Girls vs. Boys: Who is Dropping Out of School Because of Bullying?

Adan Silverio Murillo *

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Abstract

Despite the rising interest in bullying, there is little evidence about its effects on dropping out of school, and this evidence suffers from the problem of omitted variables. To understand the effect of bullying on dropping out of school, I exploit a rich data set of adolescents between 13 and 16 years old from families participating in the Mexican conditional cash transfer program PROGRESA. Boys experience higher rates of bullying than girls, but bullying affects only girls' probability of dropping out of school. In particular, a one standard deviation increase of being bullied increases girls' probability of dropping out of school by 10 percentage points. To address the problem of omitted variables, I implement two novel bounding techniques: one developed by Oster (2016) and the other by Krauth (2016). My results suggest that the estimates are robust to omitted variable bias.

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*University of Minnesota. E-mail:silve346@umn.edu

1 Introduction

Bullying is a problem that exists in many countries around the world. It ranges from 9 percent in Italy to 74 percent in Samoa among adolescents between 13 and 15 years old (United Nations, 2014). Alarmingly, bullying has been associated with increasing levels of depression (Tfoti, Farringon, Lösel, and Loeber, 2011), problems of low self-esteem (Smokowski and Kopaz, 2005), and affecting academic performance (Nakamoto and Shwartz, 2010). Despite the overall negatives effects of bullying on the well-being of adolescents, there is little research about its effects on drop out rates in schools.

To understand the effect of bullying on the probability of dropping out of school, I exploit a rich data set of adolescents between 13 and 16 years old from families participating in the Mexican conditional cash transfer program PROGRESA. The results show that boys experience higher rates of bullying than girls, but bullying has consequences for girls dropping out of school, but not for boys. In particular, one standard deviation increase in being bullied increases the probability of girls dropping out of school by 10 percentage points.

One of the United Nation's Sustainable Development Goals (SDGs) states that all girls and boys will complete their secondary education by 2030 (United Nations, 2015). Yet, bullying can be a roadblock in achieving this goal. To the best of my knowledge, there are only two papers that analyze the relationship between bullying and dropping out of school. Cornell et al. (2013), using data from 276 Virginia public schools in the United States, suggest that one standard deviation increase in being bullied is associated with 16.5% increase in the number of dropouts. Townsend et al. (2008), using data from 1,470 students in Cape Town, South Africa, find that when facing bullying, girls - but not boys - are more likely to drop out of school.[1] While these papers control for several well-known variables related with dropping out of school, their results could potentially be biased as a consequence of other important omitted variables. For example, factors related with the adolescents' personality can

[1] In particular, using a logistic regression, they report an odds ratio of 2.60

help them to cope with bullying, but this information is not completely observed in the data.

A common approach to evaluate robustness to omitted variable bias is to include additional control variables in a regression. Altonji, et al. (2005) and Oster (2016) observed that adding controls is not enough. In particular, they argue that it is necessary to observe the movements in the coefficient of interest, but also the changes in the R-squared. To assess the problem of omitted variable bias, I use two recently developed bounding methodologies: one developed by Oster (2016) and the other by Krauth (2016). Their strategy assumes that adding controls is informative about unobservable variables, and based on this assumption, conditions for bounds and identification are provided.

This paper contributes to the literature showing that bullying is an important variable that has consequences on dropping out of school. Using the methodologies of Oster (2016) and Krauth (2016), I find that bullying is robust to the problem of omitted variables. In addition, this paper provides support to the "gender paradox effect" of bullying proposed by Loeber and Keenan (1994). The gender paradox effect establishes that boys experience higher rates of bullying than girls, but bullying affects more negatively the well-being of girls than boys. Finally, using the methodology proposed by Acharia et al. (2016), I test whether bullying affects girls' probability of dropping out of school through the following channels: self-esteem, anxiety, and stress. I find a strong direct effect between bullying and dropout rates; and no evidence to suggest that the channels are via self-esteem, anxiety, or stress.

In terms of public policy, it is necessary to analyze the relationship between bullying and conditional cash transfers (CCTs). CCTs are increasing the enrollment of adolescents from low-income families in schools[2]; but the negative social stigma associated with poverty po-

[2]Conditional cash transfers (CCTs) have systematically proved to be effective policies to reduce dropout rates (Kremer et al. 2013, Snilstveit et al. 2016). These programs offer cash transfers to families living in poverty on the condition that they send their school-age children to school. These programs were started in Mexico by the well-known social program PROGRESA which showed positive impacts on school enrollment. For example, the program resulted in one additional year of school in the adolescents who are beneficiaries (Skoufias and Parker 2001). And based on this evidence, more than 50 countries have replicated the model.

tentially makes these adolescents more vulnerable to being bullied at school. Székely (2015), using a survey of dropouts between 15 and 17 years old in Mexico, finds that the percentage of dropouts who reported harassment by other students as the principal cause for dropping out of school is 2.8%. But this reason is 11.3% for dropouts who have a PROGRESA scholarship. In this sense, bullying potentially can reduce the positive effects of PROGRESA. While the results presented here are limited to adolescents participating in PROGRESA, this potentially can be an unintended consequence happening in other conditional cash transfers programs around the world.

The rest of the paper is organized as follows: Section 2 introduces some related literature; Section 3 introduces the data and the empirical strategy; Section 4 presents the results; and I conclude with Section 5.

2 Related Literature

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Székely (2015), using a national survey of dropouts between 15 and 17 years old, finds some reasons for not attending school in Mexico (see Table 1): lack of money (39%); lack of interest in school (11%); and the student failed some courses (11%). When analyzing the data for adolescents who received scholarships from PROGRESA, he found that lack of money is still one of the most significant reasons, but the percentage is reduced to 24%. More interesting is the question related to dropping out of school as a consequence of harassment by other students. At the national level, the percentage of dropouts who reported this reason is only 2.8%, but this reason is 11.3% for dropouts who have a PROGRESA scholarship. This result can be a consequence of the condition of poverty of PROGRESA's students. However, it is important to consider that it can be a social stigma associated with participating in this program.

According to INEGI (2014), 32.2% of students in Mexico between 12 and 18 years old were victims of abuse by their classmates. To the best of my knowledge, there are no studies in Mexico about the causal effects of bullying on dropping out of school, yet it is clear that being bullied has negative consequences on the adolescents' well-being. Sarzosa and Urzúa (2015) find that being bullied at school causes depression, stress, and overall dissatisfaction with life. And dissatisfaction with life is associated with low levels of self-estem. In this sense, Waddell (2006) finds that adolescents with low self-esteem complete less years of upper secondary school education and are less likely to be employed as adults. As a consequence, being bullied can be an important factor to explain why young people are dropping out of the school.

It is equally important to consider the adolescents' gender when analyzing bullying. Loeber and Keenan (1994) show that boys present higher rates of bullying than girls, but bullying affects more negatively the well-being of girls than boys (the gender paradox). Townsend et al. (2008), using data from 1,470 students in Cape Town, South Africa, find that when facing bullying, girls - but not boys - are more likely to drop out of school.

To analyze the effect of bullying on dropping out of school, I use data for adolescents participating in the Mexican conditional cash transfer program PROGRESA. PROGRESA offers cash transfers to families living in poverty on the conditions that they send their school-age children to school.[3] The scholarship amounts increase as the school-age children reach higher grades levels. The size of the scholarship under PROGRESA is designed to cover the opportunity cost to the family of keeping their children in school. This opportunity cost is measured as the potential salary these children could earn from working (Levy and Rodríguez, 2005).

[3]In addition, the adolescents need to participate in local health clinics on a regular basis.

Despite the success of PROGRESA,[4] the percentage of lower secondary students who continued onto upper secondary school was below 60% until 2010 (see Figure 1). From 2011 to 2014, this percentage increased from 64.5% to 71.4%. While this increase is considerable, almost 30% of adolescents do not reach upper secondary school.[5] Gutiérrez, Norman and Alcalá (2013), find that 35% of adolescents between 14 and 17 years old from families participating in this program are not enrolled in school, and this percentage is higher than the national rate of 27%.

Bentaouet and Székely (2014), using data from Mexico, find that having a post-secondary education is associated with income levels approximately 3.5 times higher than those observed for individuals with only a lower secondary education, and 2 times higher than individuals with an upper secondary education. If the returns on education are high in Mexico and the opportunity cost is covered, one would expect the students in the program to continue attending the school. However, the program design does not consider other potential factors that can increase the cost of attending school, such as bullying. And bullying can be a potential factor affecting the dropout rates for adolescents participating in the PROGRESA program.

[4]The evaluations of the program has shown positive impacts. For example, PROGRESA increased years of schooling by one year for adolescents who participated in the program (Skoufias and Parker, 2001), and for children between 12 and 36 months who participated in PROGRESA were one centimeter taller (Behrman, et. al. 2008). In 2002, the program changed its name to *Oportunidades*. Based on its success, the program expanded to include five million families (i.e. one in five families in Mexico) and extended the scholarships to upper secondary school students. Also, a new incentive was incorporated called *Jóvenes con Oportunidades*, which gives money directly to the students who complete upper secondary education. Under *Oportunidades*, the program increased its presence in urban areas. For the period from 2008 to 2010, the number of participating families in urban areas increased from 759,494 to 1,559,494. In 2015, the program changed its name to PROSPERA, adding new components in order to promote productive activities among the women, such as access to credits at a low interest rate. Today, the program serves more than 6.8 million families in Mexico.

[5]It is possible that this result is consequence of the expansion of the program to urban areas. When the program was predominantly in rural areas, the transition from lower secondary to upper secondary was below 60%. But, when the program incorporated a considerable number of children in urban areas this percentage increased to 71.4%. In other words, this increase in the percentage is potentially capturing the higher rates of enrollment in urban areas rather than sucessful improvements of the program.

3 Data

To analyze the effects of bullying and the death of a parent on dropping out of the school, I use a database that was developed in 2010 to analyze the conditions of families living in poverty who were participating in Mexico's PROGRESA conditional cash transfer program. The survey collected information about non-cognitive skills from adolescents and their parents. A random sample of 2,112 households was selected from families participating in the program in both rural and urban areas. In the case of the adolescents, it was decided to collect information from those between 13 and 16 years old. The survey collected information from 1,093 of these adolescents in 837 households. Two children who never went to school were excluded, so the final sample for this study is 1,091 adolescents.

Of these 1,091 young people between the ages of 13 and 16, 80.3% were attending the school and 19.7% dropped out of school. For those who were attending the school, 65.4% were attending the school and not working outside the home, and 14.9% were attending the school and working outside the home. In the case of the 19.7% who dropped out of the school, 11.5% were working outside the home and not attending school, and 8.2% were neither working outside the home nor attending school (see Table 2).[6] There are important differences between boys and girls who dropped out of school. Regarding the adolescents who neither work outside the home nor attend school, the percentage of boys in this group is only 3.3%, while the percentage of girls is four times higher (14.3%). In the case of the adolescents who are working outside the home and not attending school, the percentage of girls in this group is 5.2%, while the percentage of boys is more than three times higher (16.5%).

In the case of bullying, I develop an index based on principal components. In addition,

[6]The survey asked these adolescents about their current labor-education situation. The adolescents responded by selecting the group that they were most closely related to, i.e. attending school and not working outside the home, working outside the home and not attending school, working outside the home and attending school; and neither working outside the home nor attending school.

based on the same methodology, I develop indexes for the following variables that I will use as controls: self-esteem, authoritative parents, and family support. The bullying index is based on Rigby (1998), and the self-esteem index is based on Rosenberg (1965). The measure of authoritative parenting style is based on Arnold, O'Leary, Wolff and Acker (1993) and Robinson et al. (1995). Finally, the family support scale is based on Millburn (1987) and Zimet, Dahlem, and Farley (1988). All the tests were adapted by Palomar (2015) in Mexico. The questions have the following categorical answers: "always", "frequently", "rarely" and "never". I aggregate those answers into scales using principal components analysis where only one latent factor was retained.[7] I then standardized the value of the latent variables to have a mean of zero and a standard deviation of one. The results show that there is little difference between boys and girls regarding self-esteem, authoritative parents, and family support. However, on average, boys present higher levels of bullying than girls (see Table 3).

The data contains other information that I will use as control variables. Regarding health problems, 5.1% of the adolescents have (or have had) a disease that interferes (interfered) with their activities (see Table 3). This percentage is higher for girls (6.6%) than for boys (3.9%). There are 4.4% children who have a parent in prison, and 5.4% of children from who one of the parents has died. The data also contain information on whether girls have become pregnant and whether boys have impregnated girls. Overall, 4.8% of these adolescents stated they are in this situation. However, this percentage is 5.5% for girls and 4.2% for boys (see Table 3). Concerning siblings, on average, these adolescents have three siblings, of which two are older. Table 3 also reports information about alcohol consumption of parents. The adolescents reported that 2.3% of their mothers consume alcohol, while the percentage is 24.6% for fathers. Regarding insecurity, these adolescents were asked questions about observing the following activities in their neighborhood: gangs, people selling drugs, and prostitution. On average, boys observe more of these activities than girls, for example, 32.0% of boys have

[7] I present the results of the principal components in Table A1 of the appendix. Column 1 presents the scales with its eigenvalues, Column 2 presents the questions used to build each scale, and Column 3 shows the loading associated with each question.

observed people selling drugs, while this percentage is 23.8% for girls (see Table 3).

4 Estimation Strategy

4.1 Identification Strategy

This paper analyzes the effects of bullying on the probability of dropping out of school for adolescents participating in *PROGRESA*. The model to estimate is given by:

$$Y = \beta\ T + \gamma\ X + e\ .$$

where Y is the outcome of interest (a dummy variable indicating whether an adolescent has dropped out of school), T is the variable of interest (bullying), X is a vector of observed control variables; and e is an error term with mean zero.

A study of this type presents some econometric challenges. The measure of bullying is a proxy, so there is a potential problem of measurement error. It is well-known that when regressors are measured with random error, the parameters estimated tend to be biased toward zero. In addition, bullying may be correlated with other psychological variables not present in the data, and if such variables are correlated with the outcome of interest, then they can generate bias in estimated impacts of bullying and other observed variables. Finally, reverse causality is minimal, but can be a potential problem. In the case of students who dropped out of school, the questions regarding bullying refer to the time when the adolescents were attending school. A potential problem of reverse causality can occur if the drop outs return to the school and affect the level of bullying. However, using data from Mexico, Baron et al. (2016) find that once young people between 15 and 18 years old leave school, it is very unlikely that they will return; thus, it minimizes the possibility that not attending school can affect the level of bullying.

To address the problem of omitted variable bias, I use two recently developed bounding methodologies: one developed by Oster (2016) and the other by Krauth (2016). Consider first Oster's (2016) methodology. A common approach to evaluate robustness to omitted variable bias is to include additional control variables on the right hand side of the regression (Altonji et al., 2005). If such additions do not affect the coefficient of interest, then this coefficient can be considered to be reliable. This strategy implicitly assumes that selection on observables is informative about selection on unobservables. Oster (2016) formalize this idea, and provides conditions for bounds and identification. Following the notation in Oster (2016), the full model has the form:

$$\text{Y}= \beta \text{ T}+ X_1 + X_2 +\epsilon.$$

where T is the variable of interest, X_1 contains the *observed* control variables multiplied by their coefficients, i.e. $X_1 = \sum_{j=1}^{J_o} x_j^o \gamma_j^o$, and X_2 contains all *unobserved* variables multiplied by their coefficients, i.e. $X_2 = \sum_{j=1}^{J_u} x_j^u \gamma_j^u$. Finally, ϵ is a random error that represents measurement error in Y. Oster (2016) suggests the following approach to account for omitted variable bias:

(1) Regress Y on T, and report the parameter on T, denoted by β^0, and the R-squared coefficient, denoted by R^0.

(2) Regress Y on T and X_1, and report the parameter on T, denoted by $\tilde{\beta}$, and the R-squared coefficient, denoted by $\tilde{R}$.

(3) Define R_{max} as the overall R-squared of the model, that is the R-squared that would be obtained from a regression of Y on both, observables (T, X_1) and unobservables (X_2). Also, define δ to be a parameter that ensures the equality $\frac{Cov(T,X_2)}{Var(X_2)} = \delta \frac{Cov(T,X_1)}{Var(X_1)}$. In other

words, this relationship formalizes the idea that the magnitude and sign of the relationship between T and X_1 provides some information about the magnitude and sign of the relationship between T and X_2.[8] Oster (2016) shows that $\beta^* = \tilde{\beta} - \delta \frac{(\beta^0 - \tilde{\beta})(R_{max} - \tilde{R})}{(\tilde{R} - R^0)}$ is a consistent estimator of the effect of T on Y, β.

But, to estimate β^*, one needs estimates of δ and R_{max}. Oster proposes assumptions for δ and R_{max} that allows one to determine whether β^* is different from zero. Oster (2016) proposes that $R_{max} = min\{1.3\tilde{R}, 1\}$, where the $\tilde{R}$ is defined above.[9] An alternative value for R_{max} is given by Gonzalez and Miguel (2015), who used $R_{max} = \tilde{R} + (\tilde{R} - R^0)$. In addition to the R_{max} proposed above, I will use a conservative $R_{max} = 1$. After determining the value of R_{max}, Oster suggests that β^* be calculated for all the following ranges of δ: $0 \leq \delta \leq 1$.[10] This allows one to construct the following set $[\tilde{\beta}, \beta^*]$. If this set excludes zero, the results from the controlled regressions can be considered to be robust to omitted variable bias. In other words, the results indicate that $\beta^* \neq 0$.

One benefit of Oster's bounding methodology is that it provides an intuitive way to arrive at a bounding strategy. However, her approach requires information for two key parameters (R_{max} and δ), and her method does not provide statistical inference about the bounding. Krauth's bounding methodology, while more complex, needs information only about δ and provides inference about the bounding based on Imbens and Manski (2004) confidence intervals. His methodology proceeds using the following model:

Y=β T + X_1 + ϵ, where $E(X_1\ \epsilon) = 0$

[8]For example, if $-1 \leq \delta \leq 1$, then the variable of interest is no more correlated with unobservables (X_2) than it is correlated with observables (X_1). The case $0 \leq \delta \leq 1$ has a similar interpretation, with the additional assumption that the relationship between T and X_1 have the same sign as the relationship between T and X_2.

[9]The cut-off value of 1.3 is derived from a sample of 65 papers that have used randomized controlled trials. She determined that using this cut-off allowed 90% of the randomized results to continue being statistically significant.

[10]In addition, I will present the results for δ: $-1 \leq \delta \leq 0$.

Krauth specifies δ such that:

$$Cov(T, \epsilon)\sqrt{Var(X_1)} = \delta Cov(T, X_1)\sqrt{Var(\epsilon)}$$

where $\delta \in \Delta = [\delta^L, \delta^H]$, i.e. in a finite interval.

Let $B_T(\Delta)$ be defined as the set of all $\tilde{\beta}$ satisfying:

$$Cov(T, Y - \tilde{\beta}T - X_1)\sqrt{Var(X_1)} = \delta Cov(T, X_1)\sqrt{Var(Y - \tilde{\beta}T - X_1)}$$

Krauth shows that this set is nonempty, and more importantly, that it is possible to identify the infimum and the supremum of this set. As a consequence, a bound around β, can be generated using the infimum as the lower bound and the supremum as the upper bound. See Krauth (2016) for the details of how his approach allows him to obtain the Imbens and Manski (2004) confidence interval for the identified set.

5 Results

To analyze the effects of bullying on dropping out of school, I first present the results using an OLS regression, and then apply the bounding strategies.[11]

5.1 Determinants of Adolescents Who Dropped Out of School

Table 4 column 1, presents a linear probability model (OLS regression) of the impacts of bullying on the probability of dropping out of school. I control for father died, mother died, parent in prison, sex, number of siblings, number of siblings who are older, age, and age

[11]The Oster and Krauth strategies use a linear regression which explains why I use OLS over other alternatives such as a probit or logit. However, when analyzing the variable of interest (bullying), the results using probit or logit are similar to those using OLS (see Table A2 in appendix).

squared. The results show that one standard deviation increase in being bullied increases the probability of dropping out of school by 5.6 percentage points. To check for the robustness of this result, column 2 incorporates dummy variables for states, and column 3 uses dummy variables for municipalities. Bullying continue to be statistically significant, although their impacts are somewhat diminished.

Given that bullying is measured with error, if this measurement error is random, then the effect presented above is an estimated of the lower bound on the effect of bullying on dropping out of school. However, it is also possible that estimates of the impact of bullying is affected by omitted variable bias. One way to assess this problem is to add controls and analyze the stability of the parameter of interest. Table 4, column 4 reproduces the analysis of column 3, but includes more controls. The controls consist of information about girls' pregnancies and boys impregnating girls, the feeling of being insecure within their neighborhoods (existence of gangs, people selling drugs, and prostitution), information about self-esteem and health problems (i.e. whether the adolescent has experienced a disease that interferes with their activities), and characteristics of their parents: having authoritative parents, family support, and the alcohol consumption of the mothers and fathers.[12] Bullying continue to be statistically significant. Comparing column 3 with column 4 of Table 4, the coefficient associated with bullying decreased from 4.9 to 3.8 percentage points.

Oster (2016) shows that just adding controls, which is a common strategy, is not enough to avoid omitted variable bias. Table 5 presents results using Oster's methodology to analyze the robustness of the results presented above. Panel 1 presents the results when $0 \leq \delta \leq 1$, i.e. assuming that the relationship between the variable of interest and the (aggregated) controls have the same sign as the relationship between the variable of interest and the unobservables. Column 1 estimates bounds using the value of the R_{max} proposed by Oster (2016), which yields a bounding estimate of [0.055, 0.056]. To provide a similar robustness

[12] I do not have information on alcohol consumption of the mothers and fathers when the father or the mother has died. These missing values were replaced by the average of the respective variables.

check, I estimate bounds using the R_{max} proposed by Gonzalez and Miguel (2015). The bounding estimated is [0.055, 0.056]. To further check the robustness of the results, I use the extreme value that $R_{max} = 1$, which yields a bounding estimate of [0.045, 0.056].

Panel 2 presents the results when $-1 \leq \delta \leq 0$.[13] Assuming the R_{max} proposed by Oster, the bounding estimated is [0.056, 0.057]. Using the R_{max} proposed by Gonzalez and Miguel, the bounding is [0.056, 0.057]. Finally, using a conservative $R_{max} = 1$, the bounded estimated has a range of [0.056, 0.067]. To sum up, the effect of bullying on dropping out of school is robust when using Oster's methodology.

Table 5 column 4, presents analogous results using Krauth's methodology. Assuming $0 \leq \delta \leq 1$, the bounding associated with bullying is [0.044, 0.056]. The 95% confidence interval associated with bullying is (0.005, 0.081). Assuming $-1 \leq \delta \leq 0$, the bounding associated with bullying is [0.056, 0.065]. The interval confidence at the 95% level associated with bullying is (0.030, 0.094). Finally, I present the value of the minimum δ for which the bounds include zero, being this value 3.234. As a consecuence, regardless of which methodology is used, bullying is robust to the problem of omitted variables.

Bullying can potentially have different consequences by sex. Table 6 reproduces the results presented in Table 4, but differentiating between girls (columns 1 to 3) and boys (columns 4 to 6). When analyzing girls, the results show that bullying is statistically significant (see column 1). This result is maintained when dummy variables for states (column 2) and municipalities (column 3) are included. In the case of the boys, the OLS results are presented in Table 6, columns 4 to 6. The regressions are analogous to those presented in columns 1 to 3 for girls. Bullying is statistically significant (see column 4), and this results is maintained when dummy variables for states (column 5) and municipalities (column 6) are included.

[13]The case $-1 \leq \delta \leq 0$ assumes that the relationship between T and X_1 has different sign than the relationship between T and X_2.

To analyze the robustness of the effects of bullying on girl's probability of dropping out of school, I apply Oster's methodology and the results are presented in Table 7. Panel 1 row 1 presents the results when $0 \leq \delta \leq 1$. Column 1 use the R_{max} proposed by Oster, which yields a bounding estimated of [0.102, 0.107]. Using the R_{max} proposed by Gonzalez and Miguel (2015), the bounding estimated is [0.102, 0.115]. Finally, using a conservative $R_{max} = 1$, the bounded estimated has a range of [0.102, 0.195]. Assuming $-1 \leq \delta \leq 0$, the effects of bullying on the probability of dropping out of the school is presented in row 2. Using the R_{max} proposed by Oster, the bounding estimated is [0.097, 0.102]. Using the R_{max} proposed by Gonzalez and Miguel, the bounding is [0.090, 0.102]. Finally, using a conservative $R_{max} = 1$, the bounded estimated has a range of [0.010, 0.102]. Thus, bullying is robust to the problem of omitted variables for different assumptions using Oster's methodology.

Table 7 column 4 row 1 presents the results using Krauth's methodology for the effects of bullying on girl's probability of dropping out of school. Assuming $0 \leq \delta \leq 1$, the bounding associated with bullying is [0.102, 0.118]. The interval confidence at the 95% level associated with bullying is (0.063, 0.165). In panel 2 column 4 row 4, assuming $-1 \leq \delta \leq 0$, the bounding associated with bullying is [0.087, 0.102]. The interval confidence at the 95% level associated with bullying is (0.029, 0.141). Finally, I present the value of the minimum δ for which the bounds include zero. Being this value -9.217. The results using Krauth's methodology confirm the previous result based on Oster's methodology regarding the robustness of the bullying to the problem of omitted variables when analyzing its effects on girl's probability of dropping out of school.

To analyze the robustness of the results for the case of boys, I again apply Oster's methodology. The results are presented in Table 8. When $0 \leq \delta \leq 1$ and $R_{max} = 1$, the bounding is [-0.021,0.038]. Thus, the estimated bounds include zero. The results using Krauth's methodology are presented in column 4. The estimated bounds for bullying exclude zero.

However, when $0 \leq \delta \leq 1$ the confidence interval associated with the variables of interest include zero. So, in the case of boys, bullying is not robust to the problem of omitted variables.

5.2 Mechanisms and Discussion

Bullying is an important factor explaining the probability of dropping out of school for girls. However, this opens the question about what are the mechanisms in which bullying affects the dropout rates. In particular, is bullying increasing the dropout rates because of its effects on adolescents' well-being (self-esteem, anxiety, and stress)? Or is bullying increasing the probability of dropping out of school *independent* of the problems associated with the well-being of adolescents?

The psychological literature suggests that being bullied affects the levels of self-esteem, anxiety, and stress. First, I analyze if these relationships are present in the data, and second, if these variables are the potential mechanisms in which bullying affects the probability of dropping out of school. Table 9 presents an OLS regression of the impacts of bullying on self-esteem (column 1), anxiety (column 2), and stress (column 3). The results confirm the relationship between bullying and the variables of interest. In particular, the results presented show that a one standard deviation increase in being bullied is associated with: a decrease of .15 standard deviation in the index of self-esteem; an increase of .20 standard deviation in the index of anxiety; and an increase of .30 standard deviation in the index of stress.

To test whether bullying affects girls' probability of dropping out of school through self-esteem, anxiety, stress, and peer relationships, I will use the methodology proposed by Acharia et al. (2016). A common approach to identify mechanisms is to simply control for post treatment variables, i.e. variables that are believed to be the mechanisms through the variable of interest is affecting the outcome. In this case the potential post treatment

variables are self-esteem, anxiety, and stress. If the post treatment variables are significant and they dropped out the significance of the variable of interest (in this case bullying), then we can say that the post treatment variable is a mechanism through bullying is affecting the outcome of interest. Acharia et al. (2016) present evidence that condition on post treatment variables potentially introduces bias; and in order to handle with this problem they propose a sequential g-estimation. The basic idea is that instead of including directly the post treatment variable on the right hand side, they follow a two-step approach. In the first step, they calculate the effect of the post treatment variable (mechanism) on the outcome controlling for the variable of interest (bullying) and other controls. In the second step, they demediate the outcome of interest with the value associated with the post treatment variable. Finally, they regress the outcome demediated on the variable of interest and the pretreatment confounders.

Figure 2 presents the results when self-esteem is considered as a mechanism between bullying and dropping out of school. Model (a) is the baseline model using the covariates presented in Table 6. The coefficient associated with bullying is .102. Model (b) presents the results when using the g-estimation model, and the coefficient associated with bullying is .10. Thus, the direct effect of bullying on dropping out of school using the g-estimation is almost identical to the baseline. Figure 3 presents the analysis when the mechanism is anxiety. The coefficient associated with bullying is .0970 when using the g-estimator. Finally, Figure 4 presents the coefficient associated with bullying when the mechanism is stress and its value is .0979. So, it appears that there is a strong direct effect of bullying on dropouts even if the girls have no problems of self-esteem, anxiety, or stress. Another interpretation of this result is that other mechanisms than those used above have an indirect effect on dropout rates.

Another important question is what happens with girls after dropping out of school. Do girls, after suffering bullying, end working outside the home? Or Do girls end neither studying nor working outside the home? Table 10 presents results similar to these in Table 6, except that the dependent variable is a dummy for girls who neither work nor attend

school, and thus it excludes those who work and do not attend school. The regressions are presented in columns 1 to 3. The results show that bullying is statistically significant (see column 1). These results continue to hold when dummy variables for states (column 2) and for municipalities (column 3) are included. Regarding the coefficient associated with bullying, a one standard deviation increase in being bullied increases that probability by 7.2 percentage points. Table 10, columns 4 to 6, presents results similar to those in columns 1 to 3, except that the dependent variable is a dummy variable for girls who work but do not attend school, and thus it excludes those who neither work nor attend school. Bullying is statistically significant (see column 1). And this result is maintained when dummy variables for states (column 2) and municipalities (column 3) are included. In particular, a one standard deviation on bullying increase the probability of working but not attending the school by 5.3 percentage points. Thus, once girls dropping out of school as a consequence of bullying, they end working outside the home, but also it is probable that girls end neither studying nor working outside the home.

PROGRESA has positive effects on education, but its current design does not protect individuals (particularly girls) from the social cost of bullying. This opens the question about what can be done to protect young people from these factors. To design better public policies to attack the problem of bullying, it is necessary to understand its causes, including the possibility that being part of the PROGRESA program can generate a negative social stigma.

6 Conclusion

This paper finds evidence that bullying is an important factor to explain drop out rates. Previous literature analyzing this relationship has faced the problem of omitted variables. To address this problem, I use two newly developed bounding methodologies – one developed by Oster (2016) and the other by Krauth -, which provide evidence that bullying is robust to the problem of omitted variables. In particular, I find evidence that when bullying occurs, girls – but not boys – are more likely to drop out of school. This result supports the "gender paradox effect" of bullying proposed by Loeber and Keenan (1994). This paradox said that boys present higher rates of bullying than girls, but bullying has more negative consequences on the well-being of girls than boys. Regarding the mechanisms, I analyze whether bullying affects girls' probability of dropping out of school trough self-esteem, anxiety and stress. Using a recent methodology developed by Acharia et al. (2016), I do not find strong evidence that self-esteem, anxiety and stress are the mechanisms.

PROGRESA is a successful conditional cash transfer program that has increased the enrollment of adolescents living in poverty. Unfortunately, the condition of poverty has been associated with increasing rates of being bullied. Thus, on the one hand PROGRESA reduces the cost of attending the school for these adolescents; but, on the other hand, it increases the chances that these adolescents suffer from bullying with the potential result of dropping out of school. While the results of this paper apply to the case of PROGRESA, it is necessary to explore if this situation is happening in other conditional cash transfers around the world.

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8 Figures and Tables

Table 1: **Causes of School Dropout among Adolescents between 15 and 17 years by Types of Scholarship**

	Total	**PROGRESA Scholarship**
	%	%
Lack of money	39.4	24.0
Lack of interest toward school	10.6	23.6
The student failed some courses	10.6	22.8
Harassment by other students	2.8	11.3
Other	36.6	18.3

Source: Table adapted from Székely (2015)

Table 2: **Education and Labor Situation among Adolescents between 13 and 16 years old**

	Total	**Men**	**Women**
All	%	%	%
Studying	65.4	59.2	73.3
Studying and working outside the home	14.9	21.0	7.2
Working outside the home	11.5	16.5	5.2
Neither studying nor working outside the home	8.2	3.3	14.3
Total	1,091	608	483

Source: Encuesta de resiliencia en beneficiarios de *Oportunidades* .

Table 3: **Basic Descriptive Statistics**

	Total		Girls		Boys	
	Mean	S. D.	Mean	S. D.	Mean	S. D.
Bullying (Std)	0	1	-.184	0.803	0.143	1.109
Self-esteem (Std)	0	1	0.001	0.966	-0.001	1.003
Authoritative parents (Std)	0	1	0.038	0.993	-0.030	1.004
Family support (Std)	0	1	0.051	1.022	-0.040	0.981
Health problems	0.051	0.220	0.066	0.248	0.039	0.194
Parent in prison	0.044	0.207	0.045	0.208	0.044	0.206
Parent died	0.054	0.226	0.053	0.225	0.054	0.226
Pregnancy	0.048	0.215	0.055	0.229	0.042	0.202
Siblings	2.666	1.734	2.612	1.753	2.710	1.720
Siblings older	1.778	1.810	1.769	1.854	1.785	1.776
Mother's alcohol consumption	0.025	0.159	0.031	0.174	0.021	0.145
Father's alcohol consumption	0.246	0.431	0.230	0.421	0.258	0.438
Gangs	0.394	0.488	0.383	0.486	0.402	0.490
People selling drugs	0.284	0.451	0.238	0.426	0.320	0.467
Prostitution	0.194	0.395	0.178	0.382	0.207	0.405
Rural	0.509	0.500	0.496	0.500	0.519	0.500

Source: Encuesta de resiliencia en beneficiarios .

Table 4: **OLS Estimates: Effects of Bullying on Whether Adolescents Dropped Out of School**

	(1)	(2)	(3)	(4)
Dep Var: Dropping Out				
Bullying	0.056***	0.051***	0.049***	0.038***
	(0.011)	(0.012)	(0.012)	(0.012)
Father died	0.238***	0.222***	0.205***	0.203***
	(0.060)	(0.060)	(0.062)	(0.062)
Mother died	0.178*	0.207**	0.173	0.157
	(0.102)	(0.102)	(0.107)	(0.107)
Parent in Prison	0.040	0.024	0.003	-0.007
	(0.054)	(0.054)	(0.057)	(0.057)
Sex (Female=1)	-0.010	-0.010	-0.015	-0.011
	(0.023)	(0.023)	(0.023)	(0.023)
Siblings	0.034***	0.029***	0.029***	0.027***
	(0.007)	(0.007)	(0.007)	(0.007)
Siblings Older	-0.001	0.001	-0.004	-0.004
	(0.007)	(0.007)	(0.007)	(0.007)
Age	0.262	0.271	0.464	0.427
	(0.324)	(0.323)	(0.329)	(0.329)
Age squared	-0.007	-0.007	-0.014	-0.012
	(0.011)	(0.011)	(0.011)	(0.011)
State Fixed Effects	No	Yes	No	No
Municipality Fixed Effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
R^2	0.12	0.15	0.23	0.25
Observations	981	981	981	980

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.
The other controls are: women's pregnancy or men impregnating women (pregnancy), a feeling of being insecure within their neighborhoods (existence of gangs, people selling drugs, and prostitution), self-esteem, health problems, authoritative parents, family support, parents are separated, mother's alcohol consumption, and father's alcohol consumption.

Table 5: **Bounding Methodology: Effects of Bullying on Whether Adolescents Dropped Out of School**

	(1)	(2)	(3)	(4)
	Oster (2016)	Gonzalez and Miguel (2015)	Conservative ($R_{max} = 1$)	Krauth (2016)
		Panel 1 :	$0 \leq \delta \leq 1$	
Bullying	[0.055, 0.056]	[0.055, 0.056]	[0.045, 0.056]	[0.044, 0.056]
(95% CI)				(0.005, 0.081)
Minimum δ for which bounds include zero				3.234
		Panel 2 :	$-1 \leq \delta \leq 0$	
Bullying	[0.056, 0.057]	[0.056, 0.057]	[0.056, 0.067]	[0.056, 0.065]
(95% CI)				(0.030, 0.094)
Minimum δ for which bounds include zero				3.234

Intervals in squares brackets are the bounds, while the intervals in the round brackets are confidence intervals. The control variables are: parent in prison, sex, siblings, siblings older, age, age squared, living in a rural area, and fixed effects for municipalities.

Table 6: **OLS Estimates: Effects of Bullying on Whether Adolescents Dropped Out of School by Sex**

	Girls			Boys		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var: Dropping Out						
Bullying	0.102***	0.102***	0.088***	0.038***	0.033**	0.038**
	(0.020)	(0.021)	(0.021)	(0.014)	(0.015)	(0.015)
Father died	0.268***	0.237***	0.232***	0.237**	0.230**	0.200*
	(0.075)	(0.077)	(0.084)	(0.095)	(0.097)	(0.103)
Mother died	0.337**	0.402**	0.283	0.103	0.147	0.108
	(0.165)	(0.174)	(0.205)	(0.134)	(0.134)	(0.137)
Parent in Prison	0.044	0.057	-0.028	0.038	0.018	0.033
	(0.080)	(0.082)	(0.091)	(0.073)	(0.074)	(0.077)
Siblings	0.034***	0.028***	0.036***	0.037***	0.030***	0.029***
	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.011)
Siblings Older	-0.002	-0.000	-0.008	-0.000	0.002	-0.004
	(0.009)	(0.009)	(0.010)	(0.009)	(0.010)	(0.010)
Age	-0.096	-0.005	0.027	0.607	0.700	0.920*
	(0.466)	(0.475)	(0.485)	(0.453)	(0.455)	(0.477)
Age squared	0.006	0.003	0.002	-0.019	-0.022	-0.029*
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)
State Fixed Effects	No	Yes	No	No	Yes	No
Municipality Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.16	0.20	0.35	0.10	0.15	0.24
Observations	429	429	429	552	552	552

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Standard errors in parentheses.

Table 7: **Bounding Methodology: Effects of Bullying on Whether Adolescents Dropped Out of School (Girls)**

	(1)	(2)	(3)	(4)
Indepvar	Oster (2016)	Gonzalez and Miguel (2015)	Conservative ($R_{max} = 1$)	Krauth (2016)
		Panel 1 :	$0 \leq \delta \leq 1$	
Bullying	[0.102, 0.107]	[0.102, 0.115]	[0.102, 0.195]	[0.102, 0.118]
(95% CI)				(0.063, 0.165)
Minimum δ for which bounds include zero				-9.217
		Panel 2 :	$-1 \leq \delta \leq 0$	
Bullying	[0.097, 0.102]	[0.090, 0.102]	[0.010, 0.102]	[0.087, 0.102]
(95% CI)				(0.029, 0.141)
Minimum δ for which bounds include zero				-9.217

Intervals in squares brackets are the bounds, while the intervals in the round brackets are confidence intervals. The control variables are: parent in prison, sex, siblings, siblings older, age, age squared, living in a rural area, and fixed effects for municipalities.

Table 8: **Bounding Methodology: Effects of Bullying on Whether Adolescents Dropped Out of School (Boys)**

	(1)	(2)	(3)	(4)
	Oster (2016)	Gonzalez and Miguel (2015)	Conservative ($R_{max} = 1$)	Krauth (2016)
		Panel 1 :	$0 \leq \delta \leq 1$	
Bullying	[0.036, 0.038]	[0.032, 0.038]	[-0.021, 0.038]	[0.019, 0.038]
(95% CI)				(-0.022, 0.066)
Minimum δ for which bounds include zero				1.919
		Panel 2 :	$-1 \leq \delta \leq 0$	
Bullying	[0.038, 0.040]	[0.038, 0.044]	[0.038, 0.097]	[0.038, 0.055]
(95% CI)				(0.009, 0.090)
Minimum δ for which bounds include zero				1.919

Intervals in squares brackets are the bounds, while the intervals in the round brackets are confidence intervals. The control variables are: parent in prison, sex, siblings, siblings older, age, age squared, living in a rural area, and fixed effects for municipalities.

Table 9: OLS Estimates: Effects of Bullying on Self-esteem, Anxiety, and Stress

	(1)	(2)	(3)
Dep Var:	Self-esteem	Anxiety	Stress
Bullying	-0.157**	0.209***	0.300***
	(0.062)	(0.057)	(0.060)
Father died	0.016	0.036	0.062
	(0.229)	(0.213)	(0.225)
Mother died	0.473	-0.413	0.133
	(0.505)	(0.469)	(0.495)
Parent in Prison	0.007	0.258	0.461*
	(0.243)	(0.226)	(0.239)
Siblings	-0.054*	-0.002	-0.016
	(0.031)	(0.029)	(0.030)
Siblings Older	0.030	-0.001	-0.009
	(0.028)	(0.026)	(0.028)
Age	0.703	-0.707	-2.932**
	(1.422)	(1.323)	(1.395)
Age squared	-0.023	0.020	0.099**
	(0.049)	(0.046)	(0.048)
Constant	-5.297	6.076	21.637**
	(10.250)	(9.535)	(10.057)
R^2	0.03	0.06	0.08
Observations	429	429	429

*$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Standard errors in parentheses

Table 10: **OLS Estimates: Effects of Bullying on whether Girls who Dropped Out end Working Outside the Home or Neither Studying Nor Working outside the Home**

	Work Inside the Home			Work Outside the Home		
	(1)	(2)	(3)	(4)	(5)	(6)
Bullying	0.087***	0.085***	0.072***	0.050***	0.055***	0.053***
	(0.019)	(0.020)	(0.020)	(0.016)	(0.017)	(0.017)
Father Died	0.279***	0.241***	0.271***	0.033	0.043	0.013
	(0.069)	(0.071)	(0.075)	(0.058)	(0.060)	(0.075)
Mother Died	0.385***	0.455***	0.319*	-0.016	-0.055	0.010
	(0.147)	(0.156)	(0.181)	(0.145)	(0.160)	(0.167)
Parent in Prison	0.036	0.051	-0.051	0.015	0.015	0.014
	(0.073)	(0.075)	(0.082)	(0.054)	(0.056)	(0.062)
Siblings	0.007	0.003	0.010	0.037***	0.035***	0.040***
	(0.010)	(0.010)	(0.010)	(0.007)	(0.007)	(0.007)
Siblings Older	0.003	0.005	-0.004	-0.006	-0.008	-0.008
	(0.008)	(0.009)	(0.009)	(0.006)	(0.006)	(0.007)
Age	0.044	0.116	-0.052	-0.245	-0.201	0.029
	(0.423)	(0.433)	(0.438)	(0.306)	(0.313)	(0.329)
Age squared	-0.000	-0.002	0.003	0.010	0.008	0.001
	(0.015)	(0.015)	(0.015)	(0.011)	(0.011)	(0.011)
Constant	-0.532	-1.150	0.124	1.440	1.077	-0.646
	(3.045)	(3.120)	(3.162)	(2.203)	(2.257)	(2.375)
State Fixed Effects	No	Yes	No	No	Yes	No
Municipality Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.12	0.16	0.35	0.13	0.18	0.27
Observations	410	410	410	386	386	386

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Standard errors in parentheses

Figure 1: **Percentage of Students from Families Participating in PROGRESA who Transited from Lower Secondary to Upper Secondary**

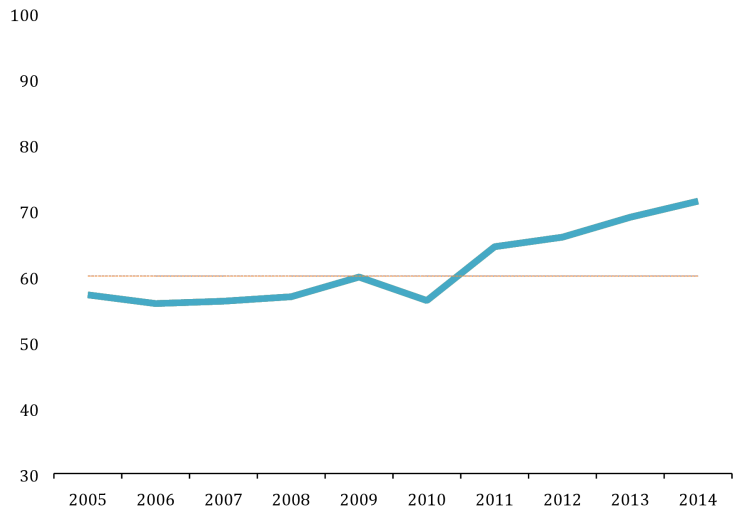
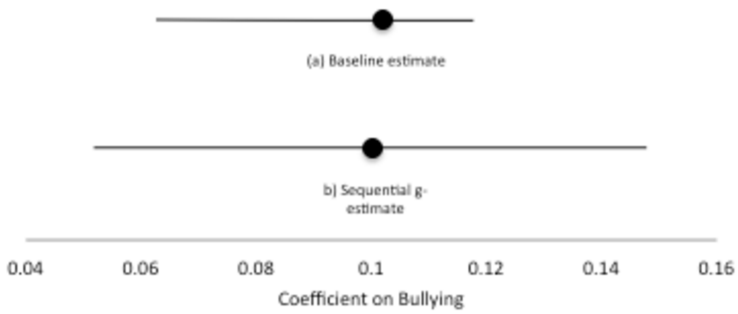
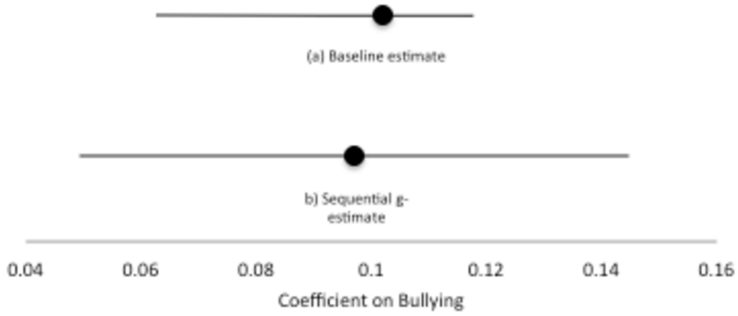


Figure 2. Estimated Effects of Bullying on Dropping Out of School trough Self-esteem



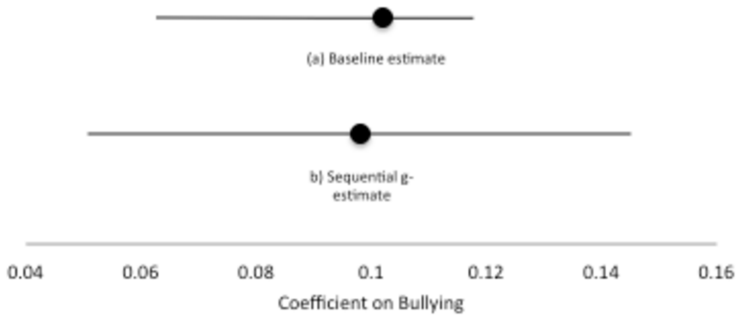
Note: Lines are 95% confidence intervals.

Figure 3. Estimated Effects of Bullying on Dropping Out of School trough Anxiety



Note: Lines are 95% confidence intervals.

Figure 4. Estimated Effects of Bullying on Dropping Out of School trough Stress



Note: Lines are 95% confidence intervals.

9 Appendix

Table A1: **Latent Variable Scales**

Scale Name	Scale Survey Question	Factor Loadings
Bullying Eigenvalue: 2.9	[1] Other students bother me (pulling hair, throwing objects, etc.)	0.3948
	[2] Other students called me bad names	0.4499
	[3] Other students left me out of an activity intentionally	0.4596
	[4] Other students threatened to hurt me	0.4686
	[5] I was beaten or kicked	0.4592
Self-esteem Eigenvalue: 2.1	[1] I am satisfied with myself	0.3678
	[2] I am able to do things as well as others	0.4358
	[3] I am a worthy person	0.4845
	[4] I have good qualities	0.4720
	[5] I have a positive attitude toward myself	0.4661
Authoritative Parents Eigenvalue: 2.8	[1] My parents make show me how much they love me	0.4651
	[2] My parents explain to me the consequences of my misconduct	0.4444
	[3] My parents encourage me to say what I feel when I disagree	0.4443
	[4] My parents reason with me when I misbehave	0.4441
	[5] My parents know my concerns	0.4400
Family Support Eigenvalue: 3.5	[1] My family recognizes what I do well	0.4295
	[2] My family really tries to help me	0.4593
	[3] My family helps me make decisions	0.4449
	[4] My family supports me when I need them	0.4648
	[5] My family is affectionate with me	0.4365

Table A2: OLS Estimates: Effects of Bullying on whether Adolescents Dropped Out of School

	(OLS)	(Probit)	(Logit)
Dep Var: Dropping Out			
Bullying	0.049***	0.214***	0.391***
	(0.012)	(0.054)	(0.094)
Father died	0.205***	0.681***	1.158***
	(0.062)	(0.257)	(0.444)
Mother died	0.173	0.818*	1.531*
	(0.107)	(0.469)	(0.794)
Parent in Prison	0.003	0.029	0.040
	(0.057)	(0.290)	(0.521)
Sex (Female=1)	-0.015	-0.060	-0.063
	(0.023)	(0.123)	(0.221)
Siblings	0.029***	0.134***	0.247***
	(0.007)	(0.036)	(0.065)
Siblings Older	-0.004	-0.016	-0.028
	(0.007)	(0.035)	(0.061)
Age	0.464	4.557**	9.713***
	(0.329)	(1.840)	(3.442)
Age squared	-0.014	-0.143**	-0.308***
	(0.011)	(0.063)	(0.117)
Constant	-3.816	-37.389***	-78.509***
	(2.377)	(13.451)	(25.256)
Municipality Fixed Effects	Yes	Yes	Yes

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Standard errors in parentheses.