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The Aftermaths of Lowering the School Leaving Age – Effects on Roma Youth

JÁNOS KÖLLŐ – ANNA SEBŐK

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ABSTRACT
In 2013, the Hungarian government cut the school leaving age from 18 to 16. We study the impact of this unique reform on the country's sizeable Roma minority using census data on the universe of 17-year-olds in 2011 and a 10 percent random sample in 2016. School attendance fell by more than 20 percentage points among Roma youth as opposed to less than 6 points with their non-Roma counterparts. Roma's post-reform drawbacks in school enrolment were predominantly explained by their family background, neighborhood characteristics, and, much less importantly, below-average school performance. Changes in local employment prospects had no remarkable impact on the post-reform ethnic gap. More stringent selection and self-selection by social status and school performance (rather than ethnicity) nevertheless affected the Roma minority disproportionally, with close to 30 percent of their 17-year-old children being out of education, training, and employment three years after the reform.

JEL codes: I24, J15, J48
Keywords: school leaving age, Roma, Hungary

János Köllő
Centre for Economic and Regional Studies and IZA
kollo.janos@ krtk.hun-ren.hu

Anna Sebők
Institute of Economics, Centre for Economic and Regional Studies
sebok.anna@krtk.hun-ren.hu

A tankötelezettségi korhatár leszállításának következményei – Hatás a roma fiatalokra

KÖLLŐ JÁNOS – SEBŐK ANNA

ÖSSZEFOGLALÓ

A magyar kormány 2012-ban 18-ról 16 évre csökkentette a tankötelezettség felső korhatárát. Ennek az intézkedésnek a hatását vizsgáljuk a 17 évesek oktatási és munkaerőpiaci részvételére a 2011-es népszámlálás és a 2016-os mikrocenzus adataival. Az iskolába járók aránya a romáknál több mint 20, a nem romáknál kevesebb mint 6 százalékponttal csökkent. A romák reform utáni iskolalátogatási hátrányát alapvetően a családi hátterük (iskolázatlan és nagy arányban munkanélküli szülők), kis részben pedig az átlagosnál gyengébb iskolai teljesítményük magyarázza. A helyi munkaerőpiacon bekövetkezett változások hasonló módon érintették a romákat és nem romákat. Bár a reziduális etnikai rés csak kis mértékben növekedett, a társadalmi háttér és iskolai teljesítmény szerinti erősebb szelekció (és önszelekció) aránytalanul erősen érintette a roma kisebbséget, melynek 17 éves gyermekei közül harminc százalék szorult ki az oktatásból, képzésből és foglalkoztatásból.

JEL: I24, J15, J48
Kulcsszavak: tankötelezettség, romák, Magyarország

The Aftermaths of Lowering the School Leaving Age – Effects on Roma Youth

János Köllő - Anna Sebők

In 2013, the Hungarian government cut the school leaving age from 18 to 16. We study the impact of this unique reform on the country's sizeable Roma minority using census data on the universe of 17-year-olds in 2011 and a 10 percent random sample in 2016. School attendance fell by more than 20 percentage points among Roma youth as opposed to less than 6 points with their non-Roma counterparts. Roma's post-reform drawbacks in school enrolment were predominantly explained by their family background, neighborhood characteristics, and, much less importantly, below-average school performance. Changes in local employment prospects had no remarkable impact on the post-reform ethnic gap. More stringent selection and self-selection by social status and school performance (rather than ethnicity) nevertheless affected the Roma minority disproportionally, with close to 30 percent of their 17-year-old children being out of education, training, and employment three years after the reform.

1 Introduction

Whether the minimum school leaving age (SLA) is too high has been debated in several countries, including Germany, Norway, Switzerland (Skirbekk 2005), and the UK, where proponents of an increase from 16 to 19 versus a decrease to only 14 were standing on two sides of the front near the millennium. The core of the argument for keeping the age limit low could best be summarised in the wording of Chris Woodhead, former chief of *Ofsted*: "I'm against arguments that the leaving age should be extended to 19. (…) Such proposals have more to do with massaging unemployment figures than the needs of the economy. Those young people who have not made much progress in the class should have the opportunity to follow an apprentice in the workplace. They are more likely to make more progress in that kind of environment than through repeated humiliation at school." (Woodhead 2002).

While this reasoning is widely accepted, we do not know actual decreases in the SLA within the OECD, with the partial exception of Saarland, Germany, 2001.[1] Announced in late 2011 and implemented in 2013, the Hungarian reform opened an exit door for students eager to leave and schools willing to discard difficult pupils. We exploit this unique natural experiment to study the short-run implications of lowering the SLA, paying particular attention to outcomes for the Roma minority, the most vulnerable social group in Hungary and the whole of Europe.

Empirically, we compare 17-year-olds in terms of school attendance and labor market status in 2011 and 2016, two years before and three years after the cutting of the SLA. In 2011, all 17-year-old teenagers had to go to school, while in 2016, they were free to leave education right after their 16th

[1] Saarland shifted the closing exam of secondary level studies from the 13th to the 12th schoolyear. Brunello et al (2009) looked at earlier changes of the leaving age in twelve European countries (1962-1975), and found only increases. Outside the OECD, Egyipt reduced compulsory primary schooling from 6 to 5 years in 1988 (Assaad et al. 2023). See later.

birthday. Notably, 2011 and 2016 were the years of the Census and the Microcensus covering ten million and one million observations, respectively, thus providing sufficiently large samples to study the resulting changes in detail.

The raw data point to a tremendous decline in school attendance among Roma youth: 25 percentage points (pp) for boys and 12 pp for girls. While employment among the 17-year-old Roma school-leavers increased, so did unemployment and inactivity, resulting in a substantial rise in the NEET rate: 15 pp for boys and 7 pp for girls. Changes among the non-Roma were minor compared to these magnitudes.

First, we study how the residual ethnic gap changes as we control for the number, educational attainment, and employment of the cohabitating parents, place of living, health status, and childbearing. The unexplained part of the ethnic gap fell from 19 to 6 pp in 2011 and 33 to 10 points in 2016.

Second, we carry out 'back-of-the envelop' calculations to assess the role of cognitive skills in the alarmingly low post-reform enrolment rate of Roma youth. We use the all-encompassing National Assessment of Basic Competences (NABC) to estimate the impact of the 8^{th}-grade reading and mathematics test scores, achieved at age 14-15, on school attendance at age 17. The estimates are based on an IV model, which accounts for a direct impact of family background on early school leaving and an indirect effect through poor test performance. Since the NABC data do not contain ethnic markers, we rely on the mean Roma/non-Roma test score gap observed in other surveys. Substituting the ethnicity-specific mean test scores (and family background indicators) to the school attendance equation, we find that the test score gap contributed to the post-reform enrolment gap by 3-4 pp or about 1/10 of the raw gap.

Finally, we study whether the decision to leave or stay in education can be explained by improvements in the local employment prospects of unskilled youth and their parent's generation. We found no noticeable difference in the reactions of Roma and non-Roma youth.

2 Previous literature

We contribute to the literature in two ways: by analyzing the exceptional event of a cut in the SLA and its impact on Europe's most disadvantaged and discriminated ethnic minority.

Direct empirical evidence on cutting the SLA is scarce; its likely implications can only be inferred from research on early school leaving, in general, and by 'reversing' the evidence on increases in the mandatory age limit. (We touch upon two exceptions later in this subsection).

The literature suggests that extended compulsory education moderates early school leaving. Analyzing school reforms in European countries, Brunello et al. (2009) found that longer compulsory schooling had affected educational attainment, especially among students belonging to the lowest quantiles of the ability distribution. They also found a positive effect on wages at the lower tiers of the labor market.

Several papers have detected different impacts on school attendance and school completion. Adamecz-Völgyi (2021) found that due to increasing the SLA in Hungary (1996), school attendance at age 16-18 increased, but the share of those acquiring an upper-secondary qualification did not. Raimondi and Vergolini (2019) came to a similar conclusion using Italian data. Anderson (2012) detected an impact of the SLA on juvenile crime. Lochner and Moretti (2004) found that US states that raised high school graduation rates by increasing the SLA experienced significant declines in incarceration rates. Machin, Marie, and Vujić (2011) found that the exogenous increase in education induced by the 1947 school reform in the UK significantly reduced property crimes.

Assad et al. (2023) and Hermann (2022) analyze responses to cutting the SLA in Egypt and Hungary, respectively. The former paper identifies a negative effect on years in school but no impact on other educational outcomes like school completion and illiteracy. Hermann analyzed the Hungarian reform addressed in this paper by comparing pre-reform and post-reform cohorts. He found that enrolment at age 16-18 decreased markedly, especially among disadvantaged students, but the fraction graduating by age 19 did not fall.

Failure to attend school at age 16-18 is a problem, even so, menacing it with a series of individually and socially harmful consequences. Pre-graduation school leaving implies a loss of human capital unless the school has zero contribution to the skills of students at the edge of dropout. Unemployment after school without qualification may have a scarring effect (Arulampalam et al. 2001, Csillag 2020). Early school leaving is often associated with delinquency as a cause (Lochner and Moretti 2004, Machin, Marie, and Vujić, 2011, Dragone et al. 2021) or an effect (Ward, Williams, and van Ours 2020). School dropout is correlated with teenage pregnancy (Rosenberg et al. 2015, Adamecz-Völgyi and Scharle 2020), substance use (Comiskey 2003, Aloise-Young and Chavez 2002), and mental health (Esch et al. 2014).

Several papers (Anderson 2012, Adamecz-Völgyi and Scharle 2020, Machin, Marie and Vujić, 2011) find incapacitation essential to short-run outcomes. Longer compulsory schooling compels many would-be dropouts to spend more time in school and less in the street-corner society and with sex partners. Adamecz-Völgyi and Scharle (2020) found that raising the SLA in Hungary decreased inceptions during the school year but not during the summer and winter vacations.

Before starting, two methodological remarks apply. First, we study the aftermath in the short run.[2] Second, as long as we are interested in outcomes for the Roma minority, we can not follow the contemporary mainstream in building models which meet the standards of the 'credibility revolution'. Rich administrative panels with exact birth dates, school attendance, and labor market outcomes are

[2] For overviews of the lon-run individual, social and fiscal implications of early school leaving see Brunello and De Paola (2004), Oreopoulos (2006), and EFILWC (2012), among others.

available in Hungary, but they do not record ethnicity. We are ready to trade off the clear-cut identification of causality for the ability to address the hit where it hurt the most.

Disentangling the impact of policy change is less straightforward in this case. As Oreopoulos (2006, p154) notes: "To estimate consistently the LATE of compulsory schooling, the timing of the law changes must not be correlated with any other policy changes or regional characteristics that also relate to the outcome variables." This condition does not hold in the Hungarian case: the years after the school reform coincided with significant changes in the job prospects of low-educated labor, and the educational system's less tolerant attitude towards laggards. We address the first problem by exploiting regional variation in labor market conditions. Second, we study the extent to which more stringent screening by cognitive skills may have contributed to the decline of Roma's enrolment.[3] Apart from the educational reform, more rigorous screening, and labor market evolutions, we see no other candidates to explain why enrolment generally shrank and did so dramatically among Roma teenagers. Further growth of substance use could have contributed to an increase in early exit. Still, the school-based surveys of ESPAD (2020) indicated slight *decreases* in alcohol consumption, heavy episodic drinking, the use of cannabis and other illicit drugs, and sedatives in Hungary within our time window (a trend that continued later).

2. The local context

Lowering the SLA was part of a broader reform package to supply the economy with blue-collar workers rather than college, university, and academic secondary school graduates. The government decided to increase the share of apprentice-based vocational training from 25 to 50 percent of all secondary-level slots, gradually cut the duration of vocational training from four to three years, shortened hours devoted to general training by almost twenty percent in vocational training schools, and more than ten percent in vocational secondary schools (Varga 2018); allowed the training schools to employ teachers without qualification, and subordinated them to the Ministry of the Economy in place of the Ministry of Education.[4]

Directing low-performing students from school to work was stimulated by a series of welfare reforms and assisted by employment policy measures. As shown in detail in Appendix 1, the net value of essential transfers substantially fell between the Census and the Microcensus, and the administration also encouraged employment growth by tax allowances.

[3] As a noteworthy exception, Adamecz (2021) reconstructed the school career of Roma and non-Roma youth interviewed in the 2011 Census to analyse the effect of an increase of the SLA from 16 to 18 in 1996, and could estimate RDD. To repeat this exercise, researchers have to wait until the microdata of the 2022 census become available.

[4] See Appendix 2 on the Hungarian public education system composed of an 8-grades primary school, vocational training schools, and vocational and academic secondary schools concluding in *érettségi* (closing exam), a precondition of applying for further studies.

Most importantly, starting in 2012, Hungary's unique Public Works Program (PW) was extended to a degree unprecedented in OECD countries. PW is a large-scale 'workfare' program for the long-term unemployed introduced by Viktor Orbán's first government in May 2000 and maintained by the socialist administrations in office between 2002 and 2010. The second and third Fidesz governments (2010-2018) put PW at the center of their employment policies. At the date of the Microcensus, PW accounted for 3 percent of total and 21 percent of unskilled employment (up from 1 and 6 percent in 2011, respectively). The program typically provides simple jobs in street cleaning, road and park maintenance, forestry, and (less frequently) social services.[5] While the government opened the program for early school leavers, the participation of 17-year-old first-time entrants grew modestly, from virtually zero in 2011 to only 1434 in 2016 (Molnár 2020).

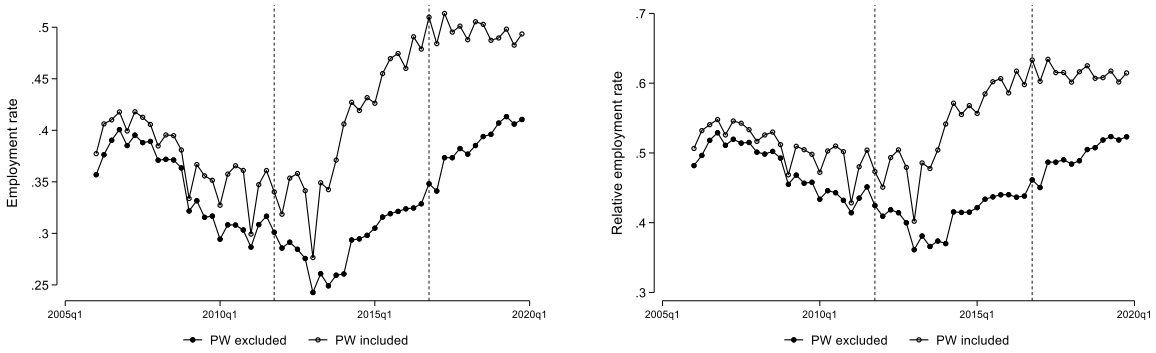
The crucial role of PW in shaping the job prospects of older but still young (17-35-year-old) unskilled people is shown in Figure 1. The curves on the left panel depict the employment/population ratios with and without the inclusion of PW. Market-based employment grew fast after the financial and economic crisis, but its level only marginally exceeded the 2011 level in 2016. Employment, including PW increased substantially, from 34 to 50 percent. On the right panel, unskilled employment is measured in relative terms: we observe a minor change in market-based jobs and a significant increase after including PW

Telling which of the definitions of employment are relevant depends on how people think about PW and whether they evaluate their labor market prospects in absolute or relative terms. Many unskilled villagers view PW as a desirable option, as it involves no costly commuting, usually requires fewer hours and less effort, and provides a low but steady flow of income compared to casual work, a typical alternative. How many think so (and how many regard it as a form of unemployment) remains an unanswered question.

[5] The rules of participation, the sanctions against non-compliers and the level of remuneration also changed drastically. Since 2011 a registered unemployed can be called to do public works on short notice, at any time, and for any duration. Declining a call may imply exclusion from UA benefits for three years, irrespective of the type of job that was offered and educational level of the person. The remuneration, formerly equal to the minimum wage, was set at 75 percent of the minimum wage.

Figure 1: Employment to population ratios of young people (aged 17-35) with primary school attainment, 2005-2019

Employment in absolute terms[a] Employment in relative terms[a]



Source: Author's calculation using the Labor Force Survey (LFS).
The vertical lines indicate the dates of the Census and the Microcensus.
a) The number of persons aged 15-35, out of full-time education, and having primary school attainment or less = 1.0
b) The employment rate of people aged 15-35, out of full-time education, and having vocational or secondary educational background = 1.0. The employment rates of those with vocational and secondary attainment have been weighted with 0.58 and 0.42, respectively. The weights reflect the shares of the two types of schools that dropouts attended in their last month spent in full-time education, according to Admin3 data.

3 Data and key variables

The primary sources cover the universe of the Hungarian population in 2011 (Census) and a ten percent random sample interviewed in 2016 (Microcensus). Both surveys relate to October and asked the same questions. The data covers the members of the observed household and yields information on their neighborhood. Further sources include the Admin3 administrative panel (Sebők 2019), of which NABC is a part; the quarterly Labor Force Survey (LFS); a geographical data set (GEO); and a municipality-level register (TSTAR). See Appendix 3 for these data.

Students are those attending an educational institution on a full-time basis. Those participating in education in other forms will be labeled as *trainees*.

We classified someone as *Roma* if she indicated Roma ethnicity in the first or second place in the Census or the Microcensus. Note that Hungary's Roma minority is sizeable, have abandoned traveling ages ago, their vast majority speak Hungarian as a mother tongue, and had a relatively high male employment probability under state socialism (above 75 percent in the early 1980s, as shown by Kertesi and Kézdi 1999) but lost their jobs on a massive scale during the post-socialist transition (Kertesi and Kézdi 2011a). Roma youth accounts for 6.5 and 9.5 percent of our samples from 2011 and 2016, respectively.

Respondents were free to decline the question on ethnicity (and state of health) in both surveys, while answering other questions was mandatory. Non-response amounted to 11.8 percent in 2011 but only 0.2 percent in 2016. In 2011, the school enrolment rate of non-respondents did not differ from the average. Therefore, we restrict the analysis to those reporting their ethnicity.

Neighborhood. The living place is recorded at the level of census tracts (CTs), small areas with 200 inhabitants on average. We computed the share of the Roma population in each CT using 2011 census data. High Roma density is associated with disadvantages beyond scarce job opportunities and poverty. As shown in Small (1997), Small and Stark (2005), and Small, Jacobs, and Massengill (2008), particularly severe residential segregation and depression emerge in cases when homogeneous neighborhoods are deprived of institutional resources as well. Appendix 4 shows that a series of amenities, including ones essential for civil integration and informal skills accumulation, are unavailable from CTs with a high Roma share.

Employment. We measure the probability of being ILO-OECD employed on the NUTS4 rather than the CT level for two reasons. A NUTS4 region ('*járás*') fits best to what could be called a local labor market. The average *járás* has about sixty thousand inhabitants. Close to 75 percent of their labor force is employed locally except for districts from the Budapest agglomeration and the connecting Fejér county, where the respective shares only slightly exceed 50 percent.[6]

Cognitive skills. The NABC data integrated into the Admin3 panel covers a randomly chosen 50 percent of sixth, eighth, and tenth-grade students in Hungary each May since 2008. We use the standardized values of cognitive-academic test scores achieved in reading and mathematics. On the NABC see Balázsi (2006).

Dealing with data problems. In the first weeks of the 2011 Census, students interviewed in dormitories were not asked about their families and housing conditions. (The aim was to avoid double-counting). The protocol changed in the later stages of the survey, but the missing information was only partly regained. As a result, in 2011, for some 17-year-olds, the permanent address was only known at the municipality level, and the household-level variables were missing. In Appendix 5, we study the direction of bias from dropping students in dormitories.

CT's selection to the Microcensus. The survey covered a 10 percent random sample of households. We checked the probability that a CT was observed in both 2011 and 2016. Appendix 6 shows that these CTs did not significantly differ regarding their 2011 school enrolment rates.

4 Descriptive statistics

The cutting of the SLA immediately broke the rising trend of school attendance. (Appendix 7). Table 1 gives an overview of the levels and changes of enrolment and economic activity by ethnicity based on the Census and Microcensus data.

[6] Authors' calculation from 2011 Census. Hungary had 174 NUTS4 regions (járás), 3300 municipalities, and 45,500 CTs in 2011.

Table 1: Activity of 17-year-old non-Roma and Roma youth in 2011 and 2016[a]

	non-Roma			Roma[b]		
	2011	2016	Change	2011	2016	Change
			Both genders			
Graduated from secondary school	0.1	2.1	2.0	0.1	3.8	3.7
Full-time student	97.5	91.6	-5.9	78.6	57.6	-21.0
Trainee	0.8	1.1	0.3	4.2	1.9	-2.3
Graduated or studying	98.4	94.8	-3.6	82.9	63.3	-19.6
Employed[c]	0.1	1.3	1.2	0.5	9.5	9.0
Graduated, studying or employed	98.5	96.1	-2.4	83.4	72.8	-10.6
Unemployed[c]	0.2	1.2	1.0	1.6	9.4	7.8
Inactive	1.5	2.7	1.2	15.0	17.8	2.8
NEET[d]	1.7	3.9	2.2	16.6	27.2	10.6
Total (of white rows)	100.0	100.0		100.0	100.0	
Observations	112,706	6,872		7,820	725	
			Boys			
Graduated from secondary school or full-time student[e]	97.8	93.6	-4.2	84.6	61.0	-23.6
Trainee	0.7	1.1	0.4	4.1	1.2	-2.9
Graduated or studying	98.5	94.7	-3.8	88.7	63.2	-25.5
Employed[c]	0.2	1.5	1.3	0.9	12.8	11.7
Graduated, studying or employed	98.7	96.2	-2.5	89.6	76.0	-13.6
Unemployed[c]	0.1	1.7	1.6	1.3	11.2	10.9
Inactive	1.2	2.2	1.0	9.1	13.7	4.6
NEET[d]	1.3	3.9	2.6	10.4	24.9	15.5
Total (white rows)	100.0	100.0		100.0	100.0	
Observations	57,578	4,064		55,128	403	
			Girls			
Graduated from secondary school or full-time student[e]	97.0	93.9	-3.1	72.5	61.8	-10.7
Trainee	0.9	1.2	0.3	4.3	2.7	-1.6
Graduated or studying	97.9	95.1	-2.8	76.8	64.5	-12.3
Employed[c]	0.1	1.0	0.9	0.2	5.2	5.0
Graduated, studying or employed	98.0	96.1	1.9	77.0	69.7	-7.3
Unemployed[c]	0.2	0.7	0.5	1.9	7.3	5.4
Inactive	1.8	3.2	1.4	21.1	23.0	1.9
NEET[d]	2.0	3.9	1.9	23.0	30.3	7.3
Total (white rows)	100.0	100.0		100.0	100.0	
Observations	55,128	3,756		3.401	322	

Sources: Census 2011, Microcensus 2016
a) 17 year old: over 17 but below 18 on the reference day of the Census (October 1)
b) Roma: reported Roma ethnic affiliation in the first or the second place
c) Based on the ILO-OECD definition
d) NEET: Not in Education, Employment, or Training
e) The two categories had to be merged to comply with the CSO's data protection rules

The first row suggests that the fraction of students who graduated before age 18 increased marginally more with the Roma. The reason is that education was cut from 4 to 3 years in some vocational training schools between 2011 and 2016.

Roma educational participation was lower already in 2011 but fell substantially, by 21 pps, while it fell by only 5.9 pp with the non-Roma. In 2016, nearly 40 percent of the 17-year-old Roma (as opposed to only 5 percent of the non-Roma) did not attend school because they dropped out or completed a shortened and simplified vocational training.

The government's expectation that early school leavers would go to work was partly met: the employment ratio of Roma boys and girls jumped from 0.9 to 12.8 percent and 0.2 to 5.2 percent, respectively. However, the same happened to unemployment, which jumped from 1.3 to 11.2 percent

(boys) and from 1.9 to 7.3 percent (girls). The NEET rate increased from 10.4 to 24.9 percent (Roma boys) and 23 to 30.3 percent (Roma girls). Compared to these magnitudes, the changes in the non-Roma population were insignificant. While labor force participation increased among Roma youth out of education and training, nearly half of the boys and more than half of the girls entering the labor market were searching but not finding a job at the time of the Microcensus.

4 Ethnicity or social background?

The data in Table 2 reveals massive ethnic differences in the social background of 17-year-olds. About 90 percent of the highest-educated Roma parents completed less than secondary school – an extreme figure for a sizeable minority.[7] More than 40 percent of the Roma families had no wage earner and a further one-third had only one. Only slightly more than one-tenth of the Roma lived with two working parents as opposed to one-half of the non-Roma. These differences can substantially contribute to the raw ethnic gap in school attendance before and after the reforms.

Table 2. Ethnic differences in selected personal and family background attributes in 2011 and 2016

	2011		2016	
	Non-Roma	Roma	Non-Roma	Roma
Female	48.8	49.5	49.0	45.7
Mother of one or more children	0.7	8.4	0.8	5.3
Overage[a]	1.6	13.5	1.7	11.0
Disabilities obstructing everyday life	5.3	8.6	7.5	12.1
Answer on disabilities missing	16.2	5.5	2.3	0.1
Education of the highest-educated cohabitating parent				
Primary or less	21.0	74.6	10.9	70.0
Vocational	27.0	21.5	24.7	23.0
Secondary	30.2	3.0	34.9	5.8
College or university	21.6	0.8	29.5	1.2
Number and employment of the cohabitating parents				
Two parents, both work	48.9	12.0	51.4	12.9
Two parents, one works	21.1	17.8	20.9	28.3
Two parents, none works	14.5	54.2	6.9	41.9
One parent, works	17.7	3.0	17.0	6.0
One parent, does not work	5.8	13.0	3.9	10.9
CT Roma population share as of 2011				
Zero	46.4	0	46.6	3.8
0-5 percent	39.7	15.7	40.2	17.6
5-10 percent	6.5	13.5	6.4	13.3
>10 percent	7.2	70.8	6.6	65.3
Number of observations	112,208	6,859	6,943	661

Source: Census 2011 and Microcensus 2016. The data relate to 17-year-olds with no completed secondary-level attainment and living in families (with at least one cohabitating parent) – the sample used in the forthcoming estimations.

[7] In the US, parental education less than high school amounted to 40 percent in the Hispanic minority and less than 15 percent in all other ethnic groups (Black, Asian, Native Hawaiian, American Indian), according to NCES (2008).

We estimate linear probability models to study how the residual ethnic gap reacts to including controls.[8] The explanatory variables include those in Table 2. The estimates relate to 17-year-olds with no completed secondary-level attainment and living in families (with at least one cohabitating parent).

Table 3. The marginal effect of Roma ethnicity on school attendance (pp)

Model specifications, controls		2011	2016
(i)	Univariate (only a Roma dummy)	-18.6	-33.3
(ii)	+ gender, and the number, education, and employment of cohabitating parents[a]	-12.4	-15.3
(iii)	+ childbearing, overage, disabilities obstructing everyday life	-7.3	-12.8
(iv)	+ CT with a Roma population share exceeding 10 percent[c]	-6.0	-10.2

Sample: 17-year-olds without secondary school attendance, living in families. N=119,303 in 2011 and N= 7604 in 2016
Estimation: linear probability models. All the coefficients are significant at 1 percent level.
a) Educational level of the highest-educated parent (4 dummies), number of employed and non-employed parents (5 dummies)
b) Overage: 17 years old and has not completed primary school. Disabilities: 3 categories (no, yes, missing)
c) Roma ethnicity interacted with four CT categories distinguished by Roma density (8 dummies)

The results for both genders are summarized in Table 3. For the detailed results by gender, see Appendix 8. The estimated ethnic gap fell by 7 pp in 2011 and 18 pp in 2016 after including only two fundamental variables relating to the parents' social status. After adding three individual-level attributes and a dummy for CTs with a Roma population share exceeding 10 percent, it tightens mildly. This variable partly captures unreported Roma ethnicity: we can reasonably assume that in CTs with a high reported Roma share, many respondents did not report Roma identity in the Census but are regarded as Roma by the majority.[9]

The data suggest that the residual ethnic gaps increased modestly, by 3-5 pp as opposed to a 14 pp increase in the raw gap.

Table 4 presents the estimates of specification (iv) in detail. The impacts of the individual-level indicators were not particularly strong in either year. By contrast, the effect of parent's higher-than-primary education rose tremendously, from 1-2 pp to 15-18 pp. The children of partly or wholly non-employed families were also more likely to drop out after cutting the SLA. The impact of living in a neighborhood with a high Roma share increased by a factor of 2.5. For estimates by gender, see Appendix 9.

[8] In this and subsequent calculations we merge boys and girls. We present the gender-specific results in the Appendix

[9] Surveys relying on a Roma definition based on external judgement rather than self-declared affiliation arrive at higher estimates. Kemény et al. (2004), for instance, report that 11 per cent of the cohort born in 1993 were of Roma origin. Their share at age 18, in the year of the Census, must have been slightly lower due to Roma's higher infant and childhood mortality (Matrix 2014) but definitely higher than the 5.8 percent share measured in the Census.

Table 4: The probability of school attendance in 2011 and 2016 – Linear probability models

Dependent: Full-time student	2011		2016	
Roma	-0.060***	(13.1)	-0.102***	(4.4)
Female	0.000	(0.6)	0.014***	(3.2)
Mother of one or more children	-0.702***	(66.5)	-0.591***	(16.1)
Overage[a]	-0.172***	(21.0)	-0.194***	(5.6)
Disability obstructing everyday life	-0.004	(1.6)	-0.030**	(2.4)
Information on disability missing	-0.004***	(3.4)	0.015	(1.3)
Highest-educated cohabitating parent				
Primary or lower[a]	0		0	
Vocational	0.014***	(8.7)	0.148***	(9.2)
Secondary	0.020***	(14.6)	0.178***	(11.6)
College, university	0.020***	(15.4)	0.179***	(11.6)
Cohabitating parents and their employment				
Two parents, both work	0		0	
Two parents, one works	-0.012***	(11.3)	-0.035***	(4.6)
Two parents, none works	-0.054***	(22.7)	-0.078***	(4.9)
One parent, works	-0.006***	(6.8)	0.010*	(1.9)
One parent, does not work	-0.014***	(5.9)	-0.041**	(2.0)
Neighborhood				
Roma population share exceeds 10 percent[b]	-0.027***	(10.7)	-0.069***	(4.3)
Constant	0.983		0.816	
aR2	0.295		0.287	
Number of observations	119,303		7,604	

Source: Census 2011, Microcensus 2016.
Sample: 17-year-olds without completed secondary education, living in a family.
Stars: significant at *10, **5, and ***1 percent level
a) 17 year old and has not completed the primary school
b) CT= census tract. The Roma share refers to 2011.

In 2016, the prediction for a non-Roma boy living with two high-educvated and working parents in a non-Roma neighborhood (population share lower than 10 percent) still amounted to 99.5 percent. For a Roma boy living with unskilled and non-working parents in a CT with a Roma share exceeding 10 percent, the estimate was 56.7 percent.

We conducted several robustness checks. To improve comparability, we matched respondents of the Microcensus to their counterparts in the Census using coarsened exact matching (Blackwell et al., 2010). The matching was based on gender, ethnicity, and coarsened values of settlement size, settlement-level unemployment rate, and the CT-level Roma population share (as of 2011 in the latter case). The results estimated for the matched and unmatched samples were qualitatively identical. For descriptive statistics on the matched and unmatched cases, see Appendix 10. Second, we dealt with the problem of non-response on ethnicity by predicting the probability that a respondent with specific characteristics was Roma. We regarded non-reporting persons as non-Roma if (i) they lived in a CT with no self-declared Roma inhabitants, (ii) the prediction fell short of 50 percent (Appendix 11). Finally, we estimated the equations with both linear and non-linear regressions. As the results did not differ, we presented the linear versions.[10]

[10] This decision is also motivated by the requirement of weighting the observations in 2016.

5 Cognitive skills and early exit

The reform package, of which lowering the SLA was a part, openly encouraged schools to let the laggards leave and "enter the labor market". Even in the absence of discrimination, Roma children would have had a high probability of dropping out as the school system became more selective. Kertesi and Kézdi (2011b) demonstrate that the Roma–non-Roma test score gap amounts to approximately one standard deviation for both reading and mathematics but disappears in reading and drops to 0.15 standard deviation in mathematics after accounting for family background, living conditions, parenting, health, and school fixed effects. However, schools and students probably base their decisions on the raw disadvantages rather than the conditional ones, which we consider in the following calculations.

Ideally, to disentangle ethnic, performance-related, and social components leading to early exit, we would use data that jointly cover these attributes and school attendance later. Since such data do not exist, we follow a circuitous route and stay content with some back-of-the-envelop calculations.

Step 1: We estimate the effect of 8th-grade (age 14-15) test performance and family background on the probability of school attendance at age 17. At this aim, we use the NABC data integrated into the Admin3 administrative panel, which comprises the 8th-grade test scores and school attendance at age 17 but does not record ethnicity. We estimate

$$(1) \quad p_{it} = \beta_t S_{i,t-\tau} + \gamma_t X_{i,t-\tau} + \Sigma_\tau \delta_{t-\tau} + u_{i,t} \ , t = 2016, \tau = 0,1,2,3$$

where the p_{it} dummy stands for school attendance in 2016, $S_{i,t-\tau}$ is the test score (mathematics or reading) achieved by student i at the 8th grade NABC tests, τ years before 2016. (In the vast majority of cases τ equals 2 or 3.) $X_{i,t-\tau}$ denotes family background variables, the $\delta_{t-\tau}$-s are year-of-test fixed effects, and $u_{i,t}$ is a random error.

Since family background has a direct impact on early school leaving and also affects the 8th-grade test scores, we instrument the latter with the same student's 6th-grade test scores under the assumption that it influences early exit only through its correlation with the 8th-grade test, taken at an age closer to the decision to leave or stay (and where to stay) in education. NABC data in the Admin3 panel are available from 2008 onwards, while those aged 17 in 2011 wrote the 6th-grade tests in 2006 or 2007 – the instrument is unavailable for them. Therefore, we estimate the IV equation for 2016 (and add the results from linear probability models from 2011 and 2016).

Table 5: IV estimates of school attendance at age 17, in 2016, in response to 8th grade test performance and family background

	Coeff,	t-test
Standardized test score in mathematics	0.038	15.8
Educational level of the highest-educated cohabitating parent		
Primary or less	0	
Vocational	0.165	15.8
Secondary or higher	0.182	17.8
Missing[a]	0.169	13.7
Number and employment of the cohabitating parents		
Two parents, both work	0	
Two parents, one works	-0.024	6.2
Two parents, none works	-0.086	9.3
One parent, works	-0.020	3.3
One parent, does not work	-0.082	6.6
Year of the 8th grade test		
2013	0	
2014	0.019	6.3
2015	-0.010	0.9
2016	0.037	1.0
Number of observations	26,368	
aR^2	0.1073	
First-stage F-test	3161.3 (0.000)	
Addendum: effect of the standardized test score in reading[b]	0.036	16.3

Data: NABC data in Admin3. The data on school attendance is based on the official student register.
Sample: 17 year-olds, who took the tests, filled out the background questionnaire, and lived in a household
Estimation: Two-stage least squares. The 8th grade test scores are instrumented with the 6th-grade test scores.
a) Parent education information is missing in 5.5 percent of the cases.
b) We skip other coefficients of the reading equations, which only marginally differ from the respective ones in the table

We have data on 26,368 students who wrote the tests, filled in the background questionnaire, lived in a household, and answered the questions on their parents' educational level and employment. For a breakdown by gender and year of the NABC test, see Appendix 12.

Table 4 presents the equation using the mathematics test score, and the last row also indicates the effect of the reading scores (which are almost identical). The estimates suggest that a one standard deviation difference in the 8th-grade test scores in mathematics and reading increased school attendance at age 17 by 3.8 and 3.6 percent, respectively.

The linear probability estimates for 2016 are slightly lower (2.8 and 3.4 percent) and negligible for 2011 (0.7 and 0.8 percent), supporting that selection and self-selection by performance became more dominant after the reform. The estimates for boys and girls are almost identical (See Appendix 13).

Step 2. We collect surveys where test scores by ethnicity are available. To our knowledge, four such data sets exist in Hungary.[11] The most reliable data come from the Life Course Survey (LCS), a large and representative panel analyzed in depth by Kertesi and Kézdi (2011b). The LCS data would be relevant for a 2011 sample, typically tested in 2008-2009, but less so for the 2016 sample, tested chiefly in 2013-2014. Therefore, we also consider test results observed in 2010, 2015, and 2017 in smaller, non-

[11] We are grateful to Dóra Kisfalusi and Gábor Kertesi for sharing their data.

representative surveys. See Appendix 14 for a brief description of these sources and Appendix 15 for a breakdown of Table 6 by gender.

Table 6: Roma students' raw disadvantage in tests of basic competences - Various surveys

			Observations		Disadvantage in	
Data source	Year	Grade	Non-Roma	Roma	Math	Reading
(LCS) Life Course Survey[a]	2006	8th	8716	1305	-0.973	-0.894
(IEFH) Inter-ethnic Friendship and Hostility[b]	2010	8th	2545	609	-0.705	-0.677
(GD1) Grading Discrimination 1[c]	2015	6th	361	221	-0.701	-0.818
(GD2) Grading Discrimination 2[c]	2017	8th	251	109	-0.934	-0.977

a) https://www.tarki.hu/eng/household-lifecourse-survey-project-hev-2006-2008
b) Hajdu, Kertesi and Kézdi (2018)
c) Kisfalusi (2018) and Kisfalusi, Janky and Takács (2021)
Note: The figures show Roma's disadvantage is terms of standardized test scores. We used the sample means and standard deviations for standardization rather than the moments of the country-wide distributions.

Step 3. We collect data on the family background of 14-15-year-old Roma and non-Roma students near the periods of the NABC tests analyzed in Step 1. We are restricted to a few variables jointly available in the Microcensus and the NABC – the chosen ones relate to the educational attainment and employment status of the cohabitating parent(s).[12]

Table 7: Education and employment of the parents of 14-15 year-olds by ethnicity, 2016

	Non-Roma	Roma
Educational attainment of the highest-educated cohabitating parent		
Primary	12.8	71.6
Vocational	27.3	21.2
Secondary or higher	59.9	7.2
Total	100.0	100.0
Number and employment of cohabitating parents		
Two parents, both work	51.1	12.5
Two parents, one works	19.5	27.7
Two parents, none works	5.9	37.9
One parent, works	17.7	5.8
One parent, does not work	5.8	16.1
Total	100.0	100.0
Number of observations	14,261	1746

Source: Microcensus 2016

Table 7 presents the year 2016 Microcensus data on parents' level of education and employment for 14-15-year-old Roma and non-Roma students. The data suggest huge ethnic differences along both dimensions. For a breakdown by gender, see Appendix 16.

Step 4. We plug the mean Roma and non-Roma test scores and family background variables into the equations estimated in Step 1. The predictions indicate the probabilities of school attendance at age 17

[12] The NABC data confirm that these variables are strongly correlated with further potential (but practically infeasible) candidates, especially those hinting at low social status such as the receipt of cash transfers and subsidized meal, and no internet and less than 50 books at home.

for students with typical Roma and non-Roma test performance and family background. We calculate the predictions as in Equation 4:

$$(2) \quad E(p^{roma})_t = \beta_t \overline{S}_{t-\tau}^{roma} + \gamma_t \overline{X}_{t-\tau}^{roma} \quad and \quad E(p^{non-roma})_t = \beta_t \overline{S}_{t-\tau}^{non-roma} + \gamma_t \overline{X}_{t-\tau}^{non-roma}$$

By comparing the predictions for persons identical in terms of the X variables but differing in test performance (achieving either the Roma or the non-Roma mean), we can roughly approximate the contribution of basic competencies to the post-reform enrolment gap. The predictions presented in Table 8 relate to students for whom the X variables and the year-of-test dummies are set at their default.[13]

Table 8: Predicted marginal effects of the 8th grade test scores on school attendance at age 17 (Eq. 2)

Field of the 8th-grade test	Source of the ethnic test score gap	Effect of the test score gap	95% confidence interval
Mathematics	LCS	3.5	2.9-4.1
	IEFH	2.6	2.1-3.0
	GD1	2.5	2.1-3.0
	GD2	3.1	2.6-3.7
Reading	LCS	3.2	2.6-3.7
	IEFH	2.4	2.0-2.8
	GD1	2.9	2.4-3.4
	GD2	3.5	2.9-4.0

The predictions relate to school attendance in October 2016, using the coefficients from Eq 2 and ethnicity-specific data on the test scores and family background. We estimated the confidence intervals using Stata's *lincom* procedure.

The enrolment rate gap induced by the Roma-non-Roma test score differential amounts to 3.5 pp if we hold the controls constant and use the LCS data on the mathematics test scores (first row). By using scores from other surveys and fields of testing, we get predictions between 2.5 and 3.5 percent. These effects account for about 1/5 of the estimated ethnic enrolment gap controlled only for family background variables (15 percent in specification 2 of Table 2). If we could observe prior test scores in the microcensus, the unexplained part of the ethnic gap would have diminished further.

6 Post-reform school attendance and evolutions in the local labor market

Our expectations concerning the role of local labor market conditions are uncertain for two reasons. First, as the aggregate data have indicated, the perception of change depends on how people view PW. Second, potential dropouts and their families can respond to changes in the labor market differently.

The outcomes can be driven by a 'textbook labor supply scenario' in which youngsters are tempted to leave education by a tightening labor market and choose to stay if their job prospects deteriorate. At the same time, parental employment pushes teenagers' decisions in the opposing direction through an 'added worker effect'. Many low-income families cannot easily bear the costs of education and painfully miss the foregone earnings of their nearly adult children. If the job prospects of the parents' generation deteriorate, more families need an additional wage earner. Lower benefits further aggravate the income loss from unemployment and add pressure on the family's teenage children to earn income. In this

[13] See the results by gender in Appendix 17.

scenario, improving labor market conditions for the parents' generation implies fewer early exits from education.

Without eliminating these uncertainties, we focus on the potentially different reactions of Roma and non-Roma youth with similar family backgrounds to changes in the local labor market. The considerations mentioned above would require the estimation of Equation 3:

(3) $S_{ij} = \beta_1 Roma_{ij} + \beta_2 ln(dM_{jY}) + \beta_3 ln(dM_{jO}) + \beta_4 Roma_{ij} \times \ln(dM_{jY}) + \beta_5 Roma_{ij} \times \ln(dM_{jY}) + [\mathbf{Z\gamma}] + + u_{ij}$,

where the dummy dependent variable S_{ij} indicates if person *i* in micro-region *j* goes to school full time. *ln*(dM_{jY}) measures log change in the local labor market indicator *M* between 2011 and 2016 for low-skilled youth aged 17-35 in 2016, while *ln*(dM_{jO}) relates to the parental generation aged 36-55. Two pairs of *M* indicators are considered: the ratio of market-based employment (E) to the respective population ($e_c = E_c/POP_c$) and the ratio of employment *cum* PW participation ($epw_c = (E+PW_c)/POP_c$)). The equations relate to 2016 and are estimated without and with the controls introduced in Table 2.

We face two data problems. First, due to the relatively small size of the Microcensus, we cannot calculate the cohort-specific e_c and epw_c ratios exclusively for primary degree holders at the NUTS4 level. Therefore, we merged those with primary and vocational qualifications.[14] While the levels of employment markedly differed across qualifications, the changes in 2011-2016 did not, as shown in Appendix 17.

Second, the changes for the younger and older generations are strongly correlated in the case of market-based employment and perfectly collinear if PW is included. Regressing the former on the latter yields:

Employment excluding PW: $ln(dM_{jY}) = 0.796 \cdot ln(dM_{jO}) - 0.080$, t=32.2, R2=0.211

Employment including PW: $ln(dM_{jY}) = 0.980 \cdot ln(dM_{jO}) - 0.025$, t=89.7, R2=0.615

Including generation-specific changes jointly into equation (3) would menace with unstable results due to multicollinearity, while using them alternately (as we do) implies inward bias since the coefficients on youth and parental job prospects are expected to have different signs (negative in the first and positive in the second case).

[14] Both qualifications prepare the students for blue collar jobs. Only 2.2 percent of the primary degree holders and 7.7 percent of the joint group were employed in white collar positions at the time of the Microcensus.

Table 9. The effect of local changes in employment probabilities on school attendance at age 17 (2016)

	Roma	*ln*(dM_{jc})	Roma×*ln*(dM_{jc})	aR2
ln(dM_c) = log change in the employment of 17-35-year-olds, excluding PW				
Uncontrolled equation	-0.338***	-0.069*	0.098	0.1005
	(11.2)	(1.8)	(0.5)	
Effect of *ln*(dM_{jY}) on the Roma		0.029		
		(0.4)		
Controlled equation	-0.108***	-0.034	0.058	0.2837
	(3.6)	(1.0)	(0.3)	
Effect of *ln*(dM_{jY}) on the Roma		0.024		
		(0.1)		
ln(dM_c) = log change in the employment of 17-35-year olds, including PW				
Uncontrolled equation	-0.380***	-0.212***	0.287*	0.1058
	(8.1)	(6.8)	(1.8)	
Effect of *ln*(dM_{jY}) on the Roma		0.075*		
Controlled equation	-0.166***	-0.033	0.278*	0.2883
	(3.8)	(1.12)	(1.9)	
Effect of *ln*(dM_{jY}) on the Roma		0.245*		
		(1.7)		
ln(dM_c) = log change in the employment of the 36-55-year-olds, excluding PW				
Uncontrolled equation	-0.400***	-0.286***	0.494	0.1026
	(7.0)	(4.0)	(1.4)	
Effect of *ln*(dM_{jO}) on the Roma		0.208		
		(0.6)		
Controlled equation	-0.151***	-0.103*	0.323	0.3328
	(2.8)	(1.7)	(1.0)	
Effect of *ln*(dM_{jO}) on the Roma		0.220		
		(0.7)		
ln(dM_c) = log change in the employment of the 36-55-year-olds including PW				
Uncontrolled equation	-0.423***	-0.351***	0.458**	0.1100
	(6.3)	(8.5)	(2.0)	
Effect of *ln*(dM_{jO}) on the Roma		0.107		
		(0.4)		
Controlled equation	-0.216***	-0.065*	0.441**	0.3337
	(3.6)	(1.7)	(2.2)	
Effect of *ln*(dM_{jO}) on the Roma		0.376*		
		(1.9)		

Significant at the *) 10, **) 5, and ***) 1 percent level. t-values in parantheses.
Number of observations = 7,604
Notes: probabilistic regression estimates of equation 3 with ln(dM_{jY}) and ln(dM_{jO}) entered separately. Dependent variable: full-time student. ln/(dM_c): log change in the NUTS4-level employment-to-population ratio of cohort *c* aged either 17-35 or 36-55, with primary or vocational attainment, 2011-2016. Employment is measured without and with PW participation. The effect on the Roma was tested with Stata's *lincom* procedure with the null being $\beta_1 ln(dMjc) + \beta_2 Roma \times ln(dMjc) = 0$.
Sources: Microcensus 2016, and Census 2011 for calculating base-period employment levels.

Table 9 and Appendix 18 present the estimates and the descriptives, respectively. Since we can not eliminate the omitted variable bias inherent in models with *ln*(dM_{jY}) and *ln*(dM_{jO}) included alternately, we only focus on the interaction effects, potentially hinting at ethnic differences.

These effects are insignificant in all of the market employment equations. When PW is treated as employment, the interactions are positive and at least weakly significant. On the one hand, this implies that Roma enrolment was slightly less responsive to an improvement in youth job opportunities in or outside of PW. On the other hand, the last equation yields some evidence that the post-reform ethnic

enrolment gap was *ceteris paribus* narrower in regions where the parents' generation had improving access to PW. This effect is relatively strong: Roma's enrolment disadvantage was estimated to be smaller by 3 pp at the lower (than the upper) end of the one-standard-deviation band around the mean.

Our attempts at identifying a link between labor market evolutions and early school leaving are admittedly flawed by the inseparability of youth and parental employment dynamics. However, the magnitudes call into question if the improving job prospects tempted students to leave education on a massive scale and that Roma students were attracted to do so more than the majority.

8 Discussion

Enrolment rate at age 17 was 96.4 percent in Hungary when its unique reform of cutting the SLA was announced.[15] By October 2016, three years after the reform, school attendance fell by 5.2 pp among 17-year-olds without completed secondary-level attainment. A macro-oriented observer may not find this figure annoying. With an enrolment rate of over 90 percent among 17-year-olds, Hungary remained in the upper half of the OECD country ranking (OECD Statistics 2021). The NEET rate stood at 4 percent in 2016, a level fitting the European standards.[16]

However, the reaction was strongly heterogeneous, and the outcome for the Roma minority was annoying by any standards. With nearly 40 percent leaving the educational system before graduation and more than 25 percent being out of training and employment, Roma youth is exposed to a high risk of social isolation and poverty – much higher than before the educational reforms. Few Roma dropouts 'followed an apprentice in the workplace': their NEET rate increased more (by 11 pp) than their employment and training participation combined (7 pp).

Our estimates suggest that the impact on Roma youth was strong mainly because they tend to come from low-educated and non-employed families rather than due to more robust discrimination. We found no convincing evidence that local labor market evolutions affected the Roma and non-Roma youth differently – this problem requires further research. Poor school performance did have an effect, albeit much weaker than the family background.

At this point, it is essential to add that Roma's below-average cognitive skills are mostly explained by their family characteristics (Kertesi and Kézdi 2011b), and their sorting to low-quality schools. In our time window, the Hungarian school system was (and still is) one of the most segregated ones in Europe. Segregation contributes to family background's strong (strongest within the OECD) impact on test scores, as shown in Jenkins et al. 2008, and OECD 2010, Vol. II, Figure 3.2. Hungary had the highest ratio of between-schools to total variance in student performance (OECD 2007). Most of what seemed

[15] Despite an age limit of 18 between 1998 and 2012, a few students did leave the school before graduation. Mártonfi (ed. 2011) presents an interview-based overview on the causes of drop-out, and the lack of sanctions.

[16] In the U.K., for instance, the rate for the age group 16-17 was 3.7 percent in 2016, according to U.K. Government (2021).

to be within-school variance at first sight came from between-class and between-premises variance (Csapó et al., 2009). The practice of routing disadvantaged children to segregated and low-quality schools and classes affected the Roma minority disproportionately. Havas and Liskó (2006) estimated that while there was a twofold increase in the share of Roma children in primary schools between 1980 and 2003, the number of hundred percent Roma classes grew by a factor of eight. They found the percentage of Roma children to be 70 percent in special classes for low-achievers.

Responding to school failure by exclusion has a long tradition in Hungary (Nagy 2009). The educational reform of 2011-2013 openly broke up with sporadic efforts to integrate difficult pupils despite some promising results (Kézdi and Surányi 2009). The vision of an economy hungry for unskilled and semi-skilled blue collars and the promise of driving early school leavers to jobs undoubtedly reduced the pressure on the educational system to cope with hard-to-teach students.

The remaining relatively small residual ethnic gap could be explained by differences between Roma and non-Roma youth, which remained unobserved in our limited variable set. There can be differences in some behavioral patterns, such as absenteeism (at identical school performance and social background), willingness to complete the closing examinations (Kézdi 2021), exposure to hostilities (Hajdu et al. 2018), and discriminatory grading practices (Kisfalusy 2018, Kisfalusi et al. 2021). These questions wait for future research based on better data.

The Hungarian experience warns that lowering the SLA is a risky adventure. In countries fragmented along social and ethnic dimensions and lacking efficient institutions to support school-to-work transition, such a reform may result in further-growing inequality and more severe social exclusion of their disadvantaged minorities.

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Appendix

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Appendix 1: Employment and welfare reforms between 2001 and 2016

Insurance-based unemployment benefit (for the first nine months after jobloss) fell from 42.3 to 11.6 percent of the net average wage, the flat-rate unemployment assistance benefit dropped from 17.8 to 13.1 percent, and the wages paid to public works participants shrank from 42.9 to 29.6 percent. Family allowance fell from 17.3 to 13.6 percent (and from 17.3 percent to zero in case the child did not attend school).[17] The amount of the flat-rate child care allowance dropped from 21.9 to 18.2 per cent of the net average wage.[18] These changes decreased the 'value' of unemployment relative to employment for both school dropouts and their families. In 2012, the government introduced *job retention subsidies* for workers younger than 25. The subsidy amounted to 57 percent of the total tax burden on 2/3 of the net average wage in 2012, and had a significant effect on young people already at work (Svraka 2018).

Table A1.1.: The value of the most important cash transfers relative to the net average wage

	Family allowance[a] if the 17-year-old child is		Child care allowance		Unemployment		PW[f]
	in school	out of school	GYED[b]	GYES[c]	benefit[d]	assistance[e]	wage
2011	17.3	17.3	59.5	21.9	42.3	17.8	42.9
2016	13.6	0.0	67.8	18.2	11.6	13.1	29.6

Sources: Fazekas at al. (eds, 2019), Tables 11.1 and 11.2 and Cseres-Gergely and Molnár (2014).
a) A flat-rate transfer available for the families raising children aged 0-18 in 2011 and schoolchildren aged 0-16 since 2016. The families of students aged 0-20 in full-time tertiary education are also eligible.. The families of children out of school and older than 16 were not eligible in 2016.
b) An earnings-related benefit for mothers employed for at least 12 months within a two-year-long period before giving birth to their child.
c) A flat-rate allowance paid until the child reached age 3 (age 10 in some cases). GYES cannot be combined with GYED.
d) An insurance-based, earnings-related benefit paid for a maximum of nine months in 2011 but only three months in 2016. The figures show the total amount of the benefit in 9 months after job loss, assuming 9 and 3 months of benefit duration, and average amount. This figure is compared to the average net wage in a 9 months period.
e) A flat-rate, means-tested benefit for the registered unemployed.
f) The figures show the fixed monthly salary of full-time PW participants with primary school attainment relative to the monthly net average wage. Note that in 2016, skilled PW participants received a higher compensation (38 percent of the net
average wage).

The EU-initiated *Youth Guarantee Program* provided wage and travel-to-work subsidies and training to NEET persons younger than 25 living in high-unemployment regions. Estimates by Krekó et al. (2020) suggest that school leavers with only primary school attainment had an average chance to make it to the program, while Krekó et al. (2021) found that the program had a modest positive effect. They came to similar conclusions by studying a 90 days job trial program for young people. Finally, in 2012, the government launched a program explicitly targeting young people not continuing their studies after primary school or dropping out of secondary education (*Bridge Program*). As discussed in Appendix 3, the program reached only 6.5 percent of the 17-year-olds out of school, and the annual dropout rate was as high as 63.6 percent in 2016 (Varga et al. 2017, Table C2.6.1.). Parallel with the cutting of the age limit the government launched a program to help children not continuing their studies after primary school or dropping out of vocational or secondary education. The program called *Híd* (Bridge) provides general and vocational training. The initiative soon lost momentum. In October 2016, 960 16 year-olds and 478 17 year-olds participated nationwide, which compares to 4,570 and 7,256 youth out of school in these age categories, or 10.4 and 6.6 percent, respectively. Annual dropout rates from the *Bridge* are

[17] The payment of family allowance can be suspended in case a student missed more than 50 hours. Hermann (2018) studied the impact of this rule on various outcomes in primary and secondary schools, and found no effect (on drop-out rates and test performance) or weak effect (on grade repetition and absenteeism in secondary school).
[18] The only exception was GYED, an insurance-based, earnings-related, high-amount benefit available to parents who spent at least one year in employment within two years before giving birth to their baby. GYED is a typically middle-class transfer. Out of one hundred high-educated (college or university) parents receiving childcare at the end of 2016, 60 received GYED as opposed to 11 among parents with primary school attainment. (Authors' calculation using the LFS).

exorbitant: 36.7 and 63.6 percent in the full-time and part-time programs in 2016, respectively (Varga 2017, table C2.6.1.) Given its minuscule size, the *Bridge* program seems to be of marginal importance.

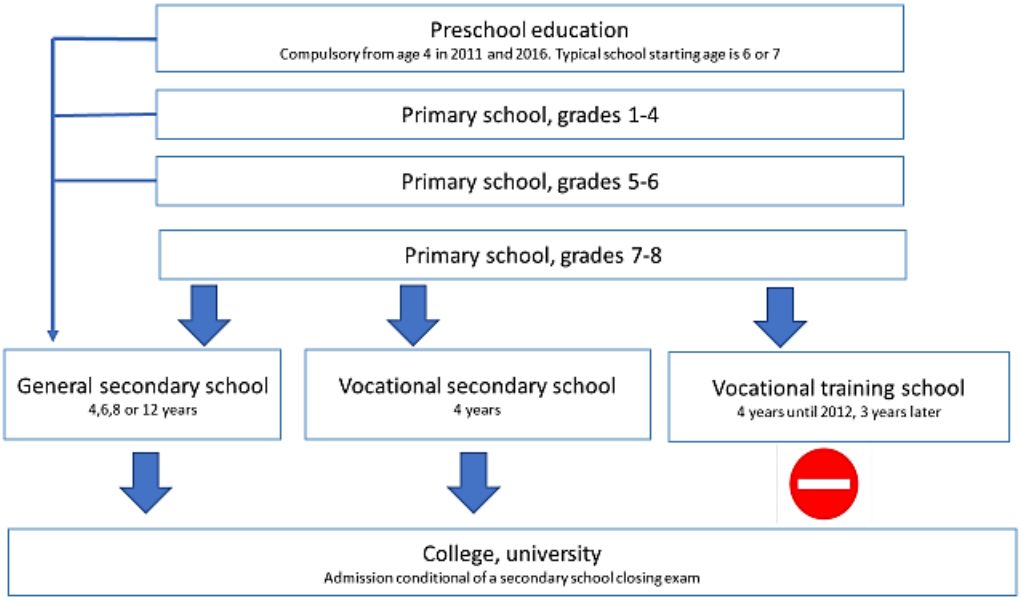
Table A1.2.. Size of the Bridge program in October 2016

	Age reached in 2016		
	16	17	18
Bridge program participants[a]	960	478	135
Persons out of full-time education			
According to the Microcensus[b]	3451	7448	11,015
Percent in Bridge	27.8	6.4	1.2
According to the Office of Education[c]	4570	7256	12,299
Percent in Bridge	21.0	6.6	1.1

a) All programs: Bridge Public Education, Bridge Vocational, Bridge II
b) Persons already having secondary school attainment are excluded.
Estimate: sum of the weights provided by the CSO
c) Persons not appearing in the Kirstat register
Data sources: Tables *a4tanu* and *a04t21* of the Kirstat data base, Microcensus, and Admin3.

Appendix 2: The Hungarian educational system

Figure A2.1.



Note that schools (including the 1st grade in primary schools) are free to admit students from outside their school districts, and children are free to apply to schools outside their school district. Schools run by churches and private schools are not obliged to accept students living in their district.

Appendix 3: Data sources and availability

Census. The Census covers all dwellings in Hungary. A questionnaire is filled in with each person living in (or absent but regularly returning to) the dwelling. The records contain personal, household-

level, and dwelling-level information. The reference day of the 2011 census was October 1. See http://www.ksh.hu/nepszamlalas/?lang=en

Microcensus. The Microcensus covered a 10 percent random sample of dwellings in Hungary. A questionnaire was filled in with each person living in (or absent but regularly returning to) the home. The records contain personal, household-level, and dwelling-level information. The reference day of the 2016 Microcensus was October 1. The Central Statistical Office (CSO) attached weights to the observations to ensure representativity. See https://www.ksh.hu/mikrocenzus2016/?lang=en

Labor Force Survey (LFS). The LFS is a quarterly survey conducted since 1992 Q1 by the CSO. It covers a random sample of dwellings in Hungary. The number of individuals interviewed ranged between 30 and 50 thousand. The LFS has a rolling panel structure with each cohort staying in the survey for six quarters and then replaced with a new cohort. The surveyed persons are identifiable across waves. The CSO attaches weights to the observations to ensure representativity. https://ec.europa.eu/eurostat/cache/metadata/EN/employ_esqrs_hu.htm

Wage Survey (WS). The WS is an annual LEED survey conducted by the Public Employment Service in 1986-2018 and the Central Statistical Office since 2019. The survey covers all employees and employers in the public sector, all firms employing more than 20 workers, and a random sample of businesses employing 20 or fewer workers. In private firms employing more than 50 workers, the individual data relate to a random sample of the workers. In the case of smaller firms and the public sector, the data cover all employees. The sample covers 100-200 thousand employees, depending on the year. The key variables are gender, age, education, work experience, occupation, wages, firm size, ownership, sector, and location. The cases are weighted to ensure representativity. See more at https://adatbank.krtk.mta.hu/en/nmh-bertarifa-felvetel/

Admin3. A LEED panel built by the CERS Databank, which covers a 50 percent random sample of the population aged 0-74 in January 2003. People are followed until December 2017 on a monthly basis. Data from the Pension Directorate, Tax Authority, Health Insurance Fund, Public Employment Service, and the Office of Education have been merged after hash-coding the original person and firm IDs. The key variables include gender, date of birth, place of residence, health proxies, sick pay, date of retirement, date of death, employment relationship, days in work, amounts earned, 4-digit occupational code, employer ID (hash-coded), sales revenues, exports, fixed assets, depreciation, material costs, wage costs, ownership shares, registration at a labor office, UI and UA benefits, pension, disability payments, child care benefit, school attendance, college/university attendance, type of educational institution, and test scores at grades 6, 8 and 10. The latter data originate in the National Assessment of Basic Competencies (NABC) linked to the Admin3 panel. See details in Sebők (2019) and https://adatbank.krtk.mta.hu/en/admin3-2003-2017/

GEO. Geo is a census tract (CT) level database built by the CERS Databank, the CSO, CEU and three private companies (Geox, Terra and Antares-NAV). The CT-level variables calculated using the 2011 Census are supplemented with a matrix of availability by driving and public transport. Distances are calculated in terms of travelling time and costs, including the shadow price of travelling time. See more at https://adatbank.krtk.mta.hu/en/geo-szamlalokorzeti-adatbazis/

TSTAR. Tstar is a municipality-level register put up by the CSO in 1990. It contains annual data on infrastructure, businesses, public institutions, tax base, and unemployment by education, among others. https://adatbank.krtk.mta.hu/en/ksh-teruleti-statisztika-t-star/

Data access

Census and Microcensus. This research was undertaken in a Research Room jointly operated by the CSO and the CERS Databank. On the rules of access see https://adatbank.krtk.mta.hu/en/-kutatoszoba/tudnivalok/ The Room can only be used in person, under CCTV surveillance, and the

results should go through an output checking procedure conducted by the CSO. The CERS Databank operates Referee Projects and Replication Projects to ensure that the data and Stata codes can be checked. The Databank treats the names of the referees confidential, and helps in finding a local partner to do the required checks. You can initiate a project via adatkeres@krtk.mta.hu. The Stata do-files are available on request.

LFS and Wage Survey. The limited variable set used in this research is made available on the Databanks' server via remote access. Apply for access at adatkeres@krtk.mta.hu

Admin 3, TSAR and GEO are available for the academic community via remote access. Apply at adatkeres@krtk.mta.hu

Appendix 4: Roma share, institutions, and the availability of amenities around census tracts

In the paper, we use the Roma population share as the key indicator of CTs. As shown in Table A4.1., the vast majority (71.1 percent) of the 17-year-old Roma live in CTs with a Roma share above 10 percent (and a mean share of 38.4 percent).[19]

Table A4.1. Roma population share in CTs, and the share and distribution of Roma youth

	Roma population share (all age groups)			
	0	0-5%	5-10%	>10%
All 17-year-olds (headcount)	52,351	45,844	8,280	13,017
Roma share within 17-year-olds (percent)	0	2.4	11.3	38.4
Distribution of 17-year-old Roma (row percent)	0.0	15.6	13.3	71.1

Source: Census 2011

In this Appendix, we show that CTs with a high Roma share (>5% and >10%) are far from schools, doctors, cultural and community institutions, meeting places, and a series of other "amenities". This remains true if we control for settlement size and population density.

We first collected selected points of interest (POI) around the population-weighted centers of CTs using year 2020 data in OpenStreetView. As a second step, we selected the closest POI, and used GEO to estimate the time needed to approach it using public transport, or by walking. Finally, we set a dummy to 1 if the POI was available within 35 minutes (applying 30 or 40 minutes do not change the qualitative results). Third, we regressed the availability dummies on log settlement size, log CT population, a Budapest dummy, and three dummies for CT-s with different Roma shares. Note that the boundaries of CTs were set by the CSO so as inteviewers can approach each dwelling in the district within a limited time frame. Consequently, CT population is a proxy of population density. In rural areas loosely spotted with farms interviewers can meet few people, while in a tower block they can approach many.

Table A4.2. Roma population share and the availability of selected amenities – CT-level regressions

				CT Roma share. Reference: 0			
	ln(tPOP)	ln(POP)	Budapest	0-5	5-10	>10	Const.
Kindergarten	0.04***	0.09***	0.02***	0.00	-0.03***	-0.07***	0.07
	(42.3)	(19.3)	(11.0)	(1.3)	(4.5)	(8.4)	
School	0.01***	0.07***	0.01***	-0.00	-0.02***	-0.04***	0.50
	(21.0)	(18.1)	(8.5)	(0.4)	(3.5)	(6.8)	
College	0.09***	0.01*	0.55***	-0.01**	-0.03***	-0.03***	-0.59

[19] Recall that the number of people regarded as Roma by external judgement is substantially higher than the number of those, who reported Roma ethnicity in the Census. Roma (by external judgement) most probably consitute a majority in the „dense" Roma CTs.

	(64.2)	(1.9)	(107.0)	(2.3)	(4.3)	(5.1)	
University	0.14***	0.01	0.36***	-0.03***	-0.04***	-0.03***	-0.91
	(109.6)	(1.4)	(80.3)	(5.9)	(5.7)	(3.6)	
Bookshop	0.14***	0.04***	0.20***	-0.04***	-0.12***	-0.16***	-0.92
	(111.0)	(10.9)	(60.2)	(9.7)	(13.3)	(18.4)	
Library	0.06***	0.08***	0.03***	-0.01***	-0.07***	-0.12***	-0.06
	(52.8)	(16.4)	(12.1)	(3.5)	(7.8)	(12.4)	
Cinema	0.14***	0.01	0.16***	-0.02***	-0.06***	-0.06***	-0.72
	(106.6)	(1.3)	(39.2)	(4.3)	(5.8)	(6.6)	
Community center	0.04***	0.07***	0.05***	-0.02***	-0.05***	-0.08***	0.17
	(38.9)	(15.0)	(22.0)	(3.9)	(6.4)	(9.4)	
Museum	0.04***	0.07***	0.03***	-0.01***	-0.06***	-0.10***	0.16
	(42.3)	(14.7)	(14.9)	(2.8)	(6.8)	(11.4)	
Theatre	0.12***	0.03***	0.17***	-0.04***	-0,10***	-0.15***	-0.64
	(90.0)	(6.9)	(50.1)	(7.9)	(10.2)	(16.3)	
Pub	0.00***	0.05***	0.01***	0.00**	-0.00	-0.02***	0.69
	(9.5)	(15.8)	(10.5)	(2.0)	(0.9)	(4.3)	
Bar	0.11***	0.06***	0.13***	-0.04***	-0.09***	-0.11***	-0.61
	(87.7)	(12.4)	(42.1)	(9.5)	(9,3)	(11.4)	
Restaurant	0.02***	0.06***	0.00***	-0.01***	-0.03***	-0.08***	0.43
	(28.8)	(17.0)	(3.5)	(3.0)	(5.4)	(11.6)	
Fast food	0.04***	0.09***	0.02***	-0.01***	-0.06***	-0.14***	0.08
	(41.5)	(20.2)	(8.3)	(4.5)	(7.6)	(15.3)	
Biergarten	0.07***	-0.01	0.50	-0.01***	-0.05***	-0.05***	-0.33
	(47.7)	(1.7)	(79.2)	(2.9)	(6.6)	(6.5)	
Café	0.05***	0.08***	0.03***	-0.02***	-0.09***	-0.16***	0.01
	(48.1)	(17.5)	(14.0)	(7.2)	(10.5)	(16.4)	
Sports center	0.07***	0.09***	0.02***	-0.01***	-0.07***	-0.11***	-0.22
	(58.2)	(20.0)	(10.3)	(2.8)	(7.8)	(11.7)	
Stadium	0.13***	-0.00	0.30***	-0.00	-0.03***	-0.02**	-0.77
	(100.0)	(0.4)	(64.2)	(0.0)	(3.7)	(2.1)	
Swimming pool	0.09***	0.06***	0.04***	-0.01***	-0.07***	-0.13***	-0.28
	(68.0)	(13.3)	(15.3)	(3.8)	(8.0)	(13.0)	
Park	0.02***	0.07***	0.01***	-0.00*	-0.03***	-0.07***	0.41
	(28.5)	(17.8)	(7.0)	(1.9)	(4.6)	(9.5)	
Playground	0.03***	0.07***	0.02***	-0.01***	-0.05***	-0.09***	0.34
	(31.4)	(17.1)	(11.7)	(3.9)	(7.6)	(11.5)	
Mall	0.14***	0.04***	0.18***	-0.04***	-0.12***	-0.14***	-0.95
	(122.4)	(9.9)	(56.3)	(9.8)	(-13.0)	(17.0)	
Supermarket	0.05***	0.08***	-0.00	-0.01**	-0.05***	-0.09***	0.10
	(44.7)	(19.4)	(1.7)	(2.0)	(6.7)	(10.7)	

lntPOP: log of the municipality's population (2011)
lnPOP: log of the CT's population, a proxy of population density (2011)
Availability of amenities: the indicator is set to one if the closest unit of the given amenity is available within 35 minutes using public transport (or walking), and set to zero otherwise.
Data sources: Census 2011, MTA GEO 2015, Open StreetView 2020

The probability of finding an educational institution within 35 minutes is lower by 3-7 pp in "dense" Roma CTs. For doctors, pharmacies and dentists, the disadvantage amounts to 10-18 pps. The chance to access cultural institutions is lower by 6 to 16 pps. For sports centers, swimming pools, parks and playgrounds the estimates are in the range of 9-16 pps. Malls and supermarkets are far away. The only amenity, for which availability does not differ markedly from the average (a disadvantage of only 2 pps) is the local pub.

Appendix 5: On dropping students in dormitories

As was mentioned in Section 3, some students interviewed in dormitories were not asked about their families and exact place of living in the 2011 Census. The place of permanent living is only known at

the municipality level. To assess the direction of bias, the regressions in Table A7.1. estimate the probability of school attendance in 2011 using only municipality-level contextual variables. The estimates are close to each other. Notably, the main effects of Roma affiliation are almost identical. The full effects at rS=1 (a fully segregated settlement, composed of 100 percent Roma and non-Roma CTs) are -0.237 and -0.247, respectively. We conclude that the bias from restricting the analysis to people living in families is not strong.

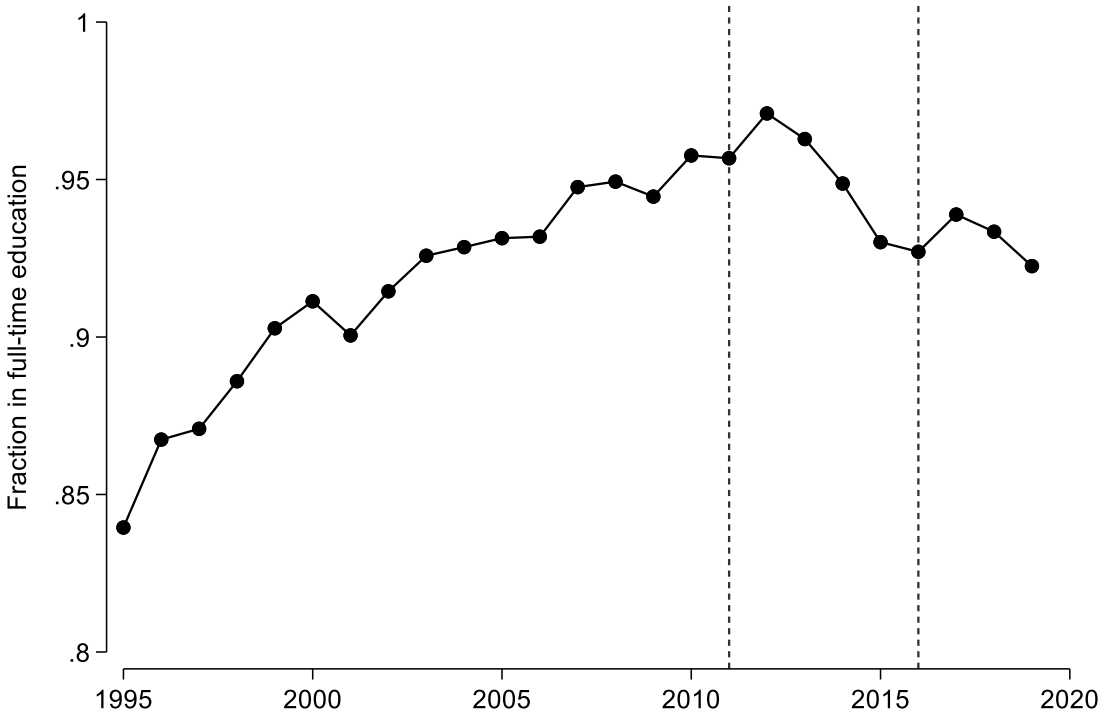
Table A5.1. Regression estimates of school attendance for all 17-year-olds and excluding students interviewed in dormitories (2011 Census)

Dependent: full-time student	With	Without
	students in dormitories	
Girl	-0.016***	-0.019***
	(13.8)	(15.5)
Roma	-0.173***	-0.164***
	(22.5)	(20.3)
Roma segregation index (rS)	0.002	0.003
	(0.3)	(0.6)
Roma*rS	-0.064**	-0.083**
	(1.8)	(2.5)
Municipality level unemployment rate (logU)	-0.021***	-0.021***
	(17.1)	(15.9)
Settlement size (logPOP)	0.007*	0.002
	(1.8)	(0.6)
Settlement size squared	-0.000	1.2e-0.6
	(0.7)	(0.01)
Constant	0.883	0.913
aR2	0.075	0.071
Number of observations	107,806	93,251

Appendix 6: Census tracts in the Census and the Microcensus

In the 2016 Microcensus, the CSO deliberately over-represented CTs in small municipalities and/or with a high Roma share. A CT with a one standard deviation higher share of Roma had a 3 percent higher likelihood to make it to the sample. A CT in a settlement bigger by one standard deviation had a lower likelihood by 3 percent. The resulting bias was corrected by the CSO in the phase of weighting. A CT's probability of making it to the 2016 sample was unrelated to school attendance in 2011. The estimates are available on request.

Appendix 7: The medium-term trend of school attendance at age 17



Source: LFS. Authors' calculation. The vertical lines indicate the dates of the Census and the Microcensus

Appendix 8. Estimates of Table 3 by gender

Table A8.1. The marginal effect of Roma ethnicity on school attendance by gender (pp)

	Boys		Girls	
Model specification	2011	2016	2011	2016
Univariate (only a Roma dummy)	-13.0	-33.0	-24.2	-32.7
+ gender, the number, education, and employment of cohabitating parents[a]	-8.6	-15.9	-16.2	-14.4
+ childbearing, overage, disabilities obstructing everyday life	-7.0	-14.4	-7.7	-11.8
+ CT with a Roma population share exceeding 10 percent[c]	-5.7	-11.2	-6.3	-9.0

Sample: 17-year-olds without secondary school attendance, living in families. N=119,303 in 2011 and N= 7604 in 2016

Estimation: linear probability models. All the coefficients are significant at 1 percent level.

a) Educational level of the highest-educated parent (4 dummies), number of employed and non-employed parents (5 dummies)

b) Overage: 17 years old and has not completed primary school. Disabilities: 3 categories (no, yes, missing)

c) Roma ethnicity interacted with four CT categories distinguished by Roma density (8 dummies)

Appendix 9. Estimates of Table 4 by gender

Table A9.1. The probability of school attendance in 2011 and 2016 – Linear probability models

Dependent: Full-time student	2011		2016	
Boys				
Roma	-0.057***	(9.0)	-0.112***	(3.7)
Overage[a]	-0.194***	(17.9)	-0.193***	(4.0)
Disability obstructing everyday life	-0.007**	(2.0)	-0.040**	(2.1)
Information on disability missing	-0.004***	(2.3)	0.005	(0.3)

Highest-educated cohabitating parent				
Primary or lower[a]	0		0	
Vocational	0.017***	(7.8)	0.157***	(6.9)
Secondary	0.022***	(11.6)	0.201***	(9.4)
College, university	0.023***	(12.4)	0.203***	(9.6)
Cohabitating parents and their employment				
Two parents, both work	0		0	
Two parents, one works	-0.009***	(6.5)	-0.035***	(3.2)
Two parents, none works	-0.046***	(14.2)	-0.082***	(3.6)
One parent, works	-0.005***	(4.2)	0.011	(1.4)
One parent, does not work	-0.017***	(3.6)	-0.032	(1.1)
Neighborhood				
Roma population share exceeds 10 percent[b]	-0.027***	(10.7)	-0.077***	(3.3)
Constant	0.980		0.816	
aR2	0.097		0.287	
Number of observations	60,948		7,604	
Girls				
Roma	-0.063***	(9.6)	-0.118***	(3.8)
Mother of one or more children	-0.703***	(62.9)	-0.591***	(16.1)
Overage[a]	-0.139***	(11.1)	-0.194***	(5.6)
Disability obstructing everyday life	-0.001	(0.2)	-0.030**	(2.4)
Information on disability missing	-0.004***	(2.4)	0.015	(1.3)
Highest-educated cohabitating parent				
Primary or lower[a]	0		0	
Vocational	0.011***	(4.6)	0.143***	(6.4)
Secondary	0.017***	(9.1)	0.159***	(7.3)
College, university	0.017***	(9.3)	0.161***	(7.5)
Cohabitating parents and their employment				
Two parents, both work	0		0	
Two parents, one works	-0.014***	(9.5)	-0.036***	(3.4)
Two parents, none works	-0.063***	(17.8)	-0.062***	(17.8)
One parent, works	-0.007***	(5.5)	-0.007***	(5.5)
One parent, does not work	-0.015***	(4.8)	-0.015***	(4.5)
Neighborhood				
Roma population share exceeds 10 percent[b]	-0.028***	(7.9)	-0.059***	(2.8)
Constant	0.987		0.846	
aR2	0.428		0.361	
Number of observations	58,355		3.662	

Source: Census 2011, Microcensus 2016.
Sample: 17-year-olds without completed secondary education, living in a family.
Stars: significant at *10, **5, and ***1 percent level
b) 17 year old and has not completed the primary school
b) CT= census tract. The Roma share refers to 2011.

Appendix 10. Matching 2011 and 2016 observations

We matched cases in the Census and the Microcensus exactly by gender and Roma ethnicity, and using coarsened values of settlement size (with the cut points being 500, 5000, 50000, and 250000), municipality-level unemployment rate (0.05, 0.17), and the CT level Roma share (0.01, 0.05, 0.1).

Table A10.1. Matched and unmatched cases – Mean and standard deviation of the key variables

	Unmatched		Matched	
	Mean	St.dev.	Mean	St.dev
Full time student	.9569	.2028	.9489	.2201
Roma	.1554	.3623	.0606	.2386
Female	.5067	.5000	.4880	.4998
Mother of one or more children	.0095	.0973	.0115	.1069
Overage[a]	.0366	.1878	.0225	.1483
Disability obstructing everyday life				
No	.7883	.4085	.8361	.3700

Yes	.0568	.2316	.0647	.2461
Missing	.1547	.3616	.0990	.2987
Cohabitating parents and their employment				
Two parents, both work	.5745	.4944	.4726	.4992
Two parents, one works	.1478	.3550	.2119	.4080
Two parents, none works	.0559	.2299	.1504	.3575
One parent, works	.1542	.3610	.1114	.3146
One parent, does not work	.0673	.2500	.0530	.2250
Highest-educated cohabitating parent				
Primary or lower[a]	.5600	.4963	.1950	.3966
Vocational	.1770	.3823	.2603	.4388
Secondary	.1400	.3470	.3073	.4613
College, university	.1200	.3266	.2366	.4250
Roma population share exceeds 10 percent	.2031	.4024	.1077	.3100
N of obs	3,670		123,663	

Appendix 11: Imputing Roma affiliation

As mentioned in Section 3, 11.8 percent of the 17-year-old respondents in 2011 and 0.7 percent in 2016 did not answer the question on ethnicity. We predicted the probability that a non-respondent is Roma by estimating probit equations with the following right-hand side variables: gender, disabilities, mother, educational level of the highest-educated parent, employment status of the parents, CT-level Roma share, and a principal component comprising variables like the CT-level share of adobe houses, no running water, no WC, separation from the core of the settlement, fraction living in a "run-down" environment according to the interviewer, and the number of firms and CT-s available using public transport in a profitable way (average unskilled wages in the accessed firms and CT-s net of the monetary and time costs exceed the income from benefits and expected PW wage). The probits estimated the probability of being Roma rather precisely (pseudo r2 of 0.33 in 2011 and 0.27 in 2016). We considered a non-respondent non-Roma if (i) she/he lived in a CT with no (self-reported) Roma inhabitants. (ii) the prediction fell short of 50 percent. Those reporting Roma affiliation were regarded as Roma irrespective of the prediction. The details are available on request.

Appendix 12: Descriptives of the NABC sample

Table A12.1: 8th grade test results, and selected answers to the background questionnaire
Sample: 17-year-olds in/out of school in 2011 and 2016, who answered the NABC test and the questionaire at the 8th grade[a]

	Full-time student in October			
	2011		2016	
Selected indicators of their 8th grade NABC survey	Yes	No	Yes	No
Mathematics level (scale 1-7)	3.7	3.3	3.9	2.7
	(1.4)	(1.4)	(1.5)	(1.4)
Reading level (scale 1-7)	4.1	3.6	4.1	2.8
	(1.4)	(1.4)	(1.4)	(1.4)
7th grade year-end score (scale 1-5)	4.0	3.6	4.0	3.2
	(0.8)	(0.7)	(0.7)	(0.7)
In-school tutoring for poor-performers (%)	29.2	36.3	28.7	41.2
Repeated class before the 8th grade (%)	6.7	12.1	4.7	13.4
Fifty of less books at home (%)	27.3	37.6	28.5	64.1
Less than two years in kindergarten (%)	3.8	4.8	1.9	5.1
Attends the local school (%)	66.9	70.0	63.0	78.0
Attends a standard course (%)[b]	70.6	75.6	73.3	81.8
Wants to complete vocational training school or less (%)	12.0	20.4	9.5	43.5

Wants to complete college or university (%)	53.0	34.5	53.4	14.5
Standardized family background index[c]	0.01	-0.32	0.08	-1.01
	(1.0)	(1.04)	(0.96)	(1.07)
Free meal in school (%)	4.0	5.6	23.8	59.2
Subsidized meal in school (%)	26.6	23.4	23.8	36.4
Lives in a poor neighborhood (%)[d]	10.0	14.2	12.0	25.7

Source: Admin3 panel, 50 percent random sample of the population
a) NABC: National Assesment of Basic Competences
b) About one-third of the 8th graders attend classes specialized in certain subjects (science, language, arts). These classes typically provide better-than-average tuition.
c) The index is computed by the Office of Education using stepwise linear regressions with test scores on the left hand and various NABC indicators on the right hand. On the basis of the parameters, the indicator considers the number of books (weight=10), parents' level of education (11), computer at home (17), and own books (33). The index is standardized to have zero mean and unit standard deviation.
d) Majority are very poor or poor according to the respondent.

Table A12.2.: Students aged 17 in October 2011 or 2016, and observed in the 8th grade NABC

				Aged 17 in 2016			
Wrote NABC8 in	Boys	Girls	Total	Wrote NABC8 in	Boys	Girls	Total
2008	6,591	8,616	15,207	2013	4,166	5,679	9,845
2009	10,579	10,473	21,052	2014	10,010	9,207	19,217
2010	1,137	760	1,897	2015	880	541	1,421
2011	204	113	317	2016	94	61	155
Total	18,511	19,962	38,473	Total	15,150	15,488	30,638

Source: Admin 3 panel, 50 percent random sample of the population

Appendix 13. NABC-based school attendance estimates by gender

Table 13.1. IV estimates of school attendance in 2016 in response to prior test performance and family background

	Boys		Girls	
Standardized 8th grade test score in mathematics	0.036	11.5	0.040	10.6
Educational level of the highest-educated cohabitating parent				
Primary or less	0		0	
Vocational	0.152	10.2	0.173	11.9
Secondary or higher	0.167	11.3	0.194	13.6
Missing[a]	0.157	9.0	0.178	10.3
Number and employment of the cohabitating parents				
Two parents, both work	0		0	
Two parents, one works	-0.027	5.0	-0.021	3.8
Two parents, none works	-0.076	5.9	-0.094	7.10
One parent, works	-0.020	2.5	-0.020	2.2
One parent, does not work	-0.062	3.7	-0.097	5.4
Year of the 8th grade test				
2013	0		0	
2014	0.021	4.8	0.018	4.5
2015	0.005	0.4	-0.038	1.9
2016	0.074	1.8	-0.015	0.2
Number of observations	12,952		13,416	
aR^2	0.096		0.118	
First-stage F-test	1712,0 (0.000)		1471.3 (0.000)	

Standardized test score in reading[b]	0.036	0.040

Data: Administrative register of the Office of Education (part of Admin3)
Estimation: Two-stage least squares. IV: 6th grade test score.
Sample: 17 year-olds, took the tests, filled the background questionnaire, and live in a household
a) Information on parent's education is missing in 5.5 percent of the cases.
b) We skip other coefficients of the reading equations, which only marginally differ from the respective ones in the table

Appendix 14. Data used to assess the mean Roma – non-Roma test score differentials

Life Course Survey. The HLCS is a panel survey that follows 10,000 youths on an annual basis, beginning in the fall of 2006. The survey sampled regular students who participated in the NABC and special needs students who did not participate in the NABC but who completed a simplified version of the
reading comprehension test. Students with lower test scores and special needs students are overrepresented in the sample, and we use sampling weights throughout the analysis to restore national representativeness. The questions in the first wave of the HLCS in 2006 focused on the respondents' family structure, financial situation, early childhood experiences, medical and school history and plans for secondary school. Subsequent waves of the survey primarily concentrated on school careers and the mechanisms underlying student dropout.

Inter-Ethnic Friendship and Hostility between Roma and Non-Roma Students in Hungary. The data relate to 82 elementary schools in the 75 towns and cities with the largest Roma populations in Hungary in April 2010. Budapest is excluded due to the prevalence of secondary schools recruiting students before grade 8. To ensure adequate Roma representation, schools with a higher proportion of Roma students are over-represented. In each school the authors surveyed all classes in the eighth grade, and retained classes with data on at least 10 students and valid data on ethnicity and friendships for more than two thirds of the students in the class (excluding 25 classes). The final sample comprises 3,430 students from 181 classes in 82 schools in 75 towns.

Grading in Hungarian Primary Schools: Mechanisms of Ethnic Discrimination against Roma Students. Data are from the third wave of a six-wave panel study conducted among Hungarian primary school students (NT3 = 1,054 students, 53 classes in 34 schools in 28 settlements). Third-wave data were collected in the autumn of 2014 among sixth-grade students. The third wave of the research was selected because participating students also took part in the NABC in the same academic year. Students with parental permission (96.9 per cent) filled out a self-administered questionnaire under the supervision of trained research assistants. Schools with a high proportion of low-status and Roma students were overrepresented in the sample by design (for more details see Kisfalusi, 2018). Five schools were located in the capital city, 9 in small- and mid-size towns, and 20 in rural areas in central Hungary. Most schools in the sample are below the national average concerning output and performance measures. For the purpose of the analysis, classes were retained for which student and teacher questionnaires, grades, and test scores were all available. Based on these selection criteria, the subsample consists of 33 classes from 23 schools (N students = 687) with a mean class size of 21 students (SD = 5.2).

Appendix 15. Roma – non-Roma test score differentials by gender

Table A15.1. Roma students' disadvantage in tests of basic competences by gender - Various surveys

		Observations		Disadvantage in	
Data source	Sex	Non-Roma	Roma	Math	Reading
(LCS) Life Course Survey	Boys	4596	625	-0.954	-0.850
2006, 8th grade[a]	Girls	4120	680	-0.986	-0.945

	Both genders	8716	1305	-0.973	-0.894
(IEFH) Inter-ethnic Friendship and Hostility 2010, 8th grade[b]	Boys	1300	294	-0.710	-0.789
	Girls	1245	315	-0.698	-0.647
	Both genders	2545	609	-0.705	-0.677
(GD1) Grading Discrimination 1 2015, 6th grade[c]	Boys	183	118	-0.713	-0.754
	Girls	178	103	-0.696	-0.877
	Both genders	361	221	-0.701	-0.818
(GD2) Grading Discrimination 2 2017, 8th grade[c]	Boys	121	59	-0.959	-0.865
	Girls	129	50	-0.931	-1.056
	Both genders	251	109	-0.934	-0.977

a) https://www.tarki.hu/eng/household-lifecourse-survey-project-hev-2006-2008
b) Hajdu, Kertesi and Kézdi (2018)
c) Kisfalusi (2018) and Kisfalusi, Janky and Takács (2021)
Note: The figures show Roma's disadvantage is terms of standardized test scores. We used the sample means and standard deviations for standardization rather than the moments of the national distributions.

Appendix 16. Family background of 14-15 year-old Roma and non-Roma boys and girls in 2016

Table A16.1. Family background of 14-15 year-old Roma and non-Roma boys and girls in 2016

	Non-Roma		Roma	
Educational attainment of the highest-educated parent	Boys	Girls	Boys	Girls
Primary	12.9	12.9	71.4	71.8
Vocational	27.2	27.3	21.1	21.5
Secondary	33.2	34.7	6.2	6.0
Higher	26.7	25.1	1.3	0.7
Number and employment of the parents	100.0	100.0	100.0	100.0
Two parents, both work	51.0	51.2	11.7	13.3
Two parents, one works	19.5	19.6	29.8	25.6
Two parents, none works	5.9	5.9	37.0	38.9
One parent, works	17.7	17.7	5.7	5.9
One parent, does not work	5.9	5.6	15.8	16.3
	100.0	100.0	100.0	100.0

Source: Microcensus

Appendix 17. Predicted marginal effects of the 8th grade test scores on school attendance at age 17 by gender

Table A17.1. Predicted marginal effects of the 8th grade test scores on school attendance at age 17 (Eq. 4)

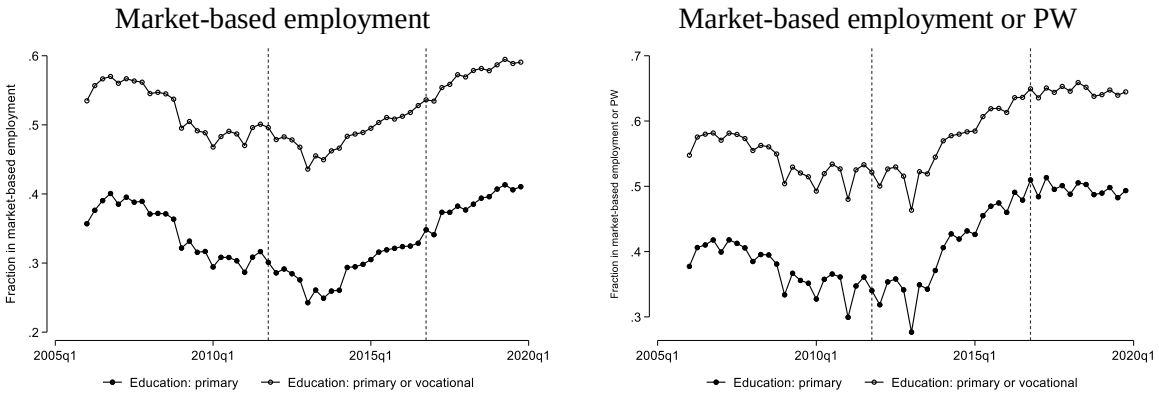
Gender and field of the 8th grade test	Source of the ethnic test score gap	Effect of the test score gap	95% confidence interval
Boys			
Mathematics	LCS	3.5	2.9-4.0
	IEFH	2.6	2.1-3.0
	GD1	2.6	2.1-3.0
	GD2	3.5	2.9-4.1

Reading	LCS	3.0	2.5-3.5
	IEFH	2.6	2.2-3.0
	GD1	2.7	2.2-3.1
	GD2	3.1	2.6-3.6
Girls			
Mathematics	LCS	4.0	3.2-4.7
	IEFH	2.8	2.3-3.3
	GD1	2.8	2.3-3.3
	GD2	3.7	3.1-4.4
Reading	LCS	3.7	3.1-4.4
	IEFH	2.6	2.1-3.0
	GD1	3.5	2.9-4.0
	GD2	4.2	3.5-4.9

The predictions relate to school attendance in October 2016, using the coefficients from Eq 3, and ethnicity-specific data on the test scores and family background. We estimated the confidence intervals using Stata's *lincom* procedure.

Appendix 18. Employment dynamics of primary and primary or vocational degree holders

Figure A18.1. Employment of primary and primary or vocational degree holders 2005-2020



Source: LFS

Appendix 19. Descriptive statistics on NUTS4-level employment dynamics

Variable: log change (2016/211) of	Obs	Mean	Std. Dev.	Min	Max
Market-based employment/population aged 17-35	175	.1058	.0588	-.0834	.4685
Market-based employment/population aged 36-55	175	.1379	.0469	-.0285	.2862
Market-based employment and PW/population aged 17-35	175	.1485	.0737	-.0244	.4381
Market-based employment and PW/population aged 36-55	175	.1598	.0671	.0386	.3945

Sources: Census 2011 and Microcensus 2016. The data relate to people with primary or vocational educational attainment.