



The impact of bullying on students' learning in Latin America: A matching approach for 15 countries



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ABSTRACT

We examine the impact of bullying on learning and non-cognitive outcomes for sixth grade students in 15 Latin America countries using data from the Third Regional Comparative and Explanatory Study (TERCE) learning survey. We apply OLS and propensity score matching to attenuate the impact of confounding factors. Matching results show that students being bullied 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. Thus, substantial learning gains could be accomplished by anti-bullying policies in the region.

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1. Introduction

During recent years, bullying at school has become widely recognized as a worldwide problem. Sadly it occurs in places where children should be the most protected, that is, in their homes, foster institutions and schools (UN, 2006). Bullying is a unique form of aggressive behaviour, based on power imbalance (Due et al., 2005; Peets and Kikas, 2006). Bullying is generally defined as negative intentional actions including physical violence, verbal abuse or intent to cause psychological harm through humiliation or exclusion (Olweus, 1993; Rigby, 1996). Global prevalence of school bullying is large. Elgar et al. (2015) using two major international surveys measuring violence in adolescents, the Health Behaviour in School-aged Children (HBSC) and Global School-based Health Survey (GSHS), estimate that 30% of adolescents report being the target of bullying across five regions covering 72 countries. The phenomenon of school violence in Latin America is more severe (Fleming and Jacobsen, 2010). For instance, Román and Murillo (2011) based on the 2006 SERCE learning survey, find an average prevalence rate of bullying incidents 51% in Latin America, though with substantial differential rates across countries. Worryingly, school violence in the region is becoming

more systematic and accepted as the norm (Plan International and UNICEF, 2015).

The negative effects of bullying on student's learning is well established in the literature (e.g., Nakamoto and Schwartz, 2009; Lacey and Cornell, 2013). Being bullied is known to significantly lower achievement and tends to increase with the severity of the bullying, but importantly has other long-term consequences (see Eriksen et al., 2014). Yet there has been little specific research in less developed countries (Dunne et al., 2013) and, as far as we are aware, there is also a lack of comparable and robust evidence from Latin America. A notable exception is the multilevel study of Román and Murillo (2011), though their study does not account for selection bias generated by confounding factors (e.g., weak family support, and unfavourable neighbourhood and school characteristics which could lead to both lowering students' achievement as well as larger bullying prevalence). Given the importance of improving the quality of learning in schools as an important part of the post-2015 development agenda, this is now a more pressing issue for less developed regions. Thus, new evidence of one of its barriers is vital to guide school violence policies in Latin America, which in turn could counterbalance the persistent and large socio-economic gradients of learning in that region (Delprato et al., 2015; Duarte et al., 2010).

Hence, in this paper, we provide robust new evidence for the associations of bullying with math and reading scores for sixth grade students in 15 Latin American countries using the Third Regional Comparative and Explanatory Study (TERCE) learning survey of 2013. We present estimates for total bullying as well as by

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bullying types –i.e., physical and psychological. Because non-cognitive skills are increasingly considered to be as central as cognitive skills in explaining academic and employment outcomes (Krishnan and Krutikova, 2013), we also extend the literature by estimating the effect of bullying on non-cognitive outcomes (i.e., sense of belonging at school, home study and socialising). To obtain robust estimates we rely on both parametric (OLS) and non-parametric techniques (matching approaches) which minimise the bias due to the correlation of the treatment (being bullied) and observed covariates. We employ propensity score matching to estimate the association that being bullied has on students' outcomes –the average effect of treatment on the treated (ATT). Through matching we are able to find groups of non-treated (non-bullied) students who are similar to treated (bullied) students, so any difference in outcomes can be attributed to the treatment (being bullied).

Furthermore, to investigate the problem of reverse causality (that is, a student can be a poor achiever due to bullying, or by the event of being a low performer he/she is more likely to be bullied) and to inspect if the effect of bullying varies across the learning distribution, we estimate quantile treatment effects for cognitive outcomes. This allows us to assess in which countries focalised programs for different groups of students according to their performance are needed to lessen the bullying-learning relationship. Also, with a policy perspective in mind, mostly missing for the region, we carry out a matched subsample analysis to shed light on policies and their related targeting to cancel out or to minimise the bullying effects on learning among students with the same background. That is, once we have identified a group of non-bullied (non-treated) students who are similar to the bullied (treated) students in all relevant characteristics through matching, we proceed to explain the 'bullying-gap' in outcomes for these matched subsamples using policy variables that may play a role in narrowing the learning gap among bullied and non-bullied students. As a robustness analysis, we also examine whether our main findings are robust to the presence of unobservables.

The paper is organised as follows. Section 1.1 provides a brief review of the literature. Section 2 describes the data and Section 3 outlines the empirical methodology. Section 4 contains the results. We present the main findings and policy implications in Section 5.

1.1. Literature review

Bullying at school is not an isolated social behaviour and, because it occurs in relatively stable groups and involves the participation of others in regular capacities or a 'continuum of behaviours' (Askew, 1999), it is an important determinant in the process of educational production, affecting the motivation, concentration and self-confidence of bullied students (Cassidy, 2009). Bullying also has harmful effects in the health and emotional wellbeing of students (Craig, 1998; Juvonen et al., 2003; Kowalski and Limber, 2013), as well as detrimental effects in adolescents attainment of cognitive (Ammermueller, 2012; Peršič et al., 2011; Ponzo, 2013) and non-cognitive skills (Kosciw et al., 2013; Hazel, 2010). For instance, Nakamoto and Schwartz (2009), in a meta-analysis of 33 studies, find a significant negative association between peer victimization and grade attainment and student achievement scores. Likewise, Ammermueller (2012) in a study for 11 European countries, finds that being bullied has a significant negative impact on contemporary and later student performance. In an analysis of 2011 TIMSS data from 48 developed countries of grade 4 students, Mullis et al. (2012) find that those who reported being bullied at school on a weekly basis scored 32 points less in mathematics. Brown and Taylor (2008) find that school bullying in the UK has similar adverse effects on educational attainment at age 16 than class size effects.

Findings from these studies (and also the current paper) somewhat present limitations from an econometric perspective since subjective questions used to measure bullying is likely to suffer from measurement error. Our main concern is social desirability (Bertrand and Mullainathan, 2001), where respondents do not want to appear victimized (i.e., bullied) or to acknowledge to interviewers that they are being subjected to stigmatizing peer behaviour.

Bullying has also a direct relationship with non-cognitive outcomes or skills – i.e., those which are less related to raw cognitive processing (Heckman and Kautz, 2014; Kautz et al., 2014). Non-cognitive skills comprise personal traits, attitudes and motivations. Three important non-cognitive skills are: perseverance (to accomplish long-term goals in the face of setbacks), self-control (self-regulation, self-discipline and willpower) and social skills (establish compatible and effective relations with others) (Gutman and Schoon, 2013).¹ Because non-cognitive skills are socially determined, students' bullying –a type of social school behaviour– is likely to affect these skills and by doing so students' academic achievement as well. For instance, students who are victims of bullying were reported to have more difficulty making or keeping friends and to be less likely to have social support (Wolke and Lereya, 2015), and these social skills have a great impact on individual's academic success (Borghans et al., 2008). Some studies argue that perseverance, too, can predict test scores and high school graduation better than measures of intelligence (Duckworth and Seligman, 2005; Duckworth et al., 2007). Non-cognitive skills, very much malleable by school bullying through diminishing a student's degree of socialisation or motivation, are as important as cognitive outcomes in determining educational attainment (Heckman and Rubinstein, 2001; Gutman and Schoon, 2013).

Crucially, the adverse effects of bullying on educational attainment extends beyond the school years and into adulthood (Brown and Taylor, 2008), making this a particularly important social and economic issue. On the educational level, the effect of bullying has consequences on whether students are willing to make the needed effort to improve their learning at the classroom level. This means, educational policy on bullying, and whether or not it has effect on reducing the incidence of bullying matters for the post-2015 education agenda on improving education quality for all by 2030.

Evidence from Latin America is limited (see, Román and Murillo, 2011; and references therein) and particularly research is scarce on the evaluation of anti-bullying policies (Plan International and UNICEF, 2015). Because the region is characterised by diverse social and cultural settings, the type of bullying and school violence and how to address this are mixed as well. This means successful policies need to permeate broad expressions of school violence which are culturally-driven and differ across Latin American sub-regions. In the case of Central America and Mexico, for example, there are high rates of social exclusion and armed violence which had led to an implicit acceptance of violence and repressive methods. In South America there is more heterogeneity in school violence forms but a lack of national legislation on bullying at lower levels of administration, although there has been some recent progress in some countries (Bolivia, Brazil, Chile, Peru and Paraguay).

The implementation of policies in the region, however, tends to be constrained with much focus on school security (Plan International and UNICEF, 2015), surpassing the bullying and school coexistence dimensions, though there have been recent policy advancements in these areas as well. Examples of successful

¹ In fact, Gutman and Schoon (2013) describe eight non-cognitive skills: self-perception of ability, motivation, perseverance, self-control, metacognitive strategies, social competencies, resilience and coping, as well as creativity.

approaches of educational and integral programs (promoting education on human rights and a peace culture, reducing domestic violence –with a bullying component) are the “Open School” of Brazil implemented in 2006 (UNESCO, 2009), the “Enjoyable School Program” of Uruguay started in 2010, and in Chile the “National School Coexistence Policy” since 2002 (Plan International and UNICEF, 2015). Yet, there is a lack of specific data and empirical evaluation on how policies should be envisaged in relation to weakening the negative associations of bullying with learning outcomes among middle aged schools.

2. Data

This article is based on the Third Regional Comparative and Explanatory Study (TERCE), a large-scale learning achievement survey implemented in 2013 across 15 Latin American countries² (Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay), in which the primary goal is to provide information on the education quality in the Region (OREALC/UNESCO, 2015a). It also aims to contribute towards informed decision making in the region for inclusive quality education by matching students’ learning measures to contextual background information. Specifically, TERCE assesses the performance of students in third and sixth grades in primary school in Mathematics, Reading and Writing (Language), as well as Natural Sciences in the case of sixth grade. The whole sample of TERCE for the sixth grade includes a total of 3065 schools and more than 67,000 students (OREALC/UNESCO, 2015b).³ A remarkable feature of TERCE is that it is culturally adapted for each country with the tests items, questionnaires and implementation designed with the participating countries in a collaborative process coordinated by the Latin American Laboratory for Assessment of the Quality of Education (LLECE), and based on each country

specific curricula and learning objectives (OREALC/UNESCO, 2015b). This permits a cross-country comparison and also across time with SERCE of year 2006 (OREALC/UNESCO, 2015c).

Following previous studies on bullying and learning outcomes in the region (e.g., Román and Murillo, 2011), we focus on the sample of students attending sixth grade. Middle-school aged adolescents tend to be more involved in bullying behaviours than younger children (Fleming and Jacobsen, 2009; Scheithauer et al., 2006) and adolescents’ bullying have distinctive and persistent features with a greater risk to public safety (Elgar et al., 2009). We concentrate on math and reading learning outcomes as a baseline comparison with other international learning surveys studies (e.g., Ammermueller, 2012; Ponzo, 2013) and we also look into bullying effects on non-cognitive outcomes.

In TERCE, math tests evaluate five domains of knowledge (numeric; geometric; measurement; statistics; and variation) and three levels of cognitive processes (recognition of objects and elements; solution to simple problems; and solution to complex problems).⁴ For reading, comprehension and metalinguistic/theoretical knowledge are examined. Tests results are presented

in two forms. A continuous indicator with an average set at 700 points and the standard deviation at 100 of the countries analysed. The second type of information is presented in (four) levels that characterise what students know and are able to do in each of the levels and grades tested.⁵ In addition, TERCE contains several background variables that influence student’s learning. That is, information on the students’ characteristics and their families and neighbourhoods where they live, teachers’ and schools’ characteristics, educational resources and classroom practices (OREALC/UNESCO, 2015d).

TERCE contains a set of questions regarding whether students suffer from bullying. Because of the differential effects of bullying on cognitive and non-cognitive outcomes, we differentiate bullying into two types: physical and psychological. Specifically, physical bullying is defined as situations where any of the following three events happens to a student in school: being afraid of classmates, feel threatened by some classmates, or fear that could be hit or hurt by classmates, whilst the definition of psychological bullying comprises cases where a student is teased, or left alone or being forced to do thing he/she does not want to do by his/her classmates. We also define the composite category any type of bullying.

Table 1 which contains summary statistics by students’ bullying status for the whole sample, shows that bullied students score between 15 and 19 points less in math and reading tests than their counterparts. There are also important differences in background characteristics among these two groups, with bullied students being disadvantaged in terms of personal/family and school characteristics. For instance, bullied students are 4% more likely to skip classes and 9% more likely to work, have inferior study conditions at home, as well as being less likely to be supervised in their studies. This is reflected by their disadvantaged socio-economic and cultural background and lower parental education. At the school level, they are more likely to attend schools with poor infrastructure and low average wealth and less qualified head masters and teachers.

Importantly, Table 2 shows that bullying is a widespread phenomenon across Latin America. For the whole sample, physical bullying average is 19% and 33% for psychological bullying, with nearly 40% of students experiencing either type of bullying.⁶ There is a considerable dispersion of bullying between countries: physical bullying varies from 11% in Costa Rica to 26% in Peru, and psychological bullying between 25% (Mexico) to 40% (Argentina).⁷ Table 1 shows the lack of gender differences by bullying forms – e.g. 19% and 18% for boys and girls for physical bullying and 34%–32% for the psychological form. What is clear is the harmful effect of bullying on learning. Table 2 (columns 11–14) shows that, for the whole region, being targeted by either type of bullying is related to lower academic performance, with effects varying from –19.4 to zero (math) and between –25 and –4 (reading).

² TERCE also includes the Mexican state of Nuevo Leon (Mexico) but, as it is not a country, we exclude it from the analysis.

³ Each country sample is representative of students of that grade by using a cluster sampling design, stratified and with systematic selection with probability proportional to the school size.

⁴ Within each domain there are various elements evaluated. For instance, in the numeric domain (e.g., positional values, power and roots, divisibility criteria); in the geometric domain (e.g., polygons, axes of symmetry, angles), in the measurement domain (e.g., system units, perimeter, area, volume), statics domain (e.g., average, mode, tabulation). See Table 13 of OREALC/UNESCO (2015c) for details.

⁵ It is estimated that 70% and 83% of sixth grade students achieve levels 1 and 2 for reading and math, respectively (OREALC/UNESCO, 2015c).

⁶ Note that since the definition of bullying relies on questions on subjective data which is prone to be misreported due to social desirability (Bertrand and Mullainathan, 2001), its’ prevalence could be higher than what is actually reported for the region.

⁷ Compared to the earlier findings there is a decrease where in 2006 (i.e., SERCE) the prevalence of any bullying incident was 51% (Román and Murillo, 2011).

Table 1
Summary statistics of learning scores and selected covariates by bullying status. Whole Sample (WS).

	Non-bullied	Bullied
<i>Learning scores</i>		
Math	715.11	699.74
Reading	715.43	696.91
<i>Student characteristics</i>		
Gender – male	0.50	0.52
Repeated	0.21	0.23
Missing school	1.94	1.98
Work	0.42	0.51
Attended preschool	0.79	0.77
Nuclear family	0.81	0.80
Number of kids at home	3.04	3.19
Study conditions at home – index	0.07	–0.18
Notebook	0.73	0.69
<i>Family characteristics</i>		
Socio-economic and cultural – index	0.01	–0.10
Study supervision at home – index	0.03	–0.07
Recreational activities with family – index	0.02	–0.05
Father's education	2.96	2.91
Mother's education	2.87	2.83
Number of books	3.28	3.21
<i>School characteristics</i>		
Public	0.79	0.82
Urban	0.75	0.74
Infrastructure – index	0.14	0.09
Number of computers with internet, average	2.61	2.55
Socio-economic and cultural average – index	–0.02	–0.10
<i>Head master characteristics</i>		
Years of experience	10.51	9.88
Education level	3.86	3.83
Further studies (specialisation, post graduate)	0.68	0.68
<i>Teacher characteristics</i>		
Years of experience	4.61	4.58
Education level	3.55	3.53
Teacher qualification	0.83	0.83
Further training in language	0.34	0.35
Further training in math	0.22	0.23
Type of contract – permanent	0.45	0.46
Sample size	31,095	19,717

Notes: (1) Sixth grade sample for all 15 countries. (2) Weighted means. (3) The bullied category refers to any bullying type (either physical or psychological).

3. Empirical approach

We employ an array of techniques to account for different issues which may bias the association between outcomes and bullying.⁸ There are several factors which could simultaneously influence the likelihood of being bullied and students' learning outcomes, varying from individual characteristics (Olweus, 1993), family support (Hemphill et al., 2012), neighbourhood and school characteristics (Chaux et al., 2009), teacher connectedness (Forrest et al., 2013) and country factors (Elgar et al., 2009). At the individual level, for example, ability will be related to students' likelihood to being a top or bottom performer, and by standing out

⁸ A further concern when estimating the association of bullying-outcomes is measurement error – mainly when it occurs at the same time in the dependent and independent variables (Bertrand and Mullainathan, 2001). The dependent variables degree of belonging and socialisation at school are attitudinal constructs where students might be reluctant to admit a lack of these attitudes. Equally, bullying incidents are likely to be misreported. We do not account for measurement error on the non-cognitive outcomes, so these associations should be interpreted with caution.

from average performers, they are more prone to be victims of bullying (Bishop, 2006). Within the family, lack of parental attention in a child's education (due to poor control, supervision or encouragement) can be both a source of lower achievement (Freeman and Viarengo, 2014) and a sign of not recognising the psychological effect of bullying on a child (Abdirahman et al., 2012). Thus, lack of parental educational investments is linked to children's achievement and non-cognitive outcomes which can be further set back by weak school policies and teaching approaches. We minimise the possible correlation between these factors and the likelihood of being bullied by employing matching techniques.⁹

3.1. OLS, matching and quantile treatment effects

We begin by estimating the net effect of bullying on cognitive and non-cognitive students' outcomes using ordinary least squares (OLS) controlling for a wide range of covariates at different levels. After estimating a null model (M0), we adopt a step-wise approach by sequentially including students' and family characteristics, school covariates and then principal/head master and teacher controls (full specification M1) as well as school fixed effects (specification M2). Because M2 is less likely to be affected by omitted variable bias than M1, we put more emphasis on the former model's results. We use weighted OLS adjusting standard errors for school-level clustering. The OLS regression (model M1) for each country is,

$$Y_i = \gamma_0 + \beta \text{bullied}_i + \gamma_1 X_{1i} + \gamma_2 X_{2i} + \gamma_3 X_{3i} + \eta_i + \varepsilon_i \quad (1)$$

where Y_i refers to students' test scores (math and reading) and non-cognitive outcomes (indices for sense of belonging to school, study at home and socialising) for student i ($i = 1, \dots, N$), bullied_i is a dummy variable indicating whether or not student i has been a victim of bullying, X_{1i} is a set of students and family exogenous characteristics (e.g., age, gender, whether repeated a grade, study conditions, family socio-economic and cultural status), X_{2i} contains school covariates (school type, infrastructure, etc.) and X_{3i} denotes principals and teachers characteristics (e.g., years of experience, qualifications, etc.), and we divide the idiosyncratic error term into η_i representing unobservable factors (e.g., parental attention, ability) and the white noise ε_i . We also estimate Eq. (1) for the boys and girls samples separately and test whether the effects of physical and psychological bullying on learning differ by gender.

We also adopt the nonparametric propensity score matching (Rosenbaum and Rubin, 1983).¹⁰ Matching's basic assumption is selection on observables (unconfoundedness) consisting on matching treatment with comparison units (bullied students with non-bullied students) which are similar in terms of their observable characteristics. Matching estimators allow us to derive the counterfactual outcomes of the treated (the outcome a bullied student would have had if he had not being bullied) using information on control individuals with the same observable characteristics of the treated. Specifically, we estimate the average treatment on the treated as $\tau_{ATT} = E[Y(1) - Y(0)|X, \text{bullied} = 1]$,

⁹ An alternative is to employ an instrumental variable approach, which requires finding an instrument – i.e., a variable correlated with bullying but not with outcomes. Some empirical studies on bullying (e.g., Carrell and Hoekstra, 2010; Eriksen et al., 2014) follow this approach. Eriksen et al. (2014) uses as an instrument the proportion of peers from troubled homes in one's classroom. The only plausible instruments in our application are measured at the contextual level (neighbourhood violence for instance) which are likely to be related to the learning scores. Hence, we do not pursue this approach.

¹⁰ Only one study, Ponzo (2013), uses a similar approach to estimate the impact of bullying on learning for Italy.

Table 2
Latin American countries prevalence of bullying and learning scores – TERCE study sixth grade.

	Physical bullying			Psychological bullying			Any bullying			N	Math		Reading	
	Male (1)	Female (2)	Total (3)	Male (4)	Female (5)	Total (6)	Male (7)	Female (8)	Total (9)		Bullied (11)	Non-bullied (12)	Bullied (13)	Non-bullied (14)
Whole sample (WS)	0.19	0.18	0.19	0.34	0.32	0.33	0.39	0.38	0.39	50,812	715.11	699.74	715.43	696.91
Argentina (ARG)	0.20	0.18	0.19	0.39	0.42	0.40	0.44	0.45	0.45	2803	720.96	730.80	708.16	721.45
Brazil (BRA)	0.18	0.19	0.18	0.36	0.34	0.35	0.40	0.41	0.40	2445	712.27	715.83	721.83	729.43
Chile (CHL)	0.16	0.15	0.15	0.28	0.25	0.26	0.32	0.30	0.31	4729	772.43	791.19	757.07	778.81
Colombia (COL)	0.23	0.18	0.21	0.35	0.32	0.34	0.42	0.39	0.40	3898	710.86	712.61	729.72	735.82
Costa Rica (CRI)	0.12	0.10	0.11	0.29	0.27	0.28	0.31	0.30	0.31	3287	725.27	732.64	743.47	756.69
Ecuador (ECU)	0.24	0.21	0.22	0.38	0.34	0.36	0.45	0.41	0.43	4739	694.85	711.60	683.80	700.44
Guatemala (GTM)	0.21	0.19	0.20	0.32	0.31	0.32	0.39	0.36	0.38	4210	684.44	683.87	684.38	689.88
Honduras (HON)	0.19	0.21	0.20	0.32	0.35	0.33	0.38	0.40	0.39	3104	668.90	680.39	674.16	682.58
Mexico (MEX)	0.19	0.16	0.17	0.26	0.24	0.25	0.33	0.30	0.32	3273	752.26	771.64	719.31	743.30
Nicaragua (NIC)	0.19	0.15	0.17	0.36	0.30	0.33	0.40	0.36	0.38	2655	653.59	657.69	663.03	673.39
Panama (PAN)	0.16	0.17	0.17	0.33	0.33	0.33	0.37	0.39	0.38	2523	660.67	661.57	684.22	688.19
Paraguay (PAR)	0.18	0.16	0.17	0.34	0.33	0.33	0.39	0.39	0.39	2651	649.97	658.18	660.71	664.71
Peru (PER)	0.25	0.28	0.26	0.40	0.39	0.39	0.47	0.47	0.47	4403	712.43	731.28	692.13	716.85
Dominican Rep. (REP)	0.24	0.24	0.24	0.36	0.36	0.36	0.44	0.44	0.44	2521	639.22	641.11	646.49	653.32
Uruguay (URU)	0.14	0.16	0.15	0.33	0.35	0.34	0.36	0.40	0.38	3571	750.93	769.46	725.82	740.81

Notes: (1) Sample sizes refer to the sixth grade sample. (2) Physical bullying is defined as 1 if either of the following three events happen to students at school: being afraid of classmates, feel threatened by some classmates, or fear that could be hit or hurt by classmates, and 0 otherwise. (3) Similarly, psychological bullying is defined as 1 if a student is either teased, or left alone or being forced to do things he/she does not want to do by his/her classmates, and 0 otherwise. (4) Bullying (or any bullying) equals to one if either physical or psychological bullying is present and 0 if neither of them happen. (5) Columns (11)–(14) bullied category refers to any bullying.

where $Y(1)$ and $Y(0)$ are students' outcomes for bullied and non-bullied groups, respectively, and X denotes the whole set of observed covariates used to calculate the propensity score (i.e. the probability of being bullied conditional to pre-treatment control variables). The estimator of the ATT relies on two assumptions: unconfoundedness and overlap. Unconfoundedness states that assignment to treatment is independent of the outcomes, conditional on the covariates: $(Y(1) - Y(0)) \perp (\text{bullied} = 1) | X$. This assumption implies that selection into treatment is solely based on observable characteristics and any difference between the treated and non-treated can be attributed to the treatment. The overlap 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. We run the propensity score matching analysis using the `psmatch2` Stata routine (Leuven and Sianesi, 2012) using nearest neighbour matching (without replacement), as well as radius and kernel matching for robustness.¹¹

Moreover, whether a student is a high or low achiever could be a risk factor for bullying and how it is linked to achievement. In other words, it is probable that the relationship of learning and bullying varies across the learning scores distributions. We employ quantile treatment effects (QTEs) as it provides a picture of the differences in the tails of the scores distributions. We use the Stata command `poparms` (Cattaneo et al., 2013) for the QTEs analysis using as benchmarks the 25th, 50th and 75th quantiles.

3.2. Matched subsample analysis

Once we have identified comparable bullied and non-bullied students with balanced individual, family, school and principal and teacher covariates through matching, we proceed to explain the

remaining (negative) effect of bullying on learning outcomes for these matched subsamples¹² with other relevant explanatory variables. These represent pathways that could be influencing students' achievement through bullying even among students with the same controls. For example, external contexts in which a school is embedded interact with internal school and student characteristics to influence levels of victimization in schools (Benbenishty and Astor, 2011); schools' poor work environment and lack of policies tackling victimization can widen school prevalence of bullying and mediate the direct effect of bullying on achievement (Benbenishty and Astor, 2005). We run OLS regressions to examine the role played by drivers at different levels (neighbourhoods and within schools) on the remaining 'adjusted' bullying gap for matched subsamples of N_m students,

$$Y_k = \gamma_0 + \beta \text{bullied}_k + \gamma_1 W_{1k} + \gamma_2 W_{2k} + \gamma_3 W_{3k} + \eta_k + \varepsilon_k \quad (3)$$

where Y_k is the outcome for matched student k ($k = 1, \dots, N_m$), W_{1k} denotes social family (conditional cash transfers) neighbourhood (violence) factors, W_{2k} includes school factors (work environment, teaching skills programs, cultural, drugs and violence school programs), W_{3k} includes teacher factors (performance appraisal, wages satisfaction, principal concerns beyond achievement, teacher's gender and experience, supervision and economic incentives).

3.3. Selection on observables and unobservables

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. We assess if our specification is robust to the presence of unobservables by providing estimates' bounds based on assumptions about the degree of selection between observables and unobservables (Altonji et al., 2005; Oster, 2015). Define the effect of observables as $O_i = \gamma_i X_i$, with equation (1) being re-expressed as $Y_i = \gamma_0 + \beta \text{bullied}_i + O_i + \eta_i + \varepsilon_i$. The proportional

¹¹ Nearest neighbour consists of an algorithm that matches each treated student with the non-treated student displaying the closest propensity score. The method is applied without replacement. The closeness of the propensity scores to find matches is defined by the value of the caliper which, following previous studies (e.g., Gou and Fraser, 2010), we set as $0.25 \times \sigma_{PS}$ (25% of the standard deviation of the estimated propensity score).

¹² Note that these matched subsamples contain fewer observations than the original sample ($N_m < N$) as unmatched comparison units are discarded.

selection relationship δ between unobservables and observables is,

$$\delta = \frac{\text{cov}(\eta, \text{bullied}) / \text{cov}(O, \text{bullied})}{\text{var}(\eta) / \text{var}(O)} \quad (4)$$

Following Oster (2015), we define the coefficient resulting from the short regression of Y on S only as $\hat{\beta}$ and the R-squared from that regression \hat{R} ; while for the intermediate regression with additional observables X the coefficient is $\tilde{\beta}$ and the R-squared is \tilde{R} ; finally, define the R-squared for the regression also including the unobservables as R_{\max} . Assuming a degree of selection for β equals to some target value $\tilde{\beta}$ leads an approximate value for δ :

$$\hat{\delta} \approx \frac{(\tilde{\beta} - \hat{\beta})(\tilde{R} - \hat{R})}{(\hat{\beta} - \tilde{\beta})(R_{\max} - \hat{R})} \quad (5)$$

We use two assumptions to construct the two identified sets for the treatment effect (Oster, 2015). The first assumption assumes equal selection (i.e., $\delta = 1$), which is an appropriate upper bound for δ since this argues that unobservables should not be more important than the observables in the treatment effect. The second assumption assumes a bounding value for R_{\max} and report the value of δ for which the estimator would produce a treatment effect of zero.¹³ A large value for δ ($\delta > 1$) would be an indication of a robust result because unobservables must be greater than observables to explain away bullying effects, and also if intervals of bullying treatment effects do not contain zero. The analysis is carried out using the `psacalc` Stata routine.

4. Results

4.1. Impact of bullying on cognitive and non-cognitive outcomes: OLS estimates

Before carrying out the main analysis, we assess whether bullying effects differ between boys and girls. We find that most effects are similar by gender for either physical or psychological bullying (see Appendix A in Supplementary material). This result is in line with recent research for the region (McClanahan et al., 2015). Thus, we conduct a country's whole sample analysis henceforth and we include gender as a student's control instead.¹⁴

Tables 3 and 4 present OLS bullying results for cognitive and non-cognitive outcomes for the 15 countries included in TERCE study, and for the whole sample. Each cell of the tables describes a specific model, providing an estimate of each of the effect of three categories of bullying: any bullying, physical and psychological under different specifications. We report results from a null model without any controls and then sequentially add different controls. Note that empirical results ought to be interpreted with caution due to the standard caveat that they represent associations, and do not necessarily imply causality.

Table 3 contains results for math and reading scores for the 15 countries (columns 2–16) and we include the whole sample (WS) results in column (1). Estimates confirm that being a victim of bullying at school is negatively associated with achievement even after accounting for either full controls at the student, family and school levels (model M1) or considering schools' unobservables within the OLS/FE specification (model M2). At the regional level, bullied students achieve a much lower performance in math and

reading of 8.02 and 8.77, respectively (M1), with a negative effect of 4.15–4.73 in the OLS school fixed effect specification (M2). This implies that, being a victim of bullying in sixth grade in Latin America leads to a reduction of 5%–10% of standard deviations in test scores, net of full controls or unobserved school effects.

Nevertheless, there is a considerable between-country heterogeneity on the association of bullying and learning. On the one hand, in the case of math (Panel A, Table 3), some countries (Colombia, Guatemala, Panama and Dominican Republic) show no effects, even without controls (model M0), while other countries show larger effects (Argentina, Chile, Ecuador, Mexico, Peru and Uruguay). Perhaps unsurprisingly, the introduction of school fixed effects for each country leads to qualitatively similar estimates than the model with school controls, suggesting that the chosen school explanatory variables capture most of the unobserved school effects driving associations of math with bullying. In model M2 (our preferred specification), half of the effects are still significant, varying between -6.8 and -12.8 . Overall, physical bullying is more harmful on math achievement than psychological bullying. On the other hand, bullying has far-reaching negative effects for reading scores (Panel B, Table 3). Here not only are there more statistically significant effects but they are also larger in magnitude (e.g., in Mexico reading has an average effect of around 16.8 points for reading and 9.4 points for math, model M2). For Colombia, Nicaragua, Panama and Dominican Republic math is not related to bullying, but it is for reading. This may suggest that students' traits are more closely connected to math aptitudes and are less malleable by school violence. For reading, too, slightly effects are obtained for physical bullying.

Whilst we find important negative effects of bullying on cognitive outcomes, it is also important to know whether this also extends to non-cognitive outcomes. In Table 4 we examine whether students' bullying affects the likelihood of sense of belonging, home studying and socialising of students.¹⁵ Table 4 shows that bullied students have a clear lower sense of belonging to educational institutions compared to their counterparts (Panel A). This result holds even in model M2 and is rather homogenous across countries. The whole sample (column 1) negative estimate for the standardised index is of 0.23, and it ranges from 0.17 (Argentina) and 0.29 (Chile). Interestingly, we find that pupils are more likely to feel less engaged if bullied psychologically rather than physically. This could be disempowering and reduce commitment to engage in learning at school/classroom level. Moreover, we find that, in a few countries, being a victim of bullying results in a student being less likely to carry out study/academic tasks at home (Panel B model M2's estimates: -0.06 and -0.12) and are less to socialise outside school if bullied (Panel C).

4.2. Impact of bullying on cognitive and non-cognitive outcomes: matching estimates

A key concern when estimating the association of bullying with outcomes is selection bias. Through matching we achieve a balance in the distributions of covariates between the bullied and non-bullied students' groups, minimising the impact of observables on the bullying-outcomes relationship. As shown by Fig. 1, a comparison of the standardised mean differences before and after matching shows that matching on the propensity score substan-

¹³ The upper bound chosen for R_{\max} is 30% higher than the R-squared for the model with students controls: $R_{\max} = \Pi\hat{R}$ and $\Pi = 1.3$.

¹⁴ In addition, in Appendix C in Supplementary material, we look at gender effects by repetition of bullying events for the whole region and find dissimilar patterns by boys/girls samples.

¹⁵ According to Gutman and Schoon (2013) non-cognitive skills are those attitudes, behaviours, and strategies which facilitate success in schools and the workplace, such as motivation, perseverance, and self-control. Home study, one of the three variables included in the group of non-cognitive outcomes, clearly fits this definition while sense of belonging to school or engagement represents a disposition towards schooling and life-long learning (Willms, 2003) which indirectly affects motivation and in turn academic success.

Table 3
Impact of bullying on math and reading scores – OLS estimates.

	WS	ARG	BRA	CHL	COL	CRI	ECU	GTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel A – outcome: math																
<i>Null model (M0)</i>																
Bullied	-15.37***	-9.84**	-3.56	-18.76***	-1.75	-7.37*	-16.75***	0.57	-11.49**	-19.37***	-4.10	-0.90	-8.21	-18.85***	-1.89	-18.52*
Physically bullied	-16.31***	-8.56	-16.66***	-13.22***	-1.36	-9.94*	-17.46***	-1.50	-12.99***	-20.16***	0.02	-6.62	-20.21***	-21.82***	1.90	-14.01
Psychologically bullied	-15.22**	-15.51***	-2.51	-21.33***	-1.25	-7.06	-16.03***	0.36	-11.65**	-19.03***	-2.56	-3.64	-8.29	-15.68***	-2.04	-24.01**
N	50,812	2803	2445	4729	3898	3287	4247	3316	3104	3273	2655	2523	2490	4403	2521	2462
<i>Full model (M1)</i>																
Bullied	-8.02***	-11.00*	-4.66	-8.20*	7.31**	-9.67**	-14.58***	-1.58	-3.48	-12.04**	-6.40*	0.77	-12.77**	-5.52	-3.68	0.44
Physically bullied	-6.57***	-5.41	-10.43	-5.14	4.69	-14.54***	-17.08***	-2.01	-3.28	-12.53*	-0.59	-6.31	-22.48***	-8.92*	5.89	13.88
Psychologically bullied	-8.12***	-12.79**	-3.94	-9.15*	9.11**	-8.08*	-14.65***	-3.08	-4.39	-10.48**	-7.03*	0.74	-8.51	-5.94	-5.01	-2.24
N	28,516	1202	1155	2798	2761	2303	2182	2279	1877	2479	1609	1423	1617	3154	1397	1655
<i>School fixed effects (M2)</i>																
Bullied	-4.15***	-7.08	1.03	-8.24**	0.80	-7.56*	-6.83**	-0.93	-7.54*	-9.40**	-2.87	9.29**	-12.83**	-6.15	-5.03	2.81
Physically bullied	-3.95**	-9.51	-8.41	1.21	-3.09	-12.17**	-8.70*	-1.33	-7.47	-9.51	-1.49	3.51	-16.11***	-6.12	5.54	15.11
Psychologically bullied	-4.29***	-11.11**	1.24	-8.91**	3.17	-6.03	-5.85*	-2.56	-7.11	-8.07*	-2.40	8.88*	-10.48*	-7.40*	-6.38	-1.81
N	34,406	1816	1444	3437	3167	2565	3467	2544	2211	2586	1932	1846	1810	3483	1639	1798
Panel B – outcome: reading																
<i>Null model (M0)</i>																
Bullied	-18.32***	-13.29***	-7.60	-21.74***	-6.10	-13.22***	-16.64***	-5.50	-8.42**	-24.00***	-10.36*	-3.97	-4.00	-24.71***	-6.83	-14.99**
Physically bullied	-22.74***	-16.92***	-20.57***	-18.95***	-5.61	-13.80**	-16.54**	-7.66	-5.08	-29.86***	-9.84	-23.08**	-23.37***	-32.22***	-10.87**	-17.13**
Psychologically bullied	-16.96**	-18.15***	-6.62	-21.93***	-7.80*	-13.89***	-15.56**	-4.23	-9.99**	-25.21***	-7.02	-1.36	-4.08	-18.59***	-5.15	-18.07**
N	50,812	2803	2445	4729	3898	3287	4247	3316	3104	3273	2655	2523	2490	4403	2521	2462
<i>Full model (M1)</i>																
Bullied	-8.77***	-8.58*	2.99	-7.50*	-9.07*	-6.77*	-8.40***	-1.78	-2.69	-12.70***	-3.33	10.81**	-3.44	-6.81**	-4.88	1.03
Physically bullied	-10.75***	-11.54*	-8.57	1.17	-9.33*	-8.47	-10.82***	-3.51	0.25	-16.95***	-1.87	-2.23	-14.79***	-12.34**	-6.37	8.07
Psychologically bullied	-8.29**	-11.62**	3.81	-9.08*	-8.99	-6.85	-6.66**	-0.73	-3.91	-13.47***	-4.02	14.11**	-1.50	-3.68	-4.88	0.45
N	28,516	1816	1444	3437	3167	2565	3467	2544	2211	2586	1932	1846	1810	3483	1639	1798
<i>School fixed effects (M2)</i>																
Bullied	-4.73***	-10.14*	-1.22	-7.12	-4.43	-10.75**	-16.26***	-4.23	-1.35	-16.83***	-11.49**	1.41	-4.79	-11.89***	-5.42	2.05
Physically bullied	-7.39***	-11.48	-12.84*	1.37	-1.59	-14.27***	-15.15**	-4.58	2.57	-18.23***	-7.35	-10.14	-14.65**	-17.81***	-8.42	9.82
Psychologically bullied	-4.65***	-11.70*	0.98	-8.98*	-5.90	-9.98**	-15.83***	-4.51	-2.42	-17.83***	-10.72**	5.28	-2.44	-9.45**	-6.00	2.59
N	34,406	1202	1155	2798	2761	2303	2182	2279	1877	2479	1609	1423	1617	3154	1397	1655

Notes: (1) Column (1) contains results for the Whole Sample (WS), and columns (2) to (16) country's estimates. (2) Null model (M0) only includes bullying as covariate. (3) The full model (M1) includes students, family, school and head master and teacher covariates. Students controls are: age, gender, whether repeated or absent or work, attended pre-primary, live with parents, number of children and index of study conditions at home, index of computer's use at school, have writing book; and family controls are: socio-economic and cultural status, index of control and study supervision, index of reading motivation and recreation, mother and father education level, number of books at home. At the school level M1 includes school controls (dummies for public and urban schools, number of students, index of infrastructure, library number of books, number of computers with internet, socio-economic and cultural school average) and head master controls (years of experience, education level, specialisation or postgraduate studies, school location size) and teacher controls (number of working hours, years of experience, education level, teaching qualification, further courses in language/math/others, material for teaching classes and type of job contract). (4) Model 2 (M2) specification has students and family controls with school fixed effects.

* p < 0.10.
** p < 0.05.
*** p < 0.01. Robust standard errors clustered at the school level. Weighted estimates.

Table 4
Impact of bullying on non-cognitive outcomes- unconditional OLS and FE estimates.

	WS	ARG	BRA	CHL	COL	CRI	ECU	GTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel A – outcome: sense of belonging																
<i>Null model (M0)</i>																
Bullied	–0.28***	–0.27***	–0.34***	–0.35***	–0.33***	–0.33***	–0.32***	–0.29***	–0.25***	–0.37***	–0.24***	–0.24***	–0.27***	–0.25***	–0.33***	–0.21***
Physically bullied	–0.26***	–0.20***	–0.25***	–0.31***	–0.27***	–0.32***	–0.35***	–0.30***	–0.23***	–0.34***	–0.25***	–0.34***	–0.24***	–0.22***	–0.25***	–0.16***
Psychologically bullied	–0.28***	–0.24***	–0.32***	–0.38***	–0.36***	–0.34***	–0.30***	–0.27***	–0.27***	–0.37***	–0.26***	–0.23***	–0.25***	–0.26***	–0.34***	–0.21***
N	46,897	2499	2277	4580	3696	3106	4321	3842	2854	3161	2372	2314	2310	4145	2150	3270
<i>School fixed effects (M2)</i>																
Bullied	–0.23***	–0.17***	–0.25***	–0.29***	–0.26***	–0.19***	–0.21***	–0.22***	–0.21***	–0.27***	–0.23***	–0.17***	–0.22***	–0.20***	–0.22***	–0.19***
Physically bullied	–0.21***	–0.22***	–0.14***	–0.27***	–0.18***	–0.24***	–0.25***	–0.15***	–0.24***	–0.23***	–0.19***	–0.22***	–0.17***	–0.12***	–0.25***	–0.15***
Psychologically bullied	–0.23***	–0.13***	–0.25***	–0.31***	–0.29***	–0.19***	–0.21***	–0.24***	–0.21***	–0.27***	–0.26***	–0.18***	–0.21***	–0.23***	–0.20***	–0.19***
N	32,103	1489	1237	3214	2823	2306	3294	2456	1849	2377	1535	1568	1437	3058	1249	2211
Panel B – outcome: study at home – engagement																
<i>Null model (M0)</i>																
Bullied	–0.08***	–0.09**	–0.05	–0.04	–0.02	–0.09**	–0.11***	–0.11***	–0.07*	–0.12***	–0.08	–0.11**	–0.06	–0.14***	–0.11***	–0.08*
Physically bullied	–0.05***	0.04	0.05	–0.03	0.01	0.02	–0.09**	–0.11***	–0.05	–0.11*	0.05	–0.04	–0.11*	–0.15***	–0.03	–0.02
Psychologically bullied	–0.08***	–0.12***	–0.07*	–0.01	–0.03	–0.10**	–0.12***	–0.09**	–0.08*	–0.10**	–0.09*	–0.11*	–0.04	–0.12***	–0.12***	–0.10***
N	48,287	2632	2373	4622	3769	3195	4468	4017	2928	3163	2369	2348	2451	4258	2299	3395
<i>School fixed effects (M2)</i>																
Bullied	–0.00	–0.06	0.07	0.05	0.06	0.10*	0.03	–0.09**	0.02	–0.03	0.04	–0.08*	–0.03	–0.06*	–0.12**	0.02
Physically bullied	0.01	0.07	0.22***	0.00	0.06	0.08	0.04	–0.04	–0.02	–0.04	0.12	0.02	–0.01	–0.08*	–0.09	0.06
Psychologically bullied	0.01	–0.06	0.03	0.11**	0.06*	0.11**	0.03	–0.07	0.03	–0.00	0.03	–0.08	–0.06	–0.04	–0.14***	0.01
N	33,065	1559	1298	3243	2892	2360	3398	2558	1900	2385	1542	1591	1523	3154	1370	2292
Panel C – outcome: socialising																
<i>Null model (M0)</i>																
Bullied	–0.08***	–0.09**	–0.06	–0.08**	–0.13***	–0.07*	–0.16***	–0.06	–0.12***	–0.01	–0.02	–0.13**	–0.18***	–0.05	–0.11**	–0.12***
Physically bullied	–0.03**	0.06	0.04	–0.02	–0.11***	–0.01	–0.10**	0.08	–0.05	0.03	0.00	–0.16**	–0.11**	0.02	–0.05	–0.14***
Psychologically bullied	–0.09***	–0.09**	–0.08	–0.10***	–0.13***	–0.07*	–0.16***	–0.07	–0.16***	0.03	–0.05	–0.15**	–0.16***	–0.04	–0.14***	–0.11***
N	46,052	2508	2282	4642	3650	3167	4308	3659	2691	3117	2152	2210	2259	4218	1972	3217
<i>School fixed effects (M2)</i>																
Bullied	–0.07***	–0.07	–0.12**	–0.09**	–0.10**	–0.08*	–0.08**	–0.09**	–0.08*	0.01	–0.05	–0.07	–0.05	–0.03	–0.10*	–0.11**
Physically bullied	–0.03**	0.04	0.02	–0.06	–0.10**	–0.06	–0.07	0.05	–0.04	0.04	–0.08	–0.11	–0.04	0.05	–0.03	–0.13**
Psychologically bullied	–0.08***	–0.07	–0.15**	–0.09**	–0.10**	–0.09*	–0.08**	–0.10**	–0.12***	0.06	–0.07	–0.12*	–0.05	–0.04	–0.17***	–0.11**
N	31,758	1505	1264	3259	2806	2347	3302	2362	1762	2348	1404	1502	1416	3113	1184	2184

Notes: (1) See Table 3 for details on which covariates are included in each model. (2) Full model (M1) and other intermediate models' estimates are available from the authors upon request.

* p < 0.10.

** p < 0.05.

*** p < 0.01. Robust standard errors clustered at the school level. Weighted estimates.

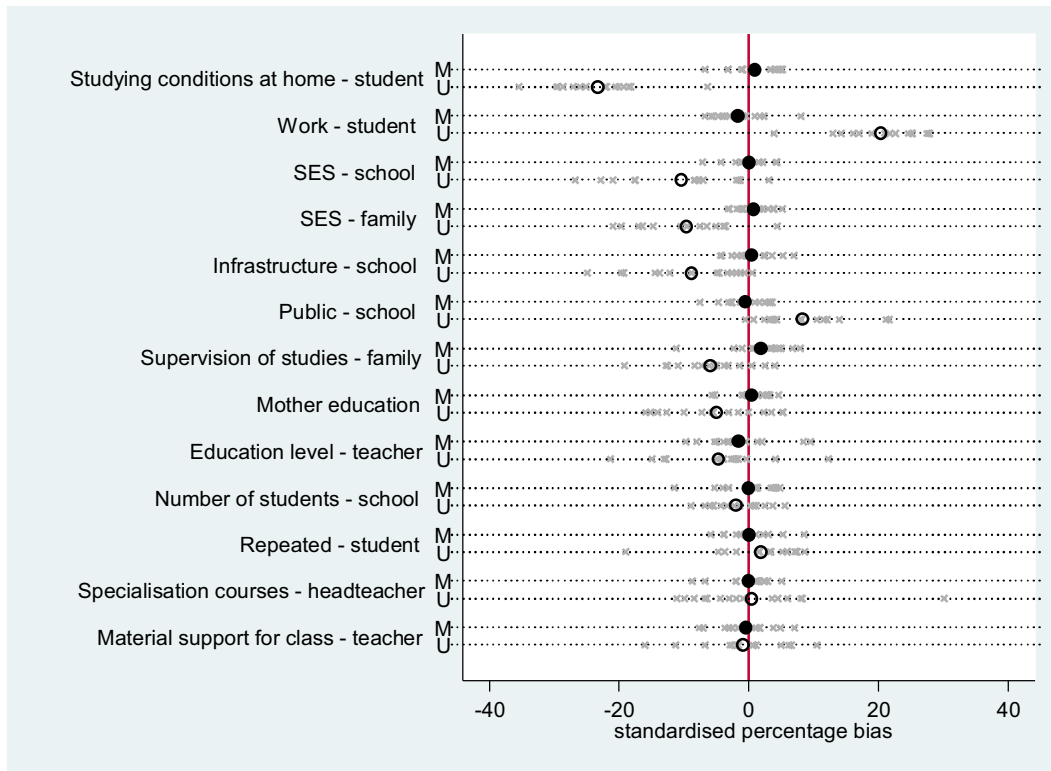


Fig. 1. Standardised bias for covariates (selected) among matched (M) and unmatched (U) groups. Notes: (1) Full and hollow circles denote the average matched and unmatched standardised bias for all 15 countries, respectively. (2) Gray crosses indicate specific countries' estimates. (3) Biases estimates are based on nearest neighbour.

tially reduce imbalances in the distributions of the explanatory variables for each country sample.¹⁶ For example, for the whole sample, socioeconomic status at the family and school levels (absolute) biases are of 9.6% and 10.4% before matching and only 0.8% and 0.1% among matched units. The bias for whether a student had repeated a grade or works are also reduced from 1.8% to 0.1% and from 20.7% to 1.7% in the matched sample. The bias of the covariate studying conditions at home is considerably lowered from 23.3% to 1.1%. Main drivers of achievement at the school level such as infrastructure, public/private school type and number of students in schools, are also balanced in the matched samples with reduction on their biases between 2% and 9.3%.¹⁷ Likewise, the common support assumption is satisfied across countries with propensity score values for the treated and untreated groups overlapping. Fig. 2 shows an improvement for all countries, with differences on conditional probabilities of the treatment disappearing after matching, as the propensity score distributions of bullied and non-bullied groups' overlap.

Table 5 contains the average treatment on the treated (ATT) results from the propensity score analysis based on three approaches (nearest neighbour, radius/caliper and kernel) controlling for the full range of covariates (model M1).¹⁸ On the one hand, ATT's estimates show that bullied pupils academic performance is consistently worse than non-bullied pupils. For the whole sample, effects are of

around –10 points (or a reduction of 11% in the standard deviations of learning scores). Nearest neighbour countries' estimates indicate that pupils being bullied attain between 9.5 and 18.4 less points in math and around 5.8 and 19.4 point less in reading (see columns 2 to 16). Only in a few cases do the three methods not coincide and in general there is a correspondence of nearest neighbour with radius and kernel matching results. Even if larger negative estimates are obtained for matching, qualitative conclusions are analogous as for OLS in terms of statistical significance. On the other hand, for non-cognitive outcomes, sense of belonging and home study estimates are similar across the three matching methods and of similar magnitude to OLS. Matching estimates validate earlier findings on the damaging effects of bullying –especially for a pupil's school attachment– while for the socialising outcome matching estimates leads to different conclusions than OLS only for three countries.

For completeness, we display in Tables 6 and 7 matching estimates for physical and psychological bullying. Either type of bullying yields negative effects on students' achievement, results for learning outcomes show above average effects of physical bullying for reading while psychological violence lead to similar effects for math and reading. Across countries, physically bullied students have math scores lower by 7.8–19.5 points than non-victims and 14.3–23.8 lower scores for reading, while 7.5–19.2 (math) and 8.7–18.8 (reading) points if they had been psychological bullied. As above, estimates agree for the three matching methods and are quite close to OLS results (especially those based on model M1).

With regards to non-cognitive outcomes, it is worthwhile to emphasize the wide-ranging influence of psychological bullying: for five countries (Brazil, Guatemala, Honduras, Nicaragua, Dominican Republic) students who had been psychologically bullied are more likely to exhibit a lower degree of socialisation than their counterparts, yet this does not hold for those physically bullied.

¹⁶ The standardised proportional bias is defined as the proportional difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (Rosenbaum and Rubin, 1985).

¹⁷ Mean *t*-tests for covariates before and after matching lead to similar conclusions. Also nearly all country mean absolute biases are below the 5% after matching. Results are available from authors upon request.

¹⁸ To save space, we don't report the probit estimations of the propensity score. Matching results impose the condition of common support for observations in the estimation process.

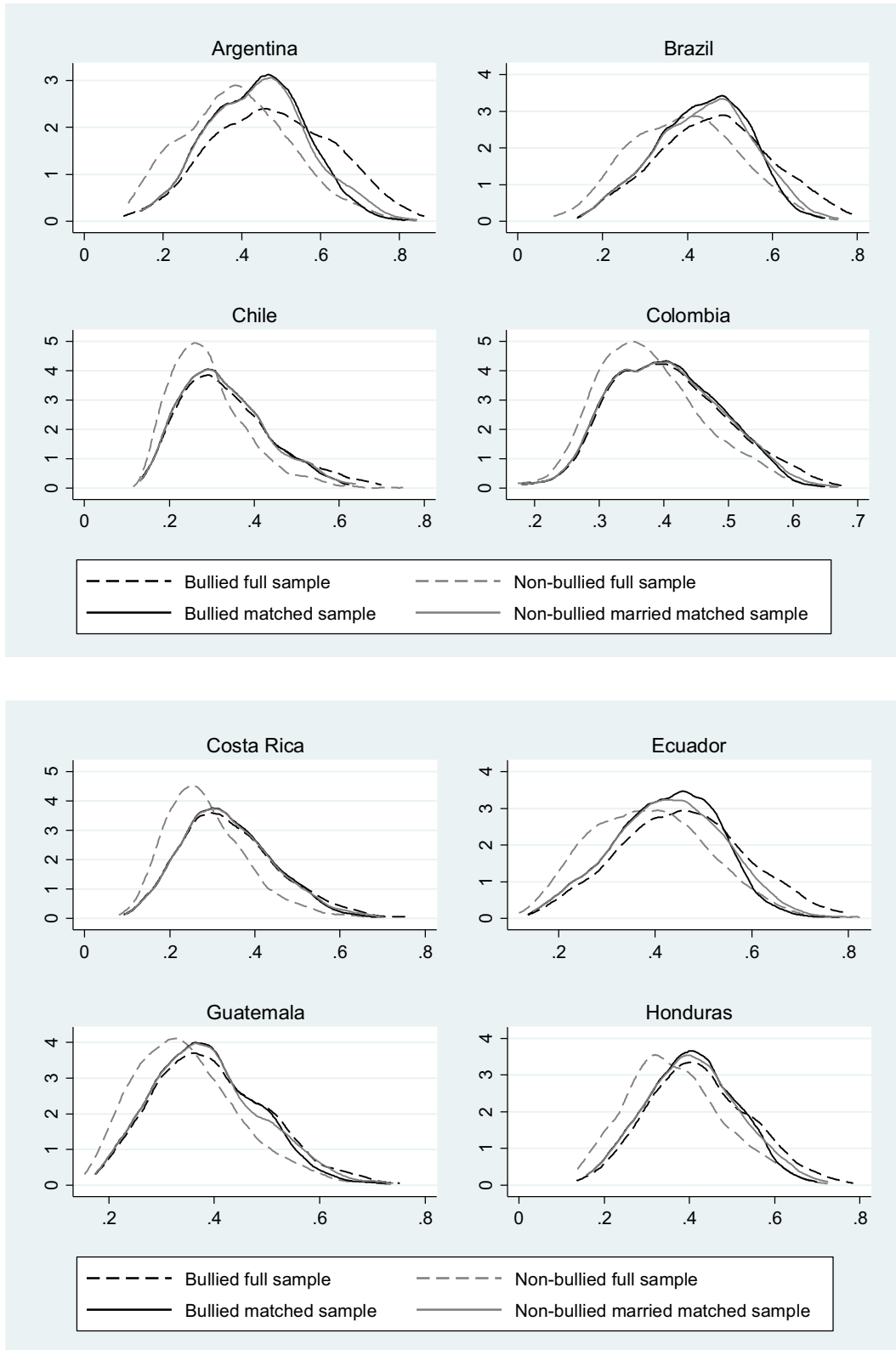


Fig. 2. Countries estimated propensity score before and after matching. Treatment: bullying. Note: Propensity score estimated by nearest neighbour (1–1 without replacement).

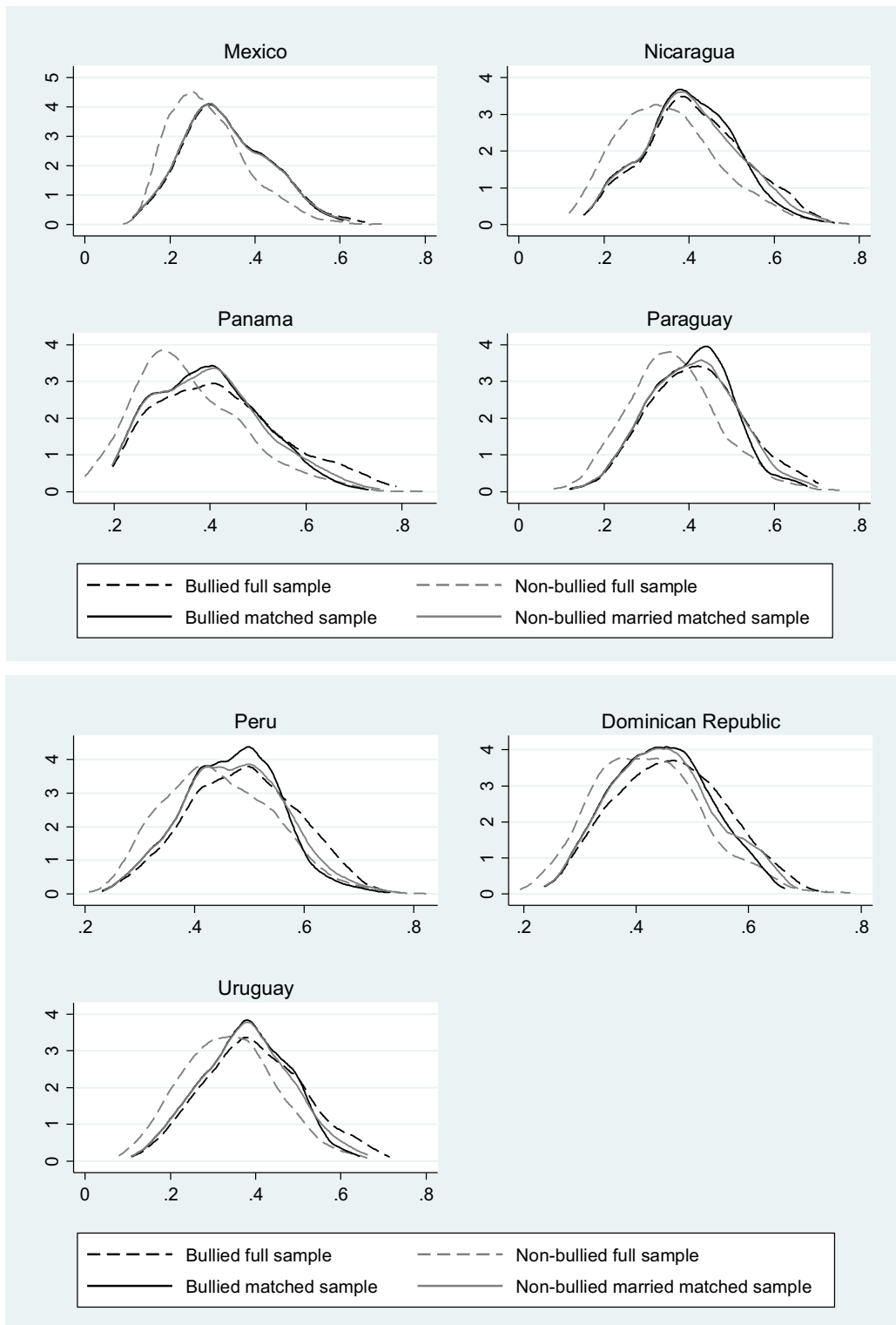


Fig. 2. (Continued)

4.3. Impact of bullying across the cognitive outcomes distributions: quantile treatment effects

Here we test the hypothesis of whether the relationship of learning and bullying varies at different points of test scores distributions. Table 8 contains estimates for the conditional QTES at the 25th, 50th and 75th quantiles. Results indicate that, for

nearly half of countries, effects are heterogeneous, in other words, they operate differently across quantiles at the tails of the math and reading scores distribution. This suggests distinct pathways from bullying to achievement for the group of low and high performing students.

First, our findings for math point out that if a country displays statistical evidence of heterogeneity on ATT (that is, if the p-value

Table 5
Impact of bullying on achievement and non-cognitive outcomes. Matching estimates –average treatment on the treated (ATT).

	WS	ARG	BRA	CHL	COL	CRI	ECU	GTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>Outcome: math</i>																
Nearest neighbour	-10.82 ***	-13.36 **	-4.60	-1.76	-0.89	-10.19 **	-12.18 ***	-2.38	-4.85	-18.44 ***	-13.33 ***	-2.48	-9.55 *	-4.827	-0.24	-13.01 **
Radius	-10.28 ***	-18.60 ***	-6.133	-9.261 **	-2.311	-6.362 *	-12.46 ***	-5.80 *	-6.94 *	-14.84 ***	-10.64 **	-5.138	-8.175 *	-6.84 *	-2.461	-9.436 **
Kernel (Epan)	-10.78 ***	-18.60 ***	-6.069	-9.80 **	-2.641	-6.579 *	-12.90 ***	-5.74 *	-7.328 *	-15.84 ***	-10.46 **	-5.216	-8.718 *	-7.346 **	-2.391	-9.932 **
<i>Outcome: reading</i>																
Nearest neighbour	-10.00 ***	-16.77 **	-1.416	-2.749	-5.843 *	-8.629 **	-18.56 ***	-7.91 **	-6.412	-15.30 ***	-19.41 ***	0.473	-1.546	-11.84 ***	1.05	-10.15 **
Radius	-9.79 ***	-19.76 ***	-1.10	-8.57 **	-7.164 **	-6.06 *	-16.07 ***	-9.674 **	-5.039	-14.25 ***	-16.58 ***	-4.652	-3.864	-10.56 ***	1.82	-8.346 *
Kernel (Epan)	-10.39 ***	-19.58 ***	-1.149	-8.878 **	-7.458 **	-6.23 *	-16.78 ***	-9.99 ***	-5.095	-15.25 ***	-16.35 ***	-5.426	-4.415	-10.96 ***	2.01	-8.516 *
<i>Outcome: sense of belonging</i>																
Nearest neighbour	-0.26 ***	-0.10	-0.345 ***	-0.363 ***	-0.27 ***	-0.251 ***	-0.383 ***	-0.246 ***	-0.263 ***	-0.292 ***	-0.132 **	-0.164 ***	-0.194 ***	-0.237 ***	-0.317 ***	-0.127 ***
Radius	-0.26 ***	-0.08	-0.325 ***	-0.357 ***	-0.28 ***	-0.241 ***	-0.392 ***	-0.219 ***	-0.256 ***	-0.285 ***	-0.179 ***	-0.21 ***	-0.22 ***	-0.25 ***	-0.30 ***	-0.155 ***
Kernel (Epan)	-0.27 ***	-0.09 *	-0.326 ***	-0.36 ***	-0.285 ***	-0.24 ***	-0.389 ***	-0.225 ***	-0.259 ***	-0.288 ***	-0.175 ***	-0.212 ***	-0.223 ***	-0.255 ***	-0.30 ***	-0.153 ***
<i>Outcome: study at home – engagement</i>																
Nearest neighbour	-0.04 ***	-0.13 *	0.01	0.04	0.09 **	-0.01	-0.03	-0.08 *	0.03	-0.15 ***	0.02	-0.08	0.00	-0.114 ***	-0.17 ***	-0.01
Radius	-0.04 ***	-0.11 *	0.01	0.05	0.08 **	-0.017	-0.029	-0.064 *	0.03	-0.10 **	0.00	-0.072	0.03	-0.11 ***	-0.20 ***	-0.041
Kernel (Epan)	-0.05 ***	-0.12 *	0.01	0.04	0.07 **	-0.02	-0.022	-0.063 *	0.03	-0.10 **	0.01	-0.079	0.03	-0.114 ***	-0.196 ***	-0.042
<i>Outcome: socialising</i>																
Nearest neighbour	-0.04 ***	-0.01	-0.016	-0.056	-0.125 ***	-0.048	-0.023	-0.092 **	-0.05	0.02	-0.073	-0.073	-0.037	0.02	-0.165 **	-0.075 *
Radius	-0.04 ***	-0.04	-0.058	-0.075 **	-0.10 ***	-0.027	-0.043	-0.063 *	-0.093 *	0.03	-0.079	-0.122 **	-0.04	0.01	-0.092	-0.093 **
Kernel (Epan)	-0.05 ***	-0.03	-0.062	-0.074 **	-0.10 ***	-0.027	-0.039	-0.062 *	-0.092 *	0.03	-0.079	-0.11 *	-0.042	0.01	-0.10 *	-0.089 **
Number of treated	8781	298	349	738	851	574	603	667	487	644	354	380	396	1038	332	614
Number of controls	15,037	491	515	1776	1351	1372	973	1258	814	1488	597	647	679	1407	504	1125

Notes: (1) Propensity score specification contains student, family, school and head master and teacher controls (Model 2 –M2). See Table 3 for model details. (2) Nearest neighbour (1–1 without replacement) and radius matching use a caliper of $0.25 \times SD$ of the estimated propensity score and Kernel (Epanechnikov) uses a bandwidth of 0.06. (3) Number of treated and controls refer to nearest neighbour observations in common support. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6
Impact of physical bullying on achievement and non-cognitive outcomes. Matching estimates –average treatment on the treated (ATT).

	WS	ARG	BRA	CHL	COL	CRI	ECU	CTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>Outcome: math</i>																
Nearest neighbour	-7.73	*** -13.48 *	-1.25	-6.05	0.52	3.26	-12.47 **	-7.84 *	-6.70	-9.13	-4.87	0.07	-19.55 **	-9.20 *	5.73	10.25
Radius	-7.85	*** -14.10 **	-11.43 *	-8.30 *	0.02	-7.787	-10.94 **	-9.62 **	-5.153	-15.30 **	-5.04	-0.181	-12.90 **	-8.34 **	1.09	3.25
Kernel (Epan)	-9.41	*** -13.93 **	-11.88 *	-9.56 *	-0.623	-7.881	-11.33 **	-10.27 **	-5.862	-15.51 ***	-5.40	-0.506	-11.63 *	-9.20 **	1.45	1.47
<i>Outcome: reading</i>																
Nearest neighbour	-10.61	*** -23.76 ***	-6.507	1.06	-2.457	-3.40	-17.98 ***	-15.73 ***	-1.654	-14.32 **	-10.65	-6.11	-10.50	-16.07 ***	-9.39	2.84
Radius	-10.18	*** -15.08 **	-9.11	1.30	-3.462	-6.349	-15.26 ***	-13.83 ***	-1.347	-14.50 ***	-10.72 *	-9.257	-12.16 **	-17.18 ***	-4.387	-1.378
Kernel (Epan)	-11.93	*** -15.44 **	-8.439	0.03	-4.60	-7.40	-15.90 ***	-14.27 ***	-1.849	-15.14 ***	-11.18 *	-10.23	-12.26 *	-18.12 ***	-5.69	-2.121
<i>Outcome: sense of belonging</i>																
Nearest neighbour	-0.24	*** -0.15 *	-0.114	-0.18 **	-0.266 ***	-0.208 **	-0.382 ***	-0.191 ***	-0.264 ***	-0.249 ***	-0.129 *	-0.382 ***	-0.386 ***	-0.174 ***	-0.284 ***	-0.091
Radius	-0.24	*** -0.02	-0.162 **	-0.291 ***	-0.247 ***	-0.275 ***	-0.369 ***	-0.20 ***	-0.258 ***	-0.21 ***	-0.18 **	-0.338 ***	-0.224 ***	-0.187 ***	-0.26 ***	-0.16 ***
Kernel (Epan)	-0.25	*** -0.02	-0.169 **	-0.30 ***	-0.248 ***	-0.282 ***	-0.366 ***	-0.217 ***	-0.26 ***	-0.218 ***	-0.185 **	-0.332 ***	-0.227 ***	-0.20 ***	-0.25 ***	-0.154 ***
<i>Outcome: study at home – engagement</i>																
Nearest neighbour	-0.03	0.04	0.36 **	0.01	0.06	0.06	0.05	-0.01	0.01	-0.15 **	0.08	-0.04	-0.06	-0.112 **	-0.18 **	0.03
Radius	-0.03	* 0.10	0.25 ***	0.01	0.07 *	0.00	0.00	-0.009	-0.034	-0.05	0.12 *	-0.078	-0.02	-0.13 ***	-0.18 **	0.02
Kernel (Epan)	-0.03	** 0.10	0.25 ***	0.01	0.07	0.01	0.00	-0.007	-0.05	-0.06	0.13 *	-0.072	-0.03	-0.135 ***	-0.176 **	0.01
<i>Outcome: socialising</i>																
Nearest neighbour	-0.02	0.09	0.12	0.00	-0.112 **	0.00	-0.063	0.05	0.03	-0.021	-0.123	-0.235 **	-0.091	0.07 *	0.07	-0.151 **
Radius	-0.01	0.20 **	0.13 *	-0.017	-0.12 ***	-0.019	-0.056	0.06	0.00	0.04	-0.106	-0.216 ***	-0.127 *	0.09 **	0.09	-0.133 **
Kernel (Epan)	-0.02	0.21 **	0.11 *	-0.027	-0.12 ***	-0.018	-0.059	0.07	0.00	0.03	-0.10	-0.227 ***	-0.127 *	0.08 **	0.08	-0.123 **
Number of treated	4255	148	169	368	430	212	333	350	250	335	166	167	177	641	194	267
Number of controls	19,820	709	733	2713	1847	1750	1329	1599	1088	1800	818	891	932	1958	675	1518

Notes: (1) See notes in Table 5.
*p < 0.10, **p < 0.05, ***p < 0.01.

Table 7
Impact of psychological bullying on achievement and non-cognitive outcomes. Matching estimates –average treatment on the treated (ATT).

	WS	ARG	BRA	CHL	COL	CRI	ECU	GTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>Outcome: math</i>																
Nearest neighbourhood	-9.10 ***	-19.20 ***	0.89	-11.95 **	-0.72	-7.49 *	-11.11 **	-3.08	-5.68	-9.54 *	-4.27	-9.96 *	-1.84	-6.26	-2.98	-4.49
Radius	-9.72 ***	-16.51 ***	-1.471	-9.585 **	-1.14	-5.857	-13.13 ***	-4.71	-7.309 *	-14.40 ***	-6.74 **	-5.187	-6.079	-7.68 **	-7.383 *	-11.34 **
Kernel (Epan)	-10.37 ***	-16.00 ***	-1.774	-9.92 **	-2.036	-5.883	-13.63 ***	-4.872	-7.443 *	-14.51 ***	-6.28 *	-5.066	-6.438	-7.921 **	-7.059 *	-11.70 **
<i>Outcome: reading</i>																
Nearest neighbourhood	-7.57 ***	-18.80 ***	2.09	-17.41 ***	-9.20 **	-9.274 **	-14.10 ***	-5.205	-5.70	-12.64 **	-8.67 *	-1.33	-0.645	-10.50 **	4.39	-2.54
Radius	-8.75 ***	-17.64 ***	0.84	-10.46 **	-7.80 **	-7.292 *	-13.86 ***	-7.489 **	-6.439	-17.22 ***	-13.05 **	3.01	-1.132	-9.02 **	0.89	-7.526 *
Kernel (Epan)	-9.56 ***	-17.36 ***	0.77	-11.29 ***	-8.567 **	-7.845 **	-14.67 ***	-8.075 **	-6.455	-16.89 ***	-12.94 **	2.76	-1.638	-9.25 **	1.32	-7.643 *
<i>Outcome: sense of belonging</i>																
Nearest neighbourhood	-0.27 ***	-0.08	-0.286 ***	-0.357 ***	-0.29 ***	-0.241 ***	-0.316 ***	-0.226 ***	-0.308 ***	-0.321 ***	-0.258 ***	-0.172 **	-0.209 **	-0.278 ***	-0.28 ***	-0.10 **
Radius	-0.26 ***	-0.09	-0.30 ***	-0.40 ***	-0.325 ***	-0.238 ***	-0.355 ***	-0.20 ***	-0.30 ***	-0.27 ***	-0.20 ***	-0.184 ***	-0.177 ***	-0.273 ***	-0.28 ***	-0.105 **
Kernel (Epan)	-0.27 ***	-0.09	-0.30 ***	-0.40 ***	-0.322 ***	-0.239 ***	-0.356 ***	-0.20 ***	-0.294 ***	-0.279 ***	-0.20 ***	-0.185 ***	-0.168 ***	-0.272 ***	-0.29 ***	-0.106 **
<i>Outcome: study at home – engagement</i>																
Nearest neighbourhood	-0.03 **	-0.07	-0.02	0.10 **	0.04	-0.03	-0.02	-0.05	0.06	-0.10 *	-0.01	-0.10	0.01	-0.06 *	-0.17 **	-0.06
Radius	-0.03 **	-0.09	-0.06	0.13 ***	0.04	-0.012	0.00	-0.058	0.03	-0.06	-0.01	-0.044	0.07	-0.08 **	-0.16 ***	-0.04
Kernel (Epan)	-0.03 ***	-0.10 *	-0.057	0.11 ***	0.04	-0.018	0.00	-0.056	0.03	-0.07 *	-0.01	-0.049	0.06	-0.084 **	-0.168 ***	-0.044
<i>Outcome: socialising</i>																
Nearest neighbourhood	-0.06 ***	-0.02	-0.126 *	-0.054	-0.135 ***	-0.034	-0.038	-0.117 **	-0.163 ***	0.05	-0.145 **	-0.125 **	-0.013	0.01	-0.258 ***	-0.10 **
Radius	-0.06 ***	-0.03	-0.10 *	-0.106 **	-0.12 ***	-0.036	-0.036	-0.053	-0.14 ***	0.06 *	-0.124 **	-0.142 **	-0.028	0.00	-0.165 **	-0.091 **
Kernel (Epan)	-0.06 ***	-0.03	-0.10 *	-0.106 ***	-0.12 ***	-0.033	-0.037	-0.055	-0.142 ***	0.07 *	-0.123 **	-0.143 **	-0.022	-0.01	-0.16 **	-0.088 **
Number of treated	7665	287	317	628	719	527	530	581	432	500	330	339	344	946	286	563
Number of controls	16,401	516	566	1892	1550	1426	1084	1367	896	1633	638	704	746	1619	570	1194

Notes: (1) See notes in Table 5.

*p < 0.10, **p < 0.05, ***p < 0.01.

Table 8
Impact of bullying on achievement. Quantile treatment effect (QTE) estimates and tests. Country estimates.

	ARG	BRA	CHL	COL	CRI	ECU	GTM	HON	MEX	NIC	PAN	PAR	PER	REP	URU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
<i>Panel A – outcome: math</i>															
Contrast estimates															
Mean	-7.66**	0.66	-13.22***	-1.84	-5.66*	-11.34***	-9.41***	-7.28**	-11.05***	-2.62	0.79	-10.04***	-11.11***	-4.02	-9.48**
Q25	0.00	-1.84	-12.58***	-2.24	-8.66	-13.23***	0.00	-2.99	-16.33***	0.00	-4.65	-9.75*	-4.72*	-4.72	-6.15
Q75	-7.93	1.40	-26.95***	0.00	-1.32	-13.32***	-10.38***	-12.51***	-11.65***	-2.33	12.97**	-10.38**	-15.23***	0.00	-14.41**
Test (mean = Q25 = Q75)															
Chi2(3)	5.40	0.28	16.62	0.83	3.97	22.04	16.85	6.70	8.42	1.09	7.04	6.29	14.67	2.29	5.75
p-val	0.145	0.964	0.001	0.842	0.264	0.000	0.001	0.082	0.038	0.780	0.071	0.098	0.002	0.514	0.124
<i>Panel B – outcome: reading</i>															
Contrast estimates															
Mean	-8.65**	2.22	-14.29***	-6.41**	-7.39**	-8.93***	-13.78***	-3.51	-12.86***	-10.65***	-2.99	-4.34	-13.99***	-3.60	-5.10*
Q25	-15.97***	2.99	-14.23***	-2.22	-2.88	-3.11	-13.83***	-10.73**	-17.95***	-13.78***	-7.25	-2.01	-13.89***	-1.09	-1.24
Q75	-13.49**	-1.89	-22.67***	-7.96*	-9.94*	-13.94***	-4.40	0.00	-15.55***	-2.23	-4.71	-7.39*	-14.81***	-4.40	-1.97
Test (mean = Q25 = Q75)															
Chi2(3)	9.93	0.99	24.86	5.48	4.96	20.17	28.80	3.10	18.59	10.31	1.80	1.78	31.49	1.14	3.13
p-val	0.019	0.804	0.000	0.140	0.174	0.000	0.000	0.376	0.000	0.016	0.615	0.620	0.000	0.768	0.372

Notes: (1) The treatment (bullying) equation contains student, family, school and neighbourhood (services, social support and violence) covariates and the outcome (learning scores) equation includes the same controls except neighbourhood controls. (2) Statistical significance based on standard errors obtained with the delta method and 2000 bootstrap repetitions.

- ** p < 0.10.
- *** p < 0.05.
- **** p < 0.01.

for the null hypothesis of equality of QTEs: QTE(0.25)=QTE(0.50)=QTE(0.75) is below 5%), then the negative effect of bullying is stronger for top performing bullied students than for top performing non-bullied students. Three countries falls into this pattern: Chile, Guatemala and Peru and also Honduras (with p-value of 0.082). In Peru, for instance, the ATT at quantile 75th is 15.23 while for those in quantile 25th only of 4.72. Second, estimates for reading hint that bullying is more prevalent across low performers if ATT differ over quantiles (e.g., Argentina, Honduras, Mexico and Nicaragua). Altogether, QTEs estimates point towards the need of focalised programs for different (and subject-specific) performing sub-populations.

4.4. Explaining the learning gap due to bullying: OLS analysis on matched subsamples

It is important to know whether specific neighbourhood and school settings are additional channels –beyond the full set of controls accounted for in matching– which may explain away (or narrow) the adjusted bullying gap. In order to evaluate this, we estimate Eq. (4) for matched subsamples –with balanced covariates obtained through nearest neighbour– including a range of contextual policy covariates. A comparison of bullying estimates of Table 5 (model M1) with those from Tables 9 and 10 gives an idea on what additional barriers matter for lowering the bullying learning gap.

Table 9 shows the first set of OLS results. Here we include a categorical variable indicating whether a family is a recipient of cash transfer (conditional on children’s health checks and school attendance) and an index of neighbourhood violence.¹⁹ Conditional

cash transfers have strong negative effects on learning scores (ranging between 23.8 and 85.1) highlighting marginalization processes that affect students’ performance and, for that reason, bullying associations with learning scores turn out to be no significant for a nearly half of countries.²⁰ Hence, by targeting those families policies can weaken the link of bullying with learning achievements. Contextual violence in the community –though not directly related to scores– also explains the bullying gaps in a similar number of countries. Note that these findings are not driven by socioeconomic differences on the distribution of families and schools as we match on these and other contextual variables.

We now turn to the role of school settings and teacher factors in Table 10. It is important to stress that estimates already account for various differences (e.g., school type and location, number of students, infrastructure, principals’ and teachers’ experience and qualifications) between treated and untreated groups. Panel A (Table 10) show school factors’ results. First, we find that a school’s work environment has moderate effects on reducing the bullying gap (e.g., in three countries for math: Argentina, Guatemala, Honduras and Peru) whilst teaching skills programs, though leading to larger achievement, do not seem to be tied to bullied populations as such (e.g., estimates for bullying become non-significant for a couple of countries). Second, estimates suggest that addressing the role of the school settings on bullying/victimization phenomena through schools’ drugs, violence and cultural programs is a powerful tool. Fostering social capital throughout school activities leads to an increase of 16.4–40.9 points in math achievement for nearly all countries and

¹⁹ The index of neighbourhood contains parents’ perception of occurrence of situations of aggression or illegal behaviour in the neighbourhood or community in which it is inserted, expressed in the existence of consumption and sale of drugs, crime or aggression between neighbours (see OREALC/UNESCO, 2015d).

²⁰ In particular, bullying effects become non-statistically significant for six countries for math (Argentina, Chile, Guatemala, Honduras, Paraguay and Peru) and for four countries for reading (Chile, Costa Rica, Guatemala and Uruguay) when compared to Table 5’s estimates.

Table 9
Explaining the bullying learning gap. Family and neighbourhood factors. Matched sub-samples OLS country estimates.

	ARG (1)	BRA (2)	CHL (3)	COL (4)	CRI (5)	ECU (6)	CTM (7)	HON (8)	MEX (9)	NIC (10)	PAN (11)	PAR (12)	PER (13)	REP (14)	URU (15)
<i>Family – conditional cash transfer</i>															
Math															
bullied	-11.48	-5.42	-1.82	-2.97	-10.92*	-11.75**	-1.17	-4.50	-19.85***	-11.58**	-3.56	-6.43	-5.93	1.21	-13.46**
conditional cash transfer	-15.29*	-33.70***	-25.78**	-50.06***	-43.86***	-35.73***	-30.95***	-42.23***	-59.82***	-36.73***	-36.66***	-45.52***	-77.82***	-12.83**	-38.79***
Reading															
bullied	-16.87**	-3.40	-2.40	-7.75*	-8.52	-18.36***	-7.15	-4.74	-16.46***	-19.13***	-1.33	1.66	-12.53**	4.05	-8.67
conditional cash transfer	-23.81**	-52.15***	-19.94*	-54.54***	-45.25***	-42.72***	-45.75***	-63.83***	-72.13***	-37.39***	-36.88***	-56.32***	-85.12***	-25.57**	-37.96***
N	577	676	1444	1666	1107	1152	1275	933	1269	667	729	769	1997	633	1193
<i>Neighbourhood – violence</i>															
Math															
bullied	-13.48*	-3.76	-1.45	-0.79	-9.41	-12.16**	-2.40	-4.51	-18.42***	-13.06**	-1.69	-10.14	-5.64	-0.24	-12.96**
neighbourhood violence index	2.28	-4.05	-5.18	-1.15	-7.27**	-3.54	0.31	-2.78	-0.54	-1.68	-7.20**	6.26*	7.27**	0.48	-1.83
Reading															
bullied	-17.03**	-2.00	-2.63	-5.85	-8.22	-18.55***	-8.08	-5.61	-15.40**	-19.36***	0.60	-2.03	-13.16**	1.07	-10.33*
neighbourhood violence index	4.88	2.81	-1.97	0.12	-3.78	-2.72	1.93	-6.46*	4.09	-0.32	-1.19	5.13	11.89***	2.31	5.81*
N	596	698	1476	1702	1148	1206	1334	974	1288	708	760	792	2076	664	1228

Notes: (1) Matched sub-samples are obtained from nearest neighbour without replacement. (2) Each covariate is introduced into the model one at a time with the bullying (any type) covariate.

significantly reduces the bullying learning gap for a few countries.²¹

Estimates for school management and teacher specific factors are shown in Panel B (Table 10). We find that teacher's performance appraisal measures (with economic and dismissal consequences) yield counterproductive effects for learning (above 20 fewer points) and their contribution to minimising bullying effects is non-existent. Teacher levels of satisfaction with remuneration is both positively associated with learning and also yields null bullying learning gaps, except in a few (three) countries. Likewise, principals concerns on students beyond achievement are not translated into weaker violence-learning associations overall. However, we find that having a female teacher in the classroom considerably increases achievement and crucially diminishes the negative effect of bullying.

4.5. Robustness analysis: selection on observables and unobservables

We exploited the richness of TERCE information and used comprehensive controls to mitigate the effect of unobservables in OLS and matching. Still, some selection bias can be at play. The earlier estimated negative relationships of bullying with outcomes hinges on the assumption that bullied and non-bullied groups have the same distribution of unobservables and so a natural question is if our results are robust to the presence of unobservables. In this section we attempt to answer this question.

We re-estimate the range of parameters (for cognitive outcomes) and provide estimates' bounds to investigate this possibility (see Table 11). For math we find that, with exception of two countries (Guatemala and Peru), the estimated bounds (columns 5 and 7) for the bullied treatment effects include negative ranges and not zero, which in turn implies that our results are robust and that bullied students performs consistently less than their non-bullied counterparts. This is true under either the assumption of $\delta = 1$ or equal selection (column 5) or under the second assumption where the value of δ for which the estimator would produce a treatment effect of zero is rather large (i.e., δ is well above 1). For reading we obtain similar results –only estimates for two countries include zero (column 5), though, under the second assumption (column 7), three additional countries estimates are not as robust. All in all, the full range of covariates employed in the earlier OLS/matching analysis seems to minimise the role of unobservables.

5. Conclusions and policy implications

In this paper we used the TERCE study, which is a cross-country comparable learning survey of Latin America of 2013, to investigate the association of bullying with cognitive and non-cognitive outcomes for 15 Latin American countries for students attending sixth grade. As cognitive outcomes we employed math and read test scores and non-cognitive group indices on sense of belonging to school, home study and socialising. We employed an overall measure of bullying and also two types of bullying –i.e., physical and psychological. As far as we are aware, there has been no previous research for the region that use matching estimators in evaluating the relationship of bullying at school with student achievement and non-cognitive outcomes. We also examined if our estimates were robust to the presence of unobservables.

As our aim was not only to produce new but also robust evidence, we employed both parametric (OLS) and non-parametric

²¹ Countries where the bullied variable is not significant and at the same time the (positive) impact of a program is statistically significant at 10% are: Guatemala, Honduras, Paraguay and Peru (math) and Chile, Colombia and Costa Rica (reading).

Table 10

Explaining the bullying learning gap. School and teacher factors. Matched sub-samples OLS country estimates.

	ARG (1)	BRA (2)	CHL (3)	COL (4)	CRI (5)	ECU (6)	GTM (7)	HON (8)	MEX (9)	NIC (10)	PAN (11)	PAR (12)	PER (13)	REP (14)	URU (15)
<i>Panel A - school factors</i>															
i. Work environment															
Math															
bullied	-12.29	-4.91	-1.91	-0.70	-10.63 [†]	-11.86 ^{**}	-2.39	-4.81	-17.52 ^{***}	-13.24 ^{***}	-2.54	-10.91 [†]	-4.20	-0.27	-12.99 ^{**}
Work environment	11.15 [†]	5.23	5.49	10.15 ^{**}	5.19	2.46	10.18 ^{***}	8.46	8.84	-1.73	13.42 ^{**}	7.65	19.98 ^{***}	0.60	-0.30
Reading															
bullied	-15.42 ^{**}	-1.77	-2.93	-5.63	-9.26	-18.17 ^{***}	-7.92	-6.38	-14.58 ^{**}	-19.16 ^{***}	0.41	-2.82	-11.13 ^{**}	0.86	-10.70 [†]
Work environment	14.09 ^{***}	5.95	6.95	11.19 [†]	7.36	3.01	8.07 [†]	6.41	6.87	-4.95	13.77 ^{**}	7.19	22.82 ^{***}	5.30	8.04 ^{**}
N	596	698	1476	1702	1148	1206	1334	974	1288	708	760	792	2076	664	1228
ii. Program on teaching skills															
Math															
bullied	-9.16	-3.06	-0.17	-0.25	-11.40 [†]	-13.99 ^{***}	-6.13	-6.01	-17.83 ^{***}	-16.64 ^{***}	-3.42	-10.75	-2.50	1.50	-12.83 [†]
prog teaching skills	-16.10	9.66	16.39	20.09 ^{**}	10.34	19.41 [†]	10.52	18.13 [†]	38.49 ^{***}	30.24 ^{***}	1.99	38.31 ^{**}	10.72	3.65	11.84
Reading															
bullied	-12.87	-1.13	-0.95	-6.87	-8.69	-17.15 ^{***}	-13.66 ^{**}	-6.86	-14.74 ^{**}	-17.12 ^{**}	-0.26	-0.86	-10.73 [†]	0.41	-11.05 [†]
prog teaching skills	-13.02	-4.37	8.14	18.30 [†]	16.80 [†]	16.99	15.80	20.70 [†]	38.72 ^{***}	19.57 [†]	1.73	29.74 [†]	15.97	17.38 [†]	11.63
N	521	668	1360	1593	1113	1063	1047	886	1234	580	694	751	1927	630	1123
iii. School programs															
Math															
bullied	-14.88 [†]	-3.04	-1.37	-1.04	-10.32 [†]	-13.36 ^{***}	-5.45	-4.85	-20.59 ^{***}	-12.77 ^{**}	-3.88	-7.51	-5.12	-0.78	-14.15 ^{**}
prog drugs	29.37 [†]	20.01	-0.39	25.25 ^{**}	-31.61	0.73	8.29	-11.89	16.35	-10.80	26.99 ^{**}	22.98 [†]	10.84	-2.31	31.70 ^{***}
prog violence	-11.06	8.04	-9.72	-12.92	-7.99	15.47 [†]	23.75 ^{**}	13.95	-6.13	-3.23	-12.17	8.65	40.32 ^{***}	1.75	-5.75
prog cultural	25.59 ^{**}	23.33 [†]	40.92 ^{***}	23.60 ^{**}	34.96 ^{***}	26.24 ^{***}	13.22	36.12 ^{***}	40.01 ^{***}	33.57 ^{***}	23.92 ^{**}	8.39	26.95 ^{***}	16.37 ^{**}	13.29
Reading															
bullied	-18.09 ^{**}	-0.81	-2.52	-5.88	-9.23	-20.35 ^{***}	-11.70 ^{**}	-6.40	-17.54 ^{***}	-19.06 ^{***}	-1.48	0.54	-12.19 ^{**}	0.09	-10.73 [†]
prog drugs	20.30	20.90 [†]	8.63	26.29 ^{**}	-14.58	6.89	5.39	-15.12	16.25	-13.95	19.13	20.69	12.74	11.96	19.49
prog violence	-8.05	-3.52	-0.07	-11.06	-10.87	22.44 ^{**}	30.38 ^{**}	20.56	-6.09	2.92	-3.93	3.34	46.54 ^{***}	-7.73	-10.81
prog cultural	36.16 ^{***}	14.62	22.39 ^{**}	19.98	35.91 ^{***}	34.54 ^{***}	19.68 ^{**}	44.38 ^{***}	41.24 ^{***}	25.83 ^{**}	31.37 ^{***}	29.79 ^{**}	30.15 ^{***}	18.85 [†]	17.34
N	596	698	1476	1702	1148	1206	1334	974	1288	708	760	792	2076	664	1228
<i>Panel B - teacher factors</i>															
i. Appraisal															
Math															
bullied	-13.12 [†]	-4.71	-0.96	-1.04	-11.42 [†]	-11.75 ^{**}	-3.42	-6.30	-17.57 ^{***}	-12.47 ^{**}	-1.46	-11.05 [†]	-3.58	1.32	-12.94 ^{**}
performance appraisal	19.08	8.74	-32.67 ^{***}	-21.62	-21.18 ^{**}	-21.57	14.39 [†]	-28.16 ^{***}	-20.44 [*]	-16.87 ^{**}	-17.43	10.68	9.80	-5.93	18.42 ^{**}
Reading															
bullied	-17.18 ^{**}	-1.81	-1.91	-6.29	-10.42 [†]	-17.08 ^{***}	-9.51 [†]	-6.18	-13.77 ^{**}	-18.52 ^{***}	0.89	-3.33	-10.06 [†]	1.06	-10.11
performance appraisal	-1.08	-1.77	-27.55 ^{***}	-19.95	-15.42	-22.71	24.49 ^{***}	-33.65 ^{***}	-24.74 ^{**}	-27.69 ^{**}	-17.58	-7.70	6.37	-13.58	12.08
N	591	682	1443	1630	1123	1180	1248	932	1257	675	739	758	2017	641	1204
ii. Wages															
Math															
bullied	-13.40 [†]	-3.95	-2.68	-1.34	-9.82	-12.92 ^{***}	-1.74	-3.84	-18.68 ^{***}	-12.83 ^{**}	-3.72	-8.03	-5.06	-0.31	-12.84 ^{**}
satisfied with wage	-4.10	20.35 ^{**}	10.05 [†]	6.27	7.69	-8.16	0.88	-1.07	10.41	2.51	5.90	20.58 ^{***}	23.41 ^{***}	4.28	-5.48
Reading															
bullied	-15.37 ^{**}	0.09	-3.34	-6.32	-8.10	-20.00 ^{***}	-7.34	-5.74	-15.40 ^{**}	-18.29 ^{***}	-0.88	1.13	-11.59 ^{**}	-1.62	-10.43 [†]
satisfied with wage	-11.58 ^{**}	16.78 ^{**}	6.48	9.36	11.26	-6.80	2.20	3.14	11.53 [†]	4.19	5.30	23.45 ^{***}	26.08 ^{***}	13.72 ^{**}	-3.65
N	578	690	1476	1656	1148	1161	1323	955	1287	693	749	736	2051	631	1197
iii. Principal concerns on students															
Math															
bullied	-14.12 [†]	-4.84	0.11	-2.77	-9.82	-12.21 ^{**}	-2.97	-3.80	-18.70 ^{***}	-12.96 ^{**}	-2.63	-9.88	-4.52	-0.30	-12.38 ^{**}
concerns beyond achievement	13.55	16.19 [†]	12.31 [†]	28.31 ^{***}	10.02	2.35	9.40 [†]	9.58	4.34	6.85	8.29	6.62	8.03	-0.52	3.39
Reading															
bullied	-18.36 ^{**}	-1.68	-1.48	-7.63 [†]	-8.61	-18.51 ^{***}	-8.74 [†]	-5.41	-15.52 ^{**}	-18.81 ^{***}	0.27	-1.34	-11.64 ^{**}	1.46	-9.95
concerns beyond achievement	6.00	18.46 ^{**}	14.69 ^{**}	28.58 ^{***}	7.26	-3.37	12.36 ^{**}	7.42	9.13	13.65	1.92	2.67	14.19 [†]	0.39	4.80
N	584	698	1420	1675	1142	1206	1315	968	1287	695	749	780	2068	661	1208

Table 10 (Continued)

	ARG (1)	BRA (2)	CHL (3)	COL (4)	CRI (5)	ECU (6)	GTM (7)	HON (8)	MEX (9)	NIC (10)	PAN (11)	PAR (12)	PER (13)	REP (14)	URU (15)
iv. Various															
Math															
bullied	-13.90	-4.18	-1.94	-1.06	-10.81	-11.44	-2.59	-5.43	-18.29	-13.64	-1.59	-9.98	-4.41	-0.18	-13.93
female	25.40	-0.49	7.06	2.06	36.26	5.32	20.40	2.37	26.31	-14.25	27.76	29.74	29.11	-1.92	-16.41
years experience at school	7.79	-4.15	-2.35	0.96	-6.75	1.91	0.82	-2.13	6.87	-4.43	4.91	-3.72	4.54	2.25	4.67
supervised at least 2 months	21.68	-21.13	-7.67	0.70	14.07	16.01	33.84	17.15	4.81	6.69	18.27	-2.37	7.43	5.67	-9.91
economic incentive	-11.12	24.26	9.17	22.98	8.42	-24.35	13.09	0.99	-7.82	10.70	52.19	21.74	40.06	-4.95	-6.77
Reading															
bullied	-17.33	-1.40	-2.95	-6.09	-9.30	-17.98	-8.21	-7.34	-15.10	-19.46	1.09	-0.97	-11.12	1.42	-10.30
female	18.57	17.91	0.65	6.63	28.58	3.12	28.58	6.93	31.52	-18.43	23.29	57.59	35.17	-11.40	4.66
years experience at school	9.26	-3.15	0.92	1.61	-7.84	2.22	-0.85	-0.87	9.10	-2.42	8.24	-5.77	2.25	-3.29	2.59
supervised at least 2 months	15.78	-15.33	0.95	11.46	13.92	20.09	36.29	21.00	6.87	11.94	18.33	-6.37	7.84	3.97	-3.72
economic incentive	-11.59	12.25	7.13	22.65	8.00	-22.37	13.40	13.40	-12.95	0.25	36.68	11.00	39.67	-12.76	-0.70
N	596	698	1476	1702	1148	1206	1334	974	1288	708	760	792	2076	664	1228

Notes: (1) Matched sub-samples are obtained from nearest neighbour without replacement. (2) Each covariates are introduced by group (i to iv) with the bullying (any type) covariate.

* p < 0.10.

** p < 0.05.

*** p < 0.01. Robust standard errors clustered at the school level.

(matching) approaches. We estimated the average effect of treatment on the treated (ATT) using propensity score matching. By doing so we were able to account for the issue of non-randomness on the likelihood of bullying, minimising the impact of observables (such as socioeconomic status, student's grade repetition and work status, school infrastructure and number of students in schools) on the bullying-outcomes relationship, comparing bullied (treated) students with the similar characteristics than non-bullied (untreated) students. We also addressed a couple of additional themes. In the first theme we looked at whether the relationship of learning and bullying varies at different points of the learning distributions and, in the second theme, we investigated which neighbourhood and school determinants were additional channels helping to lower the bullying gap among students with the same covariates (i.e., matched subsamples obtained through matching).

We found that sixth grade bullied students in Latin American schools score substantially lower than their non-victim peers, as well as in their level of non-cognitive outcomes. For the whole sample of the 15 countries, ATT matching estimates show that bullied students achieve 10.82-10.00 points less in math and reading, which implies a reduction of 11% in the standard deviations in learning outcomes. Matching results are consistent for the three matching algorithms and qualitatively similar than OLS, though when controlling for school unobservables in the OLS specification, effects are nearly a half of matching's estimates.

Importantly, we found sizable differences in how bullying translates into poorer achievement across countries. For math, ATT estimates suggest that bullied students achieve between 9.5 and 18.4 points less than their non-bullied peers, and between 5.8 and 19.4 lower scores for reading. The bound analysis of these effects supported that these estimates are robust to the presence of unobservables. Moreover, given that these associations are net of a wide set of students/families, school, principal and teacher characteristics, variability on country effects calls for additional research into extra factors that facilitate (or deter) that more bullying translates into proportionally larger losses on learning in some Latin American countries than others. We tackled this question in the matched subsample analysis and found that, in general, there is a mismatch of some in-school policies (e.g., on teachers' skills) if they are actually aimed at both boosting achievement and weakening its association with bullying. Nonetheless, simple measures such as allocating female teachers to the most problematic classrooms can have wide-ranging positive effects across countries. This is supported by the literature which finds that females teachers act in more emphatic and nurturing ways than male teachers and are more responsive to school bullying (Hirides, 2010; Yoon et al., 2011). Hence, school violence programs in the region should increase recruitment and retention of female educators.

A remarkable finding from the paper is the substantial learning gains that could be accomplished by school violence policies in the region if their aim is to raise attainment in the top brackets of achievement. We found that the gap between bullied and non-bullied students on the likelihood to reach the top two levels of achievement could be narrowed by 9%-31% in math and by 8%-20% in reading through the implementation of effective anti-bullying programs. Once more, the scale of these benefits largely varies by country. We found that both physical and psychological bullying are equally damaging to learning. Where their estimates differ, however, is for non-cognitive outcomes, with psychological bullying being a major determinant explaining low degree of socialisation among students. This result is in line with studies (e.g., Greenberg et al., 2003) which argue that programs are most effective if they simultaneously foster students' personal and social skills whilst improving the quality of the school environment. This

Table 11
Selection on observables and unobservables on the effect of bullying on achievement.

	Baseline effect		Controlled effect		Delta = 1 Identified set	Beta = 0			
	Coeff	R2	Coeff	R2		Delta	Identified set		
	(1)	(2)	(3)	(4)		(6)	(7)		
<i>Math</i>									
ARG	-12.89	**	0.004	-11.10	*	0.290	[-11.10, -10.56]	17.8396	[-11.10, -1.43]
BRA	-8.11		0.002	-6.48		0.221	[-6.48, -5.99]	12.3243	[-6.48, -0.42]
CHL	-24.26	***	0.011	-7.49	*	0.171	[-7.49, -2.12]	1.36682	[-7.49, -0.18]
COL	-8.97		0.002	6.95	*	0.266	[6.95, 11.77]	-1.2846	[6.95, 0.75]
CRI	-8.23	*	0.002	-8.70	**	0.251	[-8.70, -8.85]	-53.58	[-8.70, -1.08]
ECU	-20.15	***	0.013	-14.22	***	0.254	[-14.22, -12.34]	5.88	[-14.22, -3.21]
GTM	-16.76		0.010	-1.01		0.299	[-1.01, 3.88]	0.21	[-1.01, 0.01]
HON	-12.54	**	0.005	-4.62		0.209	[-4.62, -2.19]	1.8623	[-4.62, -0.07]
MEX	-21.59	***	0.009	-13.19	**	0.218	[-13.19, -10.56]	4.26	[-13.19, -2.07]
NIC	-2.30		0.000	-3.46		0.200	[-3.46, -3.81]	-9.56	[-3.46, -0.15]
PAN	-2.90		0.000	0.74		0.279	[0.74, 1.84]	-0.68	[0.74, 0.00]
PAR	-8.23		0.002	-14.29	**	0.255	[-14.29, -16.12]	-5.6717	[-14.29, -3.97]
PER	-27.51	***	0.016	-6.21		0.328	[-6.21, 0.50]	0.92723	[-6.21, 0.05]
REP	-1.62		0.000	-5.40		0.147	[-5.40, -6.53]	-4.0827	[-5.40, -0.78]
URU	-23.80	*	0.013	0.47		0.273	[0.47, 8.11]	-0.0618	[0.47, 0.00]
<i>Reading</i>									
ARG	-18.2543	***	0.009	-12.4278	*	0.285	[-12.43, -10.62]	5.93	[-12.43, -1.79]
BRA	-9.26		0.002	-2.29		0.235	[-2.29, -0.18]	1.09	[-2.29, 0.01]
CHL	-26.8397	***	0.015	-6.76		0.189	[-6.76, -0.21]	1.03	[-6.76, 0.01]
COL	-12.9541		0.005	-3.16		0.293	[-3.16, -0.17]	1.06	[-3.16, 0.04]
CRI	-12.477	***	0.004	-10.01	**	0.249	[-10.01, -9.25]	11.40	[-10.01, -1.51]
ECU	-20.4196	***	0.012	-16.61	***	0.38	[-16.61, -15.43]	11.14	[-16.61, -3.35]
GTM	-24.5573		0.018	-4.74		0.354	[-4.74, 1.52]	0.76	[-4.74, 0.07]
HON	-13.3226	**	0.005	-2.34		0.305	[-2.34, 1.02]	0.70	[-2.34, 0.02]
MEX	-23.599	***	0.013	-17.09	***	0.292	[-17.09, -15.05]	6.50	[-17.09, -3.89]
NIC	-9.30979	*	0.003	-11.05	**	0.277	[-11.05, -11.58]	-17.31	[-11.05, -2.04]
PAN	-9.7074		0.002	2.09		0.361	[2.09, 5.65]	-0.58	[2.09, 0.03]
PAR	-6.23001		0.001	-3.80		0.406	[-3.80, -3.07]	5.15	[-3.80, -0.06]
PER	-30.8736	***	0.021	-11.26	***	0.388	[-11.26, -5.03]	1.74	[-11.26, -0.47]
REP	-4.70653		0.001	-7.29		0.273	[-7.29, -8.07]	-8.47	[-7.29, -0.78]
URU	-19.2294	**	0.008	2.72		0.325	[2.72, 9.48]	-0.39	[2.72, 0.05]

Notes: (1) Baseline effects and controlled effects denotes the model without controls (M0) and full controls (M4), respectively. (2) The identified set in Column (5) lower bound is β and the upper bound is given by β^* based on R_{max} which is assumed to be 30% higher than the R-squared for the model with students controls: $R_{max} = \Pi \bar{R}$ and $\Pi = 1.3$. (4) Weighted OLS regression. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

finding also points towards the fact that the social skills domain of non-cognitive outcomes are very much influenced by bullying and, as consequence, it could be a chief pathway through which bullying leads to lower academic achievement. When we addressed the issue of whether the association of bullying with outcomes varies across the learning distribution, quantile treatment effects (QTEs) estimates suggest that –at least for a few countries– to boost the success of school violence policies, they should be showcased based on students’ achievements levels (i.e., top students in the case of math and bottom learning performers). This implies that programs’ design could incorporate performance based components, thereby achieving larger results.

We believe that insights from our analysis should prompt more policy attention on bullying in all its psychological and physical forms at school level as an important part of the drive to improve learning outcomes for all students. Often, this is rarely given the attention in national and global education policy on improving educational achievement. The result that bullying decreases a student’s likelihood to reach top levels of attainment suggests that addressing this issue through the appropriate policy framework could potentially improve Latin American students performance on national and international assessments. For Latin American countries, our analysis suggest that policies related to reducing the effects of bullying should be an important part of improving educational quality more generally.

Certain caveats apply to our conclusions. First, the bullying indicator available in the TERCE study does not measure the

frequency in which bullying occurs as in others international learning surveys (e.g., TIMSS, PISA) and, second, due to social desirability it is probable that students could be under-reporting incidents of bullying. Likewise, our bullying indicators do not capture other important types of bullying linked to negative school experiences such as cyber bullying. Hence, we cannot claim our estimates portray the full scope of detrimental effects of bullying on learning, but rather our estimates provide a lower bound on the learning-bullying relationship. Standard limitations on cross-section analysis apply, with results showing conditional statistical correlations rather than causality.

5.1. Implications from the matched subsample analysis

The matched subsample analysis sheds light onto what elements might contribute to the success of anti-bullying programs for the region, this is after isolating other important mediating factors (e.g., family wealth, parental education, home supervision, type of school, dimension and infrastructure, teacher’s qualifications) (Abdirahman et al., 2012; Benbenishty and Astor, 2011; Chaux et al., 2009; Konstantina and Piliou-Dimitris, 2010) which are likely to be correlated to bullying and achievement.

First, we found that targeting either students from households that receive conditional cash transfers or students living in violent communities leads to null associations of bullying with learning in half of the countries included in the TERCE study. This implies that,

if targeting is moved back to the proximal social contexts of students (and their families) by incorporating anti-bullying strategies within social programs, it can have significant leverage effects. Some current programs follow this principle (e.g., Mexican program Actions to Improve School Coexistence within the National Programme for Social Prevention of Violence and Crime that aims for better targeting using zones at risk). Second, as regards to school factors such as improved work environments or the existence of teaching skills programs, our results imply that they are disconnected from the school violence phenomenon. This is probably explained by lack of accountability of schools under severe bullying as we also found that there is no link between principals concerns on non-learning issues and violence-learning associations. Quite the opposite, school programs operating beyond internal school factors with a focus on nurturing school-community social capital are very powerful – particularly cultural programs. For instance, as an alternative to the lack of access to cultural activities in the outskirts of Brazilian cities, the Open Schools program is used to combat school violence. Our estimates reveal why this program has been successful. Third, we found that teacher's performance appraisal measures does not weaken the bullying-learning associations, whilst teachers' satisfaction with remuneration explains the bullying learning gaps, but only in a few countries.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.ijedudev.2016.10.002>.

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