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The Role of Exposure and Academic Achievement

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Inter-Ethnic Friendship and Hostility between Roma and Non-Roma Students in Hungary

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Abstract

This study examines friendship and hostility relations between Roma students and the ethnically homogeneous non-Roma majority in Hungarian schools. Using data on friendship and hostility relations of 15-year-old students from 82 schools the study focuses on the interaction between exposure to the other ethnic group and academic achievement of Roma students. High-achieving Roma students are shown to have significantly more friends and fewer adversaries than low-achieving ones, due to better inter-ethnic relations while having similar within-ethnic group relations. As a result, higher exposure to Roma students translates to more friendship and less hostility from non-Roma students in environments where more of the Roma students have higher achievement. Therefore, policies helping the achievement of Roma students can have immediate as well as long-term positive effects. Simulations suggest that a mixed policy of desegregation and closing the achievement gap may best foster positive interethnic relations. The results also support that exposure is more likely to improve intergroup contact if status is more equal.

Keywords: Social interactions, Minority students, Achievement gap

JEL codes: J15, I24

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Roma és nem roma tanulók közti barátságok és ellenségeskedések az általános iskolában

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Összefoglaló

Tanulmányunk a roma és nem roma tanulók közti kapcsolatok (barátságok és elutasítások) létrejöttét meghatározó összefüggéseket vizsgálja a nyolcadik évfolyamra járó magyarországi tanulók egy mintáján. Az interetnikus barátságok létrejöttét alapvetően két hatás befolyásolja: a tanulók iskolai eredményei, illetve az, hogy a diákok milyen mértékben vannak kitéve egymás társaságának az osztályban. A jó tanulmányi eredményű roma tanulók szignifikánsan több nem roma baráttal és kevesebb nem roma ellenséggel rendelkeznek, mint a rosszul tanuló roma fiatalok. Közvetett bizonyítékok – az ti., hogy ez az összefüggés az osztálytársak körében ismert tanulmányi átlagra nézve robusztusan teljesül, a nem megfigyelhető teszteredményekre nézve pedig nem teljesül – utalnak arra, hogy a hatás oksági jellegű lehet. A hatás erősségéhez valószínűleg hozzájárul, hogy a magyarországi általános iskolások tartós osztályközösségekben, egymást jól ismerve töltik el az általános iskola nyolc évét. Szimulációs számításokkal támasztjuk alá azt a következtetésünket, hogy az oktatáspolitika egy kombinált stratégiával tudná a leghatékonyabban elősegíteni az interetnikus barátságokat az iskolában: egyfelől, ha vegyes osztályok létrehozásával teremtene lehetőséget a roma és nem roma gyerekek közötti kontaktusokra, másfelől, ha a roma tanulókra is kiterjedő oktatási reformokkal javítaná a hátrányos helyzetű tanulók iskolai teljesítményeit, így azzal növelné a roma és nem roma tanulók közötti barátkozások esélyét, hogy csökkenti a köztük meglevő társadalmi távolságot.

Tárgyszavak: roma tanulók, általános iskola, interetnikus barátságok és ellenségeskedések, iskolai szegregáció

JEL kódok: J15, I24

1. Introduction

Friendship and hostility relations between adolescents from a disadvantaged minority and the majority are important elements of social cohesion. Inter-ethnic friendship may foster the social integration of members of the minority and may help develop tolerant attitudes among members of the majority. Conversely, inter-ethnic hostility in adolescence may hinder social integration and may reinforce exclusionary attitudes. Schools offer the most important environment for building such relationships among adolescents. Understanding what may influence inter-ethnic friendship and hostility within schools is an important task for social science research with conclusions for educational policies.

Exposure to the other ethnic group creates opportunities on inter-ethnic friendship as well as hostility. But opportunities may not translate into actual relationships. Contact theory (Allport, 1954; Pettigrew, 1998) suggest that contact is more likely the more equal status the groups have. Academic achievement is an important element of status in schools. Thus, one potential mediator of exposure to contact is the academic achievement of disadvantaged minority students. Hence, environments that help minority students become more successful in school may induce more inter-ethnic friendship and less inter-ethnic hostility for the same level of inter-ethnic exposure. At the same time, students from disadvantaged minorities may lose friends and attract hostility from their own group if their success is considered "acting white" (Fordham and Ogbu, 1986; Fryer and Torelli, 2010; Fuller-Rowell and Doan, 2010). The goal of our study is to shed light on these mechanisms in an environment with a clearly disadvantaged ethnic minority and a relatively homogenous majority.

We analyze friendship and hostility networks of 3,430 students from the Roma minority and the non-Roma majority in Hungary. Our data covers eighth-grade students in 82 schools spread across 75 towns in Hungary. Our friendship data is based on nominations of classmates and is directly comparable to the data used to friendship networks of students of similar ages in the U.S. (Currarini et al., 2010; Flashman, 2012; Fryer and Torelli, 2010; Patacchini and Zenou, 2016) and Europe (Smith et al., 2014). A novelty of our data is an inclusion of adversary a nominations question together with the usual friendship nomination questions, enabling us to analyze interethnic hostility in a direct way. We measure academic achievement by publicly observable grades as well as low-stakes test scores that are unobservable to the students.

Our first set of results show 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. 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.

Our second analysis examines the interaction between classroom composition and achievement in interethnic friendship and hostility relations. The ethnic composition of their peer group is strongly related to the number of friends and adversaries of low-achieving Roma students. However, no such association exists for high-achieving Roma students: replacing Roma peers with non-Roma peers has no effect on the total number of their friends and adversaries. We also find that the exposure of non-Roma students to Roma peers is twice as likely to translate into having a Roma friend if those Roma peers are high-achievers, and it is less likely to translate into having a Roma adversary in that case.

Finally, 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 are causal, 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 causal inference from observational data and large-scale policy conclusions based on a partial analysis (Carrell et al., 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 show important determinants of friendship and hostility relations among Roma and non-Roma students, an understudied topic despite the large size and severe disadvantages of the Roma

minority in many Eastern European countries (see Boda and Néray, 2015; Kisfalusi, 2016; Lőrincz, 2016 for exceptions, all from very recent years). Second, we show evidence of the association between networks and academic achievement as well as its interaction with exposure. Third, we show direct evidence regarding hostility as well as friendship, an aspect rarely investigated in the school context. Fourth, using the estimates of our analysis 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 adds another, immediately positive effect to policies that help minority students attain success 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).

2. 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 and 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, 2016). Most of the Roma of Hungary speak Hungarian and live in neighborhoods that are ethnically mixed (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 et al., 2014).

Most students complete all eight grades in the same elementary school. Some selective secondary schools enroll students earlier, in grades five or seven. This practice

is most prevalent in Budapest, and it usually affects elementary schools in more affluent neighborhoods. As a result, early enrollment in selective secondary schools has little effect on the students of the elementary schools Roma students attend, especially outside Budapest. 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, 2016, and the benchmark results of the simulation exercise in this paper). We know relatively little about inter-ethnic relations in Hungarian schools; recent studies indicate low levels of inter-ethnic dating (Lőrincz, 2016), low levels of inter-ethnic friendship, 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 et al., 2013; Székelyi et al., 2001; Váradi, 2014)

3. Data

To survey the friendship networks and hostility among Roma and non-Roma students, we collected data from 82 elementary schools in the 75 towns and cities with the largest Roma populations in Hungary in April 2010. We excluded Budapest from the sample due to the prevalence of secondary schools recruiting students before grade 8. 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 final sample comprises 3,430 students from 181 classes in 82 schools in 75 towns. The final dataset is available as a Supplementary Material (Data Appendix).

The data collection and the appropriateness of the measures taken to ensure privacy were reviewed and approved by the Hungarian Education Authority. In addition, the parents of the students were informed about the goal of the research, and their consent was obtained for the participation of their children. The final data were anonymized (no identifiable information was in the records). We provide more details on the sampling and the structure of the survey in S1 Appendix.

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 the 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 (Kertesi and Kézdi, 2011b; Simonovits and Kézdi, 2016), the wording of the questions invited the respondents to identify with two ethnic groups at the same time. 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 C1 in S3 Appendix shows the details). This proportion is higher than a representative sample would yield because our survey oversampled schools with a higher proportion of Roma students. It is slightly lower than the proportion of Roma students estimated by the schoolteachers (0.21 versus 0.26 on average; the cross-class correlation of the two measures is 0.9). While our sample over-represents classes with many Roma students, the Roma are still a minority in most classes of our sample (the interquartile range is 8 to 30 percent; Figure C1 in S3 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, 2016, 2011b), reflecting the selected nature of our sample. Figure C2 and Figure C3 in S3 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 (Echenique and Fryer, 2007).

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. (Currarini et al., 2010; Flashman, 2012; Fryer and Torelli, 2010; Patacchini and Zenou, 2016). In our data, 55 percent of the students exhausted the five possibilities for nominating same-sex friends; the corresponding figures are 29 percent when nominating opposite-sex friends and 24 percent when nominating adversaries (see Table C2 in S3 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.

Table 1.

Summary statistics

	All students			Roma	Non-Roma
Variable	Mean	SD	N	Mean	Mean
Roma	0.21	0.41	3430	1.00	0.00
Number of friends[a]	3.8	2.0	3430	3.3	3.9
Number of adversaries[a]	1.0	1.7	3430	1.3	1.0
Number of Roma friends[a]	0.7	1.1	3430	1.7	0.5
Number of Roma adversaries[a]	0.2	0.5	3430	0.2	0.2
Number of non-Roma friends[a]	3.1	2.1	3430	1.6	3.4
Number of non-Roma adversaries[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[c]	4.1	0.9	3427	3.5	4.3
Standardized test score in mathematics[d]	-0.3	1.0	3154	-0.8	-0.1
Standardized test score in reading[d]	0.0	1.0	3154	-0.6	0.1
Level of mathematic abilities[e]	1.4	1.0	3148	0.9	1.5
Level of reading abilities[e]	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] Nominations received from same-sex classmates
[b] from 1 (fail) to 5 (excellent)
[c] from 2 to 5
[d] Standardized at the national level (mean 0, standard deviation 1)
[e] from 0 (inadequate) to 4 (excellent)

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. On average, students received 3.8 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. Figure C4 and Figure C5 in S3 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.

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; Simonovits and Kézdi, 2016).

4. Results: achievement

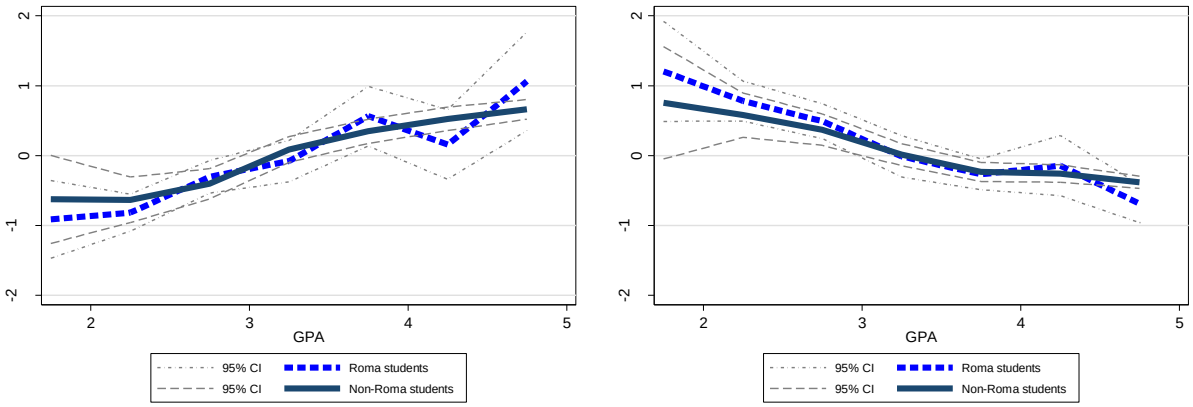
4.1 Achievement and inter-ethnic contacts

The first question of our analysis is how the number of friends and adversaries of students is related to their 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 figures comparable, 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.

Figure 1.

Number of friends and adversaries and GPA (grade point average)

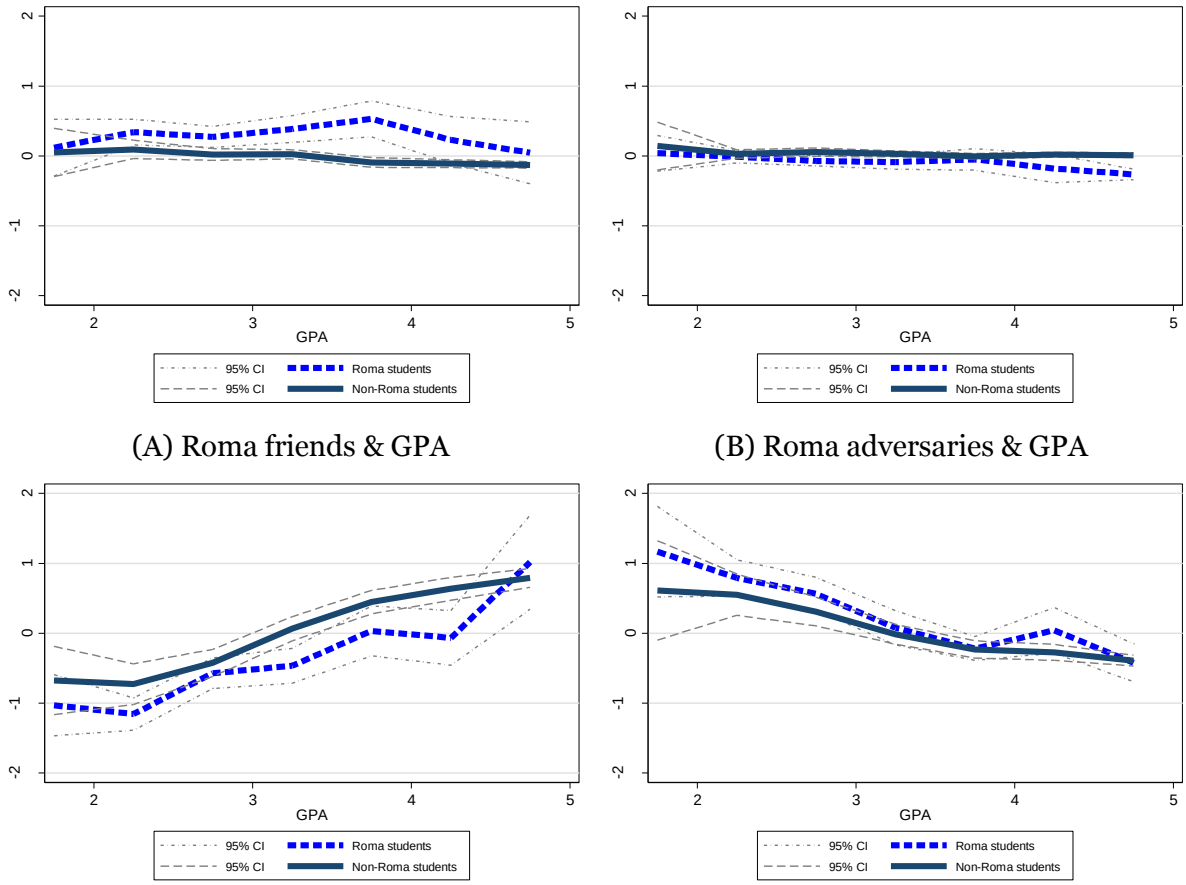


(A) Friendship nominations & GPA (B) Adversary nominations & GPA

Notes: 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.

Figure 2.

The number of Roma and non-Roma friends and adversaries by GPA



(A) Roma friends & GPA (B) Roma adversaries & GPA

(C) Non-Roma friends & GPA (D) Non-Roma adversaries & GPA

Notes: 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.

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.

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 Figure 1 and Figure 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:

$$n^r_{cgi} = \beta_c + \beta_1 GPA_{cgi} + \beta_2 GPA_{cgi} \times Roma_{cgi} + \beta_3 Roma_{cgi} + u_{cgi} \qquad (1)$$

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. Standard errors are clustered at the class level, taking care of remaining within-class correlations – thus, for example, the potential negative correlation of nominations due to the adding-up constraint in their number.

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. 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) Friends	(2) Adversaries	(3) Friends	(4) Adversaries	(5) Friends	(6) Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.58	-0.44	-0.11	-0.02	0.69	-0.42
	(0.06)**	(0.05)**	(0.02)**	(0.01)	(0.05)**	(0.05)**
Roma × GPA	0.21	-0.27	0.16	-0.06	0.04	-0.21
	(0.12)	(0.11)*	(0.08)*	(0.04)	(0.11)	(0.10)*
Roma	-0.10	0.10	0.50	-0.15	-0.59	0.25
	(0.12)	(0.10)	(0.10)**	(0.05)**	(0.12)**	(0.08)**
Class FE	YES	YES	YES	YES	YES	YES
N	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 Figure 1 and Figure 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 0.8 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 Figure 1 and Figure 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 relationships 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 3.5 is the 40th percentile among non-Roma students and 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.

4.2 Robustness checks

The results are remarkably robust in many different specifications (Table C3 through Table C21 in S3 Appendix show these results). The estimated associations are very similar in regressions without the class fixed effects, with 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 if we include covariates (grade retention, age, gender, parental education, and number of years spent in preschool). The results are 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. The estimates are similar if we use alternative measures of the relationships, including the popularity measure developed by Echenique and Fryer (2007). Remarkably, the results are also very similar if we replace nominations from same-sex classmates with nominations from opposite-sex classmates as the left-hand side variables. The associations are also robust for students who identified as Roma in the 1st place and those who identified as Roma in the 2nd place. There is some heterogeneity by gender: the associations with GPA are somewhat stronger for male Roma students than for female Roma students, and the difference is the opposite among non-Roma students. When we estimate the associations separately for the top and the bottom half of the distribution of peer groups by their average GPA we find very similar results again. Finally, the associations are very similar in towns that

are characterized by low anti-Roma prejudice and high prejudice (proxied by the fraction of votes casted on the far right party Jobbik with explicit anti-Roma platform in the general elections of 2010).

Additional regression results (Table C22, S3 Appendix) reveal that there is virtually no association between achievement and contacts among non-Roma students of lower social status, in stark contrast to what we have shown for Roma students. (We approximate low status is measured by whether the mother has 8 grades of education or less; 18% of non-Roma students have such mothers).

4.3 Results supporting causal interpretation

The robustness of the association of GPA with friendship and hostility relations is remarkable. It suggests that the associations may be in fact causal effects. However, causality could run both ways: better achievement resulting in more non-Roma friends or more non-Roma friends resulting in better achievement. To shed some light on this question we entered 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 3). 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 4). 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).

Table 3.

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	-0.37	-0.11	-0.01	0.61	-0.35
	(0.08)**	(0.07)**	(0.03)**	(0.02)	(0.07)**	(0.06)**
Test score	0.08	-0.09	0.01	-0.01	0.07	-0.08
	(0.08)	(0.07)	(0.03)	(0.02)	(0.08)	(0.07)
Roma × GPA	0.20	-0.22	0.15	-0.00	0.04	-0.22
	(0.14)	(0.12)	(0.09)	(0.04)	(0.14)	(0.11)
Roma × test score	0.02	-0.13	-0.04	-0.09	0.07	-0.04
	(0.12)	(0.12)	(0.10)	(0.05)	(0.13)	(0.10)
Roma	-0.03	0.05	0.49	-0.17	-0.53	0.22
	(0.13)	(0.12)	(0.11)**	(0.05)**	(0.13)**	(0.10)*
Class FE	YES	YES	YES	YES	YES	YES
N	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 4.

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	math
GPA	0.24	-0.08	0.76	0.28	0.19
	(0.01)**	(0.01)**	(0.05)**	(0.02)**	(0.03)**
Test score	0.06	-0.02	0.19	0.75	0.74
	(0.01)**	(0.01)*	(0.05)**	(0.02)**	(0.03)**
Roma × GPA	-0.03	-0.12	0.02	-0.03	0.03
	(0.03)	(0.03)**	(0.05)	(0.06)	(0.07)
Roma × test score	-0.00	0.03	0.02	-0.05	-0.11
	(0.02)	(0.03)	(0.05)	(0.05)	(0.06)
Roma	0.01	0.06	-0.02	-0.06	-0.17
	(0.03)	(0.02)*	(0.04)	(0.05)	(0.06)**
Class FE	YES	YES	YES	YES	YES
N	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: see Table C23.
Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Taken together, our results 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.

5. Results: the interaction of achievement and exposure

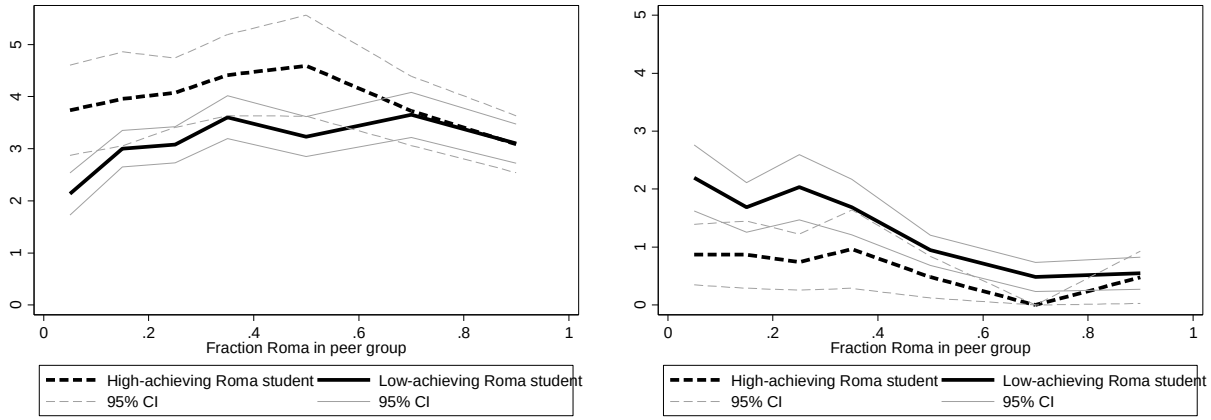
Having established the robust role of academic achievement of Roma students in inter-ethnic relations we turn to how that interacts with the composition of students' peer groups in affecting interethnic relations. We examine this question both from the viewpoint of Roma students and non-Roma students. The first question: How does exposure to non-Roma classmates translate into friends and adversaries for Roma students, depending on their achievement? The second: How does exposure to Roma classmates translate into non-Roma students having a Roma friend or adversary, depending on whether those classmates are of high achievement or low achievement?

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

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.

Figure 3.

Friends and adversaries of Roma students and the ethnic composition of their peer group



(A) Friends of Roma students (B) Adversaries of Roma students

Notes: Peer group is defined as same-sex classmates

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 (increments of 0.1 up to 0.4 and 0.2 above), and this proportion does not include the Roma student himself or herself.

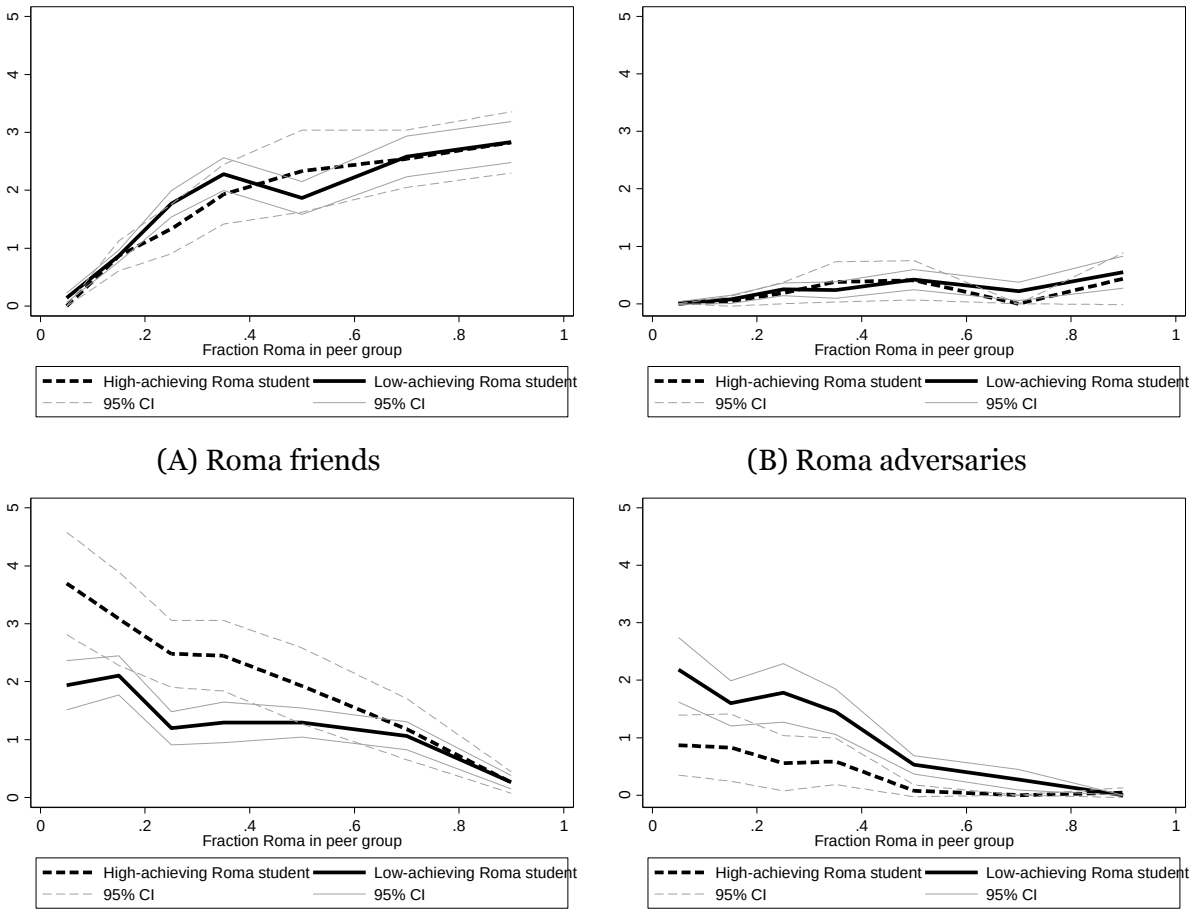
More Roma peers translates to more friends and fewer adversaries overall for low-achieving Roma students, but this relation is weak and statistically not significant among high-achieving Roma students. If 0-10% in their peer group is Roma, high-achieving Roma students have 3.7 friends and 0.9 adversary on average, while low-achieving Roma students have 2.1 friends and 2.2 adversaries on average. If, instead, 30-40% of their peer group is Roma, high-achieving Roma students have slightly more friends and the same number of adversaries on average (4.4 and 1.0), while low-achieving Roma students have significantly more friends and fewer adversaries (3.6 and 1.7). Table C23 and Table C24 in S3 Appendix show the corresponding regressions where the nonlinearities are captured by quadratic terms. The main coefficients of interest are the interactions terms. The estimates imply the same conclusion as the nonparametric figures above: the friends and adversaries Roma students have is substantially less related to the ethnic composition of their class if they are high-achievers. The results with and without individual covariates, as well as with and without class fixed-effects are very similar. 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. These results 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 C6 in S3 Appendix shows that the associations are very similar if the number of potential nominations is capped at four. Figure C7 in S3 Appendix shows the corresponding nonparametric regressions for opposite-sex relations. The results are weaker here for friendship but are just as strong for adversaries.

Importantly, the difference between high-achieving Roma students and low-achieving Roma students in how the ethnic composition of their peer groups translate into friends and adversaries overall is entirely due to the difference in their non-Roma relationships. Figure 4 shows the relationships with the number of Roma and non-Roma friends and adversaries separately. The association of class composition with Roma friends and adversaries are the same for high- and low-achieving Roma students (Panel A and B). In contrast, the association for non-Roma friends is stronger for high-achieving Roma students, while association with the number of non-Roma adversaries is weaker for them (Panel C and D).

Figure 4.

Roma and non-Roma friends and adversaries of Roma students by the fraction of Roma students in their peer group



(A) Roma friends (B) Roma adversaries

(C) Non-Roma friends (D) Non-Roma adversaries

Notes: Peer group is defined as same-sex classmates

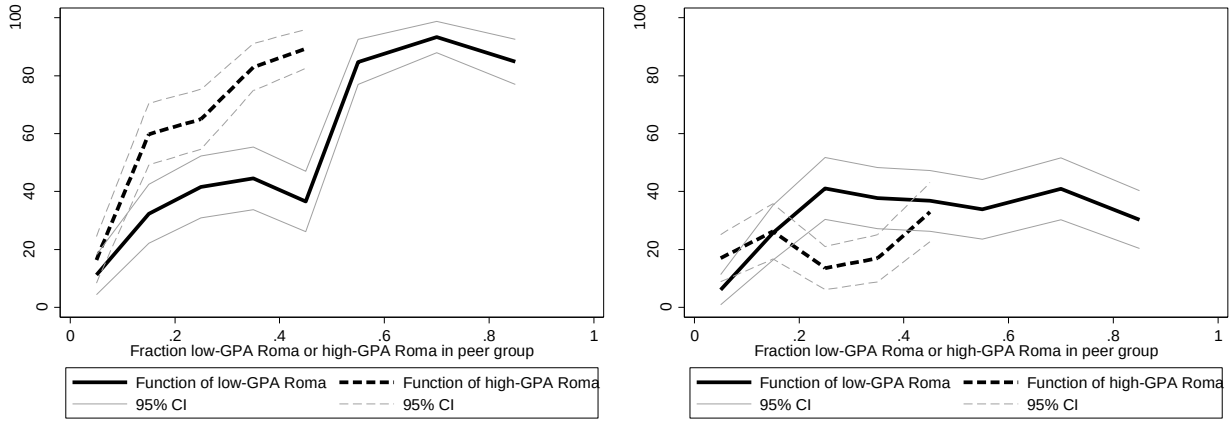
Taken together, we can conclude that desegregation (reducing the proportion of Roma students in the peer group) would decrease the number of Roma friends. At the same time, it would increase the number of non-Roma friends. This substitution is strong for high-achieving Roma students so much that the ethnic composition of their peer group is very weakly related to the number of their friends and adversaries. It is weak for low-achieving Roma students: they do not gain enough non-Roma friends but obtain more adversaries thus leading to significantly fewer friends and more adversaries when fewer of their peers are Roma.

5.2 Roma friends and adversaries of non-Roma students and the exposure to Roma classmates

The second question in this section examines the propensity of non-Roma students to nominate Roma students as friends or adversaries. The question is the extent to which higher exposure to Roma classmates translates in to more relationships, and whether the achievement of the Roma peer group matters for that.

Figure 5.

Roma friends and adversaries of non-Roma students as a function of the fraction of low-GPA Roma students (*dashed lines*) or the fraction of high-GPA Roma students (*solid lines*)



(A) Has a Roma friend (B) Has a Roma adversary

Notes: The percentage of non-Roma students nominating Roma students as a friend and as an adversary as a function of the fraction of low-GPA Roma students (*dashed lines*) or the fraction of high-GPA Roma students (*solid lines*). Both fractions are aggregated to categories. Variance of the estimates computed as p(1-p)/#schools).

Panel A of Figure 5 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). Panel B 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.

Exposure to Roma classmates translates into more non-Roma students to have a Roma friend, but this is more so if those Roma classmates are of high achievement. While exposure translates into more non-Roma students to have Roma adversaries, too, this less so if those Roma classmates are of high achievement. These are the conclusions from the nonparametric regression graphs: The regression line is significantly steeper for friendship with respect to the proportion of high-achieving Roma students, while it is significantly flatter for adversaries.

Linear probability model estimates give very similar results (Table C25, S3 Appendix). 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. The association between the probability of nominating a Roma friend and the proportion of low-achieving Roma students in the peer group is positive, but the association with the proportion of high-achieving Roma students is twice as strong (the additional slope diminishes and levels off at 50 percent, the maximum in the sample). Nominating a Roma adversary is also positively associated with the proportion of low-achieving Roma students, but there is no association with the proportion of high-achieving Roma students. The results are robust to including class fixed-effects, if we cap maximum nominations at four (Figure C8, S3 Appendix), but 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 (Figure C9, S3 Appendix).

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.

6. Discussion: policy simulation

To appreciate the consequences of our findings for educational policy we use the results 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 S2 Appendix. 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: (i) equal ethnic distribution and (ii) 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 may be different.

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 5 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 5.

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	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 S2 Appendix.

Table 6 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 6.

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 S2 Appendix.

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.

7. 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. It also shows that the ethnic composition of their class is strongly related to how many friends and adversaries low-achieving Roma students have: with fewer Roma classmates they have fewer Roma friends that is not compensated by more non-Roma friends. However, the same is not true for high-achieving Roma students: with fewer Roma classmates they have fewer Roma friends, but it is fully compensated by having more non-Roma friends. Finally, we showed that higher exposure to low-achieving Roma students implies that more non-Roma students have Roma contacts (friends and adversaries). But exposure to more high-achieving Roma students is more beneficial: twice as many non-Roma students have Roma friends, without more of them having Roma adversaries.

We can draw three conclusions from these results. First, they provide support to the contact hypothesis. Contact with members of a disadvantaged minority translates into positive inter-group relationships, and this association is substantially stronger if there is little difference in the social status of the two groups (here their academic achievement). In addition, they show that contact is substantially less likely to translate into adversary relationships if status is more similar. These results are established in an environment with high levels of open prejudice against the disadvantaged minority.

Second, the results suggest that rejection from Roma peers due to “acting white” by having higher achievement is unlikely to be a major 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 or more Roma adversaries.

Third, they have important conclusions for educational policy. Minority students can benefit from educational methods that help them succeed in schools, not only in the long term but also in the short term. Educational policy may 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 educational policies promote this goal if they increase ethnic diversity in classrooms and help the academic development of minority students.

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S1 Appendix: Data documentation

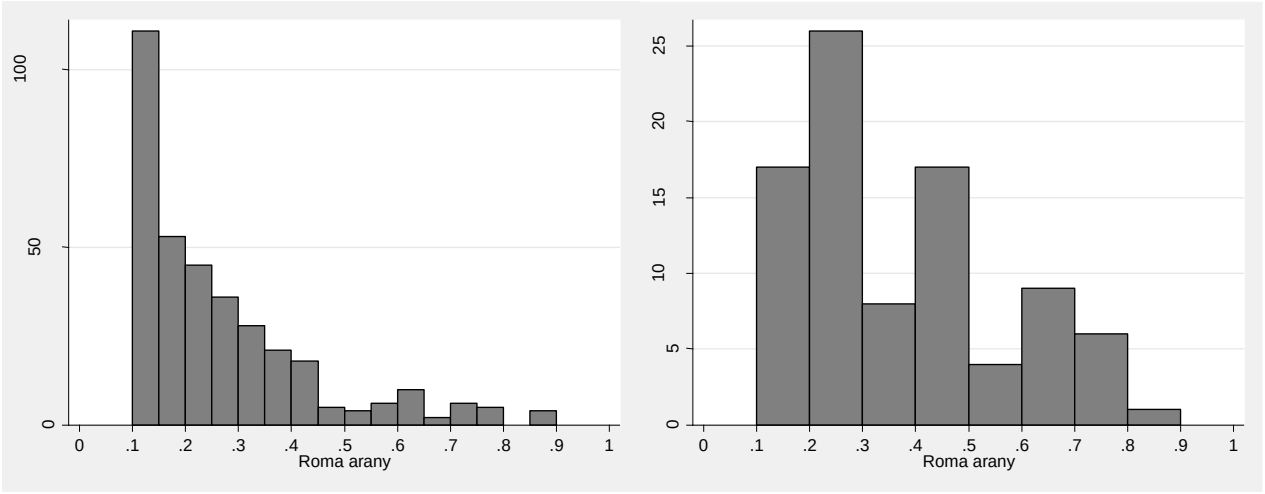
The data for our analysis comes from the "Interetnikus kapcsolatok" (Inter-ethnic relations) survey. The survey was designed by the authors of this paper and it was financed by the Educatio Kht, Hungary. The data was collected by the Adatgyujto Intezet, Hungary, in the spring of 2010.

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



(A) Distribution in the sampling frame (n=354) (B) Distribution in the sample (n=88)

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).

S2 Appendix: 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: (i) equal ethnic distribution of classes; (ii) closing the achievement gap between Roma and non-Roma students; (iii) 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 is in the sample; they 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 or 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.

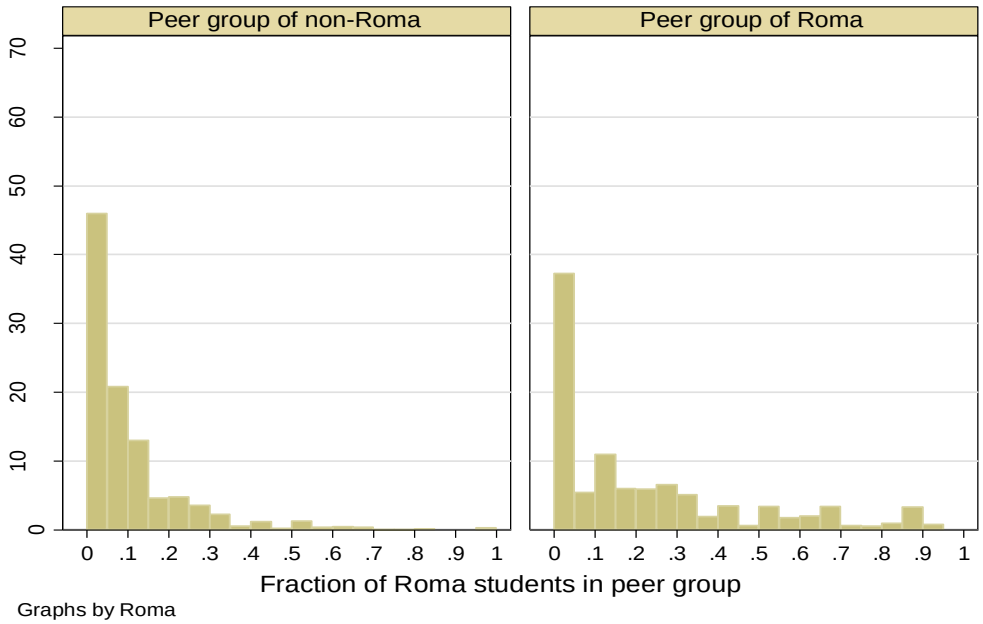
We combined the two sources of information in the following way. We first took the average of the two measures (only one measure when the other one was missing). We then replaced the estimated fraction Roma to zero if the school-level estimate was less than 2 percent, and we replaced it to one if the 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 or 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 fraction of Roma students in the peer group of non-Roma students is 9 percent, and the average fraction 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 Section 5 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)

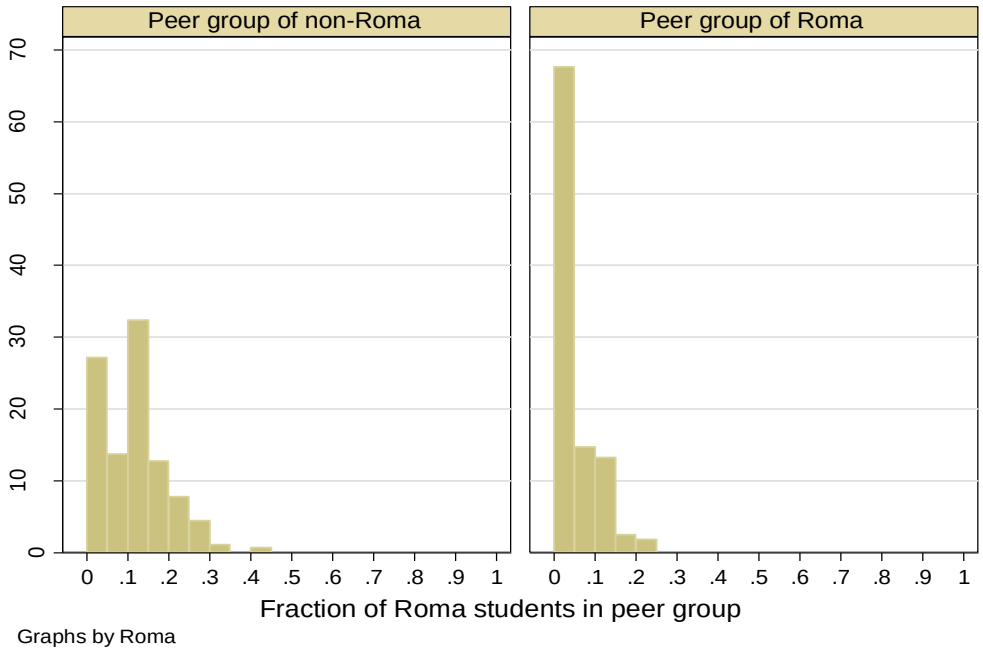


Table B1.

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
(A) Friends and adversaries of low-achieving Roma students						
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
(B) Friends and adversaries of high-achieving Roma students						
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
(C) Friends and adversaries of an average Roma student						
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

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 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
(A) Friends and adversaries of low-achieving Roma students						
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
(B) Friends and adversaries of high-achieving Roma students						
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
(C) Friends and adversaries of an average Roma student						
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
(A) Friends and adversaries of low-achieving Roma students						
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
(B) Friends and adversaries of high-achieving Roma students						
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
(C) Friends and adversaries of an average Roma student						
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

S3 Appendix: Additional Tables and Figures

Table C1.

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	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 C2.

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	30	16	19
1	6	4	4	11	12	12	15	13	13
2	10	9	9	11	15	14	15	17	16
3	14	13	14	14	17	16	12	19	18
4	17	16	16	13	11	11	8	11	10
5	50	56	55	30	28	29	20	24	24
Sum	100	100	100	100	100	100	100	15	100

Table C3.

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	0.50	-0.36	-0.16	-0.03	0.66	-0.33
	(0.05)**	(0.05)**	(0.03)**	(0.01)*	(0.05)**	(0.04)**
Roma × GPA	0.19	-0.25	0.23	-0.01	-0.04	-0.24
	(0.11)	(0.11)*	(0.08)**	(0.03)	(0.11)	(0.11)*
Roma	-0.12	-0.13	1.19	0.05	-1.30	-0.17
	(0.11)	(0.09)	(0.11)**	(0.04)	(0.12)**	(0.08)*
Class FE	NO	NO	NO	NO	NO	NO
N	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 C4.

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	0.67	-0.49	-0.11	-0.02	0.78	-0.47
	(0.06)**	(0.06)**	(0.03)**	(0.02)	(0.06)**	(0.05)**
Roma × GPA	0.22	-0.19	0.11	-0.03	0.11	-0.16
	(0.12)	(0.11)	(0.07)	(0.04)	(0.11)	(0.10)
Roma	-0.02	0.11	0.28	-0.19	-0.30	0.31
	(0.13)	(0.10)	(0.10)**	(0.05)**	(0.11)*	(0.08)**
Class-gender FE	YES	YES	YES	YES	YES	YES
N	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C5.

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	0.51 (0.06)**	-0.37 (0.05)**	-0.11 (0.03)**	-0.01 (0.02)	0.61 (0.06)**	-0.36 (0.05)**
Roma × GPA	0.22 (0.13)	-0.32 (0.12)*	0.08 (0.08)	-0.07 (0.05)	0.14 (0.13)	-0.25 (0.12)*
Roma	-0.13 (0.13)	0.13 (0.11)	0.48 (0.10)**	-0.14 (0.05)**	-0.61 (0.13)**	0.28 (0.10)**
Class FE	YES	YES	YES	YES	YES	YES
N	2,935	2,935	2,935	2,935	2,935	2,935

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C6.

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	0.48 (0.09)**	-0.41 (0.09)**	-0.21 (0.06)**	-0.04 (0.04)	0.69 (0.07)**	-0.37 (0.07)**
Roma × GPA	0.42 (0.14)**	-0.40 (0.14)**	0.26 (0.11)*	-0.01 (0.05)	0.16 (0.12)	-0.39 (0.12)**
Roma	0.08 (0.15)	-0.02 (0.12)	0.54 (0.12)**	-0.20 (0.06)**	-0.47 (0.14)**	0.19 (0.09)*
Class FE	YES	YES	YES	YES	YES	YES
N	1,571	1,571	1,571	1,571	1,571	1,571

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C7.

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	0.57	-0.41	-0.10	-0.02	0.67	-0.39
	(0.06)**	(0.06)**	(0.03)**	(0.02)	(0.06)**	(0.05)**
Roma × GPA	0.15	-0.23	0.14	-0.04	0.01	-0.19
	(0.12)	(0.11)*	(0.08)	(0.04)	(0.11)	(0.10)
Roma	0.05	0.01	0.46	-0.15	-0.41	0.16
	(0.13)	(0.11)	(0.10)**	(0.05)**	(0.12)**	(0.09)
Repeated grade	-0.04	0.17	0.12	-0.02	-0.16	0.20
	(0.17)	(0.15)	(0.08)	(0.05)	(0.15)	(0.14)
Female	-0.33	0.15	0.05	0.03	-0.38	0.13
	(0.08)**	(0.08)*	(0.05)	(0.03)	(0.08)**	(0.07)
Age 14	0.07	-0.07	0.01	-0.04	0.06	-0.04
	(0.09)	(0.08)	(0.04)	(0.02)	(0.08)	(0.08)
Age 16	-0.24	0.12	-0.05	0.10	-0.19	0.02
	(0.16)	(0.17)	(0.07)	(0.05)	(0.14)	(0.14)
Age 17 or more	-0.72	0.19	-0.28	0.03	-0.45	0.17
	(0.24)**	(0.28)	(0.13)*	(0.08)	(0.20)*	(0.24)
Years in preschool	0.06	-0.05	-0.01	-0.00	0.07	-0.05
	(0.05)	(0.04)	(0.02)	(0.01)	(0.05)	(0.04)
Mother's educ. 8 grades	0.29	-0.23	0.12	-0.07	0.17	-0.16
	(0.21)	(0.21)	(0.14)	(0.08)	(0.15)	(0.17)
Mother's educ. vocational	0.51	-0.32	0.08	-0.07	0.42	-0.25
	(0.22)*	(0.21)	(0.15)	(0.08)	(0.16)*	(0.17)
Mother's educ. high school	0.48	-0.35	0.02	-0.05	0.46	-0.30
	(0.23)*	(0.22)	(0.15)	(0.08)	(0.18)*	(0.18)
Mother's educ. college	0.29	-0.22	-0.02	0.03	0.30	-0.24
	(0.24)	(0.23)	(0.15)	(0.09)	(0.20)	(0.19)
Mother's educ. missing	-0.09	0.21	0.31	-0.09	-0.39	0.30
	(0.65)	(0.93)	(0.23)	(0.09)	(0.51)	(0.92)
Class FE	YES	YES	YES	YES	YES	YES
N	3,426	3,426	3,426	3,426	3,426	3,426

Notes: see Table C3. Standard errors, clustered at the class level, in parentheses. * $p<0.05$; ** $p<0.01$

Table C8.

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	0.45	-0.42	-0.20	-0.05	0.65	-0.36
	(0.10)**	(0.09)**	(0.06)**	(0.04)	(0.08)**	(0.07)**
Roma × GPA	0.36	-0.28	0.20	0.03	0.16	-0.32
	(0.15)*	(0.14)*	(0.11)	(0.05)	(0.13)	(0.13)*
Roma	0.17	-0.04	0.39	-0.20	-0.22	0.17
	(0.16)	(0.13)	(0.13)**	(0.07)**	(0.15)	(0.10)
Class-gender FE	YES	YES	YES	YES	YES	YES
Control variables	YES	YES	YES	YES	YES	YES
N	1,567	1,567	1,567	1,567	1,567	1,567

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C9.

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	-0.42	-0.10	-0.02	0.60	-0.40
	(0.05)**	(0.05)**	(0.02)**	(0.01)	(0.05)**	(0.04)**
Roma × GPA	0.10	-0.25	0.08	-0.05	0.02	-0.21
	(0.12)	(0.11)*	(0.08)	(0.04)	(0.10)	(0.10)*
Roma	-0.06	0.10	0.47	-0.12	-0.53	0.23
	(0.11)	(0.10)	(0.09)**	(0.04)**	(0.10)**	(0.08)**
Class FE	YES	YES	YES	YES	YES	YES
N	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C10.

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	-0.45	-0.09	0.00	0.97	-0.43
	(0.13)**	(0.10)**	(0.02)**	(0.02)	(0.12)**	(0.08)**
Roma × GPA	0.34	-0.52	0.18	-0.04	-0.17	-0.39
	(0.26)	(0.18)**	(0.11)	(0.05)	(0.19)	(0.16)*
Roma	-0.39	0.11	0.65	-0.15	-1.24	0.34
	(0.28)	(0.19)	(0.16)**	(0.06)*	(0.24)**	(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 C11.

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	-0.36	-0.13	0.02	0.47	-0.35
	(0.05)**	(0.06)**	(0.02)**	(0.02)	(0.05)**	(0.05)**
Roma × GPA	0.25	-0.19	0.08	0.01	0.15	-0.25
	(0.11)*	(0.12)	(0.08)	(0.06)	(0.11)	(0.12)*
Roma	-0.03	-0.03	0.43	-0.31	-0.56	0.47
	(0.10)	(0.11)	(0.10)**	(0.06)**	(0.12)**	(0.12)**
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 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 C12.

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	-0.03	-0.10	0.01	0.48	-0.04
	(0.04)**	(0.02)*	(0.02)**	(0.01)	(0.04)**	(0.01)**
Roma × GPA	-0.01	-0.02	0.04	0.01	-0.05	-0.03
	(0.08)	(0.04)	(0.07)	(0.02)	(0.08)	(0.03)
Roma	-0.06	0.06	0.49	-0.01	-0.55	0.07
	(0.08)	(0.03)	(0.08)**	(0.02)	(0.09)**	(0.03)*
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 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 C13.

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	-0.09	0.19
	(0.02)**	(0.05)	(0.02)**
Roma × GPA	0.12		
	(0.05)*		
Roma	-0.52		
	(0.17)**		
Class FE	YES	YES	YES
N	3,429	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 C14.

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	-0.75	-0.02	-0.08	0.66	-0.67
	(0.08)**	(0.06)**	(0.02)	(0.02)**	(0.07)**	(0.06)**
Roma × GPA	0.02	-0.06	0.00	-0.01	0.02	-0.05
	(0.16)	(0.13)	(0.07)	(0.04)	(0.13)	(0.12)
Roma	0.06	0.10	0.21	-0.11	-0.15	0.21
	(0.15)	(0.10)	(0.08)**	(0.03)**	(0.12)	(0.09)*
Class FE	YES	YES	YES	YES	YES	YES
N	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C15.

Friends and adversaries and GPA, for students who identified as Roma in the 1st place, in the 2nd place (reference group: non-Roma)

Dep. variable: # reciprocated nominations of opposite-sex	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.58	-0.44	-0.11	-0.02	0.69	-0.42
	(0.06)**	(0.05)**	(0.02)**	(0.01)	(0.05)**	(0.05)**
Roma 1st × GPA	0.20	-0.25	0.19	-0.04	0.02	-0.21
	(0.14)	(0.12)*	(0.10)	(0.04)	(0.13)	(0.12)
Roma 2nd × GPA	0.15	-0.33	0.17	-0.10	-0.02	-0.23
	(0.21)	(0.19)	(0.11)	(0.08)	(0.20)	(0.17)
Roma in 1st place	-0.15	0.12	0.58	-0.13	-0.72	0.25
	(0.14)	(0.10)	(0.11)**	(0.05)**	(0.14)**	(0.09)**
Roma in 2nd place	0.06	0.08	0.26	-0.17	-0.20	0.26
	(0.19)	(0.18)	(0.13)*	(0.08)*	(0.18)	(0.14)
Class FE	YES	YES	YES	YES	YES	YES
N	3,430	3,430	3,430	3,430	3,430	3,430

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C16.

Friends and adversaries of female students as function of GPA.

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.74	-0.53	-0.12	-0.04	0.86	-0.50
	(0.09)**	(0.09)**	(0.04)**	(0.02)	(0.08)**	(0.08)**
Roma × GPA	0.10	-0.13	0.08	0.02	0.03	-0.15
	(0.16)	(0.16)	(0.11)	(0.05)	(0.15)	(0.15)
Roma	-0.16	0.16	0.19	-0.15	-0.35	0.30
	(0.14)	(0.14)	(0.12)	(0.06)*	(0.14)*	(0.12)*
Class FE	YES	YES	YES	YES	YES	YES
N	1,666	1,666	1,666	1,666	1,666	1,666

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C17.

Friends and adversaries of male students as function of GPA.

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.59	-0.45	-0.11	-0.00	0.71	-0.44
	(0.09)**	(0.07)**	(0.03)**	(0.02)	(0.08)**	(0.06)**
Roma × GPA	0.40	-0.28	0.18	-0.11	0.22	-0.18
	(0.19)*	(0.14)*	(0.11)	(0.05)*	(0.17)	(0.14)
Roma	0.22	0.02	0.40	-0.27	-0.18	0.30
	(0.23)	(0.13)	(0.15)**	(0.07)**	(0.21)	(0.11)**
Class FE	YES	YES	YES	YES	YES	YES
N	1,764	1,764	1,764	1,764	1,764	1,764

Notes: see Table C3. Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C18.

Friends and adversaries of students as function of GPA. Peer groups with high average GPA

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.73	-0.53	-0.07	-0.01	0.80	-0.52
	(0.08)**	(0.08)**	(0.03)*	(0.02)	(0.08)**	(0.07)**
Roma × GPA	0.25	-0.19	-0.00	0.06	0.25	-0.25
	(0.20)	(0.21)	(0.12)	(0.05)	(0.18)	(0.19)
Roma	-0.23	0.24	0.36	-0.05	-0.59	0.30
	(0.17)	(0.16)	(0.15)*	(0.05)	(0.15)**	(0.14)*
Class FE	YES	YES	YES	YES	YES	YES
N	1,716	1,716	1,716	1,716	1,716	1,716

Notes: see Table C3. Higher than average GPA: Average GPA in same-sex peer group is in the top half or the average GPA distribution (above 3.6). Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C19.

Friends and adversaries of students as function of GPA. Peer groups with low average GPA

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.50	-0.41	-0.15	-0.01	0.65	-0.39
	(0.09)**	(0.07)**	(0.04)**	(0.02)	(0.07)**	(0.06)**
Roma × GPA	0.41	-0.33	0.26	-0.13	0.15	-0.19
	(0.15)**	(0.13)*	(0.10)*	(0.04)**	(0.15)	(0.12)
Roma	0.19	-0.04	0.48	-0.28	-0.29	0.24
	(0.17)	(0.13)	(0.13)**	(0.05)**	(0.16)	(0.11)*
Class FE	YES	YES	YES	YES	YES	YES
N	1,771	1,771	1,771	1,771	1,771	1,771

Notes: see Table C3. Lower than average GPA: Average GPA in same-sex peer group is in the bottom half or the average GPA distribution (less than or equal to 3.6). Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C20.

Friends and adversaries of students as function of GPA. Towns with lower than median prejudice

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.55	-0.41	-0.13	0.00	0.68	-0.40
	(0.09)**	(0.08)**	(0.03)**	(0.02)	(0.08)**	(0.07)**
Roma × GPA	0.15	-0.34	0.26	-0.11	-0.11	-0.23
	(0.17)	(0.15)*	(0.11)*	(0.06)	(0.16)	(0.14)
Roma	-0.13	0.02	0.55	-0.21	-0.68	0.23
	(0.18)	(0.14)	(0.13)**	(0.06)**	(0.17)**	(0.12)
Class FE	YES	YES	YES	YES	YES	YES
N	1,659	1,659	1,659	1,659	1,659	1,659

Notes: see Table C3. Lower than average prejudice: Fraction of votes on Jobbik (far-right party) in town in the general election of 2010 is less than 22% (median in the sample). Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Table C21.

Friends and adversaries of students as function of GPA. Towns with higher than median prejudice

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From Roma classmates		From non-Roma classmates	
GPA	0.62	-0.47	-0.08	-0.03	0.70	-0.43
	(0.08)**	(0.06)**	(0.03)*	(0.02)	(0.08)**	(0.06)**
Roma × GPA	0.27	-0.21	0.07	-0.01	0.19	-0.20
	(0.16)	(0.15)	(0.11)	(0.05)	(0.14)	(0.14)
Roma	-0.06	0.18	0.45	-0.09	-0.51	0.27
	(0.16)	(0.14)	(0.14)**	(0.07)	(0.15)**	(0.12)*
Class FE	YES	YES	YES	YES	YES	YES
N	1,771	1,771	1,771	1,771	1,771	1,771

Notes: see Table C3. Fraction of votes on Jobbik (far-right party) in town in the general election of 2010 is more than or equal to 22% (median in the sample). Standard errors, clustered at the class level, are in parentheses. * p<0.05; ** p<0.01

Table C22.

Friends and adversaries of students as function of GPA, interacted with mother's education, subsample of non-Roma students.

Dependent variable: nominations received from same-sex peers	Friends	Adversaries	Friends	Adversaries	Friends	Adversaries
			From peers with low-educated mother		From peers with high-educated mother	
GPA	0.51	-0.40	-0.01	-0.06	0.52	-0.34
	(0.06)**	(0.05)**	(0.03)	(0.02)**	(0.06)**	(0.05)**
Low ed. mother	0.12	0.00	0.05	0.02	0.07	-0.01
× GPA	(0.13)	(0.15)	(0.08)	(0.07)	(0.12)	(0.11)
Low ed. mother	-0.21	0.19	-0.04	0.01	-0.17	0.18
	(0.11)	(0.12)	(0.08)	(0.04)	(0.10)	(0.09)
Class FE	YES	YES	YES	YES	YES	YES
N	2,710	2,710	2,710	2,710	2,710	2,710

Notes. The number of friendship and adversary nominations from all peers as well as from peers separated by whether they mother has low education, as functions of GPA and ethnicity of the student. Low educated mother: 0-8 primary schools (18% in the non-Roma sample; it would be 70% in the Roma sample). 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 C23.

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

	(1) Number of friends	(2) Number of Adversaries	(3) Number of friends	(4) Number of Adversaries
High-GPA student	1.24	-1.01	1.25	-1.16
	(0.23)**	(0.19)**	(0.32)**	(0.28)**
Fraction Roma among peers	4.27	-2.08	4.66	-0.95
	(0.96)**	(0.97)*	(1.59)**	(2.43)
Fraction Roma squared	-3.59	0.25	-4.21	0.45
	(0.93)**	(1.09)	(1.34)**	(1.91)
High-GPA student interacted with fraction Roma squared	-1.44	1.25	-1.18	1.05
	(0.43)**	(0.34)**	(0.51)*	(0.45)*
Class FE	NO	NO	YES	YES
Control variables	NO	NO	NO	NO
N	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 C24.

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

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

Notes. See Table C25. 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 C25.

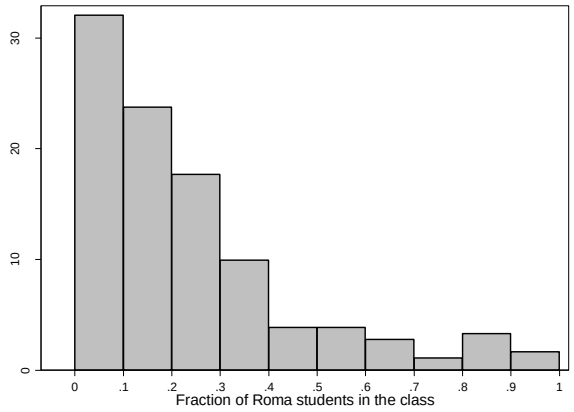
The probability that non-Roma students nominate Roma students as friends and adversaries.

	(1) Nominated any Roma friend	(2) Nominated any Roma adversary	(3) Nominated any Roma friend	(4) 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
N	2,719	2,719	2,719	2,719

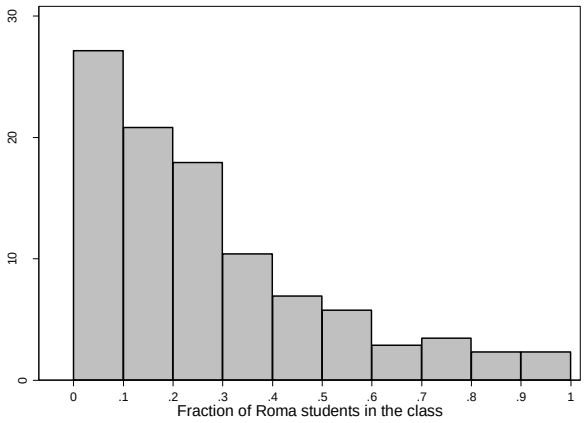
Notes. Peers refer to same-sex classmates. High-achieving refers to grade point average higher than 3.5 (the overall average and median; the 80th percentile among Roma students and the 40th percentile among non-Roma students). The constant is the average of the class fixed-effects. The fraction Roma among peers and the fraction of high-GPA Standard errors, clustered at the class level, are in parentheses. * $p<0.05$; ** $p<0.01$

Figure C1.

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



(A) Fraction Roma by self-identification



(B) Fraction Roma estimated by teacher

Figure C2.

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

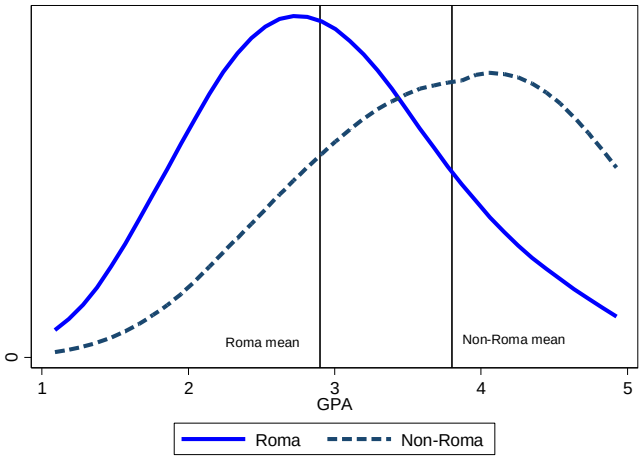
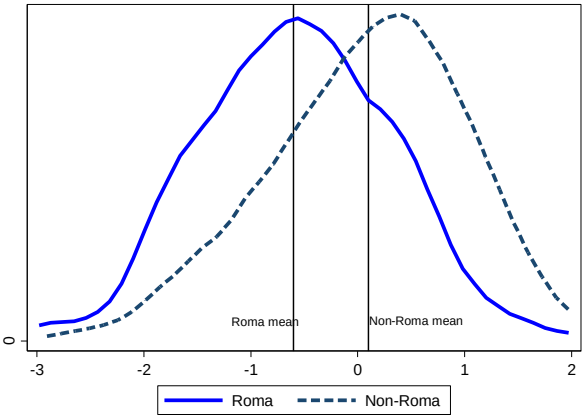
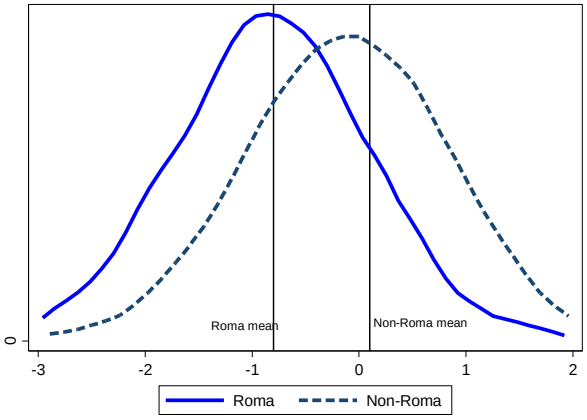


Figure C3.

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



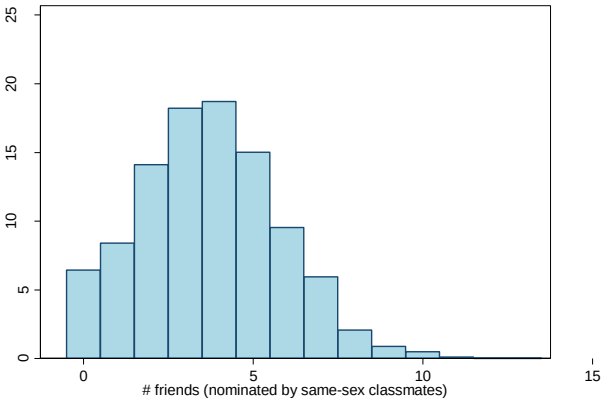
(A) Standardized reading test score



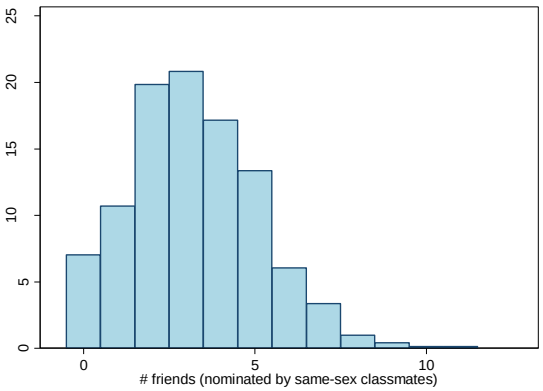
(B) Standardized mathematics test score

Figure C4.

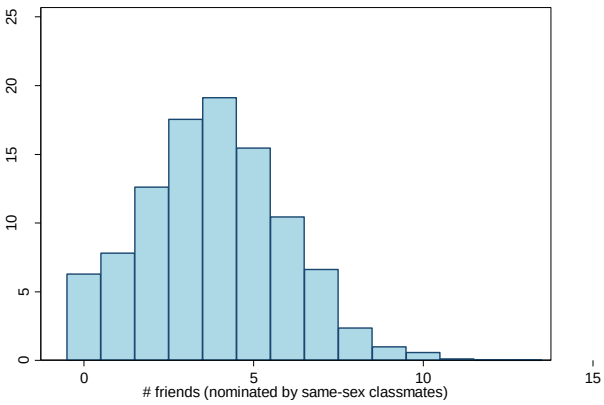
The distribution of students in the number of friendship nominations they receive



(A) All students



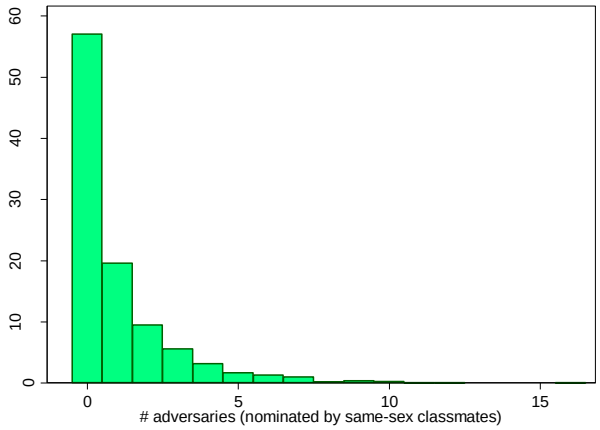
(B) Received by Roma students



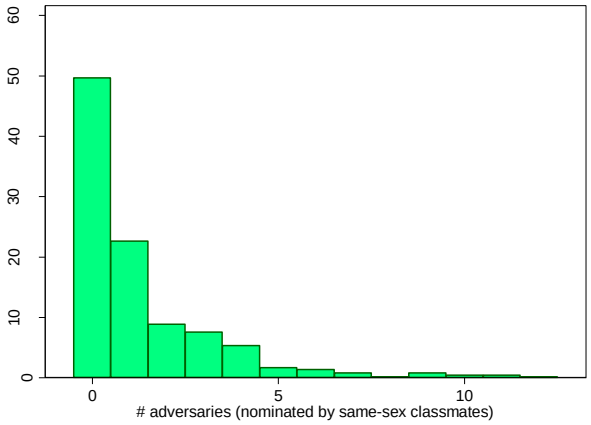
(C) Received by non-Roma students

Figure C5.

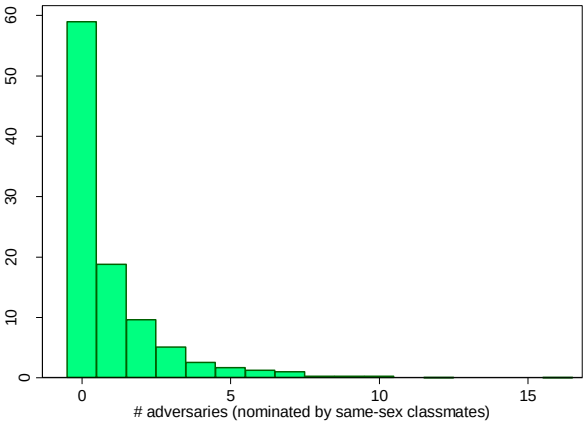
The distribution of students in the number of adversary nominations they receive



(A) All students



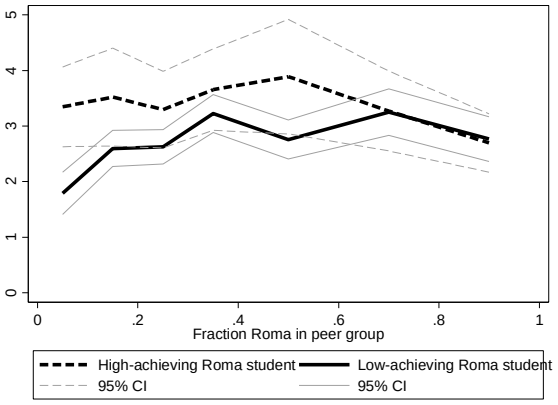
(B) Received by Roma students



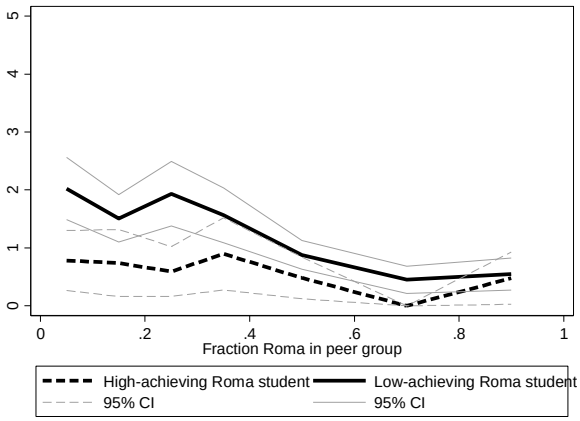
(C) Received by non-Roma students

Figure C6.

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



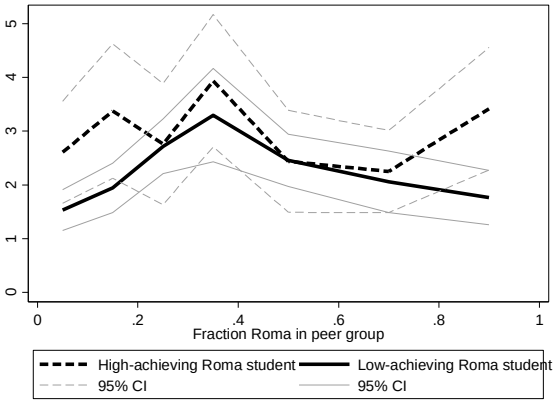
(A) Friends of Roma students



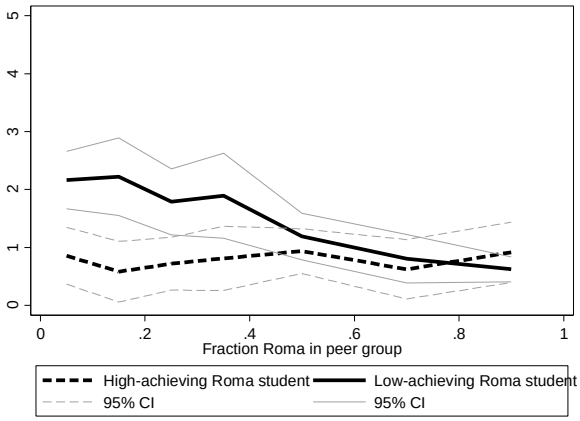
(B) Adversaries of Roma students

Figure C7.

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



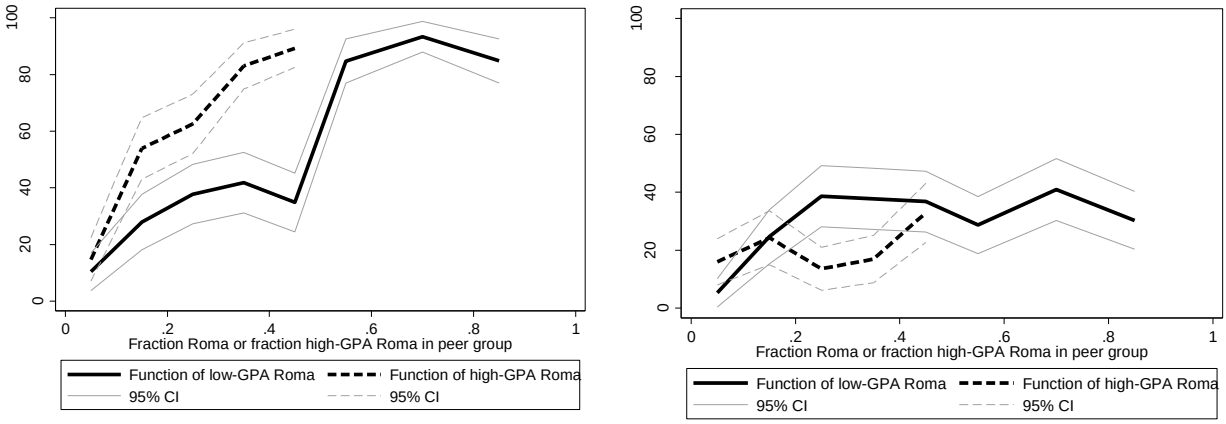
(A) Friends of Roma students



(B) Adversaries of Roma students

Figure C8.

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)

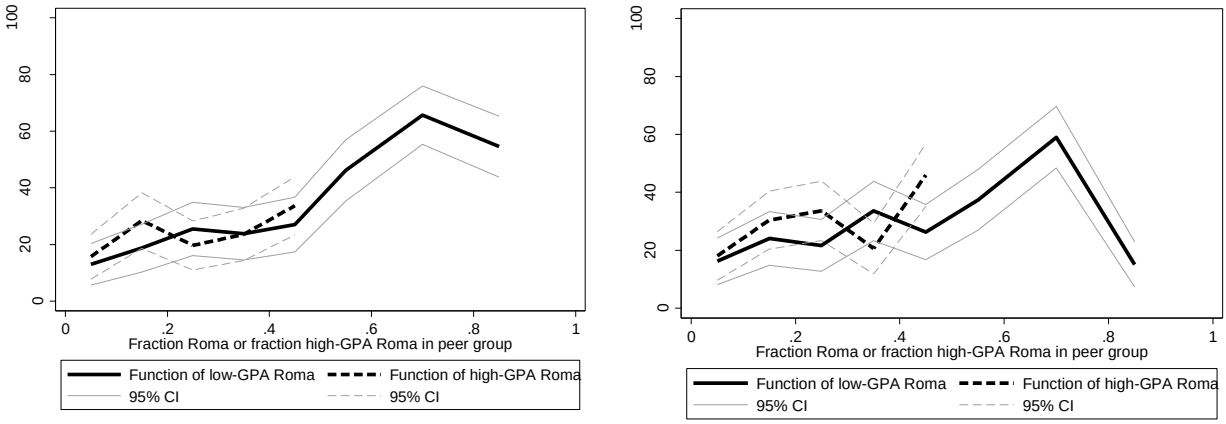


(A) Has a Roma friend (B) Has a Roma adversary

Notes: 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). Peer group is defined as same-sex classmates.

Figure C9.

The percentage of non-Roma students nominating Roma students as a friend and as an adversary (Opposite-sex nominations)



(A) Has a Roma friend (B) Has a Roma adversary

Notes: 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). Peer group is defined as opposite-sex classmates.