	0.474	0.127	0.254	0.259	0.342	0.545	0.547	0.083	0.214	0.219
Gender diff. p-value	0.021	0.001	0.002	0.016	0.002	0.003	0.000	0.002	0.003	0.000	0.001	0.001
Boys												
Victimization Score in 5th Grade	**-0.032*****	**-0.001**	**0.002**	**-0.054*****	**-0.028*****	**-0.021*****	**-0.021*****	**-0.002**	**-0.000**	**-0.036*****	**-0.022*****	**-0.015*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	131854	131854	131854	119710	119710	119710	131854	131854	131854	118630	118630	118630
Adjusted R^2	0.295	0.467	0.468	0.123	0.244	0.250	0.366	0.570	0.571	0.078	0.212	0.217
Girls												
Victimization Score in 5th Grade	**-0.042*****	**-0.011*****	**-0.009*****	**-0.065*****	**-0.039*****	**-0.032*****	**-0.036*****	**-0.016*****	**-0.013*****	**-0.060*****	**-0.043*****	**-0.036*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	150413	150413	150413	137931	137931	137931	150413	150413	150413	136609	136609	136609
Adjusted R^2	0.282	0.472	0.474	0.129	0.254	0.260	0.343	0.545	0.547	0.085	0.215	0.219
Gender diff. p-value	0.020	0.012	0.017	0.003	0.001	0.004	0.001	0.004	0.006	0.000	0.000	0.000
Boys												
Frequent Victimization in 5th Grade	**-0.048*****	**0.004**	**0.009***	**-0.096*****	**-0.053*****	**-0.040*****	**-0.024*****	**-0.005**	**0.000**	**-0.065*****	**-0.050*****	**-0.037*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)
Observations	131854	131854	131854	119710	119710	119710	131854	131854	131854	118630	118630	118630
Adjusted R^2	0.294	0.467	0.468	0.121	0.244	0.250	0.366	0.570	0.571	0.077	0.212	0.217
Girls												
Frequent Victimization in 5th Grade	**-0.036*****	**0.001**	**0.005**	**-0.088*****	**-0.058*****	**-0.045*****	**-0.023*****	**-0.012****	**-0.007**	**-0.096*****	**-0.086*****	**-0.074*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Observations	150413	150413	150413	137931	137931	137931	150413	150413	150413	136609	136609	136609
Adjusted R^2	0.280	0.472	0.474	0.127	0.254	0.259	0.342	0.545	0.547	0.084	0.215	0.219
Gender diff. p-value	0.065	0.823	0.825	0.390	0.617	0.640	0.258	0.974	0.972	0.004	0.000	0.000

Notes: OLS estimates. We estimate the Equation (2). Results from specification (1) are reported in columns 1,4,7,10; from specification (2) are shown in columns 2,5,8,11, and covariates from specification (3) are included in columns 3,6,9,12. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. Measure of bullying, *Victimization Score,* and measures of school performance are standardized to have a mean of zero and a standard deviation of one in the study sample. School fixed effects are included in all specifications. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. Gender diff.: the p-value from a test for differences in the effect between the boys and girls subgroup.

3.6.2. Socio-Economic and Cultural Status

Now we explore whether the relationship between bullying victimization and school performance varies by socio-economic and cultural status. We estimate Equation (2) using OLS with school fixed effects; we split sample regression results for *ESCS Index* (below and above the median) and present a test of the differences between results in two groups. In Table 3.12, we present estimates for the impact of the indicators of bullying on students' performance in the 8th grade, while the impact on performance in the 10th grade is reported in Table 3.13. The tables have the same structure as Tables 3.10 and 3.11 reported in Section 3.6.1.

In Table 3.12, the negative statistically significant effect of *Frequent Victimization* in the 5th grade on students' performance in literacy and numeracy in the 8th grade is found for both socio-economic groups, but it is larger for students with disadvantaged background (around -4.5% of a SD) and the differences are significant. Other measures of bullying - *Any Bullying Act* and *Victimization Score in 5th Grade* - also play a negative role in the 8th-grade performance of pupils from advantaged as well as disadvantaged socio-economic backgrounds. However, tests for differences in the effect of these two measures of bullying between advantaged and disadvantaged students are not statistically significant.

A similar pattern of results is found in Table 3.13. It can be seen from the table that the negative statistically significant effect of *Frequent Victimization* in the 5th grade on students' performance in literacy and numeracy in the 10th grade is found for both socio-economic groups, but it is larger for students with disadvantaged background (around -3% of a SD). These differences are not entirely unexpected: children who come from more advantaged family backgrounds are more likely to receive positive stimulation and more support in the home environment and to have parents who closely supervise their school work.

In conclusion, in Sections 3.5 and 3.6, we have analyzed the impact of bullying victimization in primary school on performance achieved in lower and upper secondary using ordinary least squares with school fixed effects. Our empirical findings presented in these sections suggest that individual's experience of bullying in 5th grade (at age 10) affects educational attainment later at school observed at age 13 and 15. Our results show that primary school bullying victimization has a considerable negative impact on performance in terms of the 8th and 10th grade standardized test scores and teachers' marks in literacy and numeracy. The adverse effects of victimization at school are consistently larger for girls with respect to boys, and for children who come from disadvantaged socio-economic backgrounds.

Table 3.12. The Impact of Being Bullied in Primary School on Performance in Medium School. Heterogeneous Effects by Socio-Economic and Cultural Status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*
High Socio-Economic Status												
Any Bullying Act in 5th Grade	**-0.120*****	**-0.057*****	**-0.046*****	**-0.129*****	**-0.078*****	**-0.056*****	**-0.092*****	**-0.032*****	**-0.024*****	**-0.126*****	**-0.076*****	**-0.055*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	178375	178375	178375	149279	149279	149279	178375	178375	178375	148759	148759	148759
Adjusted R^2	0.112	0.394	0.398	0.154	0.344	0.359	0.108	0.382	0.384	0.084	0.270	0.282
Low Socio-Economic Status												
Any Bullying Act in 5th Grade	**-0.121*****	**-0.055*****	**-0.045*****	**-0.142*****	**-0.086*****	**-0.066*****	**-0.084*****	**-0.029*****	**-0.023*****	**-0.128*****	**-0.080*****	**-0.061*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	180119	180119	180119	152266	152266	152266	180119	180119	180119	151600	151600	151600
Adjusted R^2	0.123	0.369	0.372	0.140	0.309	0.322	0.130	0.342	0.344	0.084	0.242	0.253
ESCS diff. p-value	0.374	0.025	0.032	0.764	0.390	0.498	0.246	0.043	0.053	0.655	0.446	0.545
High Socio-Economic Status												
Victimization Score in 5th Grade	**-0.098*****	**-0.044*****	**-0.038*****	**-0.107*****	**-0.062*****	**-0.052*****	**-0.071*****	**-0.021*****	**-0.017*****	**-0.103*****	**-0.062*****	**-0.052*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Observations	178375	178375	178375	149279	149279	149279	178375	178375	178375	148759	148759	148759
Adjusted R^2	0.119	0.395	0.399	0.162	0.347	0.361	0.111	0.382	0.385	0.092	0.272	0.284
Low Socio-Economic Status												
Victimization Score in 5th Grade	**-0.104*****	**-0.050*****	**-0.045*****	**-0.110*****	**-0.066*****	**-0.056*****	**-0.073*****	**-0.029*****	**-0.026*****	**-0.101*****	**-0.063*****	**-0.054*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	180119	180119	180119	152266	152266	152266	180119	180119	180119	151600	151600	151600
Adjusted R^2	0.132	0.371	0.374	0.150	0.312	0.324	0.134	0.343	0.345	0.092	0.245	0.255
ESCS diff. p-value	0.172	0.931	0.845	0.851	0.302	0.333	0.442	0.946	0.853	0.203	0.118	0.137
High Socio-Economic Status												
Frequent Victimization in 5th Grade	**-0.136*****	**-0.056*****	**-0.046*****	**-0.168*****	**-0.101*****	**-0.082*****	**-0.072*****	**0.001**	**0.009***	**-0.161*****	**-0.100*****	**-0.081*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)
Observations	178375	178375	178375	149279	149279	149279	178375	178375	178375	148759	148759	148759
Adjusted R^2	0.113	0.394	0.398	0.155	0.344	0.359	0.107	0.382	0.384	0.085	0.270	0.283
Low Socio-Economic Status												
Frequent Victimization in 5th Grade	**-0.191*****	**-0.094*****	**-0.084*****	**-0.208*****	**-0.127*****	**-0.107*****	**-0.118*****	**-0.039*****	**-0.033*****	**-0.186*****	**-0.117*****	**-0.098*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Observations	180119	180119	180119	152266	152266	152266	180119	180119	180119	151600	151600	151600
Adjusted R^2	0.127	0.370	0.373	0.144	0.311	0.323	0.131	0.343	0.344	0.087	0.243	0.254
ESCS diff. p-value	0.000	0.000	0.000	0.000	0.040	0.058	0.000	0.000	0.000	0.015	0.288	0.364

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. *Victimization Score* is standardized to have a mean of zero and a standard deviation of one. School fixed effects are included in all specifications. Measures of school performance are standardized to have mean zero and unit variance in the study sample. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. *ESCS diff.*: the p-value from a test for differences in the effect of school bullying victimization between the two groups.

Table 3.13. The Impact of Being Bullied in Primary School on Performance in High School. Heterogeneous Effects by Socio-Economic and Cultural Status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable:	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
High Socio-Economic Status												
Any Bullying Act in 5th Grade	**-0.035*****	**0.005**	**0.009***	**-0.071*****	**-0.036*****	**-0.022*****	**-0.033*****	**-0.005**	**-0.000**	**-0.051*****	**-0.029*****	**-0.015*****
Standard Error	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Observations	149340	149340	149340	136757	136757	136757	149340	149340	149340	135555	135555	135555
Adjusted R^2	0.250	0.444	0.445	0.141	0.277	0.284	0.323	0.549	0.551	0.086	0.232	0.238
Low Socio-Economic Status												
Any Bullying Act in 5th Grade	**-0.037*****	**0.004**	**0.007**	**-0.080*****	**-0.047*****	**-0.032*****	**-0.033*****	**-0.007**	**-0.003**	**-0.056*****	**-0.034*****	**-0.021*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)	(0.007)	(0.006)	(0.006)
Observations	134469	134469	134469	122265	122265	122265	134469	134469	134469	121059	121059	121059
Adjusted R^2	0.276	0.458	0.460	0.144	0.254	0.259	0.345	0.539	0.540	0.086	0.203	0.207
ESCS diff. p-value	0.949	0.980	1.000	0.702	0.66	0.585	0.672	0.727	0.698	0.914	0.947	0.969
High Socio-Economic Status												
Victimization Score in 5th Grade	**-0.034*****	**-0.004***	**-0.001**	**-0.056*****	**-0.030*****	**-0.023*****	**-0.027*****	**-0.007*****	**-0.004****	**-0.047*****	**-0.031*****	**-0.024*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	149340	149340	149340	136757	136757	136757	149340	149340	149340	135555	135555	135555
Adjusted R^2	0.251	0.444	0.445	0.143	0.278	0.284	0.324	0.549	0.551	0.087	0.233	0.238
Low Socio-Economic Status												
Victimization Score in 5th Grade	**-0.039*****	**-0.006*****	**-0.004****	**-0.061*****	**-0.035*****	**-0.028*****	**-0.029*****	**-0.010*****	**-0.007*****	**-0.047*****	**-0.030*****	**-0.024*****
Standard Error	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	134469	134469	134469	122265	122265	122265	134469	134469	134469	121059	121059	121059
Adjusted R^2	0.277	0.458	0.460	0.146	0.254	0.260	0.346	0.539	0.540	0.088	0.203	0.208
ESCS diff. p-value	0.352	0.672	0.677	0.416	0.531	0.563	0.992	0.869	0.852	0.555	0.383	0.352
High Socio-Economic Status												
Frequent Victimization in 5th Grade	**-0.028*****	**0.008**	**0.012****	**-0.077*****	**-0.045*****	**-0.033*****	**-0.010***	**-0.001**	**0.004**	**-0.073*****	**-0.065*****	**-0.054*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)
Observations	149340	149340	149340	136757	136757	136757	149340	149340	149340	135555	135555	135555
Adjusted R^2	0.250	0.444	0.445	0.141	0.277	0.284	0.323	0.549	0.551	0.086	0.232	0.238
Low Socio-Economic Status												
Frequent Victimization in 5th Grade	**-0.055*****	**-0.001**	**0.003**	**-0.107*****	**-0.064*****	**-0.051*****	**-0.039*****	**-0.015*****	**-0.010****	**-0.084*****	**-0.065*****	**-0.053*****
Standard Error	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Observations	134469	134469	134469	122265	122265	122265	134469	134469	134469	121059	121059	121059
Adjusted R^2	0.276	0.458	0.460	0.144	0.254	0.259	0.345	0.539	0.540	0.087	0.203	0.207
ESCS diff. p-value	0.007	0.418	0.445	0.012	0.164	0.232	0.002	0.105	0.123	0.539	0.695	0.569

Notes: OLS estimates. Standard errors, corrected for heteroskedasticity and adjusted for potential clustering at the class level, are reported in parentheses. *Victimization Score* and measures of school performance are standardized to have mean zero and unit variance in the study sample. School fixed effects are included in all specifications. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. *ESCS diff.*: the p-value from a test for differences in the effect of school bullying victimization between the two groups.

3.7. The Impact of Bullying Victimization on School Performance: Analysis with Matching Methods

In this section, we complement the OLS regression analysis with the non-parametric propensity score matching (PSM) estimates. The PSM allows to compare students who reported having suffered bullying with a control group, consisting of students who did not suffer bullying. This approach, compared to the OLS, offers the following advantages: i) increased similarity in the distribution of covariates between treated and control groups; ii) explicit consideration of the degree of overlap; and iii) a reduced reliance on a linear functional form (Becker and Ichino, 2002; Rosenbaum and Rubin, 1983).

3.7.1. Methodology

Following the literature (Delprato et al., 2017; Gorman et al., 2021; Ponzo, 2013), in order to attenuate the impact of confounding factors, we use the propensity score matching method. This estimation method does not require a particular specification of the model for bullying victimization at school. The matching's approach allows to find a group of non-treated students (non-victims of school bullying) who are similar to the treated students (victims of school bullying) in all relevant pre-treatment characteristics, X (including gender, pre-primary school attendance, family background characteristics, immigrant status, enrolment, school characteristics and school organization); the only remaining difference being that the latter experienced bullying at school while the former did not. Thus, any existing difference in school performance can be attributed to the treatment (being exposed to bullying).

In our analysis, we focus on the average effect of treatment on the treated (ATT) there as the treatment variable we consider initially *Frequent Victimization in 5th Grade*, a binary variable indicating whether at least one type of bullying (social manipulation, verbal and/or physical aggression) occurred to the student weekly or during the school year 2013/14, and then *Any Bullying Act in 5th Grade.* We estimate the ATT as follows:

$$\tau_{ATT} = \frac{1}{n_T}\sum_{i=1}^{n_T}(Y_i^T - Y_i^C) \quad (3)$$

where Y_i^T describes the outcomes of the i-th treated students; Y_i^C describes the average outcome for the group of control students matched according to the matching procedure (i.e., nearest neighbour, caliper)[94], to the i-

[94] The nearest neighbour matching consists of an algorithm that matches each treated student with the non-treated peer displaying the closest propensity score. A variant of nearest neighbour matching is caliper matching; the 'caliper' is used to exclude observations for which there is no close match, thus enforcing common support. Therefore, with caliper matching, each treated student is matched with the control units whose propensity score falls into a predefined neighborhood of the propensity score of the treated unit. The extensive description of the propensity score matching methods can be found in Blundell and Costa Dias (2002), Caliendo and Kopeinig (2008), Dehejia and Wahba (2002), Heckman et al. (1997), Becker and Ichino (2002), Rosenbaum & Rubin (1983).

th student; n_T represents the number of students in the treatment group.

The estimator of the ATT relies on two assumptions: unconfoundedness and overlap. Unconfoundedness (or the conditional independence assumption (CIA)) states that assignment to treatment is independent of the outcomes, conditional on the covariates: $(Y^T - Y^C) \perp (Bullied = 1)|X$. This assumption implies that selection into treatment is solely based on observable characteristics and any difference between treated and non-treated can be attributed to the treatment; X denotes the whole set of observed covariates used to calculate the propensity score (i.e. the probability of being bullied at school conditional to pre-treatment control variables). Under the CIA, matching estimators allow us to derive the counterfactual outcomes of the treated (the outcome a bullied student would have had if he/she had not been bullied at school) using information on control individuals with the same observable characteristics of the treated. The overlap (or common support condition) states that probability of assignment into the treatment is bounded away from zero and one: $0 < Pr(S = 1|X) < 1$, which ensures that any combination of characteristics observed in the treatment group can also be observed among the control group. A limitation of the matching approach is that it relies on observed pre-treatment information and there is no guarantee that the distribution of unobservables is the same for the bullied and non-bullied groups.

3.7.2. Results

In Table 3.14, we report the propensity score matching estimates of the ATT for performance in literacy (columns 1-4) and numeracy (columns 5-8). Results are based on the following matching approaches: nearest neighbour, caliper, and Mahalanobis, controlling for a full set of individual characteristics, family background, and school characteristics from specification (1). The propensity score balance graphs are available in Appendix 3 (see Figures A3.1 and A3.2).

Results for the ATT reported in Table 3.14 suggest that exposure to bullying has a negative statistically significant effect (at the 1% level) on the performance of the victim. We find that pupils who reported being bullied weekly or daily at school in the 5th grade obtain worse test scores and teacher-assigned marks in both the 8th and the 10th grades than non-victims. Results from ATT show that victims of primary school bullying achieve in the 8th grade 6 points less in literacy score (a reduction of 16% of a SD), 4 points less in numeracy score (- 9% of a SD), about 0.2 points less in teacher assessments (-17% in the SDs) with respect to non-victims. With regards to educational outcomes obtained in the 10th grade, bullied students have literacy score lower by 3 points (-7.8% of a SD), numeracy score lower by 2.2 points (-5.5% of a SD), and lower teacher mark in literacy by 0.11 points (-9.9% of a SD) and numeracy by 0.12 (-8.4% of a SD).

Table 3.14. Matching Estimates of the Effects of Frequent School Bullying Victimization in the 5th Grade

Dependent variable: *8th and 10th Grade Test Scores and Teacher-Assigned Marks*

	Literacy				Numeracy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Matching Methods:	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Nearest Neighbour								
ATT	-0.157***	-0.178***	-0.078***	-0.099***	-0.091***	-0.163***	-0.055***	-0.084***
Standard Error	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
Number of Treated	57,206	57,206	45,795	45,795	57,206	57,206	45,795	45,795
Number of Controls	242,184	242,184	210,176	210,176	242,184	242,184	210,176	210,176
Caliper Matching								
ATT	-0.153***	-0.178***	-0.076***	-0.097***	-0.090***	-0.166***	-0.057***	-0.083***
Standard Error	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)
Number of Treated	57,206	57,206	45,795	45,795	57,206	57,206	45,795	45,795
Number of Controls	242,184	242,184	210,176	210,176	242,184	242,184	210,176	210,176
Nearest Neighbour with Caliper								
ATT	-0.158***	-0.178***	-0.078***	-0.099***	-0.091***	-0.167***	-0.055***	-0.084***
Standard Error	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
Number of Treated	57,206	57,206	45,795	45,795	57,206	57,206	45,795	45,795
Number of Controls	242,184	242,184	210,176	210,176	242,184	242,184	210,176	210,176
Mahalanobis-Metric Matching								
ATT	-0.148***	-0.170***	-0.068***	-0.099***	-0.084***	-0.160***	-0.052***	-0.077***
Standard Error	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)
Number of Treated	57,206	57,206	45,795	45,795	57,206	57,206	45,795	45,795
Number of Untreated	242,184	242,184	210,176	210,176	242,184	242,184	210,176	210,176

Notes: The treatment variable is *Frequent Victimization in 5th Grade,* that is, if a student has been bullied in any way weekly or daily during the school year 2013/14. Matching estimates implemented using `psmatch2` in Stata. Balancing property and common support satisfied. The covariates included in the propensity score model are those from specification (1): gender, pre-primary school attendance, family background characteristics, immigrant status, enrolment, school characteristics and school organization (class size, school size, province in which the school is located). Nearest neighbour is applied with replacement and (nn=3). Caliper (0.01) for radius matching. Abadie-Imbens standard errors are in Mahalanobis metric matching. ATT = average treatment effect on the treated. Standard errors, corrected for heteroskedasticity, are reported in parentheses. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. The propensity score balance graphs are available in Appendix 3 Figure A3.1.

For completeness, in Table 3.15 we report the PSM estimates for *Any Bullying Act in 5th Grade*.

Table 3.15. Matching Estimates of the Effects of Any School Bullying Act in the 5th Grade

	Dependent variable: *8th and 10th Grade Test Scores and Teacher-Assigned Marks*							
	Literacy				Numeracy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Matching Methods:	*Rasch Literacy Score in 8th Grade*	*Teacher Mark Literacy in 8th Grade*	*Rasch Literacy Score in 10th Grade*	*Teacher Mark Literacy in 10th Grade*	*Rasch Numeracy Score in 8th Grade*	*Teacher Mark Numeracy in 8th Grade*	*Rasch Numeracy Score in 10th Grade*	*Teacher Mark Numeracy in 10th Grade*
Nearest Neighbour								
ATT	-0.113***	-0.123***	-0.048***	-0.072***	-0.079***	-0.112***	-0.048***	-0.050***
Standard Error	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Number of Treated	237,364	237,364	201,712	201,712	237,364	237,364	201,712	201,712
Number of Controls	62,023 |	62,023 |	54,258	54,258	62,023 |	62,023 |	54,258	54,258
Caliper Matching								
ATT	-0.112***	-0.121***	-0.052***	-0.075***	-0.079***	-0.114***	-0.052***	-0.052***
Standard Error	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Number of Treated	237,365	237,365	201,713	201,713	237,365	237,365	201,713	201,713
Number of Controls	62,023	62,023	54,258	54,258	62,023	62,023	54,258	54,258
Nearest Neighbour with Caliper								
ATT	-0.113***	-0.123***	-0.048***	-0.072***	-0.079***	-0.112***	-0.048***	-0.050***
Standard Error	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Number of Treated	237,364	237,364	201,712	201,712	237,364	237,364	201,712	201,712
Number of Controls	62,023	62,023	54,258	54,258	62,023	62,023	54,258	54,258
Mahalanobis-Metric Matching								
ATT	-0.110***	-0.120***	-0.058***	-0.073***	-0.078***	-0.116***	-0.053***	-0.044***
Standard Error	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Number of Treated	237,367	237,367	201,713	201,713	237,367	237,367	201,713	201,713
Number of Untreated	62,023	62,023	54,258	54,258	62,023	62,023	54,258	54,258

Notes: The treatment variable, *Any Bullying Act in 5th Grade,* is a binary variable indicating whether at least one form of bulling (physical, verbal or indirect through social exclusion) occurred to the child in the school year 2013/14. Matching estimates implemented using `psmatch2` in Stata. Balancing property and common support satisfied. The covariates included in the propensity score model are those from specification (1): gender, pre-primary school attendance, family background characteristics, immigrant status, enrolment, school characteristics and school organization (class size, school size, province in which the school is located). Nearest neighbour is applied with replacement and nn=3. Caliper (0.01) for radius matching. Abadie-Imbens standard errors are in Mahalanobis metric matching. ATT = average treatment effect on the treated. Standard errors, corrected for heteroskedasticity, are reported in parentheses. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. The propensity score balance graphs are available in Appendix 3 Figure A3.2.

3.8. Concluding Remarks

The violent and unsecure school environment has the potential to undermine the quality of education and has a wide range of negative socio-economic consequences for all learners. The present study is focused on one important influence on the formation of cognitive skills, namely, the bullying victimization of children at school.

Our study aimed to evaluate the impact of experiencing bullying in primary school on later school performance. To this end, we used census data on a cohort of 365,404 Italian primary schoolchildren who attending the 5th grade in the school year 2013/14. Thanks to the data provided by the Italian National Institute for the Evaluation of the Educational System (INVALSI), for this cohort of 5th-graders, we have detailed information not only on their psychological and physical bullying victimization status (reported by children at the end of the 5th grade, at age 10-11), as well as on their educational outcomes observed in lower and upper secondary school (in the 8th and 10th grades, at age 13 and 15). In this way, combining early-life measures of bullying victimization with later school outcomes, allows us to control for reverse causality. The data provided by INVALSI allow us to exploit a very rich conditioning set of observables.

Initially, using an ordered probit model, we explored the determinants of bullying victimization in primary school. Our findings suggest that the following individual characteristics are associated with a higher probability of being bullied frequently at age 10: being a boy, being a child of immigrants, being an early enrolled, having a less well-off family or poorly educated parents, having lower levels of achievement, being a student with schedule organized in entire day instead that only in the morning, having more extrinsic academic motivation and a week sense of perceived efficacy for self-regulated learning.

Then, using an ordinary least square with school fixed effects and matching techniques, we estimated the impact of experiencing bullying in the 5th-grade (at age 10) on subsequent performance measured by the 8th and 10th grade test scores and marks in literacy and numeracy (at age 13 and 15, respectively). Consequently, we have explored whether the relationship between being bullied at school and performance varies by gender and socio-economic and cultural status.

Our main result is that school bullying victimization in primary school has a considerable negative effect on victims' subsequent performance in literacy and numeracy not only 3 but also 5 years after the exposure to bullying. Our findings, based on average treatment effects on the treated (ATT), suggest that children experiencing frequent bullying victimization in the 5th grade obtain 6 points less (or -16% of a SD) in literacy and 4 points less (or -9% of a SD) in numeracy standardized test scores carried out in the 8th grade with respect to non-victim peers. As regards the performance of victimized 5th-graders observed in upper secondary school (i.e., after 5 years to exposure to bullying), our results suggest that victims of bullying achieve a 3-point lower literacy score (or -7.8% of a SD) and a 2.2-point lower numeracy score (or -5.5% of

a SD) compared to children who have not experienced school bullying victimization in the 5th grade. Similar findings are found using ordinary least squares with school fixed effects.

Our findings also reveal that primary-school victimized children suffer not only in terms of performance in national standardized tests in literacy and numeracy observed in secondary school, but also in terms of teacher-assigned marks. In particular, results from ATT suggest that victims of bullying in primary school achieve in the middle school (in grade 8) 0.2 points less in teacher assessments (-17% in the SDs) with respect to non-victims. Regarding the observed performance at age 15 (in grade 10), bullied students achieve lower teacher marks in literacy by 0.11 points (-9.9% of a SD) and numeracy by 0.12 (-8.4% of a SD).

Further analysis shows that the adverse effects of victimization at school are consistently larger for girls with respect to boys, and for children who come from disadvantaged socio-economic backgrounds.

We show that our findings are robust to different definitions of bullying victimization measures and different measures of school performance. Moreover, the fact that we use information on students' bullying victimization status collected well before the students' educational outcomes, allows us to deal with the reverse causality.

We hope that our results could be useful for those interested in the effects of these undesired children's experiences at school on learning outcomes.

APPENDIX 3

Table A3.1. Frequency of Different Types of School Bullying Victimization

Panel (a): Cohort of primary students followed for three years

	Verbal Victimization *Teasing*			Verbal Victimization *Insulting*			Social Manipulation *Exclusion*			Physical Victimization *Hitting*		
	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Never	29.27	27.67	30.77	48.55	44.12	52.72	55.40	58.06	52.90	82.64	76.46	88.44
Sometimes	56.24	55.43	56.99	41.47	43.51	39.55	37.19	33.80	40.37	14.72	19.56	10.16
Every week	7.51	9.26	5.86	5.47	7.09	3.94	4.08	4.69	3.50	1.51	2.29	0.77
Every day	6.99	7.64	6.38	4.51	5.28	3.79	3.34	3.45	3.23	1.14	1.69	0.63
Observations	365,404	177,007	188,397	365,404	177,007	188,397	365,404	177,007	188,397	365,404	177,007	188,397

Panel (b): Cohort of primary students followed for five years

	Verbal Victimization *Teasing*			Verbal Victimization *Insulting*			Social Manipulation *Exclusion*			Physical Victimization *Hitting*		
	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls
Never	29.86	28.08	31.45	49.57	44.88	53.77	56.24	59.00	53.77	83.46	77.22	89.05
Sometimes	56.30	55.63	56.91	41.04	43.30	39.03	36.86	33.40	39.96	14.19	19.15	9.75
Every week	7.32	9.07	5.75	5.23	6.85	3.78	3.83	4.40	3.32	1.37	2.14	0.68
Every day	6.52	7.22	5.89	4.16	4.97	3.43	3.06	3.20	2.95	0.98	1.50	0.52
Observations	297,946	140,697	157,249	297,946	140,697	157,249	297,946	140,697	157,249	297,946	140,697	157,249

Note: The table reports responses to the student questionnaire items: "This school year how often have you been i) teased ii) insulted iii) excluded or isolated iv) hit by other pupils at school?". The first two questions refer to verbal bullying, which we distinguish as *teasing* and *insulting*. The third question is related to indirect or relational bullying through social isolation and exclusion from other groups, while the last type of bullying is related to physical aggressive behavior, *hitting*.

Table A3.2. Correlation Matrix Measures of School Bullying Victimization

	Any School Victimization in 5th Grade	*Victimization Score in 5th Grade*	*Frequent Victimization in 5th Grade*
Panel (a): Cohort of primary students followed for three years			
Whole sample			
Any Bullying Act in 5th Grade	1.000		
Victimization Score in 5th Grade	0.552	1.000	
Frequent Victimization in 5th Grade	0.248	0.751	1.000
Boys			
Any Bullying Act in 5th Grade	1.000		
Victimization Score in 5th Grade	0.545	1.000	
Frequent Victimization in 5th Grade	0.265	0.758	1.000
Girls			
Any Bullying Act 5th Grade	1.000		
Victimization Intensity Score in 5th Grade	0.564	1.000	
Frequent Victimization in 5th Grade	0.230	0.739	1.000
Panel (b): Cohort of primary students followed for five years			
Whole sample			
Any Bullying Act in 5th Grade	1.000		
Victimization Intensity Score in 5th Grade	0.558	1.000	
Frequent Victimization in 5th Grade	0.244	0.746	1.000
Boys			
Any Bullying Act in 5th Grade	1.000		
Victimization Intensity Score in 5th Grade	0.549	1.000	
Frequent Victimization in 5th Grade	0.262	0.754	1.000
Girls			
Any Bullying Act in 5th Grade	1.000		
Victimization Intensity Score in 5th Grade	0.572	1.000	
Frequent Victimization in 5th Grade	0.227	0.732	1.000

Notes: All the reported correlation rates are statistically significant at the 1 percent level.

In Table A3.3. is reported a complete description of the variables used in the econometric analysis performed in Chapter 3.

Table A3.3. Variable Description

Bullying Victimization measures:	
Any Bullying Act	Binary indicator of whether the child has been bullied at school in 5th grade (at age 10).
Victimization Score	Score obtained by taking the mean item score across the four types of bullying (i.e., teasing, insulting, exclusion, and physical threats/violence) that makeup the Victimization scale. Not bullied is scored 0, bullied but not frequently is scored 1, bullied every week is scored 2, and bullied every day is scored 3.
Frequent Victimization	Binary variable equal to one if a child has been bullied weekly or daily in at least one of the four ways (teasing, insulting, social isolation, and hitting) during his or her 5th year of primary school.
Cognitive skills measures:	
Rasch Literacy Score	Literacy score computed by the INVALSI applying the IRT Rasch model to students' answers in the test, in order to account for different difficulties of single items.
Rasch Numeracy Score	Numeracy Score computed by the INVALSI applying the IRT Rasch model to students' answers in the test, in order to account for different difficulties of single items.
Teacher Mark Literacy	Oral mark assigned by Italian language teacher.
Teacher Mark Numeracy	Oral mark assigned by math teacher.
Non-cognitive skills measures:	
External Regulation	Score calculated as the average of student's responses on the items that make up the External Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Introjected Regulation	Score calculated by averaging the student's responses on the items that make up the Introjected Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Identified Regulation	Score calculated by averaging the student's answers on items that make up the Identified Regulation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Intrinsic Motivation	Score calculated by averaging the student's responses on items that make up the Intrinsic Motivation subscale. Answers are on a 4-point Likert-type scale ranging from 1 (not at all true) to 4 (very true).
Motivation (as proxied by the Relative Autonomy Index)	Score obtained by applying a weighting to the External Regulation, Introjected Regulation, Identified Regulation, and Intrinsic Motivation Subscales. Then we summed the weighted scores. To form the RAI, the following formula is used: 2 × Intrinsic + Identified - Introjected - 2 × External motivation. High positive scores indicate greater intrinsic or self-determined motivation, and low negative scores indicate more extrinsic or controlled regulation.
Self-efficacy	Score obtained as the average of responses on the items that make up the Perceived Efficacy Subscale for Self-Regulated Learning. Answers are on a 4-point Likert-type scale, where 1 corresponds to "not able to do it at all" and 4 corresponds to "able to do it at all". A higher score represents a higher level of self-efficacy.
Students' socio-demographic characteristics:	
ESCS Index	Index of social, economic and cultural status of the student's family.
Female	Dummy variable equals to 1 if the observation refers to female.
Age	Student's age (number of years).
Pre-Primary School	Pre-primary school attendance (dummy variable equals to 1 for students who went to the pre-primary school).
Immigrant	Dummy variable equals to 1 if the observation refers to first or second-generation immigrant student.
Early Enrolled	Dummy variable equals to 1 for students who is younger than regular students.
Late Enrolled	Dummy variable equals to 1 for students who is older than a regular student.
School organization and characteristics:	
Full time	Dummy variable equals to 1 if the student's schedule is organized in entire day (8 am - 4 pm).
Class Size	Average number of students in class.
School Size	Number of classes.

Table A3.4 reports means of key variables by victimization status: whether a child has never been bullied, has been bullied sometimes, or has been bullied repeatedly.

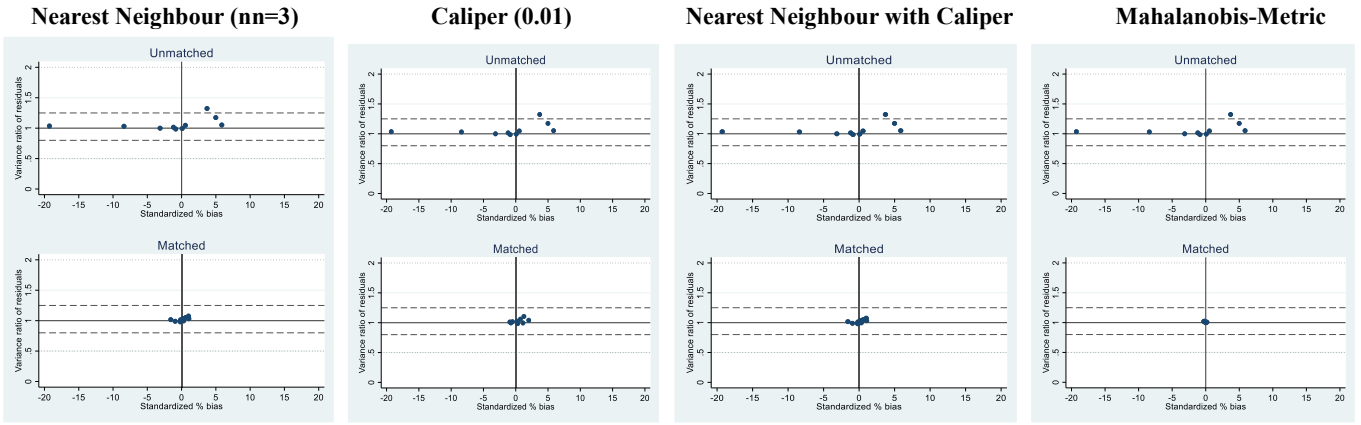
Table A3.4. Differences in Key Variables by Victimization Status

	Panel(a)				**Panel (b)**			
	Whole sample in the school year 2016/17 Grade 8				Whole sample in the school year 2018/19 Grade 10			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Never bullied	***Bullied sometimes***	***Repeatedly bullied***	***p-value from t-test of (3) – (2)***	***Never bullied***	***Bullied sometimes***	***Repeatedly bullied***	***p-value from t-test of (7) – (6)***
Rasch Literacy Score	213.190	209.469	201.940	0.000	209.811	208.743	204.144	0.000
Rasch Numeracy Score	210.695	208.062	204.796	0.000	209.036	208.402	206.181	0.000
Teacher Mark Literacy	7.302	7.184	6.922	0.000	6.637	6.577	6.425	0.000
Teacher Mark Numeracy	7.133	7.008	6.752	0.000	6.302	6.258	6.098	0.000
Rasch Literacy Score in 5th Grade	219.151	214.982	207.653	0.000	222.506	218.585	212.428	0.000
Rasch Numeracy Score in 5th Grade	221.593	217.115	211.194	0.000	224.658	220.438	215.749	0.000
Motivation in 5th Grade	1.329	1.059	0.721	0.000	1.393	1.120	0.777	0.000
Self-Efficacy in 5th Grade	3.218	3.128	3.058	0.000	3.232	3.142	3.077	0.000
External Regulation in 5th Grade	2.432	2.491	2.552	0.000	2.413	2.472	2.532	0.000
Introjected Regulation in 5th Grade	2.964	2.973	2.936	0.000	2.967	2.975	2.942	0.000
Identified Regulation in 5th Grade	3.633	3.611	3.521	0.000	3.642	3.619	3.534	0.000
Intrinsic Regulation in 5th Grade	2.762	2.702	2.620	0.000	2.771	2.710	2.624	0.000
Female	0.535	0.534	0.438	0.000	0.548	0.545	0.447	0.000
Age	13.923	13.928	13.927	0.299	15.913	15.919	15.913	0.000
Regularly Enrolled	0.971	0.971	0.965	0.000	0.985	0.986	0.985	0.023
Early Enrolled	0.014	0.013	0.014	0.053	0.015	0.014	0.015	0.023
Late Enrolled	0.015	0.016	0.020	0.000	0.010	0.011	0.013	0.000
Pre-Primary School	0.749	0.757	0.749	0.000	0.754	0.761	0.754	0.001
ESCS Index	0.171	0.134	0.062	0.000	0.154	0.129	0.082	0.000
Immigrant	0.055	0.069	0.079	0.000	0.062	0.073	0.082	0.000
Mother's years of study	12.208	12.176	12.050	0.000	13.240	13.204	13.149	0.004
Father's years of study	11.643	11.597	11.477	0.000	12.667	12.636	12.560	0.000
Full time	0.118	0.125	0.130	0.001	0.043	0.047	0.049	0.035
Class Size	21.882	21.883	21.750	0.000	23.962	23.958	23.949	0.036
Southern regions	0.431	0.360	0.372	0.000	0.432	0.367	0.381	0.000

Source: Author's calculations based on data from INVALSI (waves 2013/14, 16/17, and 18/19).

Figure A3.1. Plots summarizing the balance statistics comparing the unmatched and matched sample for results reported in Table 3.14, obtained using alternative matching methods.

A. Cohort of primary students followed for 3 years (from grade 5 up to grade 8)



B. Cohort of primary students followed for 5 years (from grade 5 up to grade 10)

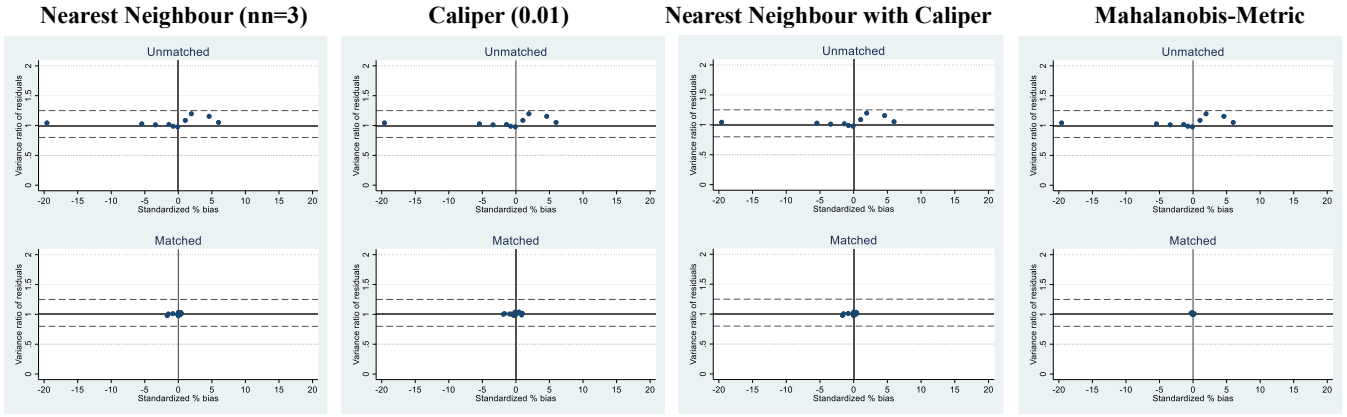
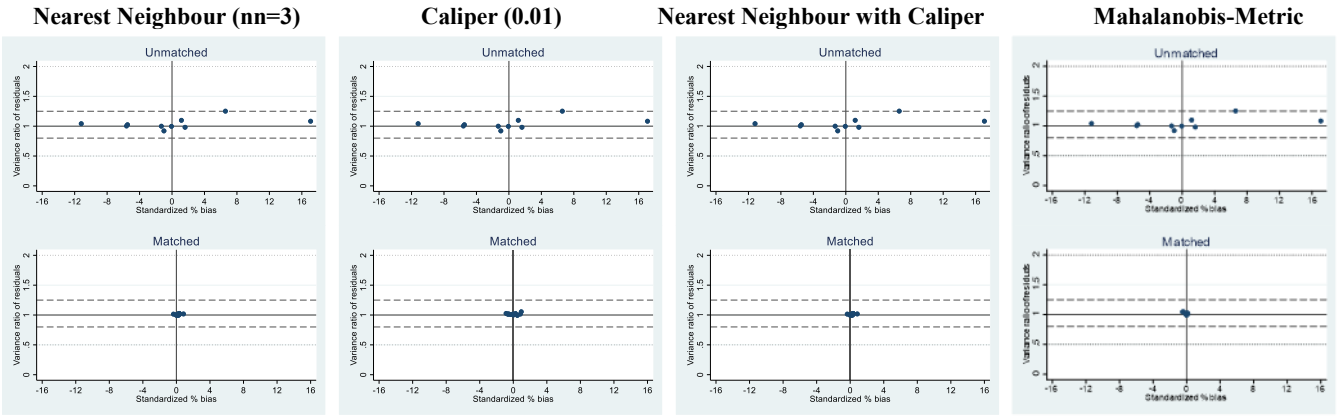
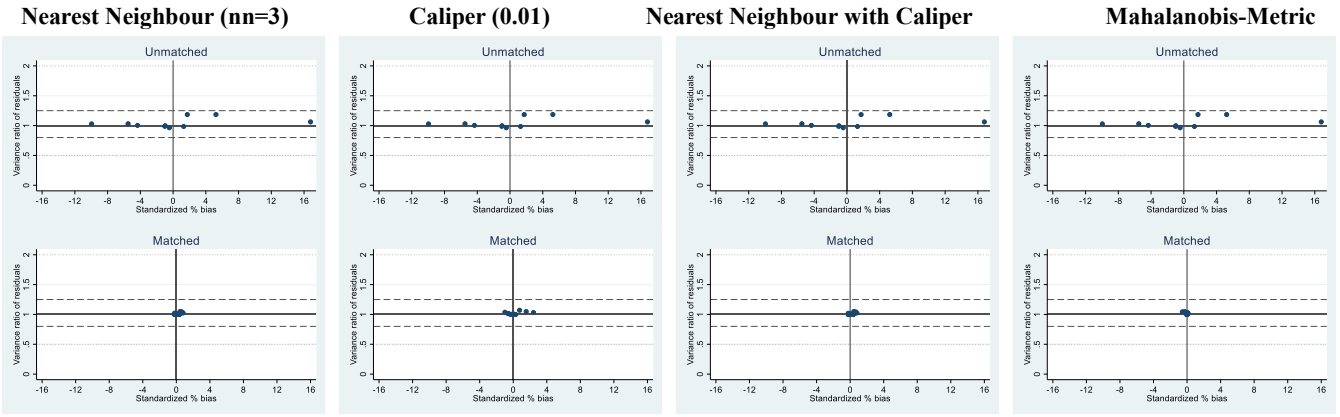


Figure A3.2. Plots summarizing the balance statistics comparing the unmatched and matched sample for results reported in Table 3.15, obtained using alternative matching methods.

A. Cohort of primary students followed for 3 years (from grade 5 up to grade 8)



B. Cohort of primary students followed for 5 years (from grade 5 up to grade 10)



Conclusion

The present thesis aims to investigate whether pupils' non-cognitive skills, social isolation, and bullying affect their school performance in Italy. Central to our analysis are census data on a whole population of Italian children attending the 5th grade in the school year 2013/14, provided by the Italian National Institute for the Evaluation of the Education System (INVALSI). It should be noticed that, the data provided by INVALSI for this students' cohort is a very rich source of information not only on their non-cognitive abilities, school-related behavioral characteristics, and bullying victimization status (collected through the Student Questionnaire in the 5th grade), but also on their cognitive abilities, as proxied by the test scores in literacy and numeracy that are collected through national standardized assessments in different moment of their educational career. For these students, the dataset INVALSI contains detailed information on their individual/family background characteristics and, in addition, allows us to observe their marks assigned by math and Italian language teachers which come from school administrative records.

In Chapter 1, for this cohort of 377,689 Italian school-aged children (183,887 boys and 193,802 girls) enrolled in the 5th year of primary school in the school year 2013/14 and followed from grade 5 across grade 8 and grade 10, we estimated how pupils' educational outcomes achieved in secondary school are affected by their academic motivation, self-efficacy, and social isolation among classmates as measured when attending primary school, controlling for their ex-ante measures of cognitive abilities. It has been found that students' more intrinsic academic motivation and higher levels of self-efficacy in the 5th grade (at age 10) have a statistically positive impact on their performance in literacy and numeracy, as measured by both test scores and teachers' marks observed 3 and 5 years later (in the 8th and 10th grade, at age 13 and 15). As regards the effects of social isolation among classmates in late childhood on subsequent school performance, it has been found that students' social isolation in the 5th grade has a negative statistically significant effect (at the 1% level) on the 8th-grade test scores and teacher-assigned marks in literacy and numeracy; this effect is smaller for the 10th-grade school outcomes and, once we include controls for prior performance in literacy/numeracy, the social isolation coefficients are not precisely estimated.

In Chapter 1, we have also performed an analysis on whether the effects of motivation, self-efficacy, and social isolation are heterogeneous according to students' gender and to the socio-economic environment in which they live. The pattern of results suggests that the positive impact of higher levels of self-efficacy on test scores and marks in literacy and numeracy is larger for boys, while intrinsic academic motivation has a more positive impact on school outcomes in literacy and numeracy for girls. The negative effects of social isolation among classmates are larger and more significant for girls than for boys. The analysis of heterogeneity by socio-economic and cultural status revealed that there are differences in the effects of motivation and self-efficacy between children from more or less well-off families. In particular, our results

suggest that the significant positive effect of motivation and self-efficacy is stronger for students who come from more advantaged socio-economic backgrounds. The negative impact of social isolation at the age of 10 on performance in lower secondary school (at age 13) has been found for children from both more and less well-off families. However, the negative effects are larger for children from more disadvantaged families.

In Chapter 2, thanks to the detailed information on students' behavior in the 5th grade, their blind and non-blind scores that cover the same area during the same school year, we analysed whether students' bullying behavior at school affects primary-school teachers' grading practices. The empirical model is based on the contrast between teacher-assigned marks in literacy and numeracy and standardized test score results taken by 5th-graders in the national external evaluation program managed by INVALSI, assuming that the latter are free from in-school behavior bias. Based on answers reported by students in the survey INVALSI, we have observed that approximately one student out of fourteen bullied other students regularly during their 5th year of primary school. Regression analysis (that was performed using ordinary least squares with school fixed effects) has revealed that students' undesired social behavior at school directly affects teachers' evaluations of their cognitive performance. It has found that schoolchildren who bully their peers are graded less favourably than better-behaved children – not bullies – in both literacy and numeracy. The estimated bias against bullying-behaved students in 5th grade is 9.7% of a standard deviation in literacy and 15.5% of a standard deviation in numeracy. These results are robust to the inclusion of other confounders that may lead to grading bias (i.e., gender, socio-economic status, immigrant status), to the inclusion of school fixed effects, and to alternative measures of student performance in blindly-graded tests. The analysis of the heterogeneous effects has shown that teachers' evaluation bias is smaller against female bullies with respect to male bullies in literacy, while the estimated bias in numeracy is smaller against male bullies compared to female bullies. Moreover, it has been found that teachers' grading bias coefficients are higher for perpetrators of bullying from less well-off families.

The analysis reported in Chapter 3 was focused on the role that school bullying victimization in primary school might play in the formation of cognitive skills for victimized children. To investigate the consequences of exposure to bullying on subsequent school performance for victims, census data on a cohort of 365,404 Italian primary schoolchildren who attended the 5th grade in the 2013/14 school year and followed from grade 5 across grade 8 and grade 10 were used. Applying both parametric estimators (ordinary least squares with school fixed effects) and non-parametric matching estimators, we quantified the impact of being bullied in the 5th grade of primary school on later educational outcomes, including standardized test scores and teacher-assigned marks in literacy and numeracy, achieved in the 8th and 10th grades of secondary school. It has been found that bullying victimization in primary school has a considerable negative effect on victims' subsequent performance in literacy and numeracy not only 3 but also 5 years after the exposure to bullying. Our results, based on average treatment effects on the treated (ATT), revealed that children experiencing

frequent bullying victimization in the 5th grade obtain 6 points less (or -16% of a SD) in literacy and 4 points less (or -9% of a SD) in numeracy standardized test scores carried out in the 8th grade with respect to non-victim peers. As regards the performance of victimized 5th-graders observed in upper secondary school (i.e., after 5 years to exposure to bullying), it has been found that victims of bullying achieve a 3-point lower literacy score (or -7.8% of a SD) and a 2.2-point lower numeracy score (or -5.5% of a SD) compared to children who have not experienced school bullying victimization in the 5th grade.

The evidence reported in Chapter 3 also has revealed that victims of primary-school bullying suffer not only in terms of subsequent performance in national standardized tests in literacy and numeracy observed in secondary school, but also in terms of teacher-assigned marks. Results from ATT have shown that victimized 5th-graders achieve lower teacher marks in literacy and numeracy by 0.2 points (-17% in the SDs) in grade 8 with respect to non-victims. As regards the school performance at age 15 (in grade 10), bullied students achieve lower marks in literacy by 0.11 points (-9.9% of a SD) and numeracy by 0.12 points (-8.4% of a SD). The results from propensity score matching estimation are consistent with those reported from ordinary least squares with school fixed effects.

Further analysis performed in Chapter 3 has shown that the adverse effects of school bullying victimization are consistently larger for girls with respect to boys, and for children who come from disadvantaged socio-economic backgrounds. The findings reported in Chapter 3 are robust to different definitions of bullying victimization measures and different measures of school performance.

In addition, we have also explored the determinants of bullying victimization in primary school. It has been found that, individual characteristics associated with a higher probability of being bullied frequently at age 10 are: being a boy, being a child of immigrants, being an early enrolled, having a less well-off family or poorly educated parents, having lower levels of achievement, being a student with schedule organized in entire day instead that only in the morning, having more extrinsic academic motivation and a week sense of perceived efficacy for self-regulated learning.

On the basis of the evidence provided in this thesis, we may safely conclude that students' motivation, self-efficacy, social interactions in the classroom, and bullying matter for the cognitive skills formation process in the Italian school setting. As was mentioned above, the empirical evidence reported in this thesis is based on census data that cover the entire population of Italian children attending the 5th grade in the school year 2013/14. This allows us to solve selection biases that might derive from specific sample and to strengthen to external validity of our results. We hope that our findings could be useful for policymakers that target cognitive and non-cognitive skills formation aimed at school-age children, for whom these abilities have been shown to be relatively malleable.

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