

# DOES BULLYING AFFECT THE SCHOOL PERFORMANCE OF BRAZILIAN STUDENTS? AN ANALYSIS THROUGH OF PISA 2015

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## ABSTRACT

This work aims to analyze the impact of the different dimensions of bullying (physical, psychological and indirect) on the school performance of Brazilian students. For this analysis data from the Programme for International Student Assessment (PISA) from the year of 2015 were used. The methodology applied was the Propensity Score Matching (PSM) and the Quantile Treatment Effects (QTE). Results show that physical bullying (being spanked and having belongings destroyed) is harmful for the school performance of students. The destruction of belongings of students negatively impacted only the Reading score, not being statistically significant for the other grades. The psychological bullying (having rumors spread, being made fun of and being threatened), paradoxically, did not affect negatively the grade of students. Being excluded by the group, considered as indirect bullying, also did not have significance in the studied subjects. Bullying carries several consequences for the student, besides the decrease of school, performance because it can result in school evasion and sometimes difficulties in the labor market. Thus, studying this phenomenon, by means of school behavior, is an important subject for the society.

**Key words:** Bullying; School performance; Aggression; Pisa; Microeconometrics.

**JEL:** I24; I25; C21.

## RESUMO

O presente trabalho tem como objetivo analisar o impacto das diferentes dimensões do bullying (físico, psicológico e indireto) no desempenho escolar dos alunos brasileiros. Para essa análise foram utilizados os dados do Programa Internacional de Avaliação de Estudantes (PISA) do ano de 2015. A metodologia empregada foi o propensity score matching (PSM) e o Efeito Quantílico de Tratamento (EQT). Os resultados mostraram que o bullying físico (apanhar e ter pertences destruídos) é prejudicial para o desempenho escolar dos alunos. A destruição de pertences dos alunos impactou negativamente apenas a nota de leitura, não sendo estatisticamente significativa para as demais notas. O bullying psicológico (ter boatos espalhados, fizeram piadas e foi ameaçado), paradoxalmente, não afetou negativamente a nota dos estudantes. Ser excluído pela turma, considerado bullying indireto, também não teve significância nas disciplinas estudadas. O bullying traz diversas consequências para o estudante além da redução no desempenho escolar, pois, pode acarretar abandono escolar e por vezes dificuldades no mercado de trabalho. Portanto, estudar esse fenômeno, por meio do comportamento escolar, é um assunto de importância para a sociedade.

**Palavras-chaves:** Bullying; School performance; Aggression; Pisa, Microeconometria.

## Área 12 - Economia Social e Demografia Econômica

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This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES) - Finance Code 001. Errors and omissions are responsibility of the authors.

## INTRODUCTION

Bullying is defined as the conscious and deliberate desire of abusing another person and to put them under tension (FANTE, 2015)<sup>1</sup>. A student is being intimidated or victimized when he or she is repeatedly exposed, during time, to negative actions by one or more students in a context of uneven power or force (OLWEUS,1993). To be a bully implies in involving in repeated and intentional negative behaviors in the individual or in a group of people with difficulty to defend themselves (OLWEUS, 1997). Bullying may have different types such as physical, verbal, social or electronic (*cyberbullying*) (OLWEUS, 1993).

Studies about school violence are recent and the first ones are from the 80's (EYNG, 2009). The theme is awakening the attention of the society, families and educators. Violence in schools is a complex phenomenon affecting the daily life of students, threatening their physical, psychological integrities, besides human dignity (EYNG, 2009). From the 90's, interpersonal violence among students expressed normally in verbal aggressions and threats increased (LEME, 2009).

Bullying is one of the most recurrent types of violence in schools (BATSCHE, 1997). Its practice during childhood is associated to problems of externalization, such as aggressive and anti-social behavior in adult age, while victimization is associated with problems of internalization such as depression and anxiety (KALTIANA-HEINO et al., 2000; SOURANDER et al., 2000). The effects of being a victim of bullying may be confused among the different effects associated to being a bully, a victim and a victim of bullying regarding behavior (GEORGIU; STAVRINIDES, 2008). Bullying affects individuals in cognitive and psychological levels. Children involved with bullying had more behavioral problems, hyper-activity and misconduct, when compared to students not involved with this practice (WOLKE et al. 2000).

Bullying is nothing more than a way of expressing the prejudice and intolerance to social, personal and structural situations that are different from the standard idealized by the consumer society (BACILA, 2005). Thus, its occurrence is related to actions of hostility and stigmatization when the victim has, as stated by Bacila (2005), characteristics socially represented as negative or inferior ones, generating the preconception.

The negative relation between school performance and bullying may be explained by the fact that the victim has a lower school attendance, less contact with their colleagues and a greater incidence of depression (VAN DER WERF, 2014). According to the authors, the victims learn less since they are less interested in studying, not only because they miss classes but also because they learn less with their colleagues, since the school is a hostile environment. Also, bullying must be a concern not only to the educational system, since the victims present lower school performance, and greater evasion, but also to the health system (AZEREDO et al., 2015). Children suffering from bullying have less class attendance due to the fear of going to school, since they have already suffered violence within it (BERTHOLD and HOOVER, 2001). Consequently, this results in possible evasions. Inside the context of the health system, bullying brings consequences for the victims, because they have more risk of psychosocial problems such as low self-esteem, anxiety, depression and suicide.

Kibriya et al. (2015) observed that bullying has negative effects in the school performance of students in Gana. Besides, the authors found that female students have their

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<sup>1</sup> According to the Brazilian Multi-professional Association of Protection to Childhood and Adolescence (ABRAPIA) as there is no word in Portuguese that represents all situations of bullying, the actions that may be present in this practice are: putting nicknames, offending, mocking, enjoying, incarnating, messing, humiliating, making suffering, discriminating, excluding, isolating, ignoring, intimidating, stalking, harassing, terrorizing, frightening, bullying, dominating, aggressing, beating, shooting, pushing, harming, stealing/breaking belongings.

school performance more affected when compared to male students who suffered bullying. However, the presence of a teacher reduces the effect of the bullying suffered by female students. Oliveira et al. (2018) found an impact of bullying on the Mathematics grades of students from the 6<sup>th</sup> grade of public schools in Recife. Also, socio-emotional skills may help students to deal with bullying (OLIVEIRA et al., 2018). Thus, the authors conclude that programs fighting this practice must evaluate non-cognitive skills.

Being male, young, exposed to domestic violence and not living with the two parents are variables associated with being a victim of bullying (AZEREDO et al, 2015). According to UNESCO (United States Educational, Scientific and Cultural Organization), bullying affects both female as well as male children, however in different ways. Girls are more prone to experience bullying based on appearance (psychological), while boys are more prone to experience physical bullying.

As reported by a study published by the United States Educational, Scientific and Cultural Organization (UNESCO,2017)<sup>2</sup>, schools where only 5% of students, or less, suffered bullying reached a grade of 517 points in the PISA test. In those unities with 10% or more of students suffering bullying, the average grade was 470 points. It is worth to highlight that the overall average of this test for Sciences is 493. Also, the youngsters who suffered bullying feel more anxious before doing the tests.

The objective of this paper is to analyze the impacts of bullying on the school performance of adolescents and also to evaluate if the effect differs considering the quantile of the student's grade. This phenomenon will be analyzed according to the six questions elaborated in the questionnaire of the Programme for International Student Assessment (PISA) disclosed in 2015 by the Organization for Economic Co-operation and Development (OECD). Besides presenting the grades of Brazilian students, it approaches the cognitive scope of the child, whereby means of the answers of the questionnaire it is possible to observe if the child self-declared to have suffered bullying.

The use of PISA is justified by means of studies showing that bullying normally happens between nine and fifteen years of age, moment when the research takes place. The dimensions investigated will be: being spanked, having gossip spread, having their belongings destroyed, being threatened, being made fun of and being left out. Bullying was divided into three categories: physical (being spanked, having their belongings destroyed), psychological (having gossip spread, being made fun of, being threatened) and indirect (being left out) as proposed by Olweus (1991). This way, it will be possible to analyze which type of aggression more affects the school performance of students. The strategy of estimation will be to compare students who suffered (treatment group) with those who did not suffer bullying (control group) according to observable characteristics. The methodology applied will be the Propensity Score Matching (PSM) in order to verify the effect on the average and the Quantile Treatment Effects (QTE) in order to observe the effects along the performance quantiles.

According to a study made by The Institute of Economic Research Foundation (FIPE, 2009)<sup>3</sup> in 501 public Brazilian schools in 2009, bullying has a significant correlation with the averages of the "Prova Brasil". Those correlations are negative, thus, in schools where there is more occurrence of bullying, the averages in this test are lower. Brazil has low levels of academic school performance in standardized international tests in addition to the existence of school violence, and according to the Talis report (2018) there was a high percentage of school Principals who stated that the students suffered bullying in Brazil compared to the rest of the countries.

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<sup>2</sup> Available at: <http://unesdoc.unesco.org/images/0026/002657/265781e.pdf>

<sup>3</sup> Available at: <http://portal.mec.gov.br/dmdocuments/relatoriofinal.pdf>

The contribution of this work is to analyze the relation between bullying and school performance in Brazil. Although there are texts with this theme, there are no, according to our knowledge, studies that used the database of PISA in order to verify the several dimensions related with bullying affecting school performance. The use of this database, nationally representative, differs from the one used by Oliveira et al (2018) whose analysis was carried out in Recife. Besides, it allows to investigate a transition period from elementary to high school, because the students are between 15 and 16 years of age. This is an especially sensible period since many students evade in this stage of school due to incentives for entering the labor market. The investigation of those factors allows the development of more assertive policies for mitigating the problem.

This paper is organized in six sections, besides this introduction. Next a literature review about the impact of bullying on the school performance of children is made. Subsequently, the database, descriptive statistics and the empirical strategy are approached. Finally, the results are discussed and the final considerations are elaborated.

## **2. LITERATURE REVIEW**

Pereira et al. (2004) analyzed bullying in Portuguese schools in students from 10 to 12 years old by means of a field research. The authors show that gender has a significant role in victims and bullies. The social class also has significance and may derivate from the social differences in the Portuguese society. The authors concluded that being male and being part of lower social classes increases the risk of suffering bullying.

Costa e Pereira (2010) evaluated school success and failure and the prevalence of bullying at the different levels of basic schools. Students with school failure are more involved in episodes of bullying. Besides, the result found corroborates the theory that the greater the failure is, the more aggressive are the children. In addition, victimization results in a lower school performance – during the period when the child is being victimized - such as the one found by Carvalhosa (2009).

The greater the contact with the school by the child is, the smaller is their association with violence (RESNICK et al., 2000). The low levels of intelligence and the poor progress in school emerge as risk factors associated with violence between children and youngsters. Children having lower school performance have a tendency of emerging as targets for bullying (SCHWARTZ et al., 2002).

Contreras et al. (2009) evaluated the relation between bullying and the school performance of students in Chile. Those with below the average school performance may be negatively impacted by being victims of bullying. Paradoxically, being a victim has positive effects in students with high school performance when compared to the other performances. In other words, to suffer bullying increases the performance of students classified in the interval from 6.5 to 7. It is worth to highlight that students with high performance are those that, most of the times, are victims of bullying. The results found by the authors suggest that there may be a heterogeneous relation between school performance and suffering/practicing bullying, depending upon the skill of the student.

Eriksen et al. (2014) analyzed the impact of bullying on the school performance of children from 10 to 12 years old in Denmark. The authors found that the qualities of the family environment as well as the individual characteristics of the child are predictive of the bullying status. Besides, children that were victims of this practice had lower grades and these effects have a tendency of increasing according to the severity of the act.

Ponzo (2013) estimated the effect of being a victim of bullying on the educational performance of Italian students enrolled in the fourth and eighth grades. The author estimated the average effect of the treatment (suffering bullying) using the score of propensity to avoid

a possible bias of selection. Results found corroborate with the analyzed literature in which having suffered bullying reduces the grades of Italian students.

Rigby and Slee (1991) analyzed bullying in Australian schools. The authors found that younger children are prone to suffer more bullying than the older ones, as well as the boys were more intimidated than the girls. Besides, bullying usually happens between nine and fifteen years of age because the victims have characteristics that waken them before the aggressor (CARNEY and MERREL, 2001). Bullying has a tendency of stopping along the years, since people start to acquire social skills, improving the self-esteem (SMITH et al., 1999).

Children who are more exposed to domestic violence affect the grades on tests of Mathematics and Reading of their classmates, and substantially increase the bad behavior of other people in the classroom (CARREL et al., 2010). Furthermore, the authors found that the externalities change according to the gender and family revenue of the child and seem to be caused by boys of families exposed to violence.

Children practicing bullying reported that the parents did not exercise the functions of care and monitoring, sometimes being negligent (BOWERS, SMITH and BINNEY, 1992). Contrary to victims of bullying who have a strong relationship with their parents being, thus, over-protected. This study was also made in Italy by Finnegan, Hodges and Perry (1998) who found similar results where the authors of bullying had relations of lower cohesion with their families, while the victims were too closely linked to them.

A consistency is observed in the international literature, since most of the studies find that bullying negatively impacts the school performance. Studies about bullying in Brazil are more recent. One of the first written texts was the one of Jaeger et al. (1997) whose authors evaluated the aggressive behaviors in schools of Santa Maria by means of a questionnaire adapted from Olweus (1989).

Mello et al. (2017) evaluated the factors associated with the practice of bullying in Brazil. The authors found that 19.8% of the aggressors are male, students of private schools and sons of mothers with higher schooling. Those aggressors also missed more classes than the other students, besides suffering more physical violence and having less supervision from the parents. Most of the victims do not react or speak about the aggression suffered (NETO, 2005). And since those acts happen outside the view of an adult, it is possible to understand why parents and teachers underestimate the prevalence of bullying and do not act in order to interrupt this situation.

There is a negative relation between maternal schooling and the victimization of bullying, while domestic violence is positively related to this phenomenon (SILVA et al., 2018). According to the authors, the advanced schooling of the mother makes her able to impose limits, supervise and help the children when they have difficulties to relate in school. The authors also found that the victims of bullying feel more alone, have less friends and have insomnia – characteristics of depressive symptoms.

Malta et al. (2014) analyzed factors associated to bullying by means of the National Research of Health of the Scholar (PeNSE) under the perspective of the victim. The authors found that males are more likely to suffer bullying. Besides, characteristics related to being young, of black color, susceptible to domestic violence and smokers are more likely to being victims of this phenomenon.

When analyzing the prevalence of bullying in the South Eastern region of Brazil, Mello et al. (2016) found that victims present greater depressive symptoms and high levels of suicidal ideation in relation to non-victims. Besides, the authors point that the school is not the only responsible for the production of violence, since bullying is a complex, multi-causal and dynamic phenomenon whose origins are also matters of macro-social and macroeconomic questions. Mello et al. (2016) suggest that educative actions are necessary where the juvenile,

the stimulus for social participation and the reflection involving the youngsters, educators and families are valued. The prevention of bullying must be treated as a socio-cultural phenomenon that must be approached in a holistic way, considering all aspects involved in the problem according to Mello et al. (2016).

### **3. METHODOLOGY AND DATABASE**

#### **3.1 Database**

The Programme for International Student Assessment (PISA) is an international evaluation that measures the educational level of 15 years old youngsters by means of tests of Reading, Mathematics and Sciences. This age cut happens because it is presupposed as the end of compulsory basic schooling in most of the countries. PISA is held every three years by the Organization for Economic Co-operation and Development (OECD) – which is formed by 30 countries that have as principles democracy and a market economy. Countries that are not part of OECD can also take part in the exam, as is the case of Brazil. The National Institute for Educational and Research “Anísio Teixeira” (INEP) is responsible for carrying out the tests of the program in the country.

PISA has the objective of producing indicators that contribute to the discussion of the quality of basic education and that may help national policies for the improvement of education. Besides, by means of the tests the program aims to identify not only how the student reproduces their knowledge, but the ability of using this knowledge inside and outside the school context.

A knowledge area is highlighted every year that PISA is carried out, in other words, most of the questions are directed towards this area. In 2015 the highlighted area was Sciences. The program is among the most recognized global evaluations of education. In Brazil, the National Plan of Education (NPE), Law number 13,005 in its seventh goal contains the strategy of improving the school performance of students in Basic Education in order to reach the averages observed every year in schools from member countries of the OECD.

PISA is applied in a sample form in which the records of the schools in each participating country are used in the data selection process. In the case of Brazil, the data used are from the School Census. The organization of PISA establishes that each country has at least 150 schools participating in the test. Brazil since 2006 is increasing its sample and in the year of 2015, there were 841 participating schools, 23,141 students and 8,287 teachers. Therefore, the size of the sample may ensure a greater reliability of the representativeness of results reached by Brazil.

By means of PISA 2015, it is possible to identify youngsters that suffered or not bullying in the last twelve months at school from the following statements answered by the students: i) “other students left me out on purpose”, ii) “other students made fun of me”, iii) “I was threatened by other students”, iv) “other students removed or destroyed my belongings”, v) “I was spanked or pushed by other students” and vi) “others students spread gossip about me”. The students could answer with the following options: “never or almost never”, “sometimes during the year”, “sometimes during the month” and “once per week or more”. The construction of each one of the aspects regarding bullying was made by means of dummies for each one of the questions above, where the answer “never or almost never” configures that students did not suffer the type of threat mentioned and the other options represented students who suffered it, according to the definition of PISA. The variables of bullying were split in three categories: physical (being spanked and having their belongings destroyed), psychological (having gossip spread, being made fun of and being threatened) and indirect (other students leaving them out on purpose) as proposed by Olweus (1991) for a better comparison.

In addition, dummies were created regarding the perception of the student inside the school. In other words, if the student feels out of place, weird, alone or part of the school unity. Through those variables it will be possible to analyze if those students who suffered bullying identify themselves as strange in the school environment when compared with those that did not suffer it. The more students perceive the school as an unsafe place, the more they report to be victims of bullying (MATOS and GONÇALVES, 2009).

Table 1 - Descriptive Statistics

Variables	Description	Did not suffered <i>bullying</i>	Suffered some kind of <i>bullying</i>
		Average (dp)	Average (dp)
<b>Dependent</b>			
grade_mathematics	Score obtained in the test of mathematics	385.9 (84.3)	400.08 (86.58)
grade_reading	Score obtained in the test of reading	421.15 (91.7)	429.09 (95.46)
grade_sciences	Score obtained in the test of sciences	409.9 (83.3)	420.59 (86.71)
<b>Independent</b>		<b>Individual and Family Characteristics</b>	
Male	Child of male sex =1, c/c =0	0.45 (0.5)	0.5 (0.5)
scholarity_father	Schooling level of the father measured from 1 to 5 where each number corresponds to a level of schooling	2.93 (1.93)	3.09 (1.95)
scholarity_mother	Schooling level of the mother measured from 1 to 5 where each number corresponds to a level of schooling	3.18 (1.9)	3.37 (1.91)
assets_home	Assets of the house	-1.28 (1.06)	-1.2 (1.07)
assets_cultural	Cultural assets of the house	-0.37 (0.79)	-0.32 (0.8)
assets_family	Wealth of the family	-1.17 (1.05)	-1.09 (1.05)
grade_repetition	Child repeated grade = 1, c/c = 0	0.28 (0.45)	0.29 (0.46)
Age	Age of the child in years	15.88 (0.28)	15.88 (0.28)
like_me	Child has the perception of other students liking them =1, c/c=0	0.78 (0.41)	0.75 (0.43)
feel_dislocated	Child feels dislocated at school =1, c/c=0	0.13 (0.34)	0.22 (0.41)
feel_belongging	Child feels part of the school =1, c/c=0	0.73 (0.44)	0.72 (0.45)
friendship_easy	Child makes friendship easy=1, c/c=0	0.70 (0.46)	0.69 (0.46)
feel_weird	Child feels weird at school =1, c/c=0	0.15 (0.35)	0.25 (0.43)
feel_alone	Child feels alone at school =1, c/c=0	0.14 (0.35)	0.23 (0.42)
<b>Independent</b>		<b>School Characteristics</b>	
Private	Child studies in the private network =1, c/c =0	0.14 (0.35)	0.18 (0.38)
size_class	Total number of students at the class of the child	36.22 (8)	35.88 (8.07)
number_teachers	Total number of teachers at the school	34.72	34.81

		(20.84)	(20.91)
number_girls	Number of girls divided by the size of the class	13.23 (7.23)	13.03 (7.3)
number_boys	Number of boys divided by the size of the class	12.28 (6.78)	12.04 (6.86)
<b>Independent</b>	<b>Different Dimensions of Bullying</b>		
spread_gossip	Child had gossip spread at school =1, c/c=0	0	0.51 (0.5)
Spanked	Child was spanked at school =1, c/c=0	0	0.17 (0.37)
belongings_destroyed	Child had their belongings destroyed at school =1, c/c=0	0	0.29 (0.45)
Threatened	Child was threatened at school =1, c/c=0	0	0.24 (0.43)
made_fun_of	Child was made fun of=1, c/c=0	0	0.56 (0.5)
left_out	Child feels left out by colleagues at school =1, c/c=0	0	0.51 (0.5)
N (number of obs)		6,693	4,230

Source: Self elaboration from data of PISA (2015)

From Table 1 it is possible to identify that the age of students is between fifteen and sixteen years old. It is possible that there is an age-grade distortion, since PISA is applied to children of 15 years old that are enrolled from the 7<sup>th</sup> grade of elementary school until the third year of high school. The cut of age happens because the end of compulsory schooling in Brazil is assumed. It is worth to highlight that only observations that had no missings in any variable were kept. So, the final number of observations of the sample was 10,923.

The columns of the table were divided into a control group – students who did not suffer any of the dimensions of bullying – and a treatment group – students who suffered from at least one of the dimensions of bullying. Besides, it presents the six dimensions of bullying studied.

Regarding the variables about the perception of the student within the school, students who suffered bullying are the ones feeling more dislocated, alone and weird. However, those that did not suffer it are the ones easily making friendships, feeling that they are part of the class and that the colleagues like them.

Variables representing the socioeconomic level of the family – “assets\_home”, “assets\_cultural” and “assets\_family” – were higher for students that did not suffer bullying. It is worth to highlight that those variables were created by PISA by means of the item response theory. Besides that, students who suffered bullying have higher educated parents, despite the averages being similar.

In order to eliminate the outliers of the sample, the size of some variables was limited. Schools that had no teachers, and those declaring to have 120 or more teachers in their staff were removed from the sample. This strategy was made by observing the frequency table, whose accumulated percentage corresponded to 99.13% of the sample. The cutting number was thus defined, because the frequency was small and less relevant above this percentage. The same happened with the variables “number\_girls” – which was limited to school unities declaring to have 1,282 girl students or more - and “number\_boys” – which was limited to schools that had 1,195 boy students or more.



## 3.2 Methodology

### 3.2.1 Propensity Score Matching

By means of the PISA questionnaire, adolescents can answer with what frequency, during the last twelve months, they suffered practices related to bullying. Therefore, the proposed identification strategy is to compare those students that answered that they never suffered bullying with those that were victims of it.

In order to estimate the effect of the several dimensions of bullying on the grade of students the method of Propensity Score Matching (PSM) was used. The methodology was developed by Rosembaum and Rubin (1983) and aims to analyze the probability of a group receiving the treatment, taking into consideration the several observable characteristics,  $X$ , in common between the two groups. Thus, it is assumed that each member of the treatment group (student who suffered some of the dimensions related to bullying) has a pair in the control group (student who did not suffer it). In order to avoid the problem of dimensionality, the vector  $X$  of observable characteristics was replaced by  $p(X)$ , which is defined as the score of propensity:

$$P(X) = Pr(T = 1|X) \quad (1)$$

Being valid the hypothesis of selection in the observable, the independence between the potential result in the absence of treatment and the decision of participating or not will also be valid. Thus,

$$Y_i(0) \perp T_i|X \Rightarrow Y_i(0) \perp T_i|p(X_i) \quad (2)$$

Where  $Y_i$  is the variable to be explained (school performance of students in Sciences, Mathematics and Reading),  $T_i$  is the treatment (suffering bullying) and  $X_i$  is the vector of explanatory variables. Thus, it is possible to estimate the average effect of the treatment over the treated making the pairing between individuals who suffered each one of the dimensions of bullying and those who did not suffer it based only on the propensity score. However, for estimating the propensity score it is necessary to apply a logit or probit model, since it is not known. In the case of this paper the logit model will be used:

$$Pr(T = 1|X = x) = \frac{\exp(x\beta)}{1+\exp(x\beta)} \quad (3)$$

Where  $\beta$  is the vector of parameters that will be estimated in a first stage. Being  $\hat{\beta}$  the estimator of  $\beta$ , then the score of propensity is estimated as:

$$\hat{p}(x) = \frac{\exp(x\hat{\beta})}{1+\exp(x\hat{\beta})} \quad (4)$$

One of the most used estimators to define the proximity of the propensity score of individuals who suffered some of the types of bullying regarding the propensity score of those individuals who did not suffer it, is by means of a pairing by the nearest neighbor. This estimator uses results of the  $N$  individuals in the group of not treated (that did not suffer bullying) having propensity scores closer to the propensity score of the individual  $i$  who suffered some of the types of bullying to estimate what would be the result of this individual  $i$  if they did not suffer bullying. Besides, in this paper the method of closer neighbor with replacement was used, because the counterfactual may be paired with different observations treated. The advantage

of using this method is that the quality of the pairing increases, as well as the bias is reduced (CALIENDO; KOPEINIG, 2008).

Being  $H_N$  the set of the  $M$  observations with lower value of  $|\hat{p}(X_j) - \hat{p}(X_i)|$ , it is possible to build the sample analogue for the potential result of the individual if they were not treated (did not suffer bullying):

$$\hat{Y}_i(0) = \frac{1}{M} \sum_{j \in H_M(i)} Y_j \quad (5)$$

The Average Treatment Effect on the Treated (ATT) ones, when the Hypothesis of Conditional Independence (HIC) is supposed, is  $E[Y_{1i} - Y_{0i} | X_i]$ . Supposing HIC, the resulting ATT from the direct pairing of the values of propensity between treated and not treated, applying the law of iterated expectation on  $X_i$ , is:

$$ATT = E[Y_{1i} - Y_{0i} | T_i = 1] = E\{E[Y_i | P(X_i), T_i = 1] - E[P(X_i), T_i = 0] | T_i = 1\} \quad (6)$$

The typical estimator of the pairing by propensity score is described below:

$$ATT_{PSM} = \frac{1}{N_T} [\sum_{i \in T} Y_{1,i} - \sum_{j \in C} \omega(i, j) Y_{0,j}] \quad (7)$$

Where  $N_T$  is the number of treated individuals belonging to the region of common support and  $\omega(i, j)$  is the scheme of weight used to aggregate the potential result of individuals from the control group and depends on the propensity score of the participant  $i$ ,  $P(X_i)$ , and of the propensity score of the non-participant  $j$ ,  $P(X_j)$ .

### 3.2.2 Rosenbaum Tests

Factors that are not observed in the estimation may skew the results of the effect of the treatment on the treated ones. Thus, the bounds analysis measures the potential impact of the selection bias that arises due to the non-observed variables. In this work it was used the method known as Rosenbaum Bounds (ROSENBAUM, 2002). The purpose of the test is to estimate what should be the influence of an eventual variable omitted over the existing selection bias in the probability of participation in the treatment and that may eventually undermine the conclusions regarding the causal effects.

This sensitivity analysis may be used to test the robustness of the results to the presence of an omitted co-variable. In this paper, the test aims to evaluate the impact of an eventual variable omitted on the grades of students. The Rosenbaum Bounds may be expressed by the equality:

$$\frac{1}{e^\gamma} \leq \frac{\theta_i(1-\theta_j)}{\theta_j(1-\theta_i)} \leq e^\gamma \quad (8)$$

Where  $i$  and  $j$  are two individuals with observable characteristics inside a logistic distribution and  $\gamma$  expresses the measurement of the degree of rupture of a sample free from the selection bias. Thus, when  $\gamma = 0$ , the degree of association will be equal to one, implying in the non-existence of a selection bias.

### 3.2.3 Quantile Treatment Effects (QTE).

In order to analyze the impacts of the dimensions of bullying among the different quantiles of the students' grades, the model of Firpo (2007) was used for estimating the Quantile Treatment Effects (QTE). Through this model it is possible to capture the

characteristics of the distribution, since the effect along the quantiles are estimated. Thus, the QTE and the Quantile Treatment Effect on the Treated (QTT) are alternative approaches allowing to verify the impact of public policies and still show robust results regarding the possible presence of outliers. The model of Firpo (2007) is defined next.

Being  $T$  the variable indicating the treatment (suffering bullying) that assumes values equal to 0 for the individual who did not suffer some of the dimensions of bullying, or 1 for the individual who suffered it. Being  $Y_i$  the response variable (performance in Sciences, Mathematics and Reading) the result observed is defined as:

$$Y_i = (Y_i(1)T_i) + (Y_i(0)(1 - T_i)) \quad (9)$$

Thus,  $\tau$  is defined as a real number between  $[0,1]$ , the quantile treatment effect (QTE) is given by:

$$\Delta_t = q_{1,\tau} - q_{0,\tau} \quad (10)$$

$$\text{Where } q_{j,\tau} \equiv \inf_q \Pr[Y(j) \leq q_{j,\tau}] \geq \tau, j = 0,1 \quad (11)$$

This expression demonstrates that the QTE is the difference between the quantile  $\tau$  values of the cumulative distribution functions of the response variable regarding the treatment group and the control group, for a given quantile. In order to estimate QTE it is necessary to follow two stages: first, the propensity score is estimated (by means of a logit or probit model – in this paper the logit model was used) and later, the difference between treated and not treated is calculated. Estimators of the propensity score are defined as the conditional probability of receiving a treatment, given by pre-treatment characteristics that can be observed,  $\Pr[T = 1 | X = x]$  or  $p(x)$ . Next, the propensity score is used to build the weights to be used in a modified version of the quantile regression estimator of Koenker and Bassett Jr (1978).

In short, the QTE and the QTT proposed by Firpo (2007) consist of an exogenous and non-conditional quantile estimator that calculates the difference between treated and not treated for each quantile of the distribution (from the conditional distribution until treatment) obtained by means of weights based on propensity estimators obtained in a first stage.

## RESULTS

The logit estimation for the probability of suffering bullying according to several dimensions (physical, psychological and indirect) controlling by means of observable characteristics is in Table A.1 (Appendix). Besides, through Figure A (Appendix) it is possible to observe the density of the propensity score for the non-paired and paired samples for each one of the dimensions of bullying. It is possible to observe that the distributions are quite similar after the procedure of pairing, since overlap is verified between the distributions of the treated and control groups. Table A.2 (Appendix) presents the robustness of the pairing. Through the table it is possible to observe a reduction in Pseudo- $R^2$  as well as in the mean and median bias in the paired sample. Besides, both the Likelihood Ratio test (LR) as well as the Pseudo- $R^2$ , show that the statistic difference among the groups post-pairing no longer exists. It is worth to highlight that the p value becomes significant after the pairing, showing robustness in the results. Thus, these results point out that post-pairing groups are similar, from a vector of observable variables.

Subsequently, the results of the PSM estimation with a closer neighbor and with replacement is found in Table 2<sup>4</sup> below.

Table 2 – Results

Variable	Math Grade	Reading Grade	Sciences Grade
<b><i>Physical Bullying</i></b>			
Being spanked	-13.02***	-33.77***	-20.82***
Having Belongings Destroyed	2.17	-10.73***	-1.21
<b><i>Psychological Bullying</i></b>			
Having Gossip Spread	5.51*	1.99	1.72
Being Threatened	-12.42***	-21.09***	-15.94**
Made fun of	8.39***	5.7*	7.52***
<b><i>Indirect Bullying</i></b>			
Being left out	2.1	0.85	2.4

Source: Self Elaboration from data of PISA (2015).

Grade: \*\*\* p<0.01, \*\* p<0.05, \* p<0.10.

Among the aspects composing the physical bullying, to suffer a physical aggression inside the school environment causes a reduction of the average school performance of Brazilian Students. Students that were spanked had lower grades compared to peers that did not suffer this type of violence. This student had their grade reduced in 13, 33 and 20 points in the subjects of Mathematics, Reading and Sciences, respectively. This type of aggression among the ones analyzed in this paper is the easiest to identify by the victims. Besides, students who had belongings destroyed had grades near ten times smaller on the Reading test. However, no similar effect is verified for the other disciplines.

Among the variables that compose the psychological bullying, to have gossip spread and being made fun of had positive effects on the grades of students. While the aspect related to being made fun of had a positive and significant effect in all disciplines, to have gossip spread was only significant in the test of Mathematics. However, being threatened had a negative effect on the grades of students regardless of the subject. This behavior, different from the others, may be due to the fact of the variable being more tangible and clear to the victim.

Regarding indirect bullying we may find an identification problem by the victim. This type of bullying happens “behind the back” of the student, making its recognition more difficult, because the victim may not know the identity of the aggressor (RAIMUNDO and SEIXAS, 2009). The more difficult the identification is, the harder it is to attack the problem, which may explain the non-significance of this variable in the grades of the students. However, the aspect related to the victim feeling left out by the colleagues was not statistically significant for none of the analyzed disciplines.

One of the limitations of this work is linked to the identification of psychological and indirect bullying since the victim, sometimes, does not know that they are suffering the aggression. Thus, results may be underestimated, which could justify the positive behavior in the grades of the students.

In addition, it is possible to observe that the subject with the greatest differences of grade is Reading. It is probable that students with Reading deficit are targets of bullying because this deficit may lead to rejection by the colleagues through bad interpretation of social situations by the affected students (LUCIANO and SAVAGE, 2007). Thus, students who already have difficulties in the subject of Reading, when they are targets of bullying,

<sup>4</sup> Other methods of pairing were tested, and results were similar. Those may be made available upon request to the authors.

they may have worsened their performance, which would explain the high differentials of grades between the treatment and the control groups.

By means of the results it is possible to identify that psychological bullying is less tangible than the others. However, among the aggressions involving this type of bullying it is perceived that being threatened is the clearest of them. Therefore, the student knows that they are being threatened, which negatively impacts their school performance. The other variables composing the psychological bullying may not be identified by the victims of the aggression.

According to the Rosenbaum tests, Table 3, the results showed to be satisfactory since they reinforce the non-existence of bias in possible non-observable characteristics affecting the result. When gamma approaches the unit it may be an indicative of non-observable bias that may influence the result (DEHEJIA, 2005). Therefore, the distancing from the unit is a parameter that gives to the result the confidence that the pairing adjusts to the observable characteristics and stays stable for the effects of the treatment.

Table 3 – Tests of Rosenbaum

Variable	Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
Grade Mathematics	1	0	0	389.63	389.63	388	391.27
	1.5	0	0	374.55	404.98	372.92	406.67
	2	0	0	364.13	415.88	362.48	417.63
Grade Reading	1	0	0	423.78	423.78	421.973	425.58
	1.5	0	0	406.93	440.7	405.1	442.54
	2	0	0	395.18	452.57	393.32	454.47
Grade Sciences	1	0	0	412.04	412.04	410.39	413.69
	1.5	0	0	396.82	427.58	395.19	429.28
	2	0	0	386.35	438.61	384.7	440.37

Source: Self Elaboration

Boards A.3 and A.4 (Appendix) present the results from the Firpo model. It is observed that students that reported they were made fun of and that had gossip spread continue to positively affect along the quantiles. Besides, students spanked as well as those threatened kept the negative behavior among the quantiles of grades.

However, this model became important for variables capturing the feeling of the student of being left out by the colleagues (composing the indirect bullying, of difficult identification) and those that had their belongings destroyed. Regarding the first one, a crescent and positive behavior is observed from the sixth quantile in the discipline of Mathematics. Thus, when the student is in the upper tail (with higher grades) they mark six more points in the test of Mathematics compared to that student who did not suffer the aggression. The student that had their belongings destroyed has a different behavior according to the analyzed discipline. In Mathematics, the effect of the variable is positive and greater in the upper tail, while in Reading and Sciences the effect is negative in the lower tails. In other words, the student with lower grades in Reading and Sciences is negatively impacted by the bullying, while the student with higher grades has positive impact in Mathematics.

The analysis by the grades quantiles is important for the creation of public policies. The effect of bullying is devastating, however, the effects show to be stronger for those with lower performance. These students may have greater chances of evasion, since the low performance leads to dropping out. Thus, it is necessary the elaboration of public policies protecting this public against this type of problem.

## FINAL CONSIDERATIONS

In the Brazilian context, violence has a great importance in the social impact and in the capacity of making vulnerable the victims and their families. Besides, children and adolescents are among the groups more victimized by the violence. Thus, studies involving child and violence in society – intra-family violence, in school and community - are necessary.

Bullying negatively affects the formation of human capital in schools. Thus, understanding the causal effects of the several aspects related with this variable in students' learning becomes an important subject for the creation of public policies. Bullying impacts the mental and personal development of the student, which sometimes may continue in adulthood. Through this work it was possible to identify which types of bullying negatively impact the grades of students.

This type of violence brings several consequences for the student besides the decrease of school performance, because it may lead to an early abandonment of the student life and, sometimes, difficulties in the labor market. The victims of bullying have greater risk to fail academically, as well as greater chances of weak performance at work (WOLKE et al., 2016). Studies point for psychological problems that children facing this type of aggression have anxiety, depression and shyness.

One country with an anti-bullying police that is having effect is Finland. The method is called KiVa (acronym of Kiusaamista Vastan, which means “against bullying” in Finnish) and has already been expanded for more than twenty countries in Europe and some nations of Latin America (Argentina, Peru and Colombia) decided to use the program. KiVa works not only after the identification of bullying with a trained team working with the victim, aggressors and witnesses, but also with the prevention of this practice. In Brazil there is a law that establishes the Program of Fight against Systematic Intimidation (Bullying)<sup>5</sup>. In article 6 it is established the provision of bi-monthly reports regarding the occurrence of bullying in States and Municipalities in order to plan the next actions. However, this law has not being fulfilled and there is no notice regarding the reports.

The present work highlights the importance of articulating different social actors and different sectors of society in order to implement public policies focusing on attitudes of peace and healthy coexistence. In addition, it is necessary to alert parents, teachers and students about this theme, since acts of bullying, mostly, happen outside the view of adults and a great part of the victims do not report them. Its prevalence is still underestimated by the society, however intervention is needed in order to reduce and interrupt such situations.

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<sup>5</sup> Available at: [http://www.planalto.gov.br/ccivil\\_03/ato2015-2018/2015/lei/113185.htm](http://www.planalto.gov.br/ccivil_03/ato2015-2018/2015/lei/113185.htm)

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## Appendix

**Figure A:** Distribution of sample before (left) and after pairing (right)

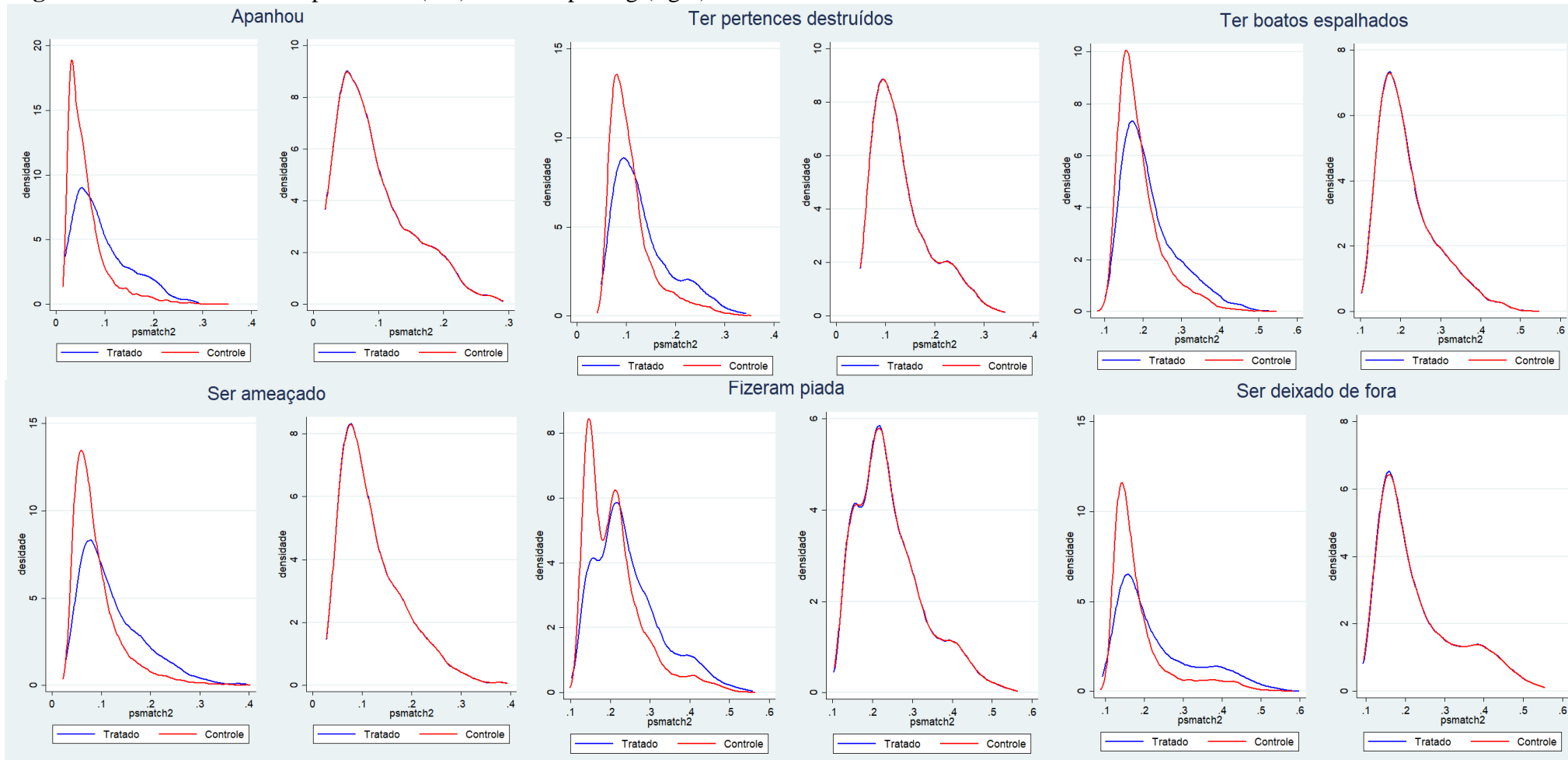


Table A.1– Results of *logit*

Variable	Having gossip spread	Being spanked	Being threatened	Having belongings destroyed	Made fun of	Being left out
private	0.22**	-0.13	-0.4***	-0.03	0.24***	0.3***
male	0.04	0.66***	0.45***	0.37***	0.5***	0.2***
schoolarity_father	0.0002	-0.019	0.03	0.017	0.004	0.001
schoolarity_mother	0.068***	0.09***	0.06***	0.05***	0.03**	0.03**
assets_home	-0.1	-0.32**	-0.28**	-0.16	-0.11	-0.12
assets_cultural	0.08*	0.18***	0.19***	0.15***	0.11***	0.07*
assets_family	0.13	0.21*	0.25**	0.14	0.04	0.04
grade_repetition	0.06*	0.36***	0.39***	0.22***	0.0009	0.05
age	-0.13	-0.38***	-0.26**	-0.29***	-0.12	-0.17**
size_class	-0.008***	-0.003	-0.007	-0.001	-0.007**	-0.007**
number_teachers	0.002	-0.0008	-0.001	-0.0002	0.003**	0.0009
number_girls	0.009	-0.004	-0.007	-0.006	-0.001	0.001
number_boys	-0.02**	0.003	0.013	0.003	-0.008	-0.01
like_me	-0.28***	-0.27***	-0.27***	-0.02	-0.02	-0.25***
feel_dislocated	0.34***	0.51***	0.49***	0.42***	0.264***	0.31***
feel_belongging	0.06	0.015	0.12	-0.015	0.05	0.027
friendship_easy	0.16***	0.07	0.07	0.04	0.06	0.067
feel_weird	0.31***	0.46***	0.39***	0.46***	0.45***	0.61***
feel_alone	0.27***	0.2**	0.135	0.09	0.31***	0.36***
_cons	0.61	2.56	1.216	2.02	0.092	1.18

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.10

Source: Self elaboration from data of PISA (2015)

Table A.2 – Balancing pre and post pairing

	Pseudo-R <sup>2</sup>	LR chi <sup>2</sup>	P-value	Average Bias	Average Median
non_paired	0.024	260.72	0	10.3	9.3
paired	0.002	9.73	0.973	1.4	1.1

Source: Self elaboration from data of PISA (2015)

Board A.3 – Results QTE

	Having Gossip Spread			Being spanked			Being Threatened		
	grade_mathematics	grade_reading	grade_sciences	grade_mathematics	grade_reading	grade_sciences	grade_mathematics	grade_reading	grade_sciences
Quantile 1	5.22 (3.24)	3.97 (3.79)	1.89 (3.24)	-12 (6.46)*	-26.9(6.4)***	-13.57(5.88)**	-10.24(5.83)*	-18.22 (5.3)***	-6.81 (4.14)*
Quantile 2	4.83 (3.06)	2.09 (3.59)	0.143 (2.72)	-8.4 (5.68)	-31.2 (5.7)***	-12.5(4.16)***	-5.11(4.37)	-19.41(5.17)***	-12.86 (3.59)***
Quantile 3	6.65 (3)**	4.26 (3.41)	0.8 (2.88)	-6.41 (5.16)	-27.8 (5.9)***	-19.4(4.78)***	-2.78(4.33)	-12.63 (4.7)***	-10.54 (4.53)***
Quantile 4	9.38 (2.8)***	7.05(3.33)**	2.76 (3.26)	-5.49 (5.22)	-27.39 (6.11)***	-15.45 (6.19)***	0.7 (3.96)	-14.85 (4.59)***	-8.26 (4.96)*
Quantile 5	7.7 (2.86)***	8.42(3.31)***	8.15 (3.09)***	-5.32 (5.16)	-27.49 (5.99)***	-12.36(5.94)**	-3.75(3.62)	-13.44 (5.17)***	-2.71(4.46)
Quantile 6	7.15 (3.03)**	7.06 (3.19)**	7.4 (3.03)***	-6.1(5.13)	-25.62(7)***	-10.97(5.73)**	-6.63(3.93)*	-11.09(5.1)***	-6.14(4.21)*
Quantile 7	8.59 (3.2)***	5.95 (3.44)*	4.333 (3.19)	-9.25 (5.77)	-21.5 (7.04)***	-13.99 (5.95)**	-10.04(4.52)**	-12.38 (5.17)***	-8.98(4.44)**
Quantile 8	6.25 (3.42)*	8.25 (3.66)**	6.88 (3.54)**	-8.02(6.71)	-16.41 (7.79)***	-11.04(7.47)	-10.28(5.16)*	-13.18 (5.11)***	-11.68(4.91)**
Quantile 9	8.08 (4.09)**	4.2 (3.83)	5.52 (3.79)	-7.65 (8.44)	-7.66 (11.73)	-9.26 (8)	-10.19(5.63)**	-14.84(6.1)**	-12.9(5.68)**

Source: Self elaboration

Board A.4 – Results QTE

	Made fun of			Being Left Out			Having Belongings Destroyed		
	grade_mathematics	grade_reading	grade_sciences	grade_mathematics	grade_reading	grade_sciences	grade_mathematics	grade_reading	grade_sciences
Quantile 1	5.43 (3.347)	4.5 (3.77)	9.44 (2.95)***	1.22 (3.37)	-1.15 (3.8)	4.4 (3.08)	-0.57 (4.26)	-11.1(4.6)**	-2.6 (3.79)
Quantile 2	5.77 (2.98)*	5.17 (3.47)	6.17 (2.66)**	1.48 (3.12)	-1.39 (3.49)	-0.002 (2.67)	1.29 (3.9)	-11.2(4.7)**	-6.9(3.32)**
Quantile 3	8.04 (2.82)***	6.62(3.09)**	6.48 (2.75)**	5.21 (2.95)*	-0.24 (3.39)	-0.27 (2.82)	0.67 (4)	-6.01(4.2)	-6.43 (3.75)*
Quantile 4	9.59 (2.77)***	7.4 (3.25)**	6.24 (2.94)**	5.16 (2.87)*	3.36 (3.44)	-0.04(3.14)	4.79 (3.81)	-7.85 (4.3)*	-5.11 (4.5)
Quantile 5	9.35 (2.92)***	10.62(3.27)***	10.4 (2.98)***	5.73 (3.03)*	3.03 (3.45)	3.89 (3.21)	4.44 (3.84)	-2.1(4.9)	3.21 (4.64)
Quantile 6	11.05 (3.15)***	9.41 (3.14)***	11.14 (3.11)***	4.98 (3.03)*	5.53 (3.27)	5.26 (3.17)	6.33 (4.02)	-0.22 (4.15)	6.21 (4.22)
Quantile 7	13.84 (3.19)***	8.57 (3.38)**	11.42 (3.3)***	5.47 (3.31)*	1.84 (3.31)	1.89 (3.33)	7.19 (4.63)	-4.3 (4.3)	4.62 (4.1)
Quantile 8	13.6 (3.46)***	10.65 (3.56)***	12.46 (3.57)***	6.23 (3.83)*	0.25 (3.61)	3.63 (3.64)	9.98 (4.67)**	-3.45 (4.7)	2.42 (4.46)
Quantile 9	14.81 (3.93)***	11.31 (4.37)***	12.92 (3.83)***	0.84 (3.71)	-2.35 (4.1)	(0.99) (4.1)	13.91 (5.44)***	-3.86 (5.49)	4.06 (5.4)

Source: Self elaboration