The Roma/non-Roma Test Score Gap in Hungary

By Gábor Kertesi and Gábor Kézdi[1]

This paper documents and decomposes the test score gap between Roma and non-Roma 8th graders in Hungary in 2006. Our data connect national standardized test scores to an individual panel survey with detailed data on ethnicity and family background. The test score gap is approximately one standard deviation for both reading and mathematics, which is similar to the gap between African-American and White students of the same age group in the U.S. in the 1980s. After accounting for on health, parenting, school fixed effects and family background, the gap disappears in reading and drops to 0.15 standard deviation in mathematics.

The Black-White test score gap has been a subject of intensive research in the United States. The Educational Testing Service (2010) provides a comprehensive overview of the time series of the test score gap, and several studies analyze its causes and consequences (see, for example, Roland G. Fryer and Steven D. Levitt, 2006 and the volume edited by Katherine Magnuson and Jane Waldfogel, 2008). This literature finds that the gap increases across grades; in all grades it narrowed considerably until the 1980s, but after that time, the trend stopped or slowed. The residual gap in regressions with family background and parenting variables is zero or small in lower grades but remains substantial in upper grades. Our results allow a direct comparison to many of the findings of the Black-White test score gap literature.

The Roma (also known as the Romani people or Gypsies) constitute one of the largest and poorest ethnic minority groups in Europe and are concentrated in the countries of Central

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and Eastern Europe. The size of the Roma population was about 4 million in the early 1990s (Zoltan Barany, 2002). Due to a high birth rate, the Roma population continues to grow, resulting in increasing population shares. In Hungary, the Roma are estimated to comprise 5 to 6 percent of the total population and 10 to 12 percent of the young adolescent population (István Kemény and Béla Janky, 2006). The Roma have resided in Central and Eastern Europe for centuries, but their history has been characterized by separation and exclusion.

Table 1. Selected social indicators for the Roma and the non-Roma in Hungary, and African-Americans and Whites in the United States.

	Hungary		United States	
	Roma	non-Roma	Black	White
Education - secondary or more (percent of all adults)[a,b,c]	16	74	80	85
Education - college or more (percent of all adults) [a,b,c]	0.3	18	17	28
Employment to population ratio, men (percent of all adults) [a,b,d]	32	57	60	72
Employment to population ratio, women (percent of all adults) [a,b,d]	17	44	55	57
Unemployment rate (percent) [d,e]	48	4	10	4
Live in rural area (percent)[e,f]	40	35	14	22
Number of all children born to women, age 40 to 44 [a,g,f]	3.4	1.9	1.9	1.8
Number of children born to women, age 15 to 19 [a,g,f]	0.19	0.04	0.15	0.06
Infants born with low birth weight (percent) [e,h]	17	7	14	7
Percentage of children in single-parent families [e,i]	17	22	54	21

[a] The Roma figures are estimates from the Hungarian Roma Survey of 2003 (Kemény and Janky, 2006). Age groups: 25 years and over for the education figures, 15 years and older and not in school for the employment figures.
[b] The "non-Roma" figures are overall national estimates from the Hungarian Labor Force Survey of 2003. Age groups: 25 years and over for the education figures, 15 years and older and not in school for the employment figures.
[c] The U.S. figures are from published tables on the U.S. Census website ("Table 224. Educational Attainment by Race, and Hispanic Origin"), and they refer to 2003. Age group: 25 years and over.
[d] The U.S. figures are from published tables on the BLS website ("Labor Force Statistics from the Current Population Survey"), and they refer to the fourth quarter in 2003. Age group: 16 years and over.
[e] The Roma and non-Roma figures are estimates from the Hungarian Life Course Survey (Kertesi and Kézdi, forthcoming), and they refer to the parents of 8th graders in 2006.
[f] The U.S. figures are from published tables on the U.S. Census website ("Profiles of General Demographic Characteristics"), and they refer to 2001.
[g] The "non-Roma" figures are overall national figures from the published tables of the Hungarian Census of 2001 (Volume 22, table 1.3).
[h] The U.S. figures are from Table 33 in the National Vital Statistics Reports, 58(24) (U.S. Census Bureau), and they refer to 2003.
[i] The U.S. figures are from Table C9 in America's Families and Living Arrangements: 2009 (U.S. Census Bureau), and they refer to all children under 18 in 2009.

Table 1 shows a comparison with some corresponding African-American figures from the United States. In terms of education and employment, the gap between Roma and non-Roma is substantially larger than the gap between African-Americans and Whites in the U.S. The Roma are somewhat more rural, and they have a substantially higher birth rate relative to the majority, but the same are not true for African-Americans. The teen birth rate is higher and low birth weight is significantly more common among the Roma than the mainstream population, and the gaps are similar in magnitude to the Black-White gap. Single-parent families are less frequent among the Roma in Hungary than among the majority, while they are substantially more frequent among African-Americans than among Whites in the U.S.

I. Data

We use the test scores of 8th-grade students measured by the Hungarian National Assessment of Basic Competences (NABC) in May 2006, which is linked to the sample of the Hungarian Life Course Survey (HLCS). The NABC measures the mathematical and reading literacy skills of entire cohorts of 6th-, 8th- and 10th-grade students. The NABC does not cover students with special education needs[2] except for 8th graders in 2006, when a special version of the reading test was administered to these students.

The Hungarian Life Course Survey (HLCS) is an individual panel survey administered yearly that follows the model of the National Longitudinal Surveys of Youth in the United States (NLSY79). The original sample is 10,000 students drawn from the population of 8th-grade students with valid test scores in May 2006. The sample includes students with special education

[2] Six percent of all 8th graders (twelve percent of the Roma 8th graders) in 2006 were students with special education needs; most of them were "mildly mentally disabled." Most special education needs students do not participate in the NABC. In 2006, a special version of the reading test was administered to these students as well, and our data include those test scores.

needs (and their scores in reading). Results excluding students with special education needs are similar and presented in the online appendix. Students with lower test scores are overrepresented in the survey, and we use sampling weights to restore population moments. Our sample consists of students who were interviewed in the first two survey waves and who lived with at least one biological parent. These sample restrictions are necessary to identify ethnicity. Each of the first two waves includes two questions on ethnic or national identity. These question-pairs allowed parents to declare multiple identities, and many did so. In this paper, we consider as Roma all students whose (biological) mother or (biological) father chose Romani identity as a first or second choice in either of the two waves. According to this definition, the fraction of Roma students is close to 8 percent, and the size of the Roma subsample is 848.[3] The size of the sample is 9056 students for the reading test and 8335 for mathematics. This difference in sample size exists because students with special education needs have test scores in reading but not mathematics. The online appendix shows the number of observations lost due to the sample selection together with some descriptive statistics on the lost individuals.

II. The test score gap

Table 2 shows the standardized test score gap between Roma and non-Roma 8th graders in Hungary in 2006 as well as the gap between African-American and White students in the U.S. for a few selected years. The U.S. series are presented in two different groups because the published time series of 8th graders begin in 1992 while the series for 13-year-olds begins in the late 1970s. The ethnic gap in Hungary is very similar to the Black-White gap among 13-year-old

[3] The survey probably captures four fifths of the students who are considered Roma by their teachers. School principals estimated the fraction of Roma students in the entire primary school population (grades 1 through 8) to be 12 percent (NABC data), which translates to around 10 percent in 8th grade.

students in 1978/80. In both cases, the gap in reading is less than one standard deviation, while the gap in mathematics is greater than one standard deviation.

Table 2. The Roma/non-Roma and Black-White test score gaps in Hungary and the U.S., respectively, among eight graders or 13-year-old students. Test scores are standardized by national standard deviations.

	Roma/non-Roma gap, 8th grade, Hungary[a]		Black-White gap, 8th grade, U.S.[b]		Black-White gap, age 13, U.S.[c]	
	Reading	Mathematics	Reading	Mathematics	Reading	Mathematics
1978/80	-	-	-	-	-0.91	-1.08
1992	-	-	-0.83	-1.10	-0.73	-0.93
2006/8	-0.97	-1.05	-0.78	-0.88	-0.56	-0.81

a The authors' calculations using the National Assessment of Basic Competences of Hungary linked to the Hungarian Life Course Survey.
b. National Assessment of Educational Progress (NAEP), "Main NAEP" tables, 1992 and 2007.
c. National Assessment of Educational Progress (NAEP), "Long-Term Trend" tables, 1980, 1992 and 2008 in reading, 1978, 1992 and 2008 in mathematics.

III. Methodology and right-hand side variables

We estimate a series of OLS regressions with the Roma dummy and control variables on the right-hand side. We start without controls and successively add measures of children's health, the parenting they experienced, school and class fixed effects and variables for family structure, parental education and permanent income. The main question is the extent to which the coefficient on the Roma dummy decreases with the inclusion of the control variables. Although all of our models are "reduced-form" regressions, the content of the control variables and the sequence of their inclusion suggest causal mechanisms that are in line with those found in previous literature. The ethnic gap in test scores may be caused by ethnic differences in health, parenting and schools, which represent the most important causal mechanisms through which differences in parental education and income may lead to large differences in test scores.

The first measure of health is a dummy for low birth weight (less than 2500 grams) as an indicator of fetal health status. Adverse fetal health status is shown to have substantive negative

consequences for cognitive development in both the short run and the long run and is also highly correlated with poverty (Nancy Reichman, 2005; Jere R. Behrman and Mark Rosenzweig, 2004; Sandra Black, Paul J. Devereux and Kjell G. Salvanes, 2007). The second health measure is teenage body height in units of gender-specific standard deviations (with age correction). Body height is a standard marker of prenatal and childhood nutritional and health history (Anne Case and Christina Paxson, 2008). The third measure is a dummy for fair or poor subjective health status as reported in the first survey wave (at modal age 15). Evidence presented by Anne Case, Darren Lubotsky and Christina Paxson (2002) shows that reported health status correlates strongly with children's chronic conditions as assessed by physicians.

Differences in parenting are likely to be important causal mechanisms underlying the ethnic test score gap. In their extensive review, Jeanne Brooks-Gunn and Lisa Markman (2005) conclude that parenting differences, particularly differences in language use, daily storybook reading and a cognitively stimulating home environment, play a crucial role. We have two sets of variables for parenting. The first set measures parenting practices in early childhood. These variables are based on retrospective questions that the parents and children were separately asked. Parents were asked about the frequency of activities that they engaged in with the child during the preschool years, for which we include dummies for the frequency of bedtime storytelling, visits to the theater and hiking. The child was also asked about the frequency of bedtime stories in a separate interview, and we enter two dummies for their frequency. The second set of parenting variables contains two standardized measures from the HOME inventory scale at modal age 15, the cognitive stimulation subscale and the emotional support subscale. Extensive research (Robert H. Bradley and al., 2000; Frank L. Mott, 2004) has demonstrated that HOME measures are highly correlated with cognitive and non-cognitive development and have

predictive power for outcomes later in life. Our measures are derived from the Short Form (27 items) of the Early Adolescent version of the Home Observation for Measurement of the Environment (HOME-SF) for children aged 10-14 years as applied in the NLSY.

School quality is controlled for through the inclusion of school fixed effects. In another specification, class fixed effects are included (interacted with school fixed) to control for differences in exposure to teachers and peers. School choice is free in Hungary, which likely results in strong sorting by income and ethnicity. As a result, the schools and classes of Roma students may differ considerably from the schools and classes of non-Roma students. School quality and teacher effectiveness are notoriously difficult to measure by observable characteristics. By entering fixed effects, we compare Roma and non-Roma students within the same schools and classes and can thus capture both the otherwise-measured and unmeasured differences in their experiences. The administrative source of the test score data includes identifiers for schools and classes, and the two-stage sampling procedure of the matched HLCS sample ensures that we have enough students in the sample who shared the same school and class in 8^{th} grade for a fixed effects analysis. At the same time, however, the majority of non-Roma students do not share a school with Roma students in our sample.

The last set of variables that we enter covers family structure, parental education and measures for permanent income that we consider pre-determined with respect to children's health, parenting environment and schools. The family structure variables include whether, at the time of the first interview (at modal age 15), students lived with their biological mother, biological father, stepmother or stepfather. In addition to variables for the mother's and the father's level of education, we include the number of books at home (in categories) and access to Internet at home. Permanent income measures are parents' employment status, the fraction of

years that they had been employed since the birth of the student, log household income, log household size, number of non-employed adults, size of the apartment both in terms of square meter per capita and number of rooms per capita, bathroom access, and five indicators of poverty (whether, in a 12-month period, the household felt that it had no money for food or heating, the household received welfare or the student received free schoolbooks and free lunches at school).

We estimate seven specifications. After reproducing the raw gap without control variables, we first include the health measures, then measures of the home environment and then school and class fixed effects. Last, we add the family background variables, first without the school and class fixed effects, and then together with those effects.

IV. Regression results

The Roma versus non-Roma test score gap estimates from the seven specifications are presented in Table 3. The standard error estimates are robust to heteroskedasticity and clustering at the school level. Missing right-hand side variables are addressed by including dummies for missing status. The detailed results are in the online appendix.[4]

The results are qualitatively similar across the two tests. Inclusion of health decreases the gap by 10 percent, and inclusion of home environment and parenting leads to a substantial further decrease of more than 50 percent in the case of reading and slightly less than 50 percent in the case of mathematics. Inclusion of school fixed effects decreases the gap by an additional third, and class fixed effects lead to a smaller but non-negligible further decrease. The combined reduction of the Roma dummy is large after the inclusion of these variables, which are intended

[4] These are linear regressions and may suffer from functional form misspecification and lack of common support between the Roma and non-Roma subsamples. We re-estimated specifications (2), (3) and (6) by nearest neighbor matching for the propensity score and got very similar results (see the online appendix).

to measure causal mechanisms. The ethnic gaps in reading and mathematics decrease to 0.16 and 0.28 of their standard deviations, respectively, indicating that ethnic differences in childhood health, home environment and schools can account for at least 75 to 85 percent of the ethnic gap in test scores in eighth grade. Addition of the rest of the family background variables but not the school and class fixed effects reduces the ethnic gap by 10 percent in reading (insignificant) and 22 percent in mathematics. After inclusion of all right-hand side variables, the gap becomes 5 percent (insignificant) in reading and 15 percent in mathematics.

Table 3. The ethnic gap in reading and mathematics: unconditional and conditional on control variables. OLS estimates of the Roma coefficient in seven specifications.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Reading							
Gap	-0.97	-0.87	-0.38	-0.25	-0.16	-0.11	-0.05
[S.E.]	[0.05]**	[0.05]**	[0.05]**	[0.06]**	[0.07]*	[0.05]*	[0.07]
Observations	9056	9056	9056	9056	9056	9056	9056
R^2	0.06	0.09	0.25	0.53	0.66	0.33	0.68
Panel B. Mathematics							
Gap	-1.05	-0.94	-0.51	-0.33	-0.28	-0.22	-0.15
[S.E.]	[0.05]**	[0.05]**	[0.05]**	[0.05]**	[0.07]**	[0.05]**	[0.07]*
Observations	8335	8335	8335	8335	8335	8335	8335
R^2	0.07	0.10	0.23	0.54	0.67	0.32	0.69
Control variables							
Health		Yes	Yes	Yes	Yes	Yes	Yes
Home environment			Yes	Yes	Yes	Yes	Yes
School FE				Yes	Yes		Yes
School × Class FE					Yes		Yes
Family background						Yes	Yes

Standard errors in brackets are clustered at the school level.
*Significant at the 5 percent level. **Significant at the 1 percent level.

V. Ethnic gap in health and parenting

Taking one step back, we also look at the ethnic gap in the most important measures of health and parenting. For each health and parenting variable, we estimate the "raw gap" (with the Roma dummy as the only variable on the left-hand side) and the "conditional gap", which is the coefficient on the Roma dummy after inclusion of the family background variables (family structure, parental education and permanent income). The goal of this analysis is to determine ethnic differences in the most important variables that can have causal effects. A similar analysis for school and class fixed effects would be less straightforward.

Table 4. Ethnic gap in health and parenting. Raw differences and differences conditional on family background variables. OLS results.

	Low birth weight	Standardized height	Fair or poor health	Frequent bedtime stories[a]	Rare theater[a]
Raw gap	0.10	-0.36	0.08	-0.30	0.26
[S.E.]	[0.02]**	[0.04]**	[0.02]**	[0.02]**	[0.02]**
Conditional gap	0.04	-0.07	0.01	-0.05	-0.03
[S.E.]	[0.02]*	[0.05]	[0.02]	[0.03]*	[0.02]

	Rare hiking[a]	Bedtime stories never[b]	Bedtime stories every day[b]	HOME cognitive	HOME emotional
Raw gap	0.31	0.15	-0.27	-1.12	-0.18
[S.E.]	[0.02]**	[0.02]**	[0.02]**	[0.05]**	[0.04]**
Conditional gap	-0.01	0.06	-0.03	-0.09	0.09
[S.E.]	[0.02]	[0.02]**	[0.02]	[0.05]*	[0.05]

Standard errors in brackets are clustered at the school level.
*Significant at the 5 percent level. **Significant at the 1 percent level.

The results are presented in Table 4. The raw ethnic gap is substantial for each variable except the emotional HOME index. The conditional gap, however, is either indistinguishable from zero or substantially smaller than the raw gap. While these results cannot be interpreted as causal effects, we take them as evidence supporting the overwhelming role of education and poverty in health and parenting, as opposed to intrinsic ethnic effects.

VI. Conclusions

Our results show that the test score gap between Roma and non-Roma 8th graders in Hungary is similar to the Black-White gap present in the U.S. during the 1980s. After accounting for health, parenting, school and class fixed effects and family background, the test score gap disappears in reading and decreases by 85 percent in mathematics. We also showed that the large ethnic gaps in health and parenting disappear or decrease considerably if parental education and measures of family income and poverty are included. While causality is difficult to determine in our regressions, these results are consistent with the conclusion that education and poverty play an overwhelming role in the large ethnic test score gaps in Hungary, with health, parenting and schools as the key transmission mechanisms.

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ONLINE APPENDIX

Table 1A. Detalis of the sample selection. Numbers of observations and statistics on test scores and the mothers' level of education.

	Number of observations	Mean standardized test score[a]		Fraction with mother's education	
		reading	mathematics	8 grades or less	college
Data from the Hungarian National Assessment of Basic Competences, grade 8					
All registered students	113,092	n.a.	n.a.	n.a.	n.a.
Students with test scores in reading	109,906	-0.08	n.a.	n.a.	n.a.
Students with test scores in mathematics	104,566	n.a.	-0.06	n.a.	n.a.
Students with test scores both in reading and mathematics	104,533	-0.03	-0.06	n.a.	n.a.
Students with test scores and family background data	88,175	-0.01	-0.04	0.18	0.21
Students who agreed to participate in the Hungarian Life Course Survey	37,027	-0.14	-0.09	0.24	0.19
Data from the Hungarian Life Course Survey					
Sample in wave 1[b]	10,022	-0.11	-0.05	0.21	0.20
Sample in wave 2[b]	9,300	-0.10	-0.04	0.21	0.20
Estimation sample[b]	9,056	-0.09	-0.03	0.20	0.20

Notes.
[a] Test scores are standardized by official figures on national means and standard deviations. Not all students' scores are included in the national statistics, therefore the nonzero means in the total population.
[b] All statistics (mean test scores and fractions) are weighted by sampling weights.

Table 2A. Summary statistics

	Roma			Non-Roma		
Variable	mean	sd	n	mean	sd	n
Low birth weight	0.17	0.38	848	0.07	0.25	8208
Body height (standardized)	-0.33	0.92	848	0.03	0.99	8208
Subjective health fair or poor	0.17	0.37	848	0.09	0.28	8208
Frequent bedtime stories (parent's answer)	0.35	0.48	848	0.65	0.48	8208
Rare theater with parents (parent's answer)	0.83	0.38	848	0.57	0.50	8208
Rare hiking with parents (parent's answer)	0.76	0.43	848	0.44	0.50	8208
Bedtime stories never (child's answer)	0.18	0.38	848	0.03	0.16	8208
Bedtime stories every day (child's answer)	0.21	0.41	848	0.48	0.50	8208
Cognitive HOME index	-1.03	0.98	848	0.09	0.94	8208
Emotional HOME index	-0.17	0.98	848	0.02	0.98	8208
Lives with biological mother	0.64	0.48	848	0.09	0.28	8208
Lives with stepmother	0.16	0.37	848	0.11	0.32	8208
Lives with biological father	0.11	0.31	848	0.23	0.42	8208
Lives with stepfather	0.04	0.20	848	0.20	0.40	8208
Mother's education 0-8th grade	0.02	0.15	848	0.17	0.37	8208
Mother's education vocational	0.01	0.09	848	0.09	0.28	8208
Mother's education secondary	reference					
Mother's education college	0.07	0.25	848	0.51	0.50	8208
Father's education 0-8th grade	0.96	0.20	848	0.97	0.18	8208
Father's education vocational	0.03	0.17	848	0.01	0.11	8208
Father's education secondary	0.78	0.41	848	0.72	0.45	8208
Father's education college	0.06	0.24	848	0.09	0.28	8208
Books: less than 50	0.79	0.41	848	0.15	0.36	8208
Books: 50	0.15	0.36	848	0.25	0.43	8208
Books: 50-150	0.04	0.20	848	0.36	0.48	8208
Books: 150-300	reference					
Books: 300-600	0.54	0.50	848	0.08	0.27	8208
Books: 600-1000	0.27	0.44	848	0.37	0.48	8208
Books: more	0.03	0.18	848	0.21	0.41	8208
Internet at home	reference					
Mother employed	0.24	0.43	848	0.70	0.46	8208
Father employed	0.35	0.48	848	0.66	0.47	8208
Fraction of years mother was employed	0.30	0.35	848	0.64	0.32	8208
Fraction of years father was employed	0.52	0.45	848	0.73	0.43	8208
ln Household income	11.68	0.46	848	12.03	0.46	8208
ln Household size	1.58	0.35	848	1.39	0.29	8208
Non-employed adults in household	1.39	0.99	848	0.67	0.81	8208
Square meter per capita	17.55	9.62	848	23.57	10.16	8208
Rooms per capita	0.55	0.25	848	0.79	0.29	8208
Bathroom	0.75	0.43	848	0.97	0.17	8208
Poverty indicator (no money for food)	0.23	0.42	848	0.05	0.21	8208
Poverty indicator (no money for heating)	0.35	0.48	848	0.12	0.32	8208
Poverty indicator (child welfare allowance)	0.67	0.47	848	0.22	0.42	8208
Poverty indicator (free lunch)	0.17	0.38	848	0.08	0.27	8208
Poverty indicator (free schoolbooks)	0.87	0.33	848	0.56	0.50	8208

Table 3A. Detailed results of the regressions on standardized test scores in reading

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Roma	-0.97	-0.87	-0.38	-0.25	-0.16	-0.11	-0.05
	[0.05]**	[0.05]**	[0.05]**	[0.06]**	[0.07]*	[0.05]*	[0.07]
Low birth weight		-0.27	-0.18	-0.11	-0.09	-0.13	-0.08
		[0.04]**	[0.04]**	[0.05]*	[0.05]	[0.04]**	[0.05]
Body height (standardized)		0.11	0.06	0.05	0.04	0.03	0.03
		[0.01]**	[0.01]**	[0.01]**	[0.02]*	[0.01]**	[0.01]
Subjective health fair or poor		-0.33	-0.18	-0.15	-0.13	-0.13	-0.12
		[0.04]**	[0.04]**	[0.04]**	[0.05]**	[0.04]**	[0.05]*
Frequent bedtime stories (parent's answer)			0.12	0.10	0.11	0.07	0.09
			[0.03]**	[0.03]**	[0.04]**	[0.02]**	[0.04]*
Rare theater with parents (parent's answer)			-0.13	-0.04	-0.04	-0.05	-0.01
			[0.03]**	[0.03]	[0.04]	[0.03]	[0.04]
Rare hiking with parents (parent's answer)			-0.06	-0.04	0.00	0.01	0.03
			[0.03]*	[0.03]	[0.04]	[0.03]	[0.04]
Bedtime stories never (child's answer)			-0.16	-0.06	-0.07	-0.14	-0.06
			[0.06]**	[0.06]	[0.07]	[0.06]*	[0.07]
Bedtime stories every day (child's answer)			0.16	0.12	0.10	0.09	0.06
			[0.02]**	[0.03]**	[0.03]**	[0.02]**	[0.03]
Cognitive HOME index			0.34	0.28	0.24	0.17	0.16
			[0.01]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**
Emotional HOME index			-0.05	-0.05	-0.03	-0.04	-0.03
			[0.01]**	[0.02]**	[0.02]	[0.01]**	[0.02]
Lives with biological mother						-0.53	-0.42
						[0.05]**	[0.08]**
Lives with stepmother						-0.33	-0.28
						[0.05]**	[0.07]**
Lives with biological father						-0.29	-0.24
						[0.04]**	[0.06]**
Lives with stepfather						-0.19	-0.11
						[0.04]**	[0.06]
Mother's education 0-8th grade						-0.13	-0.10
						[0.04]**	[0.06]
Mother's education vocational						-0.08	-0.13
						[0.04]	[0.07]
Mother's education secondary						0.18	0.15
						[0.03]**	[0.04]**
Father's education 0-8th grade						0.03	-0.28
						[0.27]	[0.34]
Father's education vocational						-0.09	-0.33
						[0.28]	[0.34]
Father's education secondary						-0.07	0.10
						[0.45]	[0.49]
Books: less than 50						-0.07	0.16
						[0.45]	[0.49]
Books: 50						-0.26	-0.11
						[0.05]**	[0.07]
Books: 50-150						-0.29	-0.17
						[0.04]**	[0.06]**
Books: 150-300						-0.13	-0.06
						[0.03]**	[0.05]
Books: 300-600						-0.37	-0.22
						[0.05]**	[0.08]**
Books: 600-1000						-0.28	-0.16
						[0.04]**	[0.06]**
Internet at home						-0.19	-0.09
						[0.04]**	[0.06]
Mother employed						-0.05	0.00
						[0.03]	[0.05]

Father employed						0.01	0.02
						[0.04]	[0.05]
Fraction of years mother was employed						-0.02	-0.11
						[0.04]	[0.06]
Fraction of years father was employed						0.11	0.10
						[0.05]*	[0.07]
ln Household income						-0.03	-0.03
						[0.03]	[0.04]
ln Household size						-0.11	-0.10
						[0.05]*	[0.08]
Non-employed adults in household						-0.05	-0.03
						[0.02]**	[0.03]
Apartment size, square meters per capita						0.00	0.00
						[0.00]	[0.00]
Rooms per capita						0.07	-0.11
						[0.05]	[0.08]
Bathroom						-0.01	-0.05
						[0.06]	[0.08]
Poverty indicator (no money for food)						-0.15	-0.03
						[0.05]**	[0.06]
Poverty indicator (no money for heating)						-0.03	0.00
						[0.03]	[0.05]
Poverty indicator (child welfare allowance)						0.10	0.07
						[0.03]**	[0.04]
Poverty indicator (free lunch)						-0.11	-0.11
						[0.04]**	[0.06]
Poverty indicator (free schoolbooks)						-0.10	-0.06
						[0.03]**	[0.04]
Missing birth weight		-0.58	-0.34	-0.40	-0.37	-0.20	-0.33
		[0.15]**	[0.13]*	[0.15]**	[0.21]	[0.14]	[0.21]
Missing height		-0.15	-0.11	-0.16	-0.16	-0.10	-0.13
		[0.08]	[0.08]	[0.09]	[0.11]	[0.07]	[0.11]
Missing subjective health		-0.29	-0.18	-0.14	0.03	-0.20	0.04
		[0.10]**	[0.09]*	[0.12]	[0.14]	[0.08]*	[0.13]
Missing bedtime stories			0.11	0.07	0.06	0.06	0.03
			[0.06]*	[0.07]	[0.08]	[0.06]	[0.08]
Missing cognitive HOME index			-0.13	-0.08	-0.06	-0.05	-0.02
			[0.09]	[0.11]	[0.14]	[0.09]	[0.15]
Missing emotional HOME index			0.06	0.09	0.15	0.05	0.12
			[0.07]	[0.09]	[0.11]	[0.07]	[0.12]
Missing number of books						-0.20	-0.19
						[0.13]	[0.18]
Missing Internet						-0.10	-0.13
						[0.19]	[0.21]
Missing education of mother						-0.31	-0.46
						[0.26]	[0.33]
Missing education of father						-0.21	0.05
						[0.45]	[0.50]
Missing household income						-0.04	-0.05
						[0.03]	[0.05]
Missing apartment size, square meters						-0.04	-0.06
						[0.09]	[0.13]
Missing number of rooms						0.04	0.16
						[0.16]	[0.19]
Missing bathroom						-0.07	-0.22
						[0.18]	[0.27]
Missing poverty indices						0.12	-0.11
						[0.11]	[0.16]
Constant	-0.01	0.04	-0.07	-0.12	-0.15	1.06	0.95
	[0.02]	[0.02]*	[0.03]*	[0.03]**	[0.04]**	[0.57]	[0.81]

School FE				YES	YES		YES
School × Class FE					YES		YES
Observations	9056	9056	9056	9056	9056	9056	9056
R-squared	0.06	0.09	0.25	0.53	0.66	0.33	0.68

Table 4A. Detailed results of the regressions on standardized test scores in mathematics

	(1)	(2)	(3)	(4)	(5)	(7)	(6)
Roma	-1.05	-0.94	-0.51	-0.33	-0.28	-0.22	-0.15
	[0.05]**	[0.05]**	[0.05]**	[0.05]**	[0.07]**	[0.05]**	[0.07]*
Low birth weight		-0.38	-0.29	-0.19	-0.17	-0.23	-0.16
		[0.04]**	[0.04]**	[0.05]**	[0.05]**	[0.04]**	[0.05]**
Body height (standardized)		0.11	0.06	0.06	0.04	0.03	0.03
		[0.01]**	[0.01]**	[0.01]**	[0.02]*	[0.01]**	[0.02]
Subjective health fair or poor		-0.35	-0.23	-0.17	-0.19	-0.16	-0.17
		[0.04]**	[0.04]**	[0.05]**	[0.06]**	[0.04]**	[0.06]**
Frequent bedtime stories (parent's answer)			0.12	0.08	0.07	0.06	0.04
			[0.03]**	[0.03]**	[0.04]	[0.03]*	[0.04]
Rare theater with parents (parent's answer)			-0.12	-0.03	-0.03	-0.02	-0.01
			[0.03]**	[0.03]	[0.04]	[0.03]	[0.04]
Rare hiking with parents (parent's answer)			-0.11	-0.09	-0.06	-0.03	-0.02
			[0.03]**	[0.03]**	[0.04]	[0.03]	[0.04]
Bedtime stories never (child's answer)			-0.06	-0.06	-0.06	-0.04	-0.04
			[0.06]	[0.06]	[0.07]	[0.06]	[0.07]
Bedtime stories every day (child's answer)			0.14	0.09	0.08	0.07	0.05
			[0.03]**	[0.03]**	[0.04]*	[0.03]**	[0.04]
Cognitive HOME index			0.31	0.24	0.20	0.12	0.10
			[0.01]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**
Emotional HOME index			-0.06	-0.05	-0.04	-0.06	-0.04
			[0.01]**	[0.02]**	[0.02]	[0.01]**	[0.02]*
Lives with biological mother						-0.39	-0.26
						[0.06]**	[0.09]**
Lives with stepmother						-0.28	-0.21
						[0.06]**	[0.08]*
Lives with biological father						-0.25	-0.14
						[0.05]**	[0.07]
Lives with stepfather						-0.15	-0.01
						[0.05]**	[0.07]
Mother's education 0-8th grade						-0.12	-0.05
						[0.05]*	[0.07]
Mother's education vocational						-0.10	-0.09
						[0.05]	[0.08]
Mother's education secondary						0.22	0.22
						[0.03]**	[0.04]**
Father's education 0-8th grade						-0.15	-0.02
						[0.30]	[0.32]
Father's education vocational						-0.23	0.01
						[0.31]	[0.33]
Father's education secondary						-0.12	-0.59
						[0.26]	[0.56]
Books: less than 50						-0.17	-0.61
						[0.26]	[0.56]
Books: 50						-0.32	-0.21
						[0.05]**	[0.07]**
Books: 50-150						-0.29	-0.22
						[0.04]**	[0.06]**
Books: 150-300						-0.11	-0.09
						[0.04]**	[0.06]
Books: 300-600						-0.50	-0.27
						[0.06]**	[0.09]**
Books: 600-1000						-0.41	-0.21
						[0.05]**	[0.07]**
Internet at home						-0.21	-0.09
						[0.05]**	[0.07]
Mother employed						-0.03	0.03
						[0.04]	[0.05]

Father employed						-0.02	-0.05
						[0.04]	[0.06]
Fraction of years mother was employed						-0.01	-0.08
						[0.05]	[0.06]
Fraction of years father was employed						0.07	0.16
						[0.06]	[0.07]*
ln Household income						0.01	0.01
						[0.03]	[0.04]
ln Household size						-0.08	-0.11
						[0.06]	[0.08]
Non-employed adults in household						-0.04	-0.03
						[0.02]*	[0.03]
Apartment size, square meters per capita						0.00	0.00
						[0.00]	[0.00]
Rooms per capita						0.09	-0.07
						[0.06]	[0.09]
Bathroom						0.03	-0.03
						[0.06]	[0.07]
Poverty indicator (no money for food)						-0.12	-0.04
						[0.05]*	[0.06]
Poverty indicator (no money for heating)						-0.02	0.02
						[0.04]	[0.05]
Poverty indicator (child welfare allowance)						0.05	0.04
						[0.03]	[0.05]
Poverty indicator (free lunch)						-0.06	-0.13
						[0.05]	[0.06]*
Poverty indicator (free schoolbooks)						-0.03	0.03
						[0.03]	[0.04]
Missing birth weight		-0.37	-0.16	-0.27	-0.22	-0.04	-0.18
		[0.16]*	[0.13]	[0.17]	[0.19]	[0.12]	[0.18]
Missing height		-0.04	-0.02	-0.10	-0.13	-0.02	-0.11
		[0.09]	[0.08]	[0.10]	[0.13]	[0.08]	[0.13]
Missing subjective health		-0.33	-0.25	-0.16	-0.04	-0.28	0.00
		[0.10]**	[0.10]**	[0.11]	[0.15]	[0.09]**	[0.15]
Missing bedtime stories			0.13	0.09	0.04	0.08	0.03
			[0.06]*	[0.07]	[0.09]	[0.06]	[0.09]
Missing cognitive HOME index			-0.21	-0.20	-0.23	-0.14	-0.18
			[0.10]*	[0.11]	[0.13]	[0.09]	[0.13]
Missing emotional HOME index			-0.02	0.01	0.03	-0.04	-0.01
			[0.08]	[0.08]	[0.10]	[0.07]	[0.10]
Missing number of books						-0.14	-0.11
						[0.15]	[0.25]
Missing Internet						-0.09	-0.25
						[0.28]	[0.21]
Missing education of mother						-0.49	-0.36
						[0.29]	[0.31]
Missing education of father						-0.46	-0.72
						[0.26]	[0.57]
Missing household income						-0.05	-0.08
						[0.03]	[0.06]
Missing apartment size, square meters						-0.08	-0.08
						[0.09]	[0.12]
Missing number of rooms						0.31	0.50
						[0.22]	[0.22]*
Missing bathroom						0.22	0.22
						[0.19]	[0.23]
Missing poverty indices						0.13	0.03
						[0.12]	[0.19]
Constant	0.04	0.10	0.01	-0.02	-0.02	0.79	0.92
	[0.02]*	[0.02]**	[0.03]	[0.03]	[0.04]	[0.39]*	[0.85]

School FE				YES	YES		YES
School × Class FE					YES		YES
Observations	8335	8335	8335	8335	8335	8335	8335
R-squared	0.07	0.10	0.23	0.54	0.67	0.32	0.69

Table 5A. Results excluding students with special education needs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Reading							
Gap	-0.95	-0.86	-0.4	-0.26	-0.19	-0.14	-0.07
[S.E.]	[0.06]**	[0.06]**	[0.06]**	[0.07]**	[0.08]*	[0.06]*	[0.08]
Observations	8201	8201	8201	8201	8201	8201	8201
R^2	0.06	0.08	0.24	0.51	0.65	0.31	0.66
Panel B. Mathematics							
Gap	-1.05	-0.94	-0.51	-0.33	-0.28	-0.23	-0.14
[S.E.]	[0.05]**	[0.05]**	[0.05]**	[0.05]**	[0.07]**	[0.05]**	[0.07]*
Observations	8193	8193	8193	8193	8193	8193	8193
R^2	0.07	0.10	0.23	0.54	0.67	0.32	0.69
Control variables							
Health		Yes	Yes	Yes	Yes	Yes	Yes
Home environment			Yes	Yes	Yes	Yes	Yes
School FE				Yes	Yes		Yes
School × Class FE					Yes		Yes
Family background						Yes	Yes

Standard errors in brackets are clustered at the school level. *Significant at the 5 percent level. **Significant at the 1 percent level.

Table 6A. Roma/non-Roma test score gap estimates by propensity score matching for specifications (2), (3) and (6).

	Nearest neighbor matching			Stratified matching		
	(2)	(3)	(6)	(2)	(3)	(6)
Panel A. Reading						
Gap	-0.82	-0.40	-0.09	-0.83	-0.39	-0.10
[S.E.]	[0.04]**	[0.05]**	[0.06]	[0.03]**	[0.03]**	[0.04]*
# treated observations	837	837	837	837	837	837
# control observations	3306	694	522	7988	7715	7757
Panel B. Mathematics						
Gap	-0.89	-0.59	-0.13	-0.89	-0.51	-0.17
[S.E.]	[0.04]**	[0.05]**	[0.06]*	[0.03]**	[0.03]**	[0.03]*
# treated observations	837	837	837	7988	837	837
# control observations	3096	597	425	425	7715	7757
Variables in the propensity score equation						
Health	Yes	Yes	Yes	Yes	Yes	Yes
Home environment		Yes	Yes		Yes	Yes
Family background			Yes			Yes

Standard errors in brackets are clustered at the school level. *Significant at the 5 percent level. **Significant at the 1 percent level.

Table 7A. Ethnic gap in health and parenting. Detailed estimates of the regressions on the Roma dummy and family background variables. OLS results.

	Low birth weight	Standardized height	Fair or poor health	Frequent bedtime stories	Rare theater	Rare hiking	Bedtime stories never	Bedtime stories every day	HOME cognitive	HOME emotional
Roma	0.04	-0.07	0.01	-0.05	-0.03	-0.01	0.06	-0.03	-0.09	0.09
	[0.02]*	[0.05]	[0.02]	[0.03]*	[0.02]	[0.02]	[0.02]**	[0.02]	[0.05]*	[0.05]
Lives with bio. Mother	-0.05	-0.37	-0.14	0.19	-0.07	0.23	0.00	0.04	-0.24	-0.21
	[0.08]	[0.31]	[0.11]	[0.15]	[0.14]	[0.14]	[0.07]	[0.15]	[0.29]	[0.33]
Lives with stepmother	-0.06	-0.47	-0.14	0.07	0.04	0.23	0.02	0.00	-0.50	-0.29
	[0.08]	[0.32]	[0.11]	[0.15]	[0.15]	[0.14]	[0.07]	[0.15]	[0.30]	[0.34]
Lives with bio. Father	-0.01	0.62	0.19	0.23	0.15	-0.01	-0.10	0.22	0.11	0.36
	[0.11]	[0.39]	[0.18]	[0.22]	[0.13]	[0.18]	[0.06]	[0.18]	[0.39]	[0.43]
Lives with stepfather	0.00	0.56	0.18	0.22	0.16	-0.02	-0.11	0.24	0.00	0.39
	[0.11]	[0.39]	[0.18]	[0.22]	[0.13]	[0.18]	[0.06]	[0.18]	[0.39]	[0.43]
Mother's edu. 0-8th grade	0.04	-0.25	0.05	-0.25	0.28	0.30	0.05	-0.30	-0.92	-0.17
	[0.01]**	[0.05]**	[0.02]**	[0.02]**	[0.02]**	[0.02]**	[0.01]**	[0.03]**	[0.04]**	[0.05]**
Mother's edu. Vocational	0.01	-0.18	0.02	-0.17	0.22	0.19	0.00	-0.22	-0.62	-0.08
	[0.01]	[0.04]**	[0.01]	[0.02]**	[0.02]**	[0.02]**	[0.01]	[0.02]**	[0.03]**	[0.04]
Mother's edu. Secondary	0.00	-0.07	0.01	-0.07	0.11	0.08	0.00	-0.13	-0.34	-0.01
	[0.01]	[0.04]	[0.01]	[0.02]**	[0.02]**	[0.02]**	[0.01]	[0.02]**	[0.03]**	[0.04]
Father's edu. 0-8th grade	0.03	-0.05	0.06	-0.13	0.14	0.17	0.02	-0.14	-0.53	-0.12
	[0.02]	[0.06]	[0.02]**	[0.03]**	[0.03]**	[0.03]**	[0.01]	[0.03]**	[0.05]**	[0.06]
Father's edu. Vocational	0.01	-0.03	0.03	-0.08	0.14	0.10	0.00	-0.08	-0.30	-0.06
	[0.01]	[0.05]	[0.01]**	[0.02]**	[0.02]**	[0.02]**	[0.01]	[0.02]**	[0.03]**	[0.05]
Father's edu. Secondary	0.00	-0.02	0.01	-0.04	0.07	0.05	0.00	-0.05	-0.15	-0.06
	[0.01]	[0.05]	[0.01]	[0.02]	[0.02]**	[0.02]*	[0.01]	[0.02]*	[0.03]**	[0.05]
Mother employed	-0.02	0.02	-0.02	-0.02	-0.02	-0.02	0.00	-0.01	0.08	-0.01
	[0.01]	[0.04]	[0.01]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.03]**	[0.04]
Father employed	-0.01	0.01	-0.02	-0.01	-0.01	-0.01	0.01	-0.03	0.05	-0.08
	[0.01]	[0.04]	[0.01]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.04]	[0.05]
Fraction of years mother was employed	0.02	0.02	-0.01	0.03	-0.01	-0.02	0.00	-0.02	0.03	0.08
	[0.01]	[0.05]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.04]	[0.05]
Fraction of years father was employed	-0.01	0.07	0.04	0.06	-0.03	-0.03	-0.03	0.07	0.21	0.20
	[0.02]	[0.06]	[0.02]*	[0.03]*	[0.03]	[0.03]	[0.01]*	[0.03]**	[0.05]**	[0.06]**
ln Household income	-0.01	0.03	0.00	0.01	-0.04	-0.05	-0.01	0.00	0.04	-0.09
	[0.01]	[0.03]	[0.01]	[0.01]	[0.01]**	[0.01]**	[0.01]	[0.02]	[0.03]	[0.03]**
ln Household size	0.00	-0.08	-0.02	-0.11	0.05	0.02	0.02	-0.07	0.04	0.12
	[0.02]	[0.06]	[0.02]	[0.03]**	[0.03]	[0.03]	[0.01]	[0.03]*	[0.05]	[0.06]*
Non-empl adults in household	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.04	-0.03
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.00]	[0.01]	[0.02]*	[0.02]
Apt sq. meters per capita	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]*	[0.00]**	[0.00]	[0.00]	[0.00]	[0.00]
Rooms per capita	-0.04	0.10	0.01	0.07	-0.13	-0.15	-0.01	0.08	0.36	0.02
	[0.02]*	[0.06]	[0.02]	[0.03]*	[0.03]**	[0.03]**	[0.01]	[0.03]*	[0.05]**	[0.06]
Bathroom	-0.01	0.20	-0.01	0.02	-0.11	-0.08	-0.09	0.02	0.52	0.13
	[0.02]	[0.06]**	[0.02]	[0.03]	[0.02]**	[0.03]**	[0.02]**	[0.03]	[0.06]**	[0.06]*
Poverty (no money for food)	0.01	-0.05	0.03	-0.04	0.03	0.04	0.04	-0.01	-0.17	-0.15
	[0.02]	[0.05]	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]**	[0.02]	[0.05]**	[0.06]**
Poverty (no money for heating)	0.00	0.02	0.01	-0.04	-0.01	0.00	0.01	-0.03	-0.16	-0.06
	[0.01]	[0.04]	[0.01]	[0.02]*	[0.02]	[0.02]	[0.01]	[0.02]	[0.03]**	[0.04]
Poverty (child welfare allowance)	-0.01	-0.03	-0.01	-0.03	0.06	0.06	0.00	-0.06	-0.15	-0.06
	[0.01]	[0.03]	[0.01]	[0.02]*	[0.02]**	[0.02]**	[0.01]	[0.02]**	[0.03]**	[0.04]
Poverty (free lunch)	0.02	-0.07	0.01	-0.02	0.05	0.04	-0.01	0.00	-0.10	-0.10
	[0.02]	[0.05]	[0.02]	[0.02]	[0.02]*	[0.02]*	[0.01]	[0.02]	[0.04]**	[0.04]*
Poverty (free	0.01	-0.01	0.03	0.04	0.01	-0.01	0.00	0.00	0.01	-0.10

schoolbooks)	[0.01]	[0.03]	[0.01]**	[0.01]**	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]**
Missing edu.	-0.04	-0.62	-0.11	-0.13	0.17	0.34	0.03	-0.27	-1.05	-0.04
of mother	[0.08]	[0.30]*	[0.10]	[0.14]	[0.14]	[0.13]**	[0.06]	[0.14]	[0.28]**	[0.32]
Missing edu.	0.01	0.66	0.24	0.15	0.20	0.03	-0.11	0.19	-0.12	-0.22
of father	[0.11]	[0.39]	[0.18]	[0.22]	[0.13]	[0.18]	[0.06]	[0.18]	[0.39]	[0.43]
Missing	0.01	0.04	0.01	0.04	-0.07	-0.07	-0.01	0.00	0.04	0.04
income	[0.01]	[0.04]	[0.01]	[0.02]*	[0.02]**	[0.02]**	[0.01]	[0.02]	[0.03]	[0.04]
Missing apt	0.08	-0.08	0.02	-0.12	0.04	0.00	0.13	-0.12	-0.07	-0.47
size	[0.05]	[0.10]	[0.04]	[0.05]*	[0.05]	[0.05]	[0.05]**	[0.04]**	[0.09]	[0.10]**
Missing	-0.03	0.54	0.00	0.13	-0.13	-0.08	-0.12	-0.05	0.04	0.65
n.rooms	[0.04]	[0.21]*	[0.05]	[0.08]	[0.09]	[0.08]	[0.03]**	[0.10]	[0.14]	[0.17]**
Missing	-0.09	0.09	0.07	-0.15	-0.11	0.00	0.06	-0.07	-0.11	0.35
bathroom	[0.02]**	[0.32]	[0.11]	[0.11]	[0.10]	[0.09]	[0.07]	[0.10]	[0.21]	[0.19]
Missing	-0.03	-0.30	0.03	-0.10	-0.10	-0.06	-0.03	-0.04	0.00	0.14
poverty	[0.03]	[0.13]*	[0.05]	[0.07]	[0.07]	[0.06]	[0.02]	[0.07]	[0.10]	[0.14]
Constant	0.28	-0.58	0.07	0.36	0.92	0.81	0.32	0.40	-0.73	0.87
	[0.12]*	[0.47]	[0.16]	[0.23]	[0.23]**	[0.25]**	[0.09]**	[0.25]	[0.49]	[0.51]
Observations	9056	9056	9056	9056	9056	9056	9056	9056	9056	9056
R-squared	0.03	0.04	0.03	0.11	0.16	0.16	0.09	0.11	0.42	0.11