

High-Achieving Minority Students Can Have More Friends and Fewer Adversaries

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This study examines friendship and hostility relations between Roma students and the ethnically homogeneous non-Roma majority in Hungarian schools, where anti-Roma sentiments are strong. High-achieving Roma students have significantly more friends and fewer adversaries than low-achieving ones because of more non-Roma friends, fewer non-Roma adversaries, and the same number of Roma friends and adversaries. The associations are strong for publicly observable GPA but weak for unobserved test scores and may be the results of assignment to the same classes for many years. Simulations suggest that a mixed policy of desegregation and closing the achievement gap may best foster positive interethnic relations in this environment.

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Friendship and hostility relations between adolescents from a disadvantaged minority and the majority are important: They may foster the social integration of members of the minority and may help develop tolerant attitudes among members of the majority. Schools offer the most important environment for building such relationships among adolescents. Using randomized assignment to roommates and military squadrons in the U.S., recent studies show that white American college students become more open towards African Americans when they are matched with African American college students (Boisjoly, Duncan, Kremer, Levy and Eccles 2006, Marmaros and Sacerdote 2006, Carrell, Hoekstra, and West 2015). The effect is particularly strong if they are matched with high-achieving African American students as opposed to low-achieving ones (Carrell, Hoekstra, and West 2015). Contrary to these findings, high-achieving minority students in American middle schools and high schools do not appear to have more friends than low-achieving minority students (Fryer and Torelli 2010).¹ Whether it is the age of the students, the nature of the college environment, the selected quality of college students, or the intensity of the exposure that makes the difference is difficult to tell without further evidence.

¹ Fryer and Torelli focus on friendship within the same racial and ethnic group and find that high-achieving Blacks and, especially, Hispanics have fewer within-group friends than their lower-achieving peers. They use “social status” in their main analysis, a measure of reciprocal friendship within groups that factors in the within-group friends of friends, etc., but simple measures of friendship lead to the same results. Their method is not suited for analyzing inter-group friendship in a direct fashion. Importantly, however, they report that high-achieving African American and Hispanic students have fewer friends overall (lower “social status” measured using friends in other groups, too), indicating that high-achieving minority students do not have more friends from other groups.

In this paper we analyze the friendship and hostility relations among 15-year-old students from a disadvantaged minority and an ethnically homogeneous majority. A typical student in our setting spends many years assigned to the same class of relatively small size. We use data from 85 schools in larger towns and cities to analyze the relations between Roma and non-Roma eighth-grade students in Hungary, a country where anti-Roma sentiments and prejudice are widespread. Our friendship data is directly comparable to the data used to analyze the friendship relations of students of similar ages in the U.S. (Currarini, Jackson, and Pin 2010; Fryer and Torelli 2010; Flashman 2012; Patacchini and Zenou 2015). Besides friendship nominations, we also collected information on adversary nominations, enabling us to analyze interethnic hostility in a direct way. Our main question is whether high-achieving Roma students have more friends and fewer adversaries than low-achieving Roma students, both from among their Roma peers and among their non-Roma peers. We measure academic achievement by publicly observable grades as well as low-stakes test scores that are unobservable to the students.

We find that Roma students with higher academic achievement have significantly more friends than Roma students with lower achievement. The difference is driven by having more non-Roma friends, while the number of Roma friends is unrelated to the achievement of Roma students. These results are monotonic, approximately linear in grade point average, and they are remarkably robust to the measure of friendship, controlling for family background, grade repetition, school and class fixed-effects, and common support restrictions. In line with the literature, we focus on same-sex relationships, but results for opposite-sex relationships are very similar. The patterns for

hostility show a mirror image, also driven by differences in interethnic relations: Higher achieving Roma students are less likely to be nominated as adversaries by their non-Roma peers, while hostility from Roma peers is not related to their achievement. In general, students have fewer friends and more refusals from the other ethnic group, showing significant “inbreeding homophily” (Jackson 2014). The degree of inbreeding homophily among non-Roma students is lower if members of the other ethnic group have high academic achievement.

Similarly to other studies that examine adolescents in a large number of schools, our analysis is correlational. At the same time, the robustness of our results suggests that causal effects may be similar. Obviously, the direction of causality is impossible to firmly establish with the data at hand, as social interactions may very well affect achievement. We present indirect evidence supporting causality from achievement to relations. When publicly observed GPA entered together with publicly unobserved test scores the associations with test scores is insignificant. The same is not true, however, in regressions with academic outcome variables on the left-hand-side such as direction of further studies, dropping out of secondary school, or test scores two years later.

To appreciate the potential consequences of our results, we examine interethnic friendship and hostility relations as functions of the ethnic composition of the peer group and its interaction with the achievement level of Roma students. We find that while the ethnic composition of their peer group is related to the number of friends and adversaries of low-achieving Roma students, no such association exists for high-achieving Roma students. We also find that the exposure of non-Roma students to Roma peers is twice as

likely to translate into nominating a Roma student as a friend and less likely to translate into nominating a Roma student as an adversary if those Roma peers are high-achievers.

We use these results in a simple simulation exercise to illustrate the potential effects of two policies: a complete de-segregation program that equalizes the ethnic distribution of classes across the nation and the closing of the ethnic achievement gap. Assuming that our results show the effect of class composition and grades on friends, we find that when the two policies are combined, the total number of friends and adversaries of Roma students improves slightly. At the same time, the ethnic composition of these relationships changes substantially: The overwhelming majority of the within-school friends of Roma students become non-Roma, which can enhance their integration into mainstream society. We also find that the number of non-Roma students with Roma friends doubles, which can lead to lower levels of prejudice in society. With the caveats of large-scale policy conclusions based on a partial analysis (Carrell, Sacerdote, and West 2013), these results suggest directions for educational policy: Achieving a more equal ethnic distribution and a narrower achievement gap may both be needed to combine improvements in the level and ethnic composition of the friendship relations of minority students.

Our study contributes to the literature in several ways. First, we use highly comparable data to the studies on middle school and high school students in the U.S., but the institutional setup has an important difference. Typical students in our setting spend many years with the same classmates in communities of two dozen students. As a result, by the time we measure their friendship and hostility relations, students have spent many years exposed to the same classmates in relatively intimate communities. Second, we

show direct evidence regarding hostility as well as friendship, an aspect rarely investigated in the school context. Third, we show evidence of the association between academic achievement and friendship networks of the Roma minority for the first time. Fourth, using the estimates of our analysis together with assumptions on causality, we provide some predictions concerning the potential effects of school desegregation and closing the ethnic achievement gap on interethnic relations.

Our results suggest that the fear of rejection due to “acting white” by having higher achievement is unlikely to be an issue for most Roma students in Hungarian schools. On the contrary, Roma students with higher academic achievement have more non-Roma friends and fewer non-Roma adversaries, without having fewer Roma friends and more Roma adversaries. This can serve as a strong incentive for Roma students to perform well in school. More generally, our results suggest that intensive exposure to high-achieving minority students can substantially reduce the social distance majority students keep from minority students, even in a society that is characterized by widespread prejudice. These results are in line with the classic contact hypothesis in social psychology that postulates exposure is more likely to improve intergroup relations if interactions are more personal and status is more equal (Allport 1954; Pettigrew 1998; Pettigrew and Tropp 2006). Finally, our results suggest that it is the difference in the environment not the age difference or the selected nature of college students that makes the studies on American college students arrive at conclusions that are different from the conclusions of the multi-school studies of younger students.

The remainder of the paper is organized as follows. Section I provides the background to our analysis; section II describes the data. Section III contains our main

analysis of interethnic relations and academic achievement. Sections IV and V complement our main analysis by estimating the association between interethnic relations and the ethnic composition of the peer group, and the interaction of these with academic achievement. Section VI uses the results in a simple simulation exercise to illustrate the potential consequences of educational policies. The last part concludes.

I. Background

The Roma (also known as the Romani people or Gypsies) constitute one of the largest and poorest ethnic minorities in Europe. Nearly 80 percent of the Roma live in East-Central Europe, from the Czech Republic in the North-West through Bulgaria in the South-East. Most Roma live in poverty, with low levels of formal employment and other disadvantages (FRA-UNDP 2012). Their low level of education is documented as a major contributor to their low employment and low wages (Kertesi and Kézdi 2011a).

The Roma are the only significant ethnic minority in Hungary, making up about 6 percent of the population overall and over 10 percent of the population of eighth-grade students (Kemény 2004; Kertesi and Kézdi 2015). Most of the Roma of Hungary speak Hungarian and live in neighborhoods that are ethnically mixed, as opposed to segregated settlements (Kemény and Janky 2006). The vast majority of Roma students complete all eighth grades of elementary school in Hungary, although with a substantial achievement gap. While almost all Roma students continue their studies in a secondary school, less than half of them attain a secondary degree in the end (Hajdu, Kertesi, and Kézdi 2014).

Most students complete all eight grades in the same elementary school. The most selective secondary schools in the larger cities enroll students earlier, in grades five or

seven, but they enroll most of their students in Budapest and from a relatively small number of elementary schools. As a result, early enrollment in these selective secondary schools has little effect on the students of the elementary schools Roma students attend. Ethnic segregation of Hungarian schools is moderate on average, but it is high in some areas, and approximately half of non-Roma Hungarian children have no Roma peers in elementary school (see Kertesi and Kézdi 2014, and the benchmark results of the simulation exercise in this paper in section VI). We know relatively little about inter-ethnic relations in Hungarian schools; recent studies indicate low levels of inter-ethnic dating (Lorincz, 2015), low levels of inter-ethnic friendship, and frequent rejections of Roma students by their non-Roma peers (Boda and Néray, 2015).

Hungarian elementary schools in larger towns and cities, represented by our sample, enroll 50 students per grade on average. Some schools are small, with one class per grade, while others are larger with two to four classes per grade. Upon enrollment, first graders are assigned to a class, and this assignment remains fixed throughout their eight years of studies, even in the schools with multiple classes per grade. Class size is below 25 on average. This fixed class assignment throughout elementary school results in exposure to the same peers for eight years in relatively intimate communities.

Prejudice against the Roma is strong and widespread in Hungary. The ethnically largely homogeneous majority holds and often expresses high levels of explicit prejudice, and many maintain a wide social distance from the Roma. For example, 60 percent of Hungarian adults agree with the statement that “the inclination for criminality is in the blood” of the Roma, and 40 percent support discriminatory bans of Roma customers from

bars serving alcohol (Bernát, Juhász, Krekó and Molnár 2013; Székelyi, Csepeli, and Örkény 2001; Váradi 2014).

II. Data

To survey the friendship networks and hostility among Roma and non-Roma students, we collected data from 88 elementary schools in the 77 towns and cities with the largest Roma populations in Hungary (excluding Budapest, the capital) in April 2010. To ensure adequate Roma representation, we oversampled schools with a higher proportion of Roma students (the administrative data used for the sampling contained estimates of the proportion of Roma students by school but not by grade or class). In each school we surveyed all classes in the eighth grade. For our analysis, we retained classes with data on at least 10 students (excluding two classes) and valid data on ethnicity and friendships for more than two thirds of the students in the class (excluding 25 classes). Our data sample comprises 3,947 students from 182 classes in 85 schools. We provide more details on the sampling and the structure of the survey in Appendix A.

Our survey was carried out in classrooms. The first part of the questionnaire asked students to nominate friends from their class. In a format identical to the National Longitudinal Study of Adolescent Health of the U.S., we asked respondents to nominate up to five of their best male friends and up to five of their best female friends. Then we asked them to nominate up to five classmates (female and male combined) with whom they would not share a train cabin on a class trip (traditional train cabins host eight people in Hungary; class trips by train were familiar to all students). To answer these questions, respondents were asked to choose names from a list of all their classmates, including those who were absent on the day of the survey. Subsequent parts of the questionnaire

asked about friends outside the class and school, as well as ethnicity and other background information. Of the 3,947 students in the classes of the final sample, we have complete information on friend and adversary nominations, as well as grades and ethnicity for 3,430 students; they comprise the sample of our analysis. The survey data were linked to administrative data on grades and test scores. Table 1 shows the summary statistics of the variables used in the analysis.

The survey asked two questions on the ethnic identity of the students. As most Roma in Hungary have a dual—Hungarian and Roma—identity,² the wording of the questions invited the respondents to identify with two ethnic groups at the same time.³ Of the 3,430 respondents in our final sample, 710 (21 percent) identified themselves as Roma in one of the two questions (16 percent as primary identification, 5 percent as secondary identification; Table O1 in the Online Appendix shows the details). This proportion is higher than a representative sample would yield because our survey oversampled schools with a relatively high proportion of Roma students.⁴ While our sample over-represents classes with many Roma students, the Roma are still a minority in

²The Hungarian Census of 2011 allowed identification with two groups (defined as nationalities or ethnic groups) for the first time in its history. Of the 3.1 percent of the population with Roma identification, 2.5 percentage points also identified themselves as Hungarian. Using longitudinal data on adolescents, Simonovits and Kézdi (2015) found that 99 percent of those who identified themselves as Roma at some point also identified as Hungarian at some point.

³ The exact wording of the two questions was “In our country, people belong to different minorities and ethnic groups. To what ethnic group do you consider yourself primarily to belong?” “To what ethnic group do you consider yourself to belong secondarily?”

⁴ To validate the ethnicity information, we asked teachers to estimate the number of Roma students in their classes. The average proportion of Roma students by self-reporting was 21 percent, compared to the average proportion of 26 percent according to teachers, with a correlation coefficient of 0.89.

most classes of our sample (the interquartile range is 8 to 30 percent; Figure O1 in the Online Appendix shows the entire distribution).

We collected student-level information on grades from the class records. These were the summary grade point average (GPA) of the first semester, complemented with grades in certain subjects. Hungarian schools give summary grades at the end of the first semester as well as in the second semester at the end of the school year. The summary grades of the first semester of the eighth grade are high stakes as they are part of the scores that determine admission to secondary schools. They are also public information: grades are often discussed with students in front of the entire class. Grades range from 1 (fail) to 5 (excellent). The overall GPA average in our sample is 3.6 (standard deviation 0.9). The average GPA of Roma students is substantially lower, equal to the 20th percentile of GPA among non-Roma students. Behavior grades, on a scale from 2 to 5, are also part of the regular grading in Hungary, reflecting potential behavioral problems in an obviously coarse way (grade 1 would result in an immediate expulsion from the school). The Roma average is low, below the 25th percentile among non-Roma students.

We linked the students in our sample to their standardized test scores in reading skills and mathematics. The source of this test score data is the May 2010 National Assessment of Basic Competencies (NABC), which is a low-stakes assessment administered to all eighth-grade students in Hungary. In contrast to the GPA and specific grades, test scores are not public information; students usually do not know their own test scores. The ethnic test score gap in the sample is 0.7 standard deviations in reading and 0.9 standard deviations in mathematics; these are somewhat smaller than the national test score gap measured for eighth graders (Kertesi and Kézdi 2011b; Kertesi and Kézdi

2015), reflecting the selected nature of our sample. Figures O2 and O3 in the Online Appendix show the distributions of GPA and test scores by ethnicity.

This study focuses on friendship and hostility relations. Our main friendship measure is the number of friendship nominations students receive, or the “indegree” of students in network science terminology. In line with the literature, we define the peer group as the group of classmates of the same sex, but we show that all of our main results are very similar with respect to opposite-sex relationships. We measure hostility by the number of adversary nominations students receive: the number of peers who listed the student as someone with whom they would not want to share a train cabin. We computed nominations from all peers, as well as Roma and non-Roma peers separately. For robustness checks, we analyze alternative measures of the relations, including the number of peers who nominate the students or are nominated by the students, the number of peers who nominate the students and are nominated by the students at the same time, and measures that include the popularity of the peers.

The number of peers each student could list was capped at five to make our data comparable to the National Longitudinal Study of Adolescent Health, the prime source of student network data in middle schools and high schools in the U.S. (Fryer and Torelli 2010; Currarini, Jackson, and Pin 2012; Flashman 2012; Patacchini and Zenou 2015). In our data, 55 percent of the students exhausted the five possibilities for nominating same-sex friends; the corresponding figures are 28 percent when nominating opposite-sex friends and 3 percent when nominating adversaries (see Table O2 in the Online Appendix for more detail). The number of nominations students could receive had no explicit cap other than the number of peers, but it too is likely affected by the cap on nominations. For

a robustness check, we re-estimated our regressions capping the number of nominations at four and received very similar results.

On average, students received 3.7 friendship nominations and 1.0 refusals from their peers. Friendship nominations are distributed relatively symmetrically, whereas adversary nominations have a long right tail: most students are not nominated by anyone as an adversary and a few are nominated by many. The shapes of the distributions are very similar for Roma and non-Roma students. Figures O4 and O5 in the Online Appendix show the empirical densities.

The average age in the sample is 15 years; 10 percent repeated a grade in the past (30 percent of Roma students and 7 percent of non-Roma students). Students spent over three years on average in preschool (state-subsidized preschool is available in Hungary from age three); the non-Roma average is somewhat higher, and the Roma average is 2.8. The mothers of Roma students have substantially lower levels of education. Table 1 shows the summary statistics of the variables in our analysis. It shows the mean, standard deviation and number of observations for the entire sample and the mean values by ethnicity.

We use two other data sources in a simulation exercise that illustrates the potential policy consequences of the results of our analysis. The first data source is the National Assessment of Basic Competencies (NABC), the source of the test score data presented above. This is an administrative data set that also contains some school-level information, including principals' estimates of the ethnic composition of the student body in their schools. The other data source is the Hungarian Life Course Survey (HLCS), a nationally representative survey of 10,000 adolescents with linked records from the

NABC. In contrast to the individual-level test score data, the HLCS has ethnic markers that are of high quality (for more details on the HLCS data, see Kertesi and Kézdi 2011b and Simonovits and Kézdi 2015).

Table 1. Summary statistics

Variable	All students			Roma	Non-Roma
	Mean	Std.D.	N	Mean	Mean
Roma	0.21	0.41	3430	1.00	0.00
Number of friendship nominations ^a	3.8	2.0	3430	3.3	3.9
Number of refusals ^a	1.0	1.7	3430	1.3	1.0
Number of friendship nominations from Roma ^a	0.7	1.1	3430	1.7	0.5
Number of refusals from Roma ^a	0.2	0.5	3430	0.2	0.2
Number of friendship nominations from non-Roma ^a	3.1	2.1	3430	1.6	3.4
Number of refusals from non-Roma ^a	0.8	1.6	3430	1.0	0.8
GPA ^b	3.6	0.9	3430	2.9	3.8
Mathematics grade ^b	3.1	1.2	3404	2.4	3.3
Hungarian grade ^b	3.5	1.1	3427	2.8	3.7
Behavior grade ^b	4.1	0.9	3427	3.5	4.3
Standardized test score in mathematics ^c	-0.3	1.0	3154	-0.8	-0.1
Standardized test score in reading ^c	0.0	1.0	3154	-0.6	0.1
Level of mathematic abilities ^d	1.4	1.0	3148	0.9	1.5
Level of reading abilities ^d	2.3	1.1	3148	1.7	2.4
Repeated grade in past	0.10	0.30	3430	0.23	0.07
Age 14 years	0.20	0.40	3430	0.14	0.22
Age 15 years	0.68	0.47	3430	0.62	0.70
Age 16 years	0.09	0.29	3430	0.18	0.07
Age 17 years or more	0.03	0.16	3430	0.06	0.02
Number of years in pre-school	3.15	0.84	3426	2.77	3.25
Mother's education less than 8 grades	0.04	0.19	3430	0.13	0.01
Mother's education 8 grades	0.25	0.43	3430	0.55	0.17
Mother's education vocational secondary school	0.32	0.47	3430	0.24	0.34
Mother's education high school	0.27	0.44	3430	0.06	0.33
Mother's education college or more	0.12	0.32	3430	0.02	0.14
Mother's education missing	0.00	0.05	3430	0.00	0.00
Fraction Roma in class (from student survey)	0.21	0.20	3430	0.40	0.16
Fraction Roma in class (teacher assessment)	0.25	0.22	3282	0.44	0.20
Size of peer group (same-sex classmates)	11.9	3.3	3430	11.3	12.1

^a Received from same-sex classmates

^b from 1 (fail) to 5 (excellent)

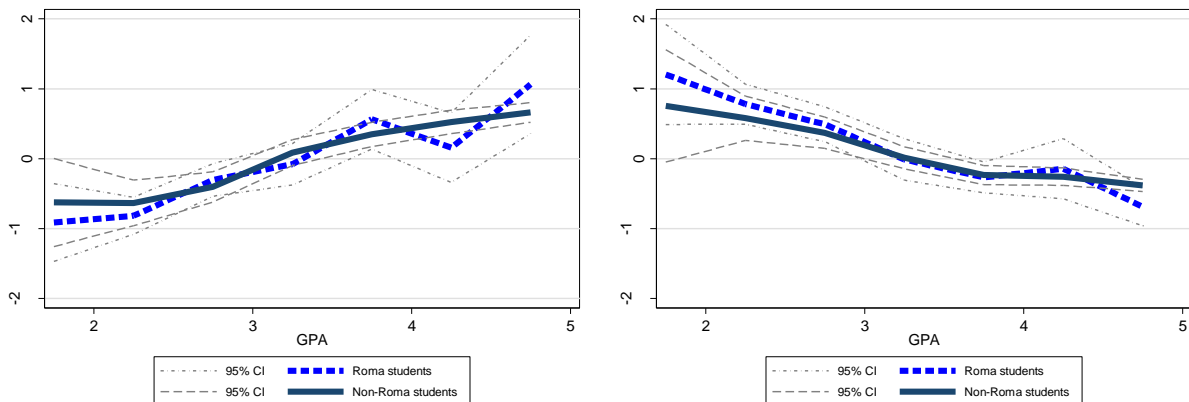
^c Standardized at the national level (mean 0, standard deviation 1)

^d from 0 (inadequate) to 4 (excellent)

III. Friendship and Hostility by Ethnicity and Academic Achievement

The main question of our analysis is how the number of friends and adversaries is related to academic achievement. Beyond the total numbers, we are interested in the ethnic composition of these relationships. In our baseline analysis we investigate relationships with GPA, and we examine alternative measures of academic achievement as extensions.

First we show nonparametric regression results. We created categories of GPA using increments of 0.5, and estimated the mean number of friends and adversaries in those categories separately for Roma students and non-Roma students. To make the interpretation simple, we normalized the number of friends and adversaries to have a zero mean by subtracting their average numbers within each class. Figure 1 shows the results for the total number of friends and adversaries.



A. Friendship nominations & GPA

B. Adversary nominations & GPA

Figure 1.
Number of friends and adversaries and GPA (grade point average).

The average number of same-sex nominations received by Roma and non-Roma students, normalized to average nominations in the class to be zero. Estimated averages by GPA category and 95% confidence intervals

Panel A of Figure 1 shows that students with higher GPA have more friends, whether they are Roma or non-Roma. Panel B shows the mirror image of that pattern: students with higher GPA have fewer adversaries, again regardless of their ethnicity. The two graphs show approximately linear relationships of opposite signs and similar magnitudes. The Roma and non-Roma lines have similar levels, and the slopes are possibly steeper for the Roma.

The positive association of GPA with the number of friends and its negative association with the number of adversaries both come from non-Roma students. Whether Roma students nominate others as friends or adversaries is largely unrelated to the other students' GPA. Figure 2 shows the associations according to the ethnicity of the friends and adversaries.

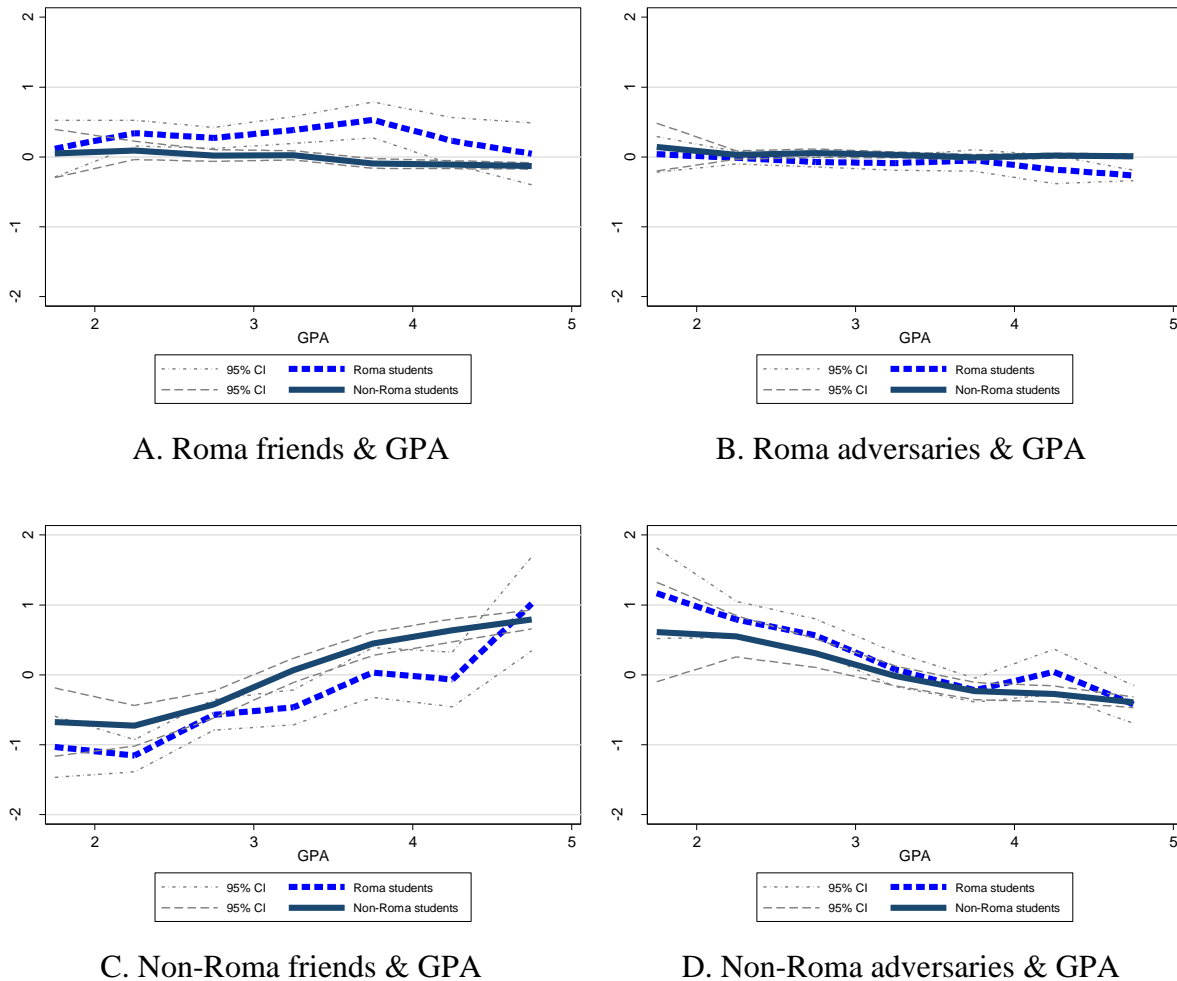


Figure 2.
The number of Roma and non-Roma friends and adversaries by GPA.

The average number of same-sex nominations received by Roma and non-Roma students from each ethnic group, normalized by average nominations from the respective ethnic group in the class. Estimated averages by GPA category and 95% confidence intervals

We estimate linear regressions to assess the magnitudes of the associations and their robustness. We examine the six left-hand side variables that are shown in Figures 1 and 2: the total number of friends and adversaries, and the number of Roma and non-Roma friends and adversaries. We denote the generic left-hand side variable as n^r , where n is the number of nominations and superscript r means that these are nominations

received by the individual. We estimate the following regression for each of the six left-hand side variables:

$$n_{cgi}^r = \beta_c + \beta_1 GPA_{cgi} + \beta_2 GPA_{cgi} \times Roma_{cgi} + \beta_3 Roma_{cgi} + u_{cgi} \quad (1)$$

where index c is class, g is gender group (male or female), and i is student. Coefficients β_c are class fixed effects; GPA_{cgi} is the grade point average of student i in gender group g in class c , normalized so that 0 represents the approximate average in the sample (3.5); $Roma_{cgi}$ is whether the student is Roma. Students in different classes may develop differential attitudes to their peers and the academic achievement of those peers due, for example, to differences in the composition of their class, the differential anchoring of their grades, or differences in the teachers or the school environment they experience. The class fixed effects eliminate the effect of such differences on the estimated friendship–GPA relations to the extent that they affect all students in a class in similar ways. As robustness checks, we estimate regressions with class–gender fixed effects β_{cg} instead of the class fixed effects β_c and obtain very similar results.

The coefficients of main interest are β_1 and β_2 . β_1 shows the difference in the average number of friendship or adversary nominations by two non-Roma students in the same class with a unit difference in GPA. β_2 shows the extent to which this is different for Roma students so that $\beta_1 + \beta_2$ shows the difference in the nominations received by two Roma students in the same class who have different GPA scores. If β_1 and β_2 have the same sign, the relationship is of the same direction but stronger for Roma students. Coefficient β_3 shows the extent to which Roma students receive more nominations than

non-Roma students if both have a GPA of 3.5 (the approximate mean in the sample). The results of regression (1) are shown in Table 2.

Table 2. Friends and adversaries by ethnicity and GPA of the nominated student.

Dependent variable: nominations received from peers	(1)	(2)	(3)	(4)	(5)	(6)
	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.57 (0.06)**	-0.44 (0.05)**	-0.11 (0.02)**	-0.02 (0.01)	0.67 (0.05)**	-0.42 (0.05)**
Roma × GPA	0.14 (0.12)	-0.27 (0.11)*	0.13 (0.08)	-0.06 (0.04)	0.01 (0.11)	-0.21 (0.10)*
Roma	-0.15 (0.12)	0.10 (0.10)	0.46 (0.10)**	-0.15 (0.05)**	-0.61 (0.12)**	0.25 (0.08)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes. The number of friendship and adversary nominations from all peers, as well as from Roma and non-Roma peers separately, as functions of GPA and ethnicity of the student. Peers are same-sex classmates. GPA is publicly observable grade point average ranging from 1 to 5, normalized to be zero at its mean value 3.5.

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

The results are in line with the conclusions of Figures 1 and 2. According to columns 1 and 2, non-Roma students with a one point higher GPA receive 0.6 more friendship nominations and 0.4 fewer adversary nominations on average from their peers (β_1 in columns 1 and 2). Roma students with a one point higher GPA receive 0.7 more friendship nominations and 0.7 fewer adversary nominations on average from their peers ($\beta_1 + \beta_2$ in columns 1 and 2). The association with GPA is statistically significantly stronger among Roma students than non-Roma students in terms of adversaries but not in terms of friends.

Columns 3 to 6 show that the relationships observed are almost exclusively due to differential nominations from non-Roma peers, again in line with the conclusions of

Figures 1 and 2. Roma students with different GPA have the same number of Roma friends and adversaries on average ($\beta_1 + \beta_2$ in columns 3 and 4). In contrast, their relations with non-Roma peers are strongly related to their GPA: Roma students with a one point higher GPA have 0.7 more non-Roma friends and 0.6 fewer non-Roma adversaries on average ($\beta_1 + \beta_2$ in columns 3 and 4). The friendship relationships among the non-Roma students are similarly related to their GPA, but the adversary relationship are less strongly related to GPA (0.4 fewer non-Roma adversaries of non-Roma students if their GPA is higher by one point).

The coefficients on the Roma variable (β_3) reveal the average differences in the nominations received by Roma students versus non-Roma students with the same GPA, fixed at 3.5. Note that while 3.5 is the approximate average and median GPA overall, it is the 40th percentile among non-Roma students but the 80th percentile among Roma students. Roma and non-Roma students with a GPA of 3.5 have approximately the same number of friends and adversaries overall (β_3 in columns 1 and 2), but the composition differs by ethnicity: approximately 0.5 more friends and 0.2 fewer adversaries from the same ethnic group than from the opposite ethnic group (the differences in β_3 between columns 3 vs. 5 and 4 vs. 6 are statistically not significant). These results suggest a bias toward favoring peers from one's own ethnic group over peers from the other ethnic group, a phenomenon known as inbreeding homophily in network science. In relation to peers with a GPA of 3.5, the bias is similar in the two ethnic groups. At the same time, GPA and nominations are related, and this relationship differs for Roma and non-Roma students. As a result, the magnitude of the ethnic bias differs in relation to peers with different levels of achievement.

Tables O3 to O13 in the Online Appendix show the estimates of alternative specifications. All of the results are robust to leaving out the class fixed effects, including class–gender fixed effects instead of class fixed effects, restricting the sample to those who have not repeated grades, restricting the sample to the common support in ethnic composition (two or more same-sex classmates in both ethnic groups), and the inclusion of covariates (grade retention, age, gender, parental education, and number of years spent in preschool). The results also seem robust to the cap on nominations in the data: we obtain very similar estimates if we impose a cap of four names instead of five. Our estimates remain similar if we use alternative measures of the relationships. We consider four such measures: received nominations weighted by the nominations of those peers; the number of peers that are nominated by the student or nominate the student; the number of peers that are nominated by the student and nominate the student; the popularity measure developed by Echenique and Fryer (2007), and used by Fryer and Torelli (2010) to analyze interethnic and interracial relationships in the U.S. Again, the results are qualitatively unchanged.

When we replace nominations from same-sex classmates with nominations from opposite-sex classmates as the left-hand side variables, the results are again very similar, whether we look at friendship nominations received, originated, or reciprocal ones (Tables O14 through O16 in the Online Appendix).

The robustness of the results is remarkable. They suggest that causal effects may be similar to the associations we uncover. However, they are not informative on the direction of causality. To get some indirect evidence on the direction of causality we enter GPA together with scores from low-stakes tests in our regressions. As we indicated

in the Data section above, GPA is publicly observable in Hungarian schools as grades are typically discussed in front of the whole class, while test scores are publicly, and often privately, unobserved. If causality runs from social relations to performance we would expect them to show up in both measures of achievement, resulting in nonzero coefficients for both. In contrast, if causality runs from achievement to relations public observability is likely to be important, and we would expect the coefficients on GPA to be the same as before while the coefficients on test scores to be zero. Our results are exactly these latter ones: when both are entered the coefficient on GPA retains its original magnitude while the coefficient on test scores is statistically zero in all regressions (table O17 in the Appendix). While in principle this may simply reflect that test scores are too noisy to contain any information conditional on GPA, we show that that is unlikely to be the case. We examine analogous regressions with subsequent outcome measures on the left-hand-side: admission to academic secondary school, dropping out of secondary school, GPA and test scores in grade 10 (table O18 in the Appendix). Test scores are statistically significant in all of these regressions, with coefficient magnitudes ranging from one quarter of that of GPA (admission, dropping out, GPA) to three times as large (future test scores).

Taken together, our result indicate that Roma students can gain more non-Roma friends without losing Roma friends if they perform better in school, and they can decrease hostility by non-Roma students without inducing hostility by their Roma peers. These results contradict the notion of the detrimental effects of “acting white” in the context of Hungarian schools. Instead of being punished for their better achievement,

eighth-grade Roma students in Hungary are rewarded by the majority ethnic group and keep their social status in their own ethnic group at the same time.

In the next sections, we explore the consequences of these findings for the association of the composition of students' peer groups and interethnic relations. We are interested in the following two sets of questions. First, how do the number and ethnic composition of the friends and adversaries of Roma students vary with the ethnic composition of their peer group? And how is this association different for high- and low-achieving Roma students? Second, how does the number of non-Roma students who nominate Roma students as friends and adversaries vary with the ethnic composition of their peer group? And how different are these associations if the Roma students in the peer group have high achievement? The answers to these questions can inform educational policy about the potential effects of ethnic desegregation and the closing of the achievement gap on the interethnic friendship and hostility relations in schools. To quantify the potential effects, we carry out a simulation exercise using our results, calibrated to the ethnic and achievement distribution of the population of eighth-grade students in Hungary.

IV. Friends and Adversaries of Roma Students and the Ethnic Composition of their Peer Groups

Our results on the ethnic biases in the friendship and hostility relationships suggest that Roma students have more friends and fewer adversaries if a higher proportion of their peer group is Roma. We have also shown that the degree of ethnic bias of non-Roma students is stronger towards low-achieving Roma students than toward high-achieving

Roma students. As a result, the ethnic composition of the peer group is likely to have a weaker association with the number of friends and adversaries for high-achieving Roma students than for low-achieving Roma students. In this section, we explore the magnitude of these relationships and pay special attention to potential nonlinearities.

Figure 3 shows the non-parametric regression results with the average number of friends and adversaries of high-achieving Roma students and low-achieving Roma students as the function of the proportion of Roma students in their peer group. We define high achievement as having a GPA of 3.5; 60 percent of the non-Roma students are high achievers, compared to 20 percent of Roma students. Similarly to the previous section, friends and adversaries are defined as nominations received from same-sex classmates. The proportion of Roma students in the peer group of Roma students is aggregated to categories, and this proportion does include the Roma student himself or herself.

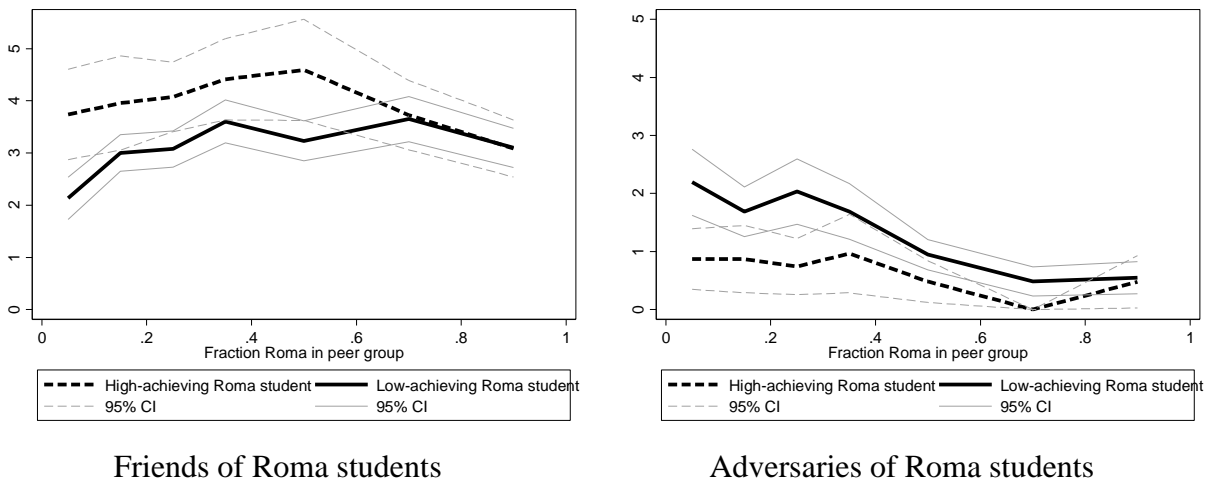


Figure 3
Friends and adversaries of Roma students and the ethnic composition of their peer groups

If nobody in their peer group is Roma, high-achieving Roma students have 4 friends and 1 adversary on average (using rounded estimates), while low-achieving Roma students have 2 friends and 2 adversaries on average. If, instead, half of their peer group is Roma, high-achieving Roma students have the same number of friends and only slightly fewer adversaries on average (4 and 0.8), while low-achieving Roma students have significantly more friends and fewer adversaries (3 and 1.2).

Tables O19 and O20 in the Online Appendix show the corresponding regressions where the nonlinearities are captured by quadratic terms. These are results without individual covariates; adding covariates does not change the main results. The results with class fixed effects also show very similar associations. The coefficients in the regressions with class fixed-effects are identified from within-class differences in the ethnic composition of girls versus boys, as peer groups are defined by gender. They show the extent to which the number of friends and adversaries differ if the composition of the peer group differs within the same class. These results therefore control for all observed and unobserved differences between classes that may affect relationships and the composition of peer groups at the same time, such as ability tracking or preferences of parents or teachers for ethnic mixing. Figure O6 in the Online Appendix shows that the associations are very similar if the number of potential nominations is capped at four.

Figure O7 in the Online Appendix shows the corresponding nonparametric regressions for opposite-sex relations. The association of opposite-sex friendships with the ethnic composition of opposite-sex classmates is weak both for high-achieving Roma students and low-achieving Roma students, while the results for opposite-sex hostilities are very similar to those for same-sex hostilities. Figures O8 and O9 (Online Appendix)

show the relationships with the number of Roma and non-Roma friends and adversaries separately. The average number of Roma friends increases strongly with the proportion of Roma students in the peer group, while the number of Roma adversaries increases only a little and stays very close to zero. Importantly, both of these associations are the same for high- and low-achieving Roma students. In contrast, the association between the proportion of Roma peers and the number of non-Roma friends is stronger for high-achieving Roma students, while association with the number of non-Roma adversaries is weaker for them. The differential results for the total number of friends and adversaries are driven by the differential results for non-Roma friends and adversaries.

The robustness of these results gives support to a causal interpretation of the associations. Reducing the proportion of Roma students in the peer group would decrease the number of Roma friends. At the same time, it would increase the number of non-Roma friends. This substitution is substantially stronger for high-achieving Roma students: they would lose the same number of Roma friends as low-achieving Roma students, but they would gain more non-Roma friends. As a result, decreasing the proportion of Roma students in the peer groups of Roma students is expected to result in low-achieving Roma students having fewer friends and more adversaries, but it is not expected to change the overall number of friends and adversaries of high-achieving Roma students. Therefore, a desegregation policy reducing the proportion of Roma students in the peer group would for most Roma students shift the ethnic composition of their friends and adversaries to encompass more non-Roma students. It also has the potential to have a detrimental effect on the friendship relations of low-achieving Roma students but not of high-achieving Roma students. Before we quantify these potential effects in a simulation

exercise, we turn to our second set of questions: the association of peer group composition with the propensity of non-Roma students to nominate Roma students as friends or adversaries.

V. Roma Friends and Adversaries of Non-Roma Students and the Ethnic Composition of their Peer Groups

Whether or not students from the majority have friends and adversaries from a disadvantaged ethnic minority can have long-lasting effects on their prejudice and anti-minority sentiments. In this section, we look at the likelihood of non-Roma students nominating Roma peers as a function of the composition of their peer group by ethnicity and achievement. A mechanical relationship should lead to more non-Roma students having Roma friends and adversaries if a larger proportion of their peer group is Roma. Our previous results imply that the achievement of these Roma peers should also matter: the higher the achievement of the Roma peers, the more non-Roma students would nominate some of them as friends and the fewer non-Roma students would nominate some of them as adversaries. We explore the magnitude and potential nonlinearities in these associations.

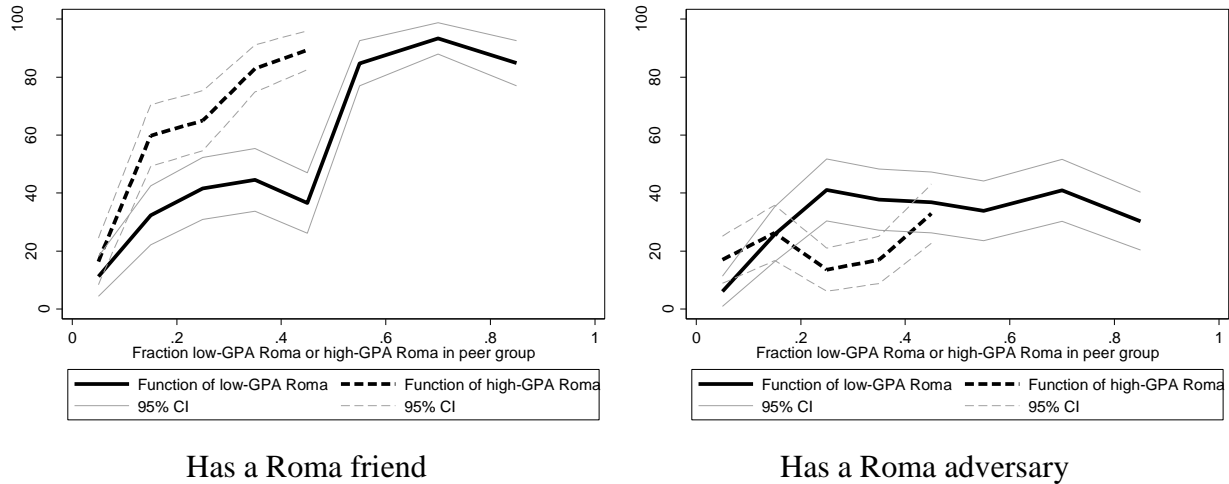


Figure 4
 The percentage of non-Roma students nominating Roma students as a friend and as an adversary
 (as a function of the proportion of low-achieving Roma students and the proportion of high-GPA Roma students in the peer group; both of these proportions are aggregated to categories; variance of the estimates computed as $p(1-p)/\#schools$)

The left panel of Figure 4 shows the percentage of non-Roma students who nominate at least one Roma student as a friend as a function of the proportion of low-achieving Roma students in her or his peer group, and separately as a function of the proportion of high-achieving Roma students (the achievement cutoff is a GPA of 3.5, as before). The right panel shows the corresponding figures for whether non-Roma students nominate a Roma student as an adversary. The figures are created by aggregating the data to categories of the proportion of low-achieving and high-achieving Roma students, and the domain of the latter is narrower and does not go above 50 percent.

Non-Roma students are more likely to nominate at least one Roma student as friend if a greater proportion of their peers is Roma. The slope of the regression line is significantly higher with respect to the proportion of high-achieving Roma students among their peers. When the proportion of low-achieving Roma students is between 0

and 10 percent, approximately 10 percent of the non-Roma students have Roma friends; when the same proportion is 30 to 40 percent, 40 percent of them have Roma friends. When the proportion of high-achieving Roma students is between 0 and 10 percent, 15 percent of the non-Roma students have Roma friends; when the same proportion is 30 to 40 percent, 80 percent of them have Roma friends. The likelihood that non-Roma students nominate Roma adversaries is a positive function of the proportion of low-achieving Roma students in the peer group below 30 percent and levels off beyond that. The corresponding association with the proportion of high-achieving Roma students does not show a clear increasing pattern. Note that the proportion of non-Roma students with a Roma adversary is higher when the proportion of high-achieving Roma students is below 10 percent than when the proportion of low-achieving Roma students is below 10 percent. This difference is small, statistically not significant, and it runs counter to our earlier robust finding of high-achieving Roma students receiving fewer adversary nominations from their non-Roma peers than low-achieving Roma students. Nevertheless, this statistically not significant difference will have a counterintuitive effect in our simulation exercise, predicting a slight increase in the number of non-Roma students who nominate Roma adversaries if Roma students have higher achievement, because most non-Roma students have Roma peers. Figure O10 in the Online Appendix shows that the estimated associations are essentially the same when the number of nominations is capped at 4. Figure O11 shows that there is virtually no difference in the likelihood of nominating an opposite-sex Roma student as a friend or an adversary based on the achievement level of the group.

We estimate linear probability models to assess the robustness of the associations of our figures. The regressions include the proportion of low-achieving Roma students in the peer group together with the proportion of high-achieving Roma students in the peer group, both in a quadratic specification. Table O21 in the Online Appendix shows the results. Similar to the nonparametric results, the association between the probability of nominating a Roma friend and the proportion of low-achieving Roma students in the peer group is strong and positive. The probability of nominating a Roma adversary shows a similar relationship, which starts out stronger but levels off when the proportion is 50 percent and gets close to zero again when it is 100 percent. Conditional on the proportion of low-achieving Roma students, the proportion of high-achieving Roma students increases the probability more than twofold at low proportions, and the additional association diminishes at higher proportions. The results for nominating a Roma adversary are a mirror image to these findings, but there is no association with the proportion of high-achieving Roma students. Remarkably, the ordinary least squares (OLS) and the class fixed effects results are very similar. The only difference between the OLS and the fixed effects results is that the additional association with the exposure to high-achieving Roma students diminishes less in the latter results.

Our results lead to conclusions that are similar to those obtained by Carrell, Hoekstra, and West (2015). They find that when white students in the U.S. Air Force Academy spend a year with high-achieving African American students in the same squadron (based on random assignment), they are more likely to choose an African American student as a roommate in the following year than if they spent that year with lower-achieving African American students. Hence, students from an otherwise

prejudiced majority appear to reduce their social distance from a disadvantaged racial or ethnic minority if they are exposed to high-achieving members of the minority for a long time in a relatively intimate setting.

VI. Policy Simulations

We use the results from the previous sections to simulate the effects of two policy experiments. The first experiment is complete ethnic desegregation: achieving uniform ethnic distribution across classes in the entire country. The second experiment is closing the achievement gap: increasing the proportion of high-achieving Roma students to the non-Roma level. We are interested in how the two experiments separately, or combined, affect the number and ethnic composition of friends and adversaries of Roma students, and how they affect the likelihood that non-Roma students nominate at least one Roma student as a friend or an adversary. These experiments represent extreme outcomes of policies that aim at increasing inter-ethnic exposure in schools and improving academic achievement of disadvantaged students.

The details of the simulation exercise are presented in Appendix B. First, we make use of various additional data sources to simulate the national distribution of eighth-grade classes by gender, ethnicity, and achievement. Second, we estimate the expected number of friends and adversaries in each class–gender–ethnicity group using the simulated distribution and our estimates from the previous two sections. These class–gender–ethnicity level estimates are then used to estimate national averages for the number of friends and adversaries by ethnicity. Finally, we repeat the exercise for the two hypothetical changes in the distribution: equal ethnic distribution and an increased

proportion of high-achieving students among Roma students to the non-Roma level. Importantly, we pay attention to indivisibility issues and the fact that with only a few Roma students in a class, their distribution across same-gender peer groups is not necessarily the same.

The simulated national distributions suggest that 46 percent of non-Roma students and 37 percent of Roma students have zero Roma in their peer group. The majority of the peer group is Roma for only 2 percent of the non-Roma students and 13 percent of the Roma students. Equalized distribution of Roma students across classes leads to only 27 percent of non-Roma students and 69 percent of Roma students having zero Roma in their peer group.

Table 3 shows the simulated effects of the policy changes on the number of friends and adversaries of an average Roma student. At baseline, Roma students have 3.1 friends and 1.4 adversaries on average, constituted by having 1 Roma friend, 2.1 non-Roma friends, 0.1 Roma adversaries, and 1.3 non-Roma adversaries. The effects of an equalized ethnic distribution would be negative on the total numbers: 0.3 fewer friends and 0.3 more adversaries. These are the results of 0.8 fewer Roma friends not fully compensated by the increased number of non-Roma friends, and 0.4 more non-Roma adversaries not fully compensated by the decreased number of Roma adversaries. In contrast, closing the achievement gap would result in positive effects only: 0.4 more friends and 0.3 fewer adversaries, resulting from no changes in the relations with Roma peers and improved relations with non-Roma peers. When the two policies are combined, the effects of closing the achievement gap would dominate for the total numbers, but this

would be accompanied by a substantial redistribution of the ethnic composition of friends and adversaries due to equalized exposure to the other ethnic group.

Table 3. Friends and adversaries of Roma students: the simulated effect of equal ethnic distribution and closing the achievement gap

	The number of					
	Friends	Adversaries	Roma Friends	Roma Adversaries	Non-Roma Friends	Non-Roma Adversaries
Benchmark estimates for an average Roma student						
Number of friends and adversaries	3.1	1.4	1.0	0.1	2.1	1.3
Simulated change under alternative scenarios						
Effect of equalized distribution	-0.3	0.3	-0.8	-0.1	0.5	0.4
Effect of closing the achievement gap	0.4	-0.3	0.0	0.0	0.4	-0.3
Effect of both	0.2	-0.1	-0.8	-0.1	1.0	0.0

Notes. Results of the simulation exercise; see details in Appendix B.

Table 4 shows that under the current distributions, 18 percent of the non-Roma students have at least one Roma friend and 14 percent have at least one Roma adversary. Equal ethnic distribution leads to an increase in both, but a substantially larger increase in those with a Roma friend, to 26 and 15 percent, respectively. Closing the achievement gap in itself leads to a similar increase in the percentage of non-Roma students with a Roma friend, to 25 percent, and a substantial decrease in those with a Roma adversary, to 5 percent. The two policies combined would result in a striking increase in friendship

nomination and a small decrease in adversary nomination, to 32 and 10 percent, respectively.

Table 4. The percentage of non-Roma students with at least one Roma friend or adversary

	Percentage who have at least one	
	Roma friend	Roma adversary
Benchmark estimates	18	14
Simulated change under alternative scenarios		
Effect of equal distribution	26	15
Effect of closing the achievement gap	25	5
Effect of both	32	10

Notes. Results of the simulation exercise; friends and adversaries are defined as nominations extended by non-Roma students. See details in Appendix B.

The results of the simulation exercise suggest that equalizing the ethnic distribution of classes would lead to a major interethnic redistribution of the friendship and hostility relations of Roma students. It would also lead to a moderate deterioration in their situation in terms of overall number of friends and adversaries. The increase in the proportion of non-Roma students having a Roma friend is moderate, but it comes at the cost of a slight increase in the proportion having a Roma adversary. Closing the achievement gap would lead to an improvement in the friendship and adversary relations of Roma students without major shifts in their ethnic composition. It would also lead to an increase in the percentage of non-Roma students with Roma friends and a decrease in the number having Roma adversaries.

When equalizing the ethnic distribution is combined with closing the achievement gap, the relations of Roma students show improvements together with major shifts in the ethnic composition of their friends and adversaries. In addition, the proportion of non-

Roma students with a Roma friend would increase compared to the baseline percentage, and the percentage with a Roma adversary would decrease. The magnitudes implied by our simulation exercise are significant. For example, when combined, the policies considered have the potential to increase the number of non-Roma students with Roma friends by 80 percent, although they would still be a minority among all non-Roma students (32 percent). The same combination of policies can lead to even more substantial shifts in the ethnic composition of friends of Roma students.

Of course, the actual effects of large policy changes may be very different from our simulation results. The changes may lead to interethnic dynamics that undermine some or even most of the positive effects, similar Carrell, Sacerdote, and West's (2013) findings in their policy experiment. Alternatively, these policies may contribute to lowering the overall level of prejudice, which could have additional positive effects. Nevertheless, our results suggest that educational policies can improve interethnic relations if they achieve both a more equal ethnic distribution across classes and a narrower achievement gap between minority and majority students.

VII. Conclusions

This paper provides strong evidence that high-achieving eighth-grade students from the disadvantaged Roma minority in Hungary have significantly more friends and fewer adversaries than low-achieving ones. The relationship is monotone and remarkably robust across a wide range of specifications, providing support for a causal interpretation. The association is very similar for same-sex friendships and opposite-sex friendships, it is strongest for publicly observable academic achievement, and the association between

achievement and the number of adversaries is a mirror image of the findings for friendship relations. These associations are, if anything, stronger for Roma students than non-Roma students, and they are driven by relationships with their non-Roma peers. Roma–Roma relations are not significantly related to academic achievement.

Instead of reducing the social status of Roma students as postulated by the “acting white” hypothesis, high academic achievement increases their social status in general, without decreasing their status among their minority peers. This is a remarkable finding given the generally strong and open anti-Roma sentiments in general. It also seems to be at odds with findings from studies on African American and Hispanic minorities of similar age in the U.S. using comparable data and methodology (Fryer and Torelli, 2010). At the same time, it is in line with findings on the effects of exposure to roommates and military squadrons of college students in the U.S. We speculate that it is the institutional framework of social interaction—more similar to the roommate and military squadron assignments than class assignments in U.S. middle schools and high schools—that can explain the difference. Similarly to most countries in Europe, students in Hungarian schools are assigned to the same class throughout their school career, leading to intensive exposure to their classmates in relatively intimate communities for many years. Perhaps such an environment is more conducive to fostering peer appreciation of the high academic achievement of disadvantaged students.

Our finding has important implications for social policy—similarly, with an opposite sign, to the potential importance of the “acting white” phenomenon that is refuted in our context. Minority students can benefit from working harder in schools, not only in the long term but also in the short term. Learning environments that help minority

students achieve higher academic results also foster their social wellbeing and integration right away. Educational policy can leverage this extra incentive when aiming to close the achievement gap between minorities and the majority. Indeed, our simulation results suggest that a policy that combines desegregation and closing the achievement gap can improve the social relations of minority students both in terms of having more friends and having more of their friends from the majority. While desegregation, in itself, increases the hostility they face, also closing the achievement gap would counter-balance that, leading to better social status along all dimensions. This combined policy has the highest potential to result in more of the majority students having minority friends.

Tensions along ethnic and racial lines have been strong in many countries, and may have become stronger in recent years. The social integration of disadvantaged minorities is as important a social goal as ever: it improves the lives of minorities and reduces social tensions at the same time. Our finding suggests that ethnic diversity in classrooms and educational practices that help the academic development of minority students promote this goal if students are exposed to each other for substantial time in relatively intimate communities.

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Appendix A: Data documentation

The data for our analysis comes from the “Interetnikus kapcsolatok” (Inter-ethnic relations) survey. The survey was designed by the authors of this paper and it was financed by the Educatio Kht, Hungary. The data was collected by the Adatgyujto Intezet, Hungary, in the spring of 2010.

The target population of the survey was the eighth grade students in the towns and cities of Hungary who studied in schools with at least 10 percent and at most 90 percent Roma students. The sampling frame was selected from the set of schools in the National Assessment of Basic Competencies, the nationwide student testing framework that includes administrative data on schools as well. Among other information, this data contains school principals’ estimates of the proportion of Roma students in their schools. We used the average of this information from 2006, 2007 and 2008 to select the schools in the 10 percent to 90 percent range. The final sampling frame consisted of 354 schools that were located in towns and cities (except Budapest) so we excluded all village schools.

The sample was stratified random sample of 88 schools in 74 towns and cities. The strata were based on the proportion of Roma students and the schools’ participation in an integrated education framework program implemented by the Hungarian government (“IPR program”); this latter information was not used in our analysis. The geographic distribution of the sample was not restricted or stratified. As there were few schools with high proportion of Roma students we used higher sampling weights for such schools to obtain more even distribution in the sample. Figure A1 shows the histogram of the proportion of Roma students; panel A shows the distribution in the sampling frame, while panel B shows the distribution in the sample.

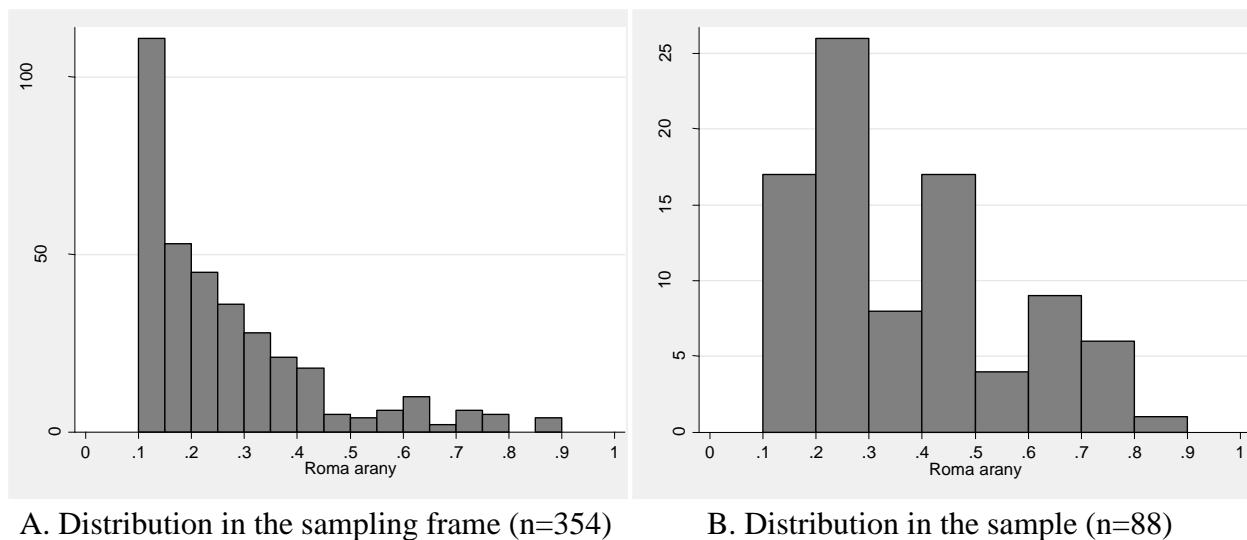


Figure A1. Distribution of the schools by the proportion of Roma students

All students in grade 8 in the 88 selected schools were part of the data collection. The data was collected in classrooms. The main instrument was a student questionnaire with the lists of friends and adversaries and some background information. The names of all students in the class were written on the blackboard, and students were asked to list the names of their five best male friends, their best five female friends (with some information that help assess the intensity of their friendship) and five classmates with whom they would not share a train cabin during a field trip. Students who were absent on the day of the data collection did not fill out this questionnaire but their names were listed on the blackboard, too. The background information included the ethnic identity of the students, asked in the form of two questions (what is your national or ethnic identity in the first place? what is your national or ethnic identity in the second place?) Schoolteachers were asked to provide grades and some additional information on a separate questionnaire. The school administration was then asked to assign the student identifiers to each name, and the names were removed from the questionnaires before they were collected by the data collection agency. Our data collection took place a few weeks before the testing day. We used these identifiers to merge administrative data on test scores once those scores became available. This data collection and the appropriateness of the measures taken to ensure privacy were approved by the Oktatasi Hivatal (Educational Agency, the governmental organization responsible for the testing).

Appendix B: Documenting the simulation exercise

The simulation exercise consists of three steps: (1) creating a simulated population of 8th grade students of different ethnicity (Roma or non-Roma) and achievement category (high-achiever or low-achiever) estimated from a representative survey; (2) creating classes and peer groups within classes in this simulated population and simulating the ethnic composition of the peer group for each student, using administrative data on the ethnic composition of schools and representative survey data on the ethnic composition of classes within schools; (3) simulating the number of friends, by ethnicity, using estimates from our main analysis. The benchmark results of this exercise are our estimates of the friendship and hostility relations in the entire population. The purpose of this exercise is to compare its estimates to estimates under three alternative scenarios: equal ethnic distribution of classes; closing the achievement gap between Roma and non-Roma students; the two together: equal ethnic distribution and no gap. These alternative estimates are based on the same simulation exercises with appropriate changes in the composition of peer groups and students' achievements.

Step 1. The population of 8th grade students

Source: Hungarian Life Course Survey (HLCS; the “Eletpalya” survey of TARKI). First survey wave, 10,022 adolescents interviewed in the fall after they finished 8th grade.

Ethnicity

Individuals are considered Roma if

- they identified as Roma in any of the survey waves (asked in 4 out of 6 survey waves),
- any of their parents identified themselves as Roma in any of the survey waves (asked in 2 out of 6 survey waves), or
- any of their parents identified their parents or other ancestors as Roma in any of the survey waves (asked in 2 out of 6 survey waves).

There are 1320 Roma individuals defined this way in the sample; their fraction, using the appropriate sampling weights is 11% (using weight is necessary as low-achieving students were oversampled in the survey, resulting in an oversampling Roma students).

Achievement

Information on the grade point average (GPA) at the end of the 1st semester of 8th grade (the same point in time it is measured in the IEFH survey) is available in the administrative National Assessment of Basic Competences (NABC) dataset. We linked this information to each student in the HLCS sample (the sampling frame of the HLCS sample was the NABC administrative data).

This measure of GPA was missing for 1373 observations. We filled the missing values by predictions from a regression of GPA on Roma and piecewise linear splines of the reading and mathematics test scores (test scores were available for all students in the sample as the administrative test score data formed the frame of the sample).

High-achieving students were defined as having a GPA of 3.5 or higher.

Expanding the sample to the simulated population

The HLCS represents the student population using its sampling weights (see earlier about the weights). These weights vary from 0.2 to 42.5 (mean is 10.9). We used the rounded integer values of the sampling weights of the HLCS survey (replaced it to 1 for the 124 observations for which the sampling weights were below 0.5). This resulted in a dataset of the simulated population of 8th grade students, n=109,119. This number is approximately the number of 8th grade students in the administrative data on test scores; the small difference is due to rounding errors.

Step 2. The ethnic composition of the peer group

Ethnic composition of the class

Two sources of information are used to estimate the estimate the ethnic composition of the 8th-grade class of the individuals in the HLCS sample.

- The first wave of the HLCS as a categorical variable on students' assessment of the composition of their class in 8th grade. We transformed the categories to estimated fractions (0.05 if “no or very few Roma”, 0.2 if “some Roma but less than half”, 0.5 if “half Roma”, 0.7 if “majority but not all Roma” and 1 if “all or almost all Roma”).
- The school-level file of the NABC contains the school principals' estimates of the fraction of Roma students in the entire school.
- The first measure was missing for 138 of the 10,022 observations; the second measure was missing for 1,174 of the 10,022 observations; the two were jointly missing for 23 observations; those were dropped from the analysis.

We combined the two sources of information in the following way. We first took the average of the two measures (only one measure when the other one was missing). We then replaced the estimated fraction Roma to zero if the school-level estimate was less than 2 percent, and we replaced it to one if the school-level estimated was greater than 90 percent.

Ethnic composition of the peer group

The peer group is defined as same-sex classmates. We have information on the size of the 8th-grade class for each individual (from the linked administrative NABC database) but we have no complete information on the gender composition of the classes. We assumed that exactly half of each class is female. For each student the size of the peer group is the rounded integer of the half of the class minus one. For each student the number of Roma students in her or his peer group is the size of the peer group multiplied with the fraction Roma in the class and rounded to the nearest integer. For Roma students the number of Roma in their peer group is one minus this number. When this estimate turned out to be negative we replaced it by zero. The fraction of Roma in one's peer group is the ratio of these two numbers: the estimated number of Roma students in the peer group divided by the estimated size of the peer group.

Figure B1 shows the simulated fraction of Roma students in the peer groups of Roma students and non-Roma students. 46 percent of non-Roma students and 37 percent of Roma students have zero Roma in their peer group. The average number of Roma

students in the peer group of non-Roma students is 9 percent, and the average number of Roma students in the peer group of Roma students is 21 percent.

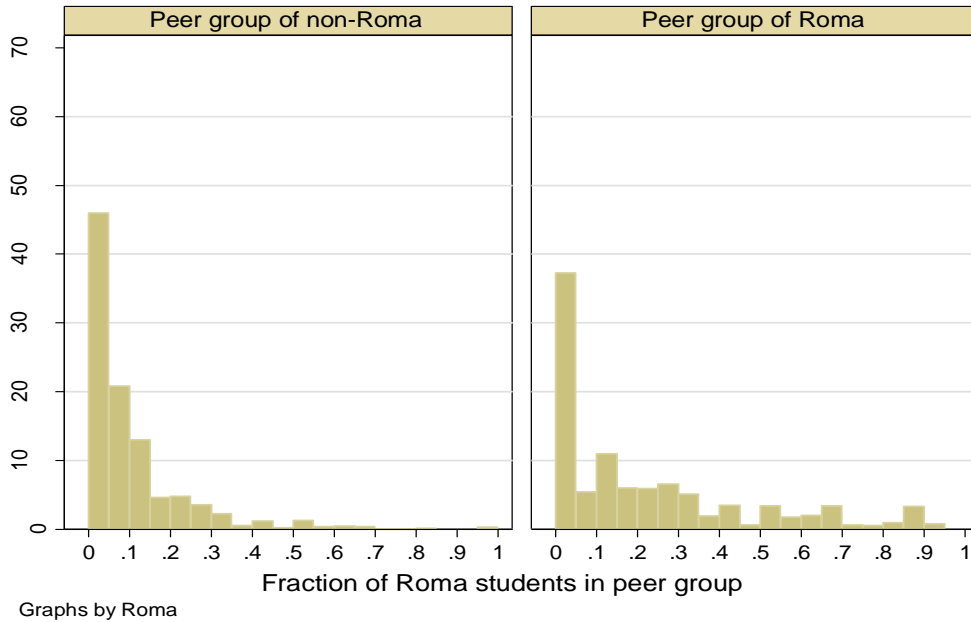


Figure B1: Simulated distribution of students' exposure to Roma peers.
Benchmark case

Step 3. The estimated number of friends and adversaries

We estimated the number of friends and adversaries Roma students receive, also by the ethnicity of the nominating peer, and the number of Roma friends and adversaries non-Roma students nominate.

Estimation

The estimation procedure is the same as the one outlined in sections 5 and 6 of the main text: We created categories by the fraction of Roma in the peer group using increments of 0.1 up to 0.4 and 0.2 above. We then estimated the average number of friends and adversaries Roma students receive in those categories, separately for high-GPA Roma students and low-GPA Roma students. For the number of Roma peers nominated by non-Roma we created similar categories separately of the fraction of high-GPA Roma students and low-GPA Roma students and estimated the average number of peers non-Roma students nominate in the two-dimensional distribution of these categorical variables. We replaced the number of friends to 0 when the size of the appropriate peer group was 0.

Importing estimates to the simulated data

We used the first set of estimates to predict the number of friends and adversaries Roma students receive, by the GPA of the Roma student and fraction Roma in her or his peer group. We used the second set of estimates to predict the number of Roma friends and adversaries non-Roma students nominate by the two-dimensional distribution spanned by

the categories of the fraction of high-GPA Roma students and low-GPA Roma students in the peer group.

Benchmark

Steps 1 through 3 provide the estimated number of friends and adversaries of Roma students under the current distribution of academic achievement and the ethnic composition of classes. These estimates for the benchmark to our policy simulations.

Policy simulation 1: Equal ethnic distribution of students

In this exercise we simulate the effect of equalizing the ethnic composition of classes across the nation. We simulate the fraction of Roma students in the peer groups of each student in the population first. We start with replacing the fraction of Roma students in each class from the benchmark estimates to 11 percent. In a typical class that would imply exactly two Roma students. Simply projecting this 11 percent fraction to each class-gender group would amount to assume that of those two Roma students one is always a girl and one is a boy. Instead, a complete random allocation would result in a same-sex Roma students in only 50 percent of the cases. We implement this second assumption in our simulation exercise by allocating zero Roma peers to a random one quarter of class-gender groups and two peers to another quarter.

Then we see the number of Roma students this fraction would imply in each group defined by class and gender by rounding the implied number to the nearest integer. Then we create the fraction of Roma students in the peer group of each student, defining the size of the peer group and the number of Roma peers the way we did in Step 2 above (making sure we don't double count Roma students). This procedure incorporates the inherent indivisibility of peer groups that can result to zero Roma peers to many people.

Figure B2 shows the simulated fraction of Roma students in the peer groups or Roma students and non-Roma students in this scenario. Now only 27 percent of non-Roma students have zero Roma students in their peer group, and 69 percent of the Roma students have no Roma peer. The average number of Roma students in the peer group of non-Roma students is now 11 percent, while the average number of Roma students in the peer group of Roma students is 0.5 percent.

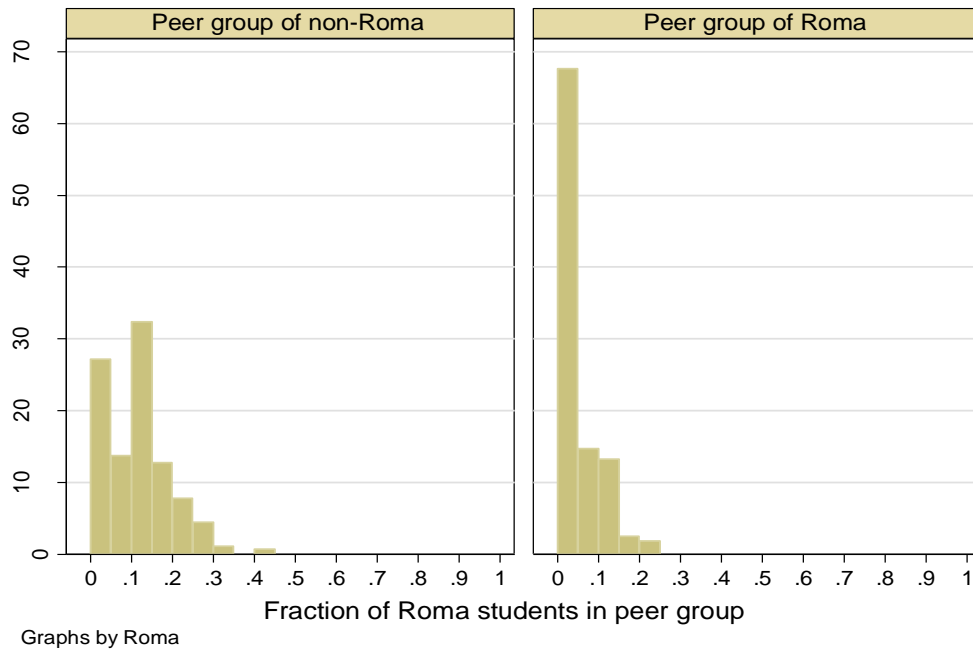


Figure B2: Simulated distribution of students' exposure to Roma peers.
Equal ethnic composition of classes

Applying the non-parametric regression estimates of the implied number of friends and adversaries to this simulated distribution of peer group composition we receive the following results. Table B1 shows the simulated number of friends and adversaries of Roma students; Table B2 shows the simulated percent of non-Roma students with at least one Roma friend and the percent with at least one Roma adversary.

Table B1. Number of friends and adversaries of Roma students in the benchmark simulation and the simulated effect of equal ethnic distribution

	Number of		Number of		Number of	
	Friends	Adversaries	Roma Friends	Roma Adversaries	Non-Roma Friends	Non-Roma Adversaries
<i>Friends and adversaries of low-achieving Roma students</i>						
Benchmark	2.7	1.7	1.0	0.1	1.7	1.6
Equal distribution	2.2	2.1	0.2	0.0	2.1	2.1
Equal - Benchmark	-0.5	0.4	-0.8	-0.1	0.4	0.5
<i>Friends and adversaries of high-achieving Roma students</i>						
Benchmark	3.8	0.7	1.0	0.1	2.8	0.6
Equal distribution	3.7	0.9	0.2	0.0	3.6	0.9
Equal – Benchmark	-0.1	0.1	-0.8	-0.1	0.7	0.2
<i>Friends and adversaries of an average Roma student</i>						
Benchmark	3.1	1.4	1.0	0.1	2.1	1.3
Equal distribution	2.8	1.7	0.2	0.0	2.6	1.7
Equal - Benchmark	-0.3	0.3	-0.8	-0.1	0.5	0.4

Table B2. The simulated percent of non-Roma students with Roma friends and adversaries

	Percent who have at least one	
	Roma friend	Roma adversary
Benchmark estimates	18	14
Equal ethnic distribution	26	15

The benchmark results are in line with our previous results from, with slightly different levels. These differences are due to the fact that the sample used for our main analysis is not representative of the entire population of 8th grade students in Hungary by design.

Policy simulation 2: Closing the achievement gap

In the benchmark simulated dataset 69 percent of the non-Roma students and only 34 percent of the Roma students have high GPA (a GPA of 3.5 or more; maximum is 5.0). In this simulation exercise we increased the GPA of Roma students between 3.0 and 3.5 to above 3.5. The fraction of high-GPA students in this exercise increased from 34 percent to 67 percent.

Table B3 shows the estimated number of friends and adversaries of Roma students in this case with the simulated ethnic distribution of peers and under the scenario of closing the achievement gap; Table B4 shows the simulated percent of non-Roma students with at least one Roma friend and the percent with at least one Roma adversary.

The number of friends and adversaries of low-achieving Roma students and high-achieving Roma students is the same in this exercise as in the benchmark case. The difference is in the number of friends and adversaries of the *average* Roma student: these are a lot closer to the high-achieving numbers because this average student is now more likely to have high achievement. The percent of non-Roma students with Roma friends in this experiment is very similar to the previous experiment (25 percent versus 26 percent), but the percent with Roma adversaries is reduced substantially, to 5 percent.

Table B3. The number of friends and adversaries of Roma students in the benchmark scenario and the simulated scenario of closing the achievement gap

	Number of		Number of		Number of	
	Friends	Adversaries	Roma Friends	Roma Adversaries	Non-Roma Friends	Non-Roma Adversaries
<i>Friends and adversaries of low-achieving Roma students</i>						
Benchmark	2.7	1.7	1.0	0.1	1.7	1.6
Closed gap	2.8	1.7	1.1	0.2	1.6	1.5
Closed gap - Benchmark	0.0	0.0	0.1	0.0	0.0	-0.1
<i>Friends and adversaries of high-achieving Roma students</i>						
Benchmark	3.8	0.7	1.0	0.1	2.8	0.6
Closed gap	3.8	0.8	0.9	0.1	2.9	0.6
Closed gap - Benchmark	0.0	0.0	0.0	0.0	0.0	0.0
<i>Friends and adversaries of an average Roma student</i>						
Benchmark	3.1	1.4	1.0	0.1	2.1	1.3
Closed gap	3.5	1.1	1.0	0.1	2.5	0.9
Closed gap - Benchmark	0.4	-0.3	0.0	0.0	0.4	-0.3

Table B4. The simulated percent of non-Roma students with Roma friends and adversaries

	Percent who have at least one	
	Roma friend	Roma adversary
Benchmark estimates	18	14
Closing the achievement gap	25	5

Policy simulation 3: Equal ethnic distribution of students and closing the achievement gap

Our third simulation exercise combines the previous two. Table B5 shows the simulated number of friends and adversaries of Roma students, and Table B6 shows the simulated percent of non-Roma students with at least one Roma friend and the percent with at least one Roma adversary.

Table B5. The number of friends and adversaries of Roma students in the benchmark simulation and the simulated effect of equal ethnic distribution and closing the achievement gap at the same time

	Number of		Number of		Number of	
	Friends	Adversaries	Roma Friends	Roma Adversaries	Non-Roma Friends	Non-Roma Adversaries
<i>Friends and adversaries of low-achieving Roma students</i>						
Benchmark	2.7	1.7	1.0	0.1	1.7	1.6
Equal distribution + closed gap	2.3	2.1	0.2	0.0	2.0	2.1
Equal + closed gap - Benchmark	-0.5	0.4	-0.8	-0.1	0.4	0.5
<i>Friends and adversaries of high-achieving Roma students</i>						
Benchmark	3.8	0.7	1.0	0.1	2.8	0.6
Equal distribution + closed gap	3.7	0.9	0.2	0.0	3.6	0.9
Equal + closed gap - Benchmark	-0.1	0.1	-0.8	-0.1	0.7	0.2
<i>Friends and adversaries of an average Roma student</i>						
Benchmark	3.1	1.4	1.0	0.1	2.1	1.3
Equal distribution + closed gap	3.2	1.3	0.2	0.0	3.1	1.3
Equal + closed gap - Benchmark	0.2	-0.1	-0.8	-0.1	1.0	0.0

Table B6. The simulated percent of non-Roma students with Roma friends and adversaries

	Percent who have at least one	
	Roma friend	Roma adversary
Benchmark estimates	18	14
Equal distribution + closing the achievement gap	32	10

Online Appendix: Additional Tables and Figures

Table O1. Ethnic identification in the sample.

(All respondents who indicated a primary or a secondary identification)

	Primary identification (%)	Secondary identification (%)
Hungarian	81.5	6.9
German	0.3	2.3
Serbian	0.2	0.5
Croat	0.1	0.4
Romanian	0.8	1.2
Slovak	0.0	0.5
Roma/Cigany	16.2	4.5
Other	0.8	1.8
No identification	0.2	82.0
Sum	100.0	100.0
Observations	3,430	3,430

Table O2. The distribution of friendship and adversary nominations in the sample (percent)

	# same-sex friends nominated by			# opposite-sex friends nominated by			# adversaries nominated by		
	Roma	Non-Roma	All	Roma	Non-Roma	All	Roma	Non-Roma	All
0	3	2	2	21	17	18	41	0	54
1	6	4	4	12	12	12	22	1	20
2	10	9	9	11	15	14	19	2	13
3	14	14	14	14	17	16	12	3	7
4	17	16	16	13	10	11	4	4	4
5	50	57	55	30	28	28	2	5	3
Sum	100	100	100	100	100	100	100	15	100

Table O3. Friends and adversaries as function of GPA. *OLS results without fixed-effects.*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.46 (0.05)**	-0.36 (0.04)**	-0.08 (0.02)**	-0.01 (0.01)	0.55 (0.05)**	-0.35 (0.04)**
Roma × GPA	0.14 (0.10)	-0.25 (0.10)**	0.11 (0.07)	-0.05 (0.04)	0.03 (0.09)	-0.21 (0.09)*
Roma	-0.02 (0.10)	0.00 (0.08)	0.38 (0.08)**	-0.12 (0.04)**	-0.39 (0.09)**	0.13 (0.07)
Class FE	NO	NO	NO	NO	NO	NO
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes. The number of friendship and adversary nominations from all peers as well as from Roma and non-Roma peers separately, as functions of GPA and ethnicity of the student. Peers are same-sex classmates. GPA is publicly observable grade point-average ranging from 1 to 5, normalized to be zero at its mean value 3.5.

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O4. Friends and adversaries as function of GPA. *Results with class-gender fixed-effects.*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.65 (0.06)**	-0.49 (0.06)**	-0.11 (0.03)**	-0.02 (0.02)	0.76 (0.06)**	-0.47 (0.05)**
Roma × GPA	0.14 (0.13)	-0.19 (0.11)	0.08 (0.08)	-0.03 (0.04)	0.06 (0.11)	-0.16 (0.10)
Roma	-0.08 (0.13)	0.11 (0.10)	0.24 (0.10)*	-0.19 (0.05)**	-0.32 (0.12)**	0.31 (0.08)**
Class-gender FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O5. Friends and adversaries as function of GPA. *Sample restricted to students who did not repeat grades and are not older than grade level age 15*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.48 (0.06)**	-0.37 (0.05)**	-0.11 (0.03)**	-0.01 (0.02)	0.59 (0.06)**	-0.36 (0.05)**
Roma × GPA	0.17 (0.14)	-0.32 (0.12)*	0.06 (0.09)	-0.07 (0.05)	0.11 (0.13)	-0.25 (0.12)*
Roma	-0.17 (0.14)	0.13 (0.11)	0.45 (0.11)**	-0.14 (0.05)**	-0.62 (0.13)**	0.28 (0.10)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	2,935	2,935	2,935	2,935	2,935	2,935

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O6. Friends and adversaries as function of GPA. *Sample restricted to common support (peer group has at least two Roma and two non-Roma members).*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.47 (0.09)**	-0.41 (0.09)**	-0.21 (0.05)**	-0.04 (0.04)	0.69 (0.07)**	-0.37 (0.07)**
Roma × GPA	0.32 (0.15)*	-0.40 (0.14)**	0.22 (0.11)*	-0.01 (0.05)	0.10 (0.12)	-0.39 (0.12)**
Roma	-0.00 (0.15)	-0.02 (0.12)	0.49 (0.12)**	-0.20 (0.06)**	-0.49 (0.14)**	0.19 (0.09)*
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	1,571	1,571	1,571	1,571	1,571	1,571

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O7. Friends and adversaries as function of GPA. *Results with control variables.*

Dep.va: nominations received	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.55 (0.06)**	-0.41 (0.06)**	-0.10 (0.03)**	-0.02 (0.02)	0.65 (0.06)**	-0.39 (0.05)**
Roma × GPA	0.09 (0.12)	-0.23 (0.11)*	0.11 (0.08)	-0.04 (0.04)	-0.03 (0.11)	-0.19 (0.10)
Roma	-0.01 (0.13)	0.01 (0.11)	0.42 (0.10)**	-0.15 (0.05)**	-0.43 (0.12)**	0.16 (0.09)
Repeated grade	0.03 (0.17)	0.17 (0.15)	0.14 (0.08)	-0.02 (0.05)	-0.11 (0.15)	0.20 (0.14)
Age 14	-0.33 (0.08)**	0.15 (0.08)*	0.05 (0.05)	0.03 (0.03)	-0.39 (0.08)**	0.13 (0.07)
Age 16	0.07 (0.09)	-0.07 (0.08)	0.01 (0.04)	-0.04 (0.02)	0.06 (0.08)	-0.04 (0.08)
Age 17 or more	-0.29 (0.16)	0.12 (0.17)	-0.07 (0.07)	0.10 (0.05)	-0.22 (0.14)	0.02 (0.14)
Years in preschool	-0.78 (0.24)**	0.19 (0.28)	-0.30 (0.13)*	0.03 (0.08)	-0.49 (0.20)*	0.17 (0.24)
Mother's educ. 8 grades	0.06 (0.05)	-0.05 (0.04)	-0.01 (0.02)	-0.00 (0.01)	0.07 (0.04)	-0.05 (0.04)
Mother's educ. vocational	0.27 (0.21)	-0.23 (0.21)	0.10 (0.14)	-0.07 (0.08)	0.17 (0.15)	-0.16 (0.17)
Mother's educ. high school	0.46 (0.22)*	-0.32 (0.21)	0.06 (0.15)	-0.07 (0.08)	0.40 (0.16)*	-0.25 (0.17)
Mother's educ. college	0.45 (0.23)	-0.35 (0.22)	-0.00 (0.15)	-0.05 (0.08)	0.44 (0.18)*	-0.30 (0.18)
Mother's educ. missing	0.27 (0.24)	-0.22 (0.23)	-0.04 (0.15)	0.03 (0.09)	0.30 (0.20)	-0.24 (0.19)
Class FE	-0.05	0.21	0.29	-0.09	-0.33	0.30
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O8. Friends and adversaries as function of GPA. *Results with class-gender fixed-effects, control variables and sample restricted to common support.*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.46 (0.10)**	-0.42 (0.09)**	-0.20 (0.06)**	-0.05 (0.04)	0.66 (0.08)**	-0.36 (0.07)**
Roma × GPA	0.24 (0.15)	-0.28 (0.14)*	0.15 (0.11)	0.03 (0.05)	0.08 (0.13)	-0.32 (0.13)*
Roma	0.07 (0.16)	-0.04 (0.13)	0.34 (0.13)**	-0.20 (0.07)**	-0.27 (0.15)	0.17 (0.10)
Class-gender FE	YES	YES	YES	YES	YES	YES
Control variables	YES	YES	YES	YES	YES	YES
<i>N</i>	1,571	1,571	1,571	1,571	1,571	1,571

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O9. Friends and adversaries as function of GPA. *Nominations capped at 4.*

Dependent variable: nominations received from peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.49 (0.05)**	-0.42 (0.05)**	-0.10 (0.02)**	-0.02 (0.01)	0.60 (0.05)**	-0.40 (0.04)**
Roma × GPA	0.10 (0.12)	-0.25 (0.11)*	0.08 (0.08)	-0.05 (0.04)	0.02 (0.10)	-0.21 (0.10)*
Roma	-0.06 (0.11)	0.10 (0.10)	0.47 (0.09)**	-0.12 (0.04)**	-0.53 (0.10)**	0.23 (0.08)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O10. Friends and adversaries as function of GPA. *Nominations weighted by the friends of the nominating students.*

Dependent variable: nominations received from peers weighted by their friends	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.84 (0.13)**	-0.45 (0.10)**	-0.09 (0.02)**	0.00 (0.02)	0.97 (0.12)**	-0.43 (0.08)**
Roma × GPA	0.34 (0.26)	-0.52 (0.18)**	0.18 (0.11)	-0.04 (0.05)	-0.17 (0.19)	-0.39 (0.16)*
Roma	-0.39 (0.28)	0.11 (0.19)	0.65 (0.16)**	-0.15 (0.06)*	-1.24 (0.24)**	0.34 (0.14)*
Class FE	YES	YES	YES	YES	YES	YES
N	3,430	3,430	3,430	3,430	3,430	3,430

Notes. Dependent variable: The number of friendship and adversary nominations from all peers as well as from Roma and non-Roma peers separately, weighted by the friendship nominations they receive; the number of same-sex friends of each nominating friend or adversary is added and the result is divided by two (when Roma or non-Roma nominations are considered only same ethnicity friends are added). Peers are same-sex classmates. Right hand side variable: GPA is publicly observable grade point-average ranging from 1 to 5, normalized to be zero at its mean value 3.5.

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O11. Friends and adversaries as function of GPA. *Relations defined as the union of nominations given and received.*

Dependent variable: measure of popularity	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.31 (0.05)**	-0.36 (0.06)**	-0.13 (0.02)**	0.02 (0.02)	0.47 (0.05)**	-0.35 (0.05)**
Roma × GPA	0.25 (0.11)*	-0.19 (0.12)	0.08 (0.08)	0.01 (0.06)	0.15 (0.11)	-0.25 (0.12)*
Roma	-0.03 (0.10)	-0.03 (0.11)	0.43 (0.10)**	-0.31 (0.06)**	-0.56 (0.12)**	0.47 (0.12)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes. Dependent variable: The number of friends and adversaries defined as the union of nominations given and received (number of peers who were nominated by the student or who nominated the student). All peers as well as from Roma and non-Roma peers separately. Peers are same-sex classmates. Right hand side variable: GPA is publicly observable grade point-average ranging from 1 to 5, normalized to be zero at its mean value 3.5.

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O12. Friends and adversaries as function of GPA. *Reciprocal relations.*

Dependent variable: measure of popularity	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.39 (0.04)**	-0.03 (0.02)*	-0.10 (0.02)**	0.01 (0.01)	0.48 (0.04)**	-0.04 (0.01)**
Roma × GPA	-0.01 (0.08)	-0.02 (0.04)	0.04 (0.07)	0.01 (0.02)	-0.05 (0.08)	-0.03 (0.03)
Roma	-0.06 (0.08)	0.06 (0.03)	0.49 (0.08)**	-0.01 (0.02)	-0.55 (0.09)**	0.07 (0.03)*
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes. Dependent variable: The number of reciprocal friends and reciprocal adversaries (number of peers who were nominated by the student and who nominated the student at the same time). All peers as well as from Roma and non-Roma peers separately. Peers are same-sex classmates. Right hand side variable: GPA is publicly observable grade point-average ranging from 1 to 5, normalized to be zero at its mean value 3.5. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O13. Friends and adversaries as function of GPA. *The Echenique-Fryer measure of popularity on the LHS.*

Dependent variable: measure of popularity	Friends	Roma friends of Roma students	Non-Roma friends of non-Roma students
GPA	0.14 (0.02)**	-0.09 (0.05)	0.20 (0.02)**
Roma × GPA	0.12 (0.05)*		
Roma	-0.51 (0.16)**		
Class FE	YES	YES	YES
<i>N</i>	3,430	774	2,853

Notes. Dependent variable: The Echenique-Fryer (2007) measure of popularity, as used by Fryer and Torelli (2010). Intuitively, it measures the number of friends weighted by the number of their friends, iterated. Technically, it uses the symmetric matrix of connections (using the union of nominations given and received.), and takes the largest eigenvalue and the corresponding eigenvector of the matrix, multiplies the two, and multiplies it with the determinant of the matrix. The individual measure of is the value of this vector that corresponds to the individual. The measure can be computed for friendship among all students as well as friendship within ethnic groups (it is defined for symmetric and transitive relations, so it is not defined for adversary relationships or relationships across ethnic groups).

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O14. Friends and adversaries of opposite sex (nominations received) and GPA

Dep. variable: # nominations from opposite-sex peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.65 (0.08)**	-0.75 (0.06)**	-0.02 (0.02)	-0.08 (0.02)**	0.66 (0.07)**	-0.67 (0.06)**
Roma × GPA	0.02 (0.16)	-0.06 (0.13)	0.00 (0.07)	-0.01 (0.04)	0.02 (0.13)	-0.05 (0.12)
Roma	0.06 (0.15)	0.10 (0.10)	0.21 (0.08)**	-0.11 (0.03)**	-0.15 (0.12)	0.21 (0.09)*
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O15. Friends and adversaries of opposite sex (nominations originated) and GPA

Dep. variable: # nominations of opposite-sex peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.23 (0.05)**	0.08 (0.04)	-0.03 (0.02)	0.04 (0.02)*	0.26 (0.05)**	0.02 (0.04)
Roma × GPA	0.01 (0.10)	0.11 (0.08)	-0.07 (0.06)	0.10 (0.04)*	0.05 (0.09)	-0.07 (0.08)
Roma	0.28 (0.11)**	0.01 (0.07)	0.25 (0.07)**	-0.12 (0.04)**	-0.11 (0.10)	0.29 (0.09)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O16. Friends and adversaries of opposite sex (reciprocated nominations) and GPA

Dep. variable: # reciprocated nominations of opposite-sex	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.58 (0.06)**	-0.44 (0.05)**	-0.11 (0.02)**	-0.02 (0.01)	0.69 (0.05)**	-0.42 (0.05)**
Roma × GPA	0.21 (0.12)	-0.27 (0.11)*	0.16 (0.08)*	-0.06 (0.04)	0.04 (0.11)	-0.21 (0.10)*
Roma	-0.10 (0.12)	0.10 (0.10)	0.50 (0.10)**	-0.15 (0.05)**	-0.59 (0.12)**	0.25 (0.08)**
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table O3. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O17. Friends and adversaries as function of *GPA as well as the average of the standardized test scores in mathematics and reading.*

Dep. variable: # nominations from peers	Friends	Adversaries	Friends Adversaries		Friends Adversaries	
			From Roma classmates		From non-Roma classmates	
GPA	0.49 (0.08)**	-0.37 (0.07)**	-0.11 (0.03)**	-0.01 (0.02)	0.61 (0.07)**	-0.35 (0.06)**
Test score	0.08 (0.08)	-0.09 (0.07)	0.01 (0.03)	-0.01 (0.02)	0.07 (0.08)	-0.08 (0.07)
Roma × GPA	0.20 (0.14)	-0.22 (0.12)	0.15 (0.09)	-0.00 (0.04)	0.04 (0.14)	-0.22 (0.11)
Roma × test score	0.02 (0.12)	-0.13 (0.12)	-0.04 (0.10)	-0.09 (0.05)	0.07 (0.13)	-0.04 (0.10)
Roma	-0.03 (0.13)	0.05 (0.12)	0.49 (0.11)**	-0.17 (0.05)**	-0.53 (0.13)**	0.22 (0.10)*
Class FE	YES	YES	YES	YES	YES	YES
<i>N</i>	3,154	3,154	3,154	3,154	3,154	3,154

Notes. Dependent variable: The number of friendship and adversary nominations from all peers as well as from Roma and non-Roma peers separately. Peers are same-sex classmates. Main right-hand-side variables: GPA (publicly observable) and standardized scores of low-stakes test in mathematics and reading (the simple average of the two scores; results of this test are typically unobservable to the students). Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O18. Subsequent academic outcomes as function of *GPA as well as the average of the standardized test scores in mathematics and reading.*

Dependent variable: future academic outcomes	Admission to academic secondary school	Dropout from secondary school	GPA in grade 10	Standardized test score in grade 10	
				reading	maths
GPA	0.24 (0.01)**	-0.08 (0.01)**	0.76 (0.05)**	0.28 (0.02)**	0.19 (0.03)**
Test score	0.06 (0.01)**	-0.02 (0.01)*	0.19 (0.05)**	0.75 (0.02)**	0.74 (0.03)**
Roma × GPA	-0.03 (0.03)	-0.12 (0.03)**	0.02 (0.05)	-0.03 (0.06)	0.03 (0.07)
Roma × test score	-0.00 (0.02)	0.03 (0.03)	0.02 (0.05)	-0.05 (0.05)	-0.11 (0.06)
Roma	0.01 (0.03)	0.06 (0.02)*	-0.02 (0.04)	-0.06 (0.05)	-0.17 (0.06)**
Class FE	YES	YES	YES	YES	YES
<i>N</i>	3,154	3,154	3,154	3,154	3,154

Notes. Dependent variables: whether admitted to academic secondary school (“gimnazium”) after grade 8; whether dropped out of secondary school by the end of grade 10; GPA (1 through 5) at mid-year in grade 10; standardized (0,1) scores of low-stakes tests in reading and mathematics at the end of grade 10. Main

right-hand-side variables: se previous table.

Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O19. Friends and adversaries of Roma students and the ethnic composition of their peer group, interacted with whether they have high GPA.

Non-Roma students	(1) Number of friends	(2) Number of Adversaries	(3) Number of friends	(4) Number of Adversaries
High-GPA student	1.24 (0.23)**	-1.01 (0.19)**	1.25 (0.32)**	-1.16 (0.28)**
Fraction Roma among peers	4.27 (0.96)**	-2.08 (0.97)*	4.66 (1.59)**	-0.95 (2.43)
Fraction Roma squared	-3.59 (0.93)**	0.25 (1.09)	-4.21 (1.34)**	0.45 (1.91)
High-GPA student interacted with fraction Roma squared	-1.44 (0.43)**	1.25 (0.34)**	-1.18 (0.51)*	1.05 (0.45)*
Class FE	NO	NO	YES	YES
Control variables	NO	NO	NO	NO
<i>N</i>	710	710	710	710

Notes. Peers refer to same-sex classmates (not including the student). High-GPA refers to grade point average higher than 3.5 (the overall average and median; the 80th percentile among Roma students and the 40th percentile among non-Roma students). The interaction of high-GPA and the linear term of fraction Roma is dropped from the specification as it is never statistically significant. The predicted left hand side variables have the same shape from the OLS and the FE regressions; they overlap completely for the number of friends and the discrepancy is small for the number of adversaries. Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O20. Friends and adversaries of Roma students and the ethnic composition of their peer group, interacted with whether they have high GPA.

	(1)	(2)	(3)	(4)
Non-Roma students	Number of friends	Number of Adversaries	Number of friends	Number of Adversaries
High-GPA student	1.10 (0.24)**	-0.96 (0.19)**	1.13 (0.34)**	-1.03 (0.32)**
Fraction Roma among peers	4.52 (0.95)**	-2.14 (0.93)*	4.83 (1.62)**	-1.14 (2.49)
Fraction Roma squared	-3.83 (0.92)**	0.36 (1.05)	-4.54 (1.34)**	0.68 (1.96)
High-GPA student interacted with fraction Roma squared	-1.34 (0.44)**	1.19 (0.36)**	-1.03 (0.51)*	0.92 (0.51)
Class FE	NO	NO	YES	YES
Control variables	YES	YES	YES	YES
<i>N</i>	707	707	707	707

Notes. See table B23. Control variables are gender, year of age dummies, whether repeated grade, years in preschool, mother's education.

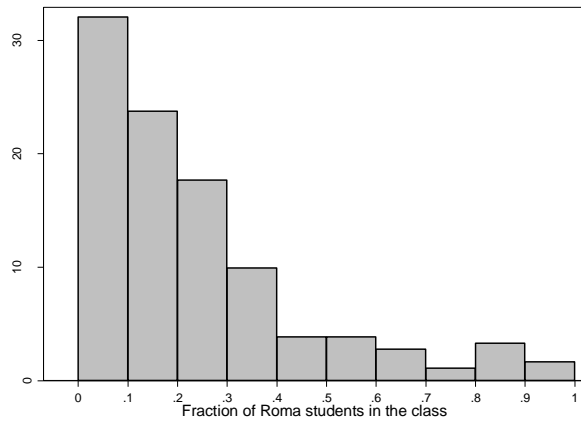
Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$

Table O21. The probability that non-Roma students nominate Roma students as friends and adversaries.

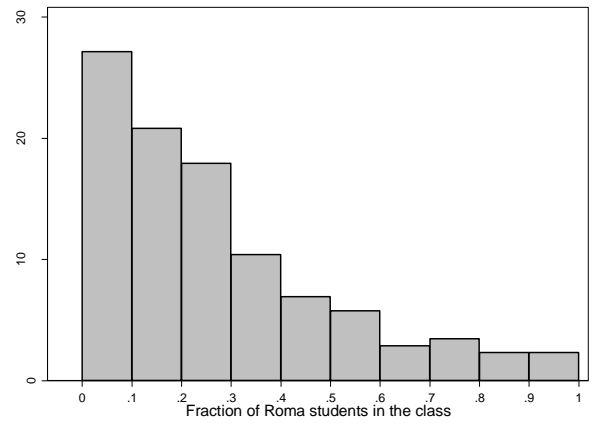
	(1)	(2)	(3)	(4)
	Nominated any Roma friend	Nominated any Roma adversary	Nominated any Roma friend	Nominated any Roma adversary
Fraction low-GPA Roma among peers	1.22 (0.17)**	1.81 (0.16)**	1.41 (0.34)**	1.64 (0.31)**
Fraction low-GPA Roma, squared	-0.44 (0.24)	-2.01 (0.28)**	-0.92 (0.63)	-1.80 (0.63)**
Fraction high-GPA Roma among peers	2.79 (0.26)**	0.18 (0.24)	2.74 (0.38)**	0.07 (0.39)
Fraction high-GPA Roma, squared	-2.26 (0.54)**	-0.27 (0.54)	-1.88 (0.70)**	-0.60 (0.64)
Constant	0.05 (0.01)**	0.04 (0.01)**	0.04 (0.03)	0.06 (0.03)*
Class FE	NO	NO	YES	YES
<i>N</i>	2,719	2,719	2,719	2,719

Notes. Peers refer to same-sex classmates. High-achieving refers to grade point average higher than 3.5 (the overall average and median; the 80th percentile among Roma students and the 40th percentile among non-Roma students).

The constant is the average of the class fixed-effects. The fraction Roma among peers and the fraction of high-GPA Standard errors, clustered at the class level, are in parentheses. * $p < 0.05$; ** $p < 0.01$



Fraction Roma by self-identification



Fraction Roma estimated by teacher

Figure O1
The distribution of classes in the sample by the fraction of Roma students

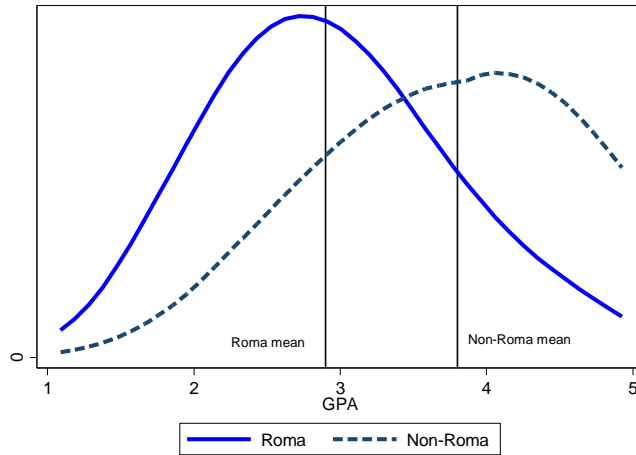


Figure O2
The distribution of students in the sample by their grade point average (GPA)

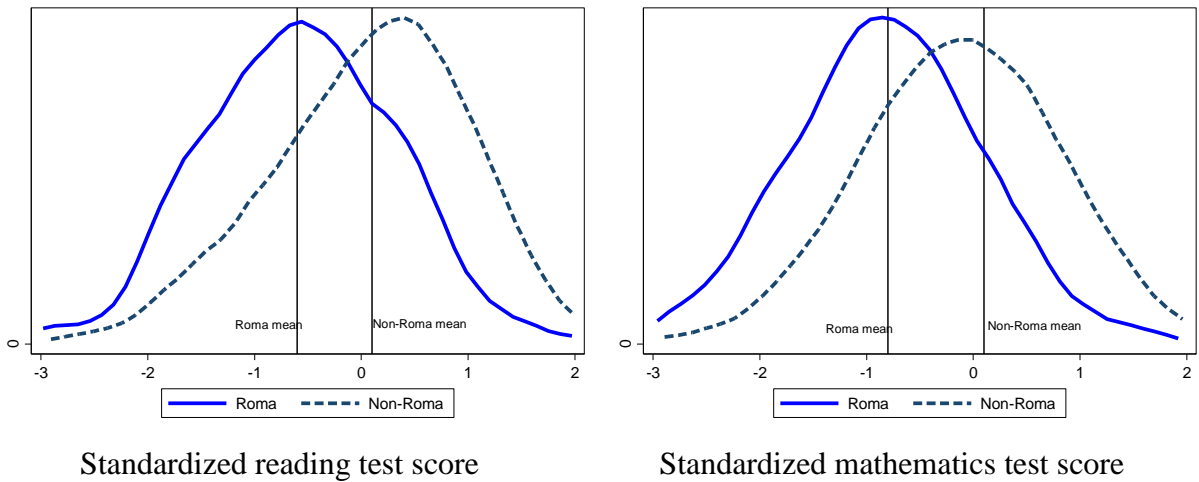
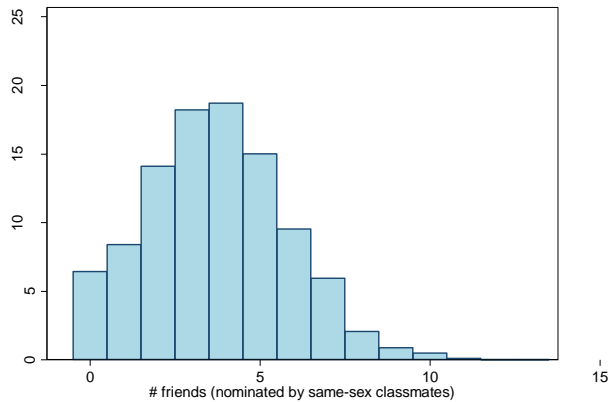
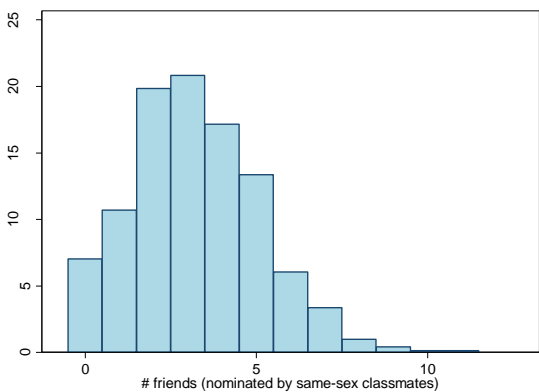


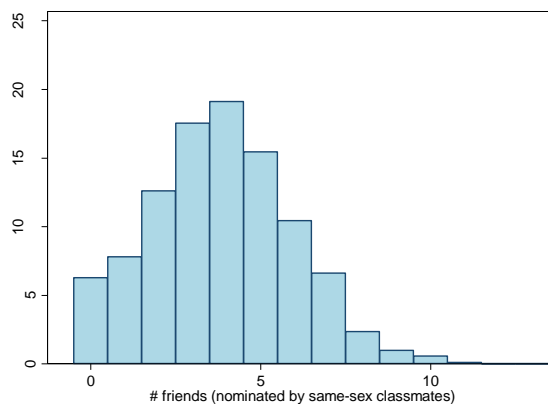
Figure O3
The distribution of students in the sample by their standardized test scores (reading and mathematics)



All students

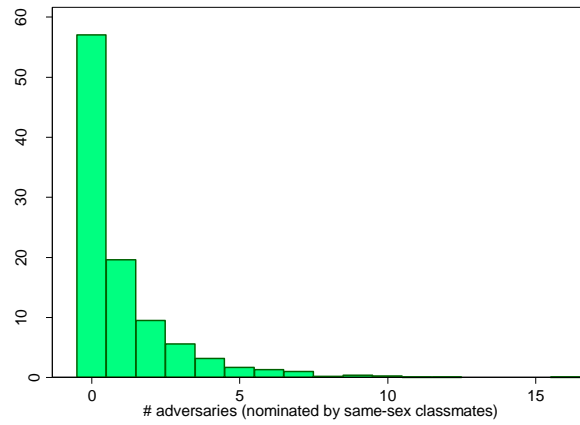


Received by Roma students

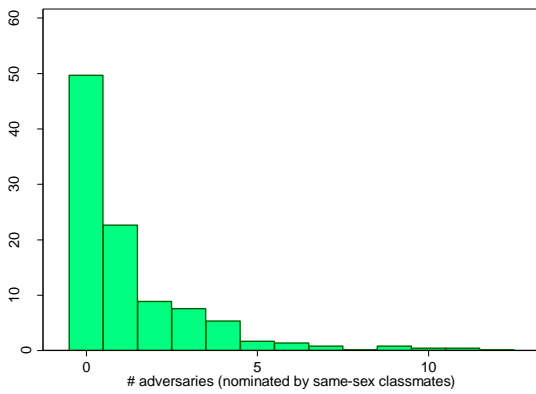


Received by non-Roma students

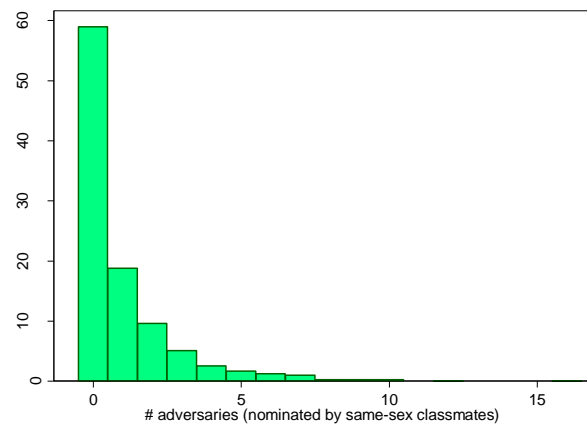
Figure O4
The distribution of students in the number of friendship nominations they receive



All students

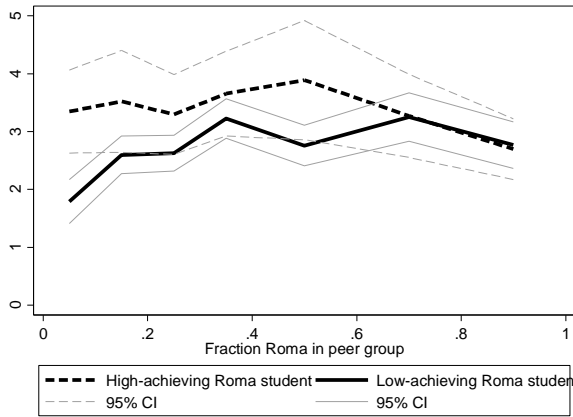


Received by Roma students

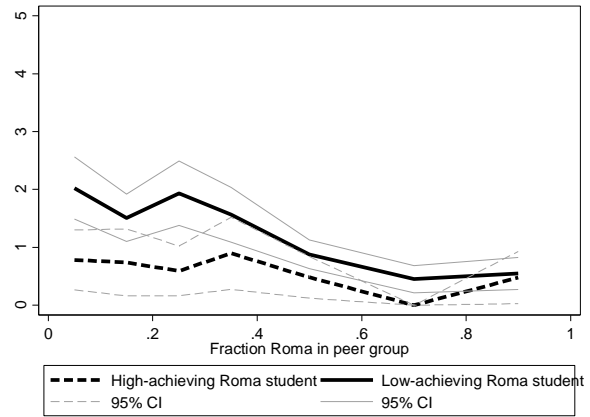


Received by non-Roma students

Figure O5
The distribution of students in the number of adversary nominations they receive



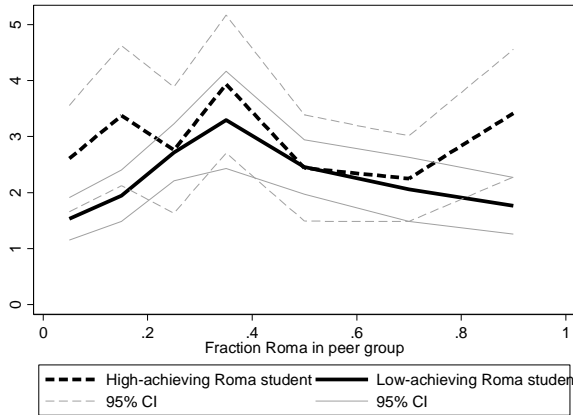
Friends of Roma students



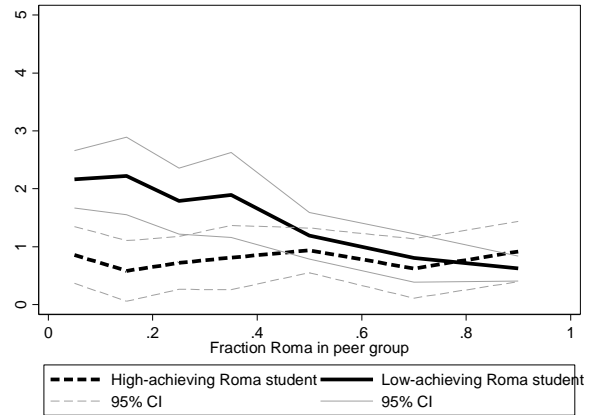
Adversaries of Roma students

Figure O6

Number of friends and adversaries of Roma students by the fraction of Roma students in the group. Same-sex nominations; number of nominations capped at 4



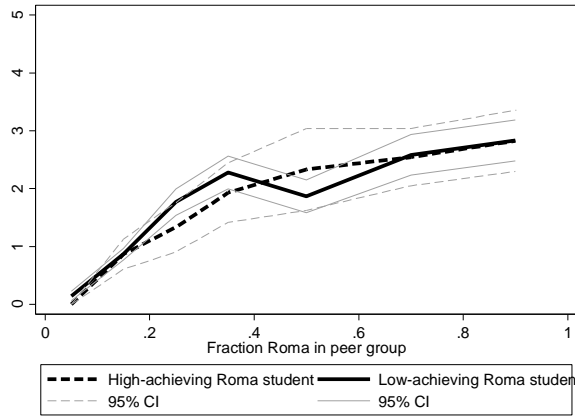
Friends of Roma students



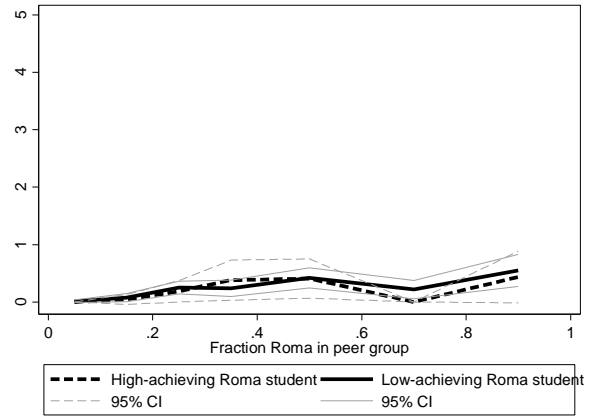
Adversaries of Roma students

Figure O7

Number of friends and adversaries of Roma students by the fraction of Roma students in the group. Opposite-sex nominations

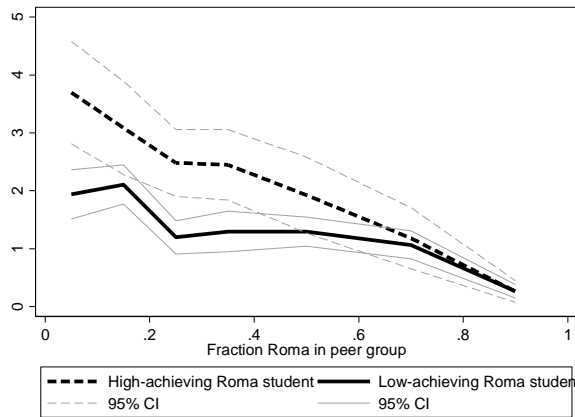


Roma friends of Roma students

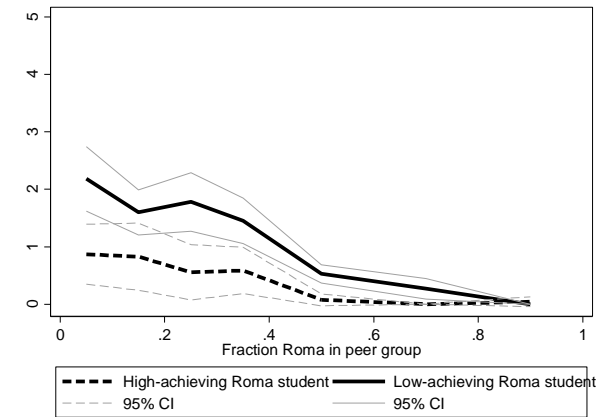


Roma adversaries of Roma students

Figure O8
Number of Roma friends and adversaries of Roma students by the fraction of Roma students in their peer group.



Non-Roma friends of Roma students



Non-Roma adversaries of Roma students

Figure O9
Number of non-Roma friends and adversaries of Roma students by the fraction of Roma students in their peer group.

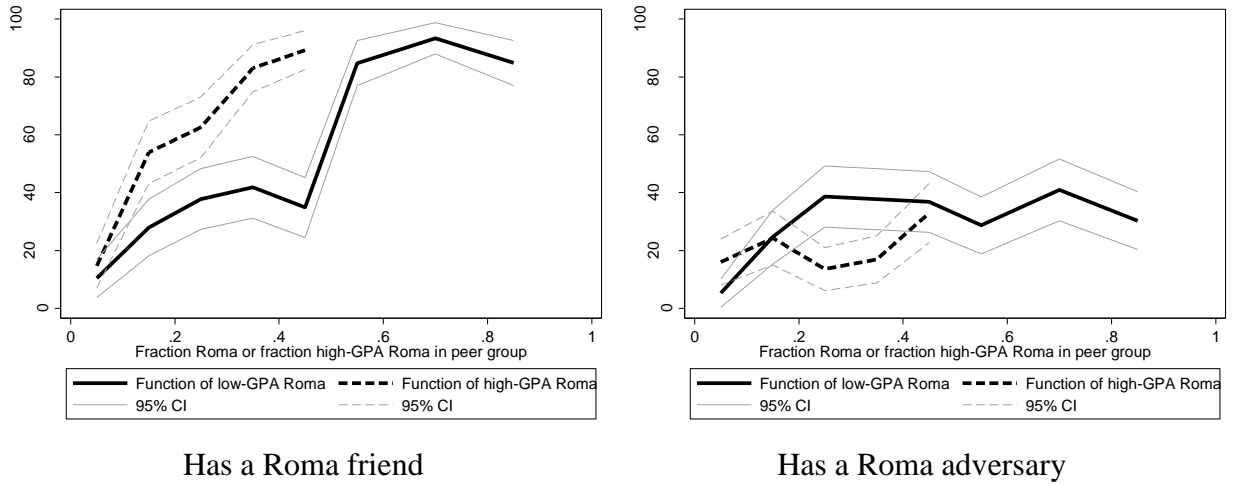


Figure O10
 The percentage of non-Roma students nominating Roma students as a friend and as an adversary
 Same-sex nominations; number of nominations capped at 4
 (As a function of the fraction of low-achieving Roma students and the fraction of high-GPA Roma students in the peer group; both of these fractions are aggregated to categories; variance of the estimates computed as $p(1-p)/\#schools$)

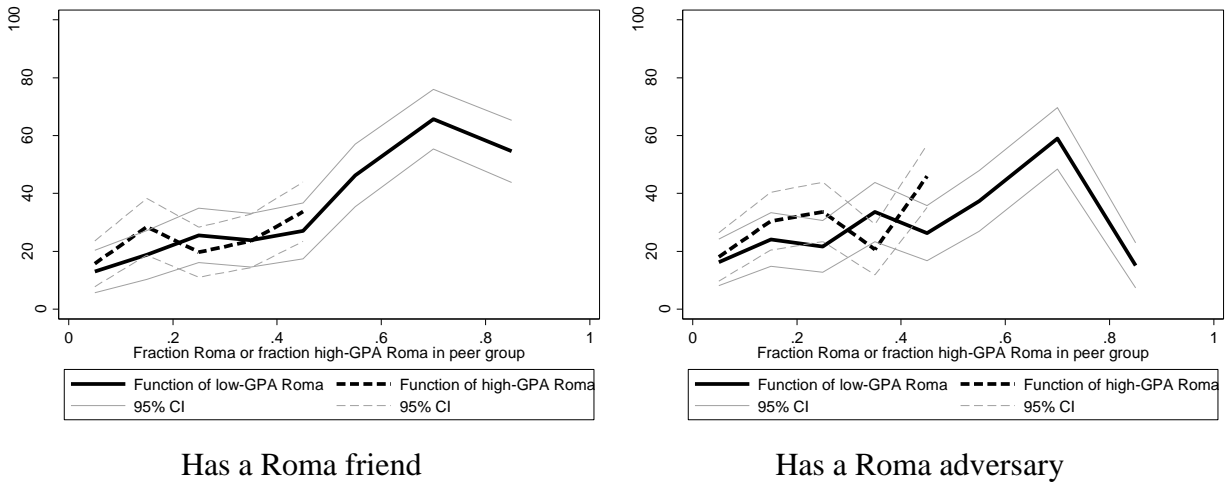


Figure O11
 The percentage of non-Roma students nominating Roma students as a friend and as an adversary
Opposite-sex nominations
 (As a function of the fraction of low-achieving Roma students and the fraction of high-GPA Roma students in the peer group; both of these fractions are aggregated to categories; variance of the estimates computed as $p(1-p)/\text{\#schools}$)