Do Fewer School Transitions Imply Less Segregation? The Effects of Abolishing Middle Schools on Access to Upper Secondary Education in an Urban Context

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Abstract

This study evaluates the impact of Poland's 2017 education system reform on secondary schools in Warsaw. The reform eliminated middle schools, restored K-8 primary schools, and shortened the duration of common compulsory education from nine to eight years. Using a quasi-experimental design comparing two cohorts transitioning under different systems, we investigate changes in school segregation and student sorting. We found that the reform reduced school segregation, with the share of test score variance attributable to between-school at end of middle/K8 education decreasing from 38% to 25%. However, K-8 graduates entered an equally stratified secondary education system, reflecting persistent inequalities in access to high-quality schools. These results highlight the reform's mixed success: although it successfully balanced academic achievement levels among 15-year-old students during primary education, selective admission practices continued to sort students by ability at the upper secondary level.

Introduction

This paper assesses the effects of Poland's recent education reform on the selectivity of access to secondary schooling in the country's capital, Warsaw. Over the last two decades, the Polish educational system has been transformed through significant reforms (Wiśniewski & Zahorska, 2020). In 1999, a major reform shortened the duration of primary education from eight to six years, introduced a three-year middle school period, and expanded common comprehensive general education from eight to nine years. Although middle schools were meant to serve their local catchment areas, those in large cities effectively became selective institutions. This selectivity led to significant differences in the academic abilities of incoming students between schools, with some schools attracting higher-performing students while others enrolled lower-performing ones (Dolata et al., 2012). The 1999 reform was reversed in 2017, resulting in the restoration of the eight-year primary school structure, an expansion of upper-secondary education, and the phasing out of middle schools. The transition period produced two distinct student cohorts: those who experienced pre-reform middle schools and those under post-reform primary schools, who continued their education in grades seven and eight rather than ending education in primary education after grade six. Both cohorts completed their schooling and entered upper-secondary education in 2019, offering a unique natural experiment for educational research (for a similar approach using Polish reform, see Karwowski & Milerski, 2020).

Most existing studies focused on the consequences of different configurations of school grades or the role of tracking have prioritised students' further educational achievements, typically represented by test results. We take a different approach. Our goal is to understand how the organisational model of education affects students at the precise moment of their transition from compulsory general education to the next tier of schooling. Rather than comparing K-8 and middle school graduates' further achievements, this study analyses how students choose their upper secondary schools, how frequently they are accepted into their preferred institution, and the level of

stratification that emerges between schools as a result of recruitment to upper secondary schools within two organisational models. The quasi-experimental setting of two cohorts completing their education in the same year offers a unique opportunity to investigate the mechanisms of secondary school admission in two organisational schooling models.

More specifically, the analysis strives to answer three primary questions regarding the effects of Poland's structural education reform, particularly focusing on the urban environment. Firstly, we seek to understand how the reform affected between-school stratification in Warsaw at the end of general compulsory schooling and the start of the upper secondary stage, namely to what extent students' prior academic achievements influence their secondary school placement, and how the level of between-school stratification at the secondary level—based on students' prior achievements—changed from before to after the reform.

Secondly, we are interested in how students from the two cohorts select their most desired school, namely, the one they place at the top of the preference list in the city-wide application procedure. We assume that students' decisions in this matter reflect their expected test results, their self-esteem (partly shaped by their educational experiences), and their beliefs about the openness of the current schooling system. To explore this, we address a number of questions. Are their choices more ambitious or more conservative after the structural reform? To what extent do they depend on students' achievements? Similar considerations may apply to the schools that students ultimately qualify for – are the patterns different before and after the reform? To answer these questions, we will refer to the competitiveness of secondary schools, understood in terms of the threshold admission score necessary for qualification. Competitiveness is undoubtedly related to school quality, although the latter notion is broader and more meaningful.

Thirdly, the study considers whether the reform has affected students; chances of qualifying for their first-choice school. This will help assess how realistic students' choices are depending on the educational path they have experienced. This will also allow us to understand how well students are matched to schools under the alternative organisational arrangements, with consideration of students' achievements, their declared preferences for secondary schools, and the quality of the latter.

The remainder of this paper is structured as follows. The paper first reviews the literature on the consequences of different structural arrangements in education for students' further educational careers. It then presents the features of Warsaw's school admission system in 2019, before introducing our methodological framework. The final sections are devoted to the analysis results and conclusions.

Organisation of schooling, student aspirations, and between-school stratification: A literature review

The 2017 reform reduced the number of between-school transitions in Poland and increased the age of the first transition. Additionally, it shortened the duration of comprehensive general education by one year due to the earlier tracking of students into vocational or academic pathways. These two changes may have distinct effects on students' aspirations and further educational careers. Furthermore, both elements are likely to have a heterogeneous impact on students, depending on their prior achievements and socioeconomic status.

For clarity, this literature review is grouped into sections. The first section refers to the debate over middle schools, which is particularly lively in the United States and Canada, where various school grade configurations coexist within singular schooling systems, and educational decisions are made locally. In the context of our study, this evidence helps us to understand the potential benefits and limitations arising from the abolition of middle schools in Poland.

The second section focuses on the age at which students are tracked into academic or vocational secondary school, a regulation that – at least in some education systems – simultaneously determines the duration of universal, comprehensive education. The extensive literature on this topic may help us better understand the consequences of decreasing the tracking age in Poland's education system due to the restoration of K-8 schools.

The final part of the review discusses the inter-school stratification of students in relation to different organisational arrangements in education. The Polish government declared tackling inequalities to be their primary motivation in implementing the reform; thus, it appears necessary to assess the extent to which the policymakers' expectations were grounded in the evidence. As our analysis focuses on Warsaw's school system, we will also consider the urban context when discussing the reform's potential effects on educational segregation.

Middle schools vs. K-8 school

Advocates of the extended duration of education within a single institution argue that K-8 schools are better suited to provide students with a friendly learning environment compared to education split between primary and middle schools. Eliminating the transition between tiers reduces student stress and prevents the early disruption of student-teacher relationships. Studies have determined that changing schools may adversely impact students' achievements (Schwartz et al., 2011; Hanushek, Kain & Rivkin, 2004).

A further potentially detrimental effect of the transition to middle school relates to the disintegration of student groups. Peers can affect the learning process in multiple ways, including through mutual teaching, affecting the teacher's attention, or establishing social norms (Hoxby, 2000; Sacerdote, 2001; Carrell et al., 2009). Therefore, changing the peer group implies at least a temporary disruption to the learning environment. Recently, Herbst et al. (2023) demonstrated the importance of peer group stability for student performance in Polish schools.

Most studies specifically focusing on the K-8 versus middle school alternative have suggested that the transition to middle school, as opposed to remaining in primary school for a longer time, has a negative effect on students' achievements and well-being in the subsequent period (Dhuey, 2013; Clark et al., 2013; Rockoff & Lockwood, 2010). However, the results have differed vastly with respect to the persistence of any adverse effect, varying from one year (Hong & Zimmer, 2018) to even four or five years (Schwerdt & West, 2013). At the same time, there are arguments in favour of middle schools. One such perspective contends that, by covering a smaller grade span, instructional and pedagogical strategies can be developed that are best suited for middle school-aged students (Hough, 2005; Tamer, 2012). Creating a distinction between early grades and teenage students also prevents primary schools from getting too large; in this way, better learning conditions for all students can be ensured. Finally, middle schools allow more effective resource use. Given that the recent teacher shortage has become a sad reality even in otherwise highly-developed countries (Sutcher et al., 2016), the consolidation of later grades into smaller schools may seem to be a reasonable measure for preserving the quality of instruction.

Age of tracking into academic or vocational secondary education

Policy solutions for student tracking at the end of compulsory comprehensive education differ strongly between countries. Some systems (e.g., Finland, France, Italy, and Poland) do not split students into different tracks until after grade eight or nine when they graduate from primary or middle school. In other countries, students experience their first tracking as early as grade four or five. The implications of such policy choices are significant for us since Poland's recent reform reduced the length of compulsory general education from nine to eight years, thus hastening tracking by one year.

Although some studies have demonstrated that tracking can be beneficial to students if combined with a better-tailored instruction level (Duflo et al., 2011), most international evidence has indicated that early tracking adversely affects the further academic achievements of students from low-profile or vocational schools. This was the case for Bavaria's school reform, which shifted the timing of tracking in low- and middle-track schools from grade six to grade four. The reform resulted in a reduction in the performances of 15-year-old students in all but high-track schools and increased the proportion of very low-performing students at low-track schools (Piopiunik, 2014). Similarly, in Lower Saxony, earlier tracking was seen to increase test scores in the upper tail of skill distribution and reduce test scores in its lower tail (Roller & Steinberg, 2020). Conversely, in some

German states, postponing tracking seemingly attenuated the effects of parental education on student achievement, at least for male students (Lange & von Werder, 2017). In Poland, the 1999 educational reform delayed the tracking of students by one year, which had a positive and significant impact on the achievements of students who would likely have been directed into vocational schools pre-reform (Jakubowski et al., 2016). The beneficial long-term effects of detracking were also observed in France, where the postponement of separating students into academic and vocational tracks increased educational attainment and wages at ages 40–45, with the benefits most pronounced for those from low socioeconomic backgrounds (Canaan, 2020).

While the age of tracking affects students' post-tracking achievements, evidence indicates that it also influences the choice of track. According to Schneeweis and Zweimüller (2014), a strong relative age effect on track choice in the Austrian school system persists beyond grade eight for students from less favourable socioeconomic backgrounds and those in urban areas. These findings suggest that early tracking may affect students' self-concept, thus shaping their motivation.

Stratification between schools and student-school matching

As has been documented in research on educational inequalities, the transition between school tiers is typically accompanied by sorting based on prior achievements, which the equity perspective perceives as an undesired phenomenon (Greaves, 2023). Sorting makes schools more homogenous in terms of socioeconomic status, reinforcing the division into low and high achievement and ambition cultures through unequal learning environments (Goldsmith, 2011; Kelly, 2009). The correlation between a free choice of school and the high segregation in education is almost universal in empirical studies (Wilson & Bridge, 2019).

In urban-intense areas, school segregation typically reflects socio-residential differences (Boterman, 2019). However, evidence from schools in Paris and Milan indicates that educational inequalities may be even more severe compared to general residential segregation, as parents with higher socioeconomic status will seek to overcome the assignment of school based on catchment area (Oberti & Savina, 2019; Cordini et al., 2019). In the absence of catchment areas, as is the case in the primary education of Germany's North Rhine-Westphalia region or the upper secondary schooling of numerous countries, one may expect that school enrollment will directly contribute to greater segregation due to students' and parents' socially-selective choice of schools (Ramos Lobatoa & Groos, 2019). There are, however, also other factors at play. Drawing on data from Amsterdam, Oosterbeek, Sóvágó, and van der Klaauw (2021) argued that where there are no constraints in secondary school admission, school segregation is significantly driven by preference heterogeneity – that is, diverse preferences in choosing schools, even when controlling for geographical proximity or student ability. The nature of school segregation is, therefore, multi-faceted and results in complex interactions between school preferences, ability tracking, policy interventions, and socioeconomic factors.

A separate strand of the literature, which is relevant for understanding preferences and choices, relates to the quality and consequences of matches between students and schools. Academic discussions have predominantly focused on the highly differentiated U.S. higher education system and the ways that the different qualities of students, such as their academic performance or socioeconomic status, affect their sorting into colleges or other tertiary institutions (Hoxby & Avery, 2013; Dillon & Smith, 2017). The primary focus is on the "fit", or match, that assumes a complementarity between students and institutions. The existing literature has documented the existence of both over- and undermatching, which can mostly be explained by students' application behaviours. For instance, students from high-income families, otherwise similar to other pupils with respect to academic performance, are more likely to "overmatch", while high-performing students from low-income backgrounds typically "undermatch". Peer influence is also essential in educational choices. Using data on Swedish students' choices of upper-secondary schools, Rosenqvist (2017) highlighted peer and group composition as important factors: students can either conform to their peers' decisions or be discouraged by more successful peers.

Overall, this review showcases that Poland's educational reform may have triggered mechanisms that are at least partially contradictory in how they impact students in their transition to upper

secondary school. Remaining in one school for longer may positively affect students' performance and, thus, their further educational aspirations. However, the reduced age at the time of choosing the secondary education track may, in turn, result in more conservative choices and less accurate matching between students and schools. The effects of school reforms on school segregation is challenging to predict but surely depends on the degree of socio-residential segregation in a given school district.

Warsaw and its schools in 2019

Admission to secondary school in 2019

Warsaw's public school admission system operates through a city-wide centralised algorithm that allocates graduates to secondary schools based on students' preferences and composite admission scores[1]. Similarly to other admission systems, the algorithm seeks to enhance the efficiency of assigning graduates to schools using information on students' academic performances. Students are able to provide a ranking of their preferred school choices and specific classes within schools (e.g., humanistic, scientific, and mathematical). In Poland, secondary schools do not have catchment areas. Thus, choices are not restricted so much by the student's place of residence and are primarily driven by a combination of students' and parents' preferences and the student's abilities, as revealed by test scores, school grades, and other achievements. As there are no restrictions on the number of schools and programmes chosen, the first school choice does not need to be strategic.

Importantly, students make their choices after taking the final test in primary school (new system) or middle school (old system), but before finding out the test results. Therefore, they can only speculate on their admission score while choosing schools. They can also have erroneous beliefs about the school's rank, although some information on past recruitments is made available. Registration to secondary schools in Poland is typically closed in late May, and test results are announced in mid-June. Students' actual admission scores can only be calculated in late June, at which point the school year has ended. Ipso facto, it is only then when the true "quality" of secondary schools is revealed, as the achievements of students determine their thresholds of acceptance.

In 2019, students' admission scores were calculated based on 1) their eighth- and ninth-grade results on the nationwide standardised test, 2) their school grades during the previous year, 3) their achievements in different academic contests, and 4) their extracurricular activities. Of the maximum possible score of 200, 100 points were based on test results. In terms of primary/middle school grades, achievements in mathematics and Polish were obligatorily considered. However, secondary institutions could select additional subjects of importance for admission to classes of different specialisations (e.g., biology, geography, and chemistry). Therefore, a single student could have differing admission scores among the schools and classes they chose. Additionally, being a laureate of a ministry-approved contest in any subject guaranteed a 200-point admission score, which, in practice, translated into acceptance to the most preferred school.

2019 was a transitional year for the fading out of the old system and the introduction of the new system – two cohorts of Polish students simultaneously completed their compulsory general education and transitioned to secondary institutions. The 2003 cohort (the modal age of starting school) was the last to graduate from middle school – typically at the age of 16 - after completing nine grades of comprehensive education, which was divided education into six years in primary school and three in middle school. Importantly, this cohort had already experienced similar recruitment after completing six years of primary school in 2016, in which catchment areas were prioritised but students' scores could be considered for bilingual and proprietary programmes, leading to the greater stratification of schools. The 2004 cohort was the first to graduate after eight years of primary school, typically at the age of 15. They were recruited to school at the age of seven, and

[1] The system allocates students to public schools; private schools use their own admission criteria. However, graduates of private primary and middle schools who want to enrol in public secondary schools are included in the admission system. Graduates of schools outside of Warsaw, who can also participate in the Warsaw admission system, are of equal importance. Applying to schools outside of Warsaw is also a less popular option for some students educated in Warsaw-based middle or primary schools.

changes in student composition could only be affected by students moving schools. Students in this cohort were more likely to attend schools closer to their place of residence. Both cohorts applied to the same secondary institutions (general or vocational), although they continued their secondary education in separate classes due to curricular differences between the old and new systems. Figure 1 presents the educational pathways of the two cohorts in graph form.

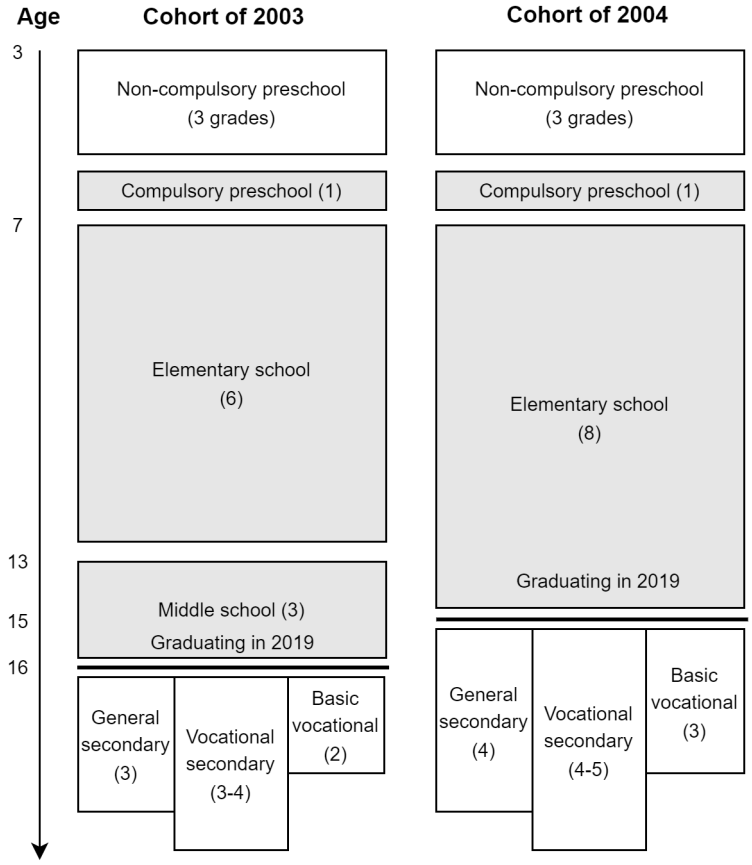

Figure 1. School grade configuration as experienced by the cohorts of 2003 and 2004 (Thick horizontal lines denoting the end of compulsory schooling)

Notably, alongside the fact that the two cohorts transitioning to secondary schools took different tests at the end of their compulsory education, the algorithm used to evaluate students and match them to schools was similar to that used for graduates of middle schools and K-8 institutions. The higher the student's total score, the more likely they would be accepted to their preferred school. More competitive schools had a higher admission threshold, determined by the last accepted student's admission score.

Methods

Decomposing variance to measure the level of between-school stratification

The first step common in education research is to assess the distribution of variance in the levels. We employed 2-level hierarchical models and cross-classified multilevel models to decompose this variation into within- and between-school components, offering insight into student composition across schools. The use of cross-classified multilevel models was particularly appropriate given that students can be assigned to a combination of origin and destination schools (for a discussion of the details of such models, see Chapter 13 of Snijders & Bosker, 2012). Using models without predictors, we calculated the intraclass correlations of student performance, that is, in students attending the same primary/middle school and secondary school.

Simply speaking, the model predicted the test score for a student (*i*) who completed primary/middle school *p*, and, depending on the model, was accepted in secondary school *s* or chose *s* as his/her top preferred school. The specification of the model included two additive and uncorrelated random effects, C_{1s} and C_{2p}, both assumed to have zero mean with estimated variance, and a residual effect also assumed to have zero mean and estimated variance:

$$y_{isp}=\beta_0+C_{1s}+C_{2p}+\varepsilon_{isp}$$

We compared variance decompositions for students graduating from K-8 schools versus those from middle schools to identify which arrangement leads to a more equal distribution of students' performance across secondary schools. We also analysed counterfactual scenarios by comparing students' actual school placements to hypothetical allocations based on their first-choice schools. To better visualise and interpret the school-level variation in our results, we used empirical Bayes estimates and best linear unbiased predictions (BLUPs) from these models.

Clustered regression for explaining the competitiveness of top-preferred school and destination school

Mixed effects models provide insights into the variation of achievements but can be complex to interpret and involve additional distributional assumptions. Employing simpler regression techniques, we investigated how the reform has affected students' approaches to selecting their top-preferred upper secondary school and its impact on the competitiveness of schools to which students qualified, using predictors on the individual level. We utilised the following regression models:

- An OLS model, with standard errors clustered at the school level, explained the competitiveness of students' top preferred secondary school.
- An OLS model, with standard errors clustered at the school level, explained the competitiveness of the secondary school to which students were admitted.

  The OLS specification took the following form:

$$q_j = \gamma_0 + \gamma_1 m_i + \gamma_2 (m_i a_i) + \gamma_3 a_i + \sum_{k=4}^{n} \gamma_k x_{ki} + \epsilon_i \quad (1)$$

The dependent variable q_j is the measure of a secondary school's competitiveness, which we calculated as the average test score of all students applying to the school. In the first specification, we matched students with the dependent variable referring to first-choice school. In the second specification, students were matched to the school to which they were admitted. Looking at the right side of the equation, *m* refers to the variable indicating whether student *i* attended middle school or K-8 school, a_i is the student's individual score at the test, and x_4 to x_n depicts additional student characteristics. These characteristics included family status (single vs. both parents), migration experiences, special needs, the number of schools indicated in the admission system, final grades at the end of compulsory schooling, final test scores in three subjects, and whether they graduated with honours. To evaluate the effects of the reform, we included the interactions between school types and the origin school's mean performance level, alongside the individual student's relative performance within their origin school. We also visualised the results with marginal effects plots.

Logit regression to assess the chances of getting to the first-choice school

In the next step, we examined the quality of student-school matching by analysing how the reform affected students' likelihood of being admitted to their first-choice schools. We used a logit model with the binary dependent variable (success) defined as admission to their first-choice school.

Specification of the logit model was as follows:

$$log\frac{p_i}{1-p_i} = \beta_0 + \beta_1 m_i + \beta_2 (m_i\, a_i) + \beta_3 a_i + \sum_{k=4}^{n} \beta_k x_{ki} + \varepsilon_i \quad (2)$$

where p_i refers to the probability of a student being successful in their application to their most preferred secondary school. Other explanatory variables remained the same as for specification (1).

Data

This study used data from the admission system for Warsaw secondary schools in 2019. Data covered two full cohorts of students: the last graduates of middle schools and the first students to leave K-8 institutions. The available information consisted of students' achievements, which were used directly in calculating admission scores; these achievements included final school grades, standardised test scores, prizes in official academic contests, and certificates of special needs. For each student, the database identified the former school (K-8 or middle) and all secondary institutions to which they applied. One crucial piece of missing information was the student's gender, as this was not used in the admission process.

To obtain a single measure of students' performances at the end of school (K-8 and middle school, respectively), test scores for Polish and mathematics were standardised within cohorts (and thus within structural models of schooling), aggregated into a single variable, and again standardised.

Regarding the grades students received in middle or K-8 schools, we utilised the average final grade in 10 subjects taught in both institution types.

Table 1 shows descriptive statistics of the data on both cohorts.

Table 1. Descriptive statistics

Variable	Graduates of middle school		Graduates of K-8 school	
	Mean	Std deviation	Mean	Std deviation
Average school grade	4.10	0.94	4.17	0.92
Unstandardised test score (Polish and mathematics)	70.94	18.27	69.93	20.03
Number of selected secondary schools	9.90	6.56	9.99	6.59
Number of selected classes	15.80	15.11	15.79	15.31
	Percent of the respective cohort			
Admitted to any public secondary school in Warsaw	94.0		92.9	
Students living with both parents	78.1		80.5	
Graduating from non-public primary/middle school	5.2		7.1	
Students with SEN	1.7		1.8	
Graduating from primary/middle school outside Warsaw	7.2		7.3	
N	14,760		12,936	

Results

Decomposition of variance

Our analysis began by examining how students were distributed across schools before their transition to upper secondary education. We decomposed the variance of students' test scores to assess the level of total variability within and between schools. Separate assessments were undertaken for the cohorts who attended middle schools and those who attended K-8 schools (panels *a* and *b* of Table 2, respectively).

Intraclass correlations measure the proportion of total variability in exam scores attributable to differences at each level. In our dataset, 186 Warsaw-based middle schools sent students to 155 upper-secondary schools. In a parallel manner, the graduates of 301 Warsaw-based K-8 schools entered 150 upper-secondary schools with dedicated programmes for those following the K-8 curriculum. On average, middle schools were larger than K-8 schools (with an average of 64 vs. 45 graduates), yet were more varied in size (with a min/max of 1–358 and 1–209, respectively). As Table 2 shows, the shift from a two-level district and school system to a more integrated K-8 system appeared to decrease the test score variation attributed to between-school differences (from 38% to 25%). This demonstrates that the reform has achieved one of its goals, namely the reduction of student segregation early in their educational career (seventh to eighth grades).

Table 2. Results of the two-level and cross-classified multilevel models for origin and destination schools (empty models predicting standardised examination scores with no predictors) for pre-reform vs. post-reform arrangements

a) Middle schools

	Middle school	**First choice**	**Allocated school**		
	(1) Middle school	**(2) Secondary schools**	**(3) Cross-classified**	**(4) Secondary schools**	**(5) Cross-classified**
Fixed part					
_cons	0.0308	0.501	0.483	0.202	0.219
Random part					
sd(middle school)	0.6561		0.675		0.834
sd(secondary)		0.763	0.644	0.885	0.546
sd(residual)	0.829	0.677	0.256	0.567	0.180
N	11,949	11,949	11,949	11,303	11,303
Intraclass correlations					
2-level	0.385	0.559		0.709	
Same secondary and different middle/K-8 school			0.486		0.678
Same middle/K-8 school and different secondary			0.070		0.032
Same secondary and the same middle/K-8 school			0.557		0.709
Model fit					
AIC	30,004.0	25,265.3	24,397.5	20,042.0	19,465.3
BIC	30,026.2	25,287.4	24,427.1	20,064.0	19,494.7

* Only Warsaw-based schools were included in the analyses.

b) K-8 schools

	K-8 schools	**First choice**	**Allocated school**		
	(1) Primary schools	**(2) Secondary schools**	**(3) Cross-classified**	**(4) Secondary schools**	**(5) Cross-classified**
Fixed part					
_cons	0.012	0.498	0.499	0.209	0.221
Random part					
sd(primary)			0.758		0.902
sd(secondary)	0.528	0.793	0.648	0.9241	0.541
sd(residual)	0.902	0.674	0.212	0.558	0.153
N	13,612	13,612	13,612	12,745	12,745
Intraclass correlations					
2-level	0.255	0.581		0.732	
Same secondary and different middle/K-8 school			0.552		0.721

	K-8 schools	First choice	Allocated school		
	(1) Primary schools	(2) Secondary schools	(3) Cross-classified	(4) Secondary schools	(5) Cross-classified
Same middle/K-8 school and different secondary			0.043		0.021
Same secondary and the same middle/K-8 school			0.596		0.741
Model fit					
AIC	36,546.2	28,614.3	27,995.3	22,153.5	21,707.2
BIC	36,568.8	28,636.9	28,025.3	22,175.8	21,737.0

* Only Warsaw-based schools were included in the analyses.

Student stratification in terms of achievements became much stronger after the transition to upper-secondary school. This was visible in how students chose their top-preferred schools. If all student preferences came true, secondary institutions would be more homogenous than both K-8 and middle schools. Notably, the intraclass correlation based on these preferences was highly similar for graduates of K-8 and middle schools (0.56 and 0.58, respectively).

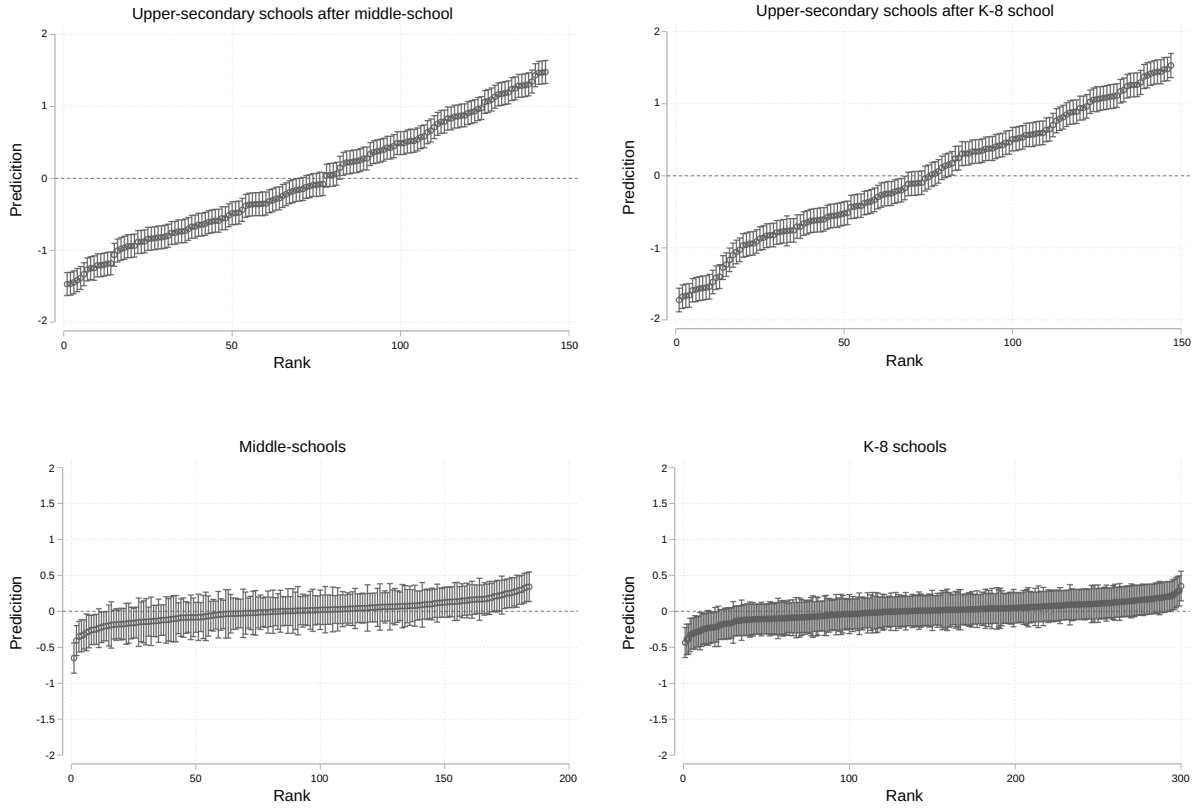

Figure 2. The caterpillar plot of ranked school random effects predictions with 95% confidence intervals from two cross-classified additive models: for middle and K-8 schools and the upper-secondary schools to which students were admitted – only Warsaw-based schools

When we compared pre-reform and post-reform scenarios accounting for students' preferences (first-choice school and the school to which they were admitted), we identified that the stratification was higher in the second case. This could be expected, given that students with high achievements have a greater chance of acceptance to their first-choice school. For the graduates of middle schools, we observed that 71% of the total variability could be attributed to schools. This share was similar in the case of the first graduates of K-8 schools, where schools accounted for 73% of the total variance of students' test scores, with the remainder being between students (residual)

(Table 2). The results from cross-classified models showed correlations representing the proportion of total variance in the standardised examination scores attributable to between-group differences for various school classifications. In both scenarios (preferred school and actual admissions), we observed a similar pattern in the correlations post-reform, with slightly stronger correlations for the performance of students who arrived to the same secondary schools after completing K-8 schools than those who graduated from middle schools.

The variability between schools and their deviation from the means at school level pre- and post-reform was illustrated using empirical Bayes estimates (or BLUPs) from the cross-classified models. Figure 2 presents the results for the two models estimated for the origin schools and those to which students were actually admitted. Schools were sorted from lowest to highest estimates of school means. Middle schools showed greater inequality than K-8 schools, but most school estimates were close to the mean. This contrasted with upper-secondary schools, which varied greatly, and more so in the case of graduates from K-8 schools, which was particularly evident in the group of schools with the lowest results.

Overall, the most striking finding from this part of the analysis was that although the reform held back the stratification of students aged 13 to 14 and caused them to graduate in more fragmented and diversified schooling, it ultimately contributed to a similar or slightly higher stratification level in upper-secondary schools.

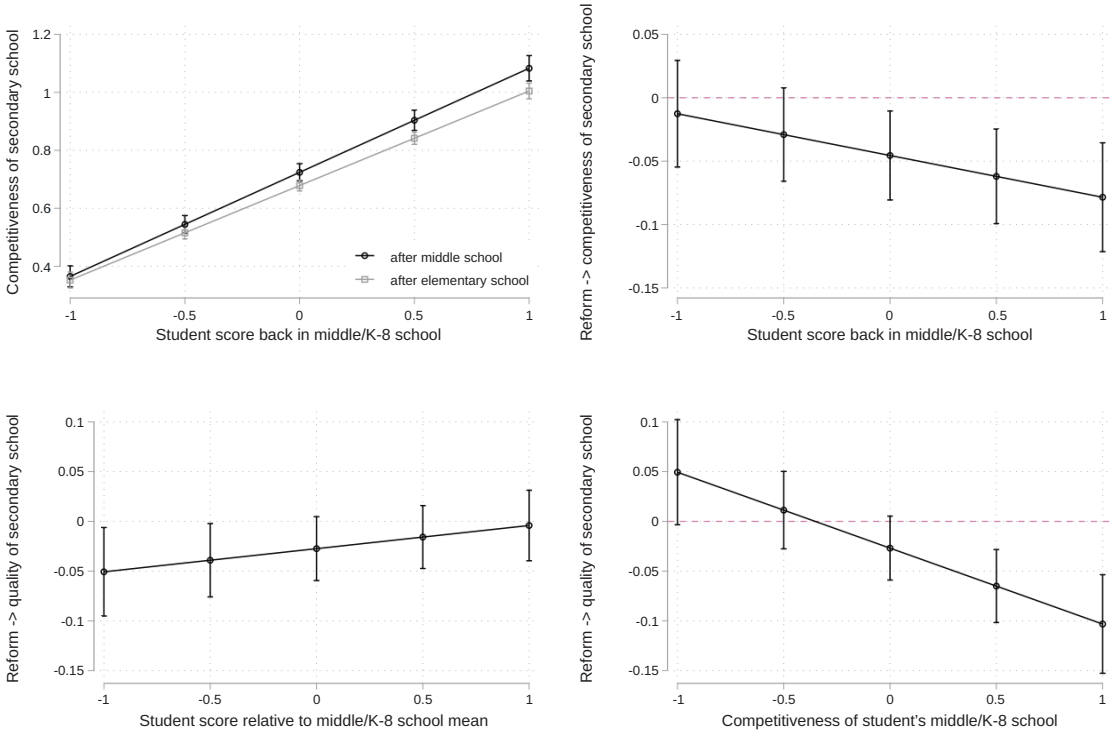

Figure 3. Marginal effects of the reform on the competitiveness of the student's top preferred secondary school

Competitiveness of the top preferred secondary school[2]

To understand better how the reform influences school selection dynamics we focus on the school competitiveness, defined as the average test score of all applicants to a school.

[2] While discussing the results in this section and the following sections, we will not refer to the parameters of regression models, as their interpretation is not always straightforward (particularly for logit models). Instead, we will discuss the marginal effects of the reform, as obtained in post-estimation procedures and visualised in Figures 3, 4, and 5. Full estimation results are available in the annexe (Table A1).

Figure 3 demonstrates that K-8 school graduates made slightly more conservative choices while selecting their first-choice school. On average, their first-choice school was less competitive (by 0.05 standard deviation) than the top choice of middle school graduates. Interestingly, this applies to students throughout the achievement distribution, although the "precaution" effect is stronger for high-achieving students. At the same time, aspiring to attend a secondary school with a better performing graduate became less linked to the quality of previously attended institutions post-reform. This was the consequence of more even achievement distribution between K-8 schools than between middle schools. Consequently, the average graduate of a high-performing K-8 school (one standard deviation above mean) placed a slightly weaker secondary school (by 0.1 standard deviation) as their first choice compared to the choices of a typical graduate from a similarly strong middle school. In turn, graduates from low-performing K-8 schools typically set more ambitious goals than their peers from poorly performing middle schools (see the bottom-right chart in Figure 3).

Competitiveness of the destination secondary school

Considering the competitiveness of the secondary institutions to which students ultimately qualified, the reform appears to have had a slightly adverse effect on most students. However, the negative effects are visibly stronger for high-performing students (see Figure 4). For students whose test scores were one standard deviation above the mean, a combination of a less ambitious choice and the reduced probability of being accepted into their first-choice school resulted in a drop in the expected competitiveness of a secondary institution by approximately 0.1 standard deviation. This effect was weaker for those with lower achievements on the test, although remained negative for most parts of the achievement distribution.

However, it is evident that the successful candidates to highly competitive secondary schools are now recruited from a broader range of K-8 schools than is the case for (already stratified) middle schools. As shown in the bottom-right chart of Figure 4, the expected competitiveness of the secondary school demonstrated a slight improvement for those completing a less-competitive school at the previous tier. At the same time, it decreased for those who attended a very prestigious institution at the compulsory education stage.

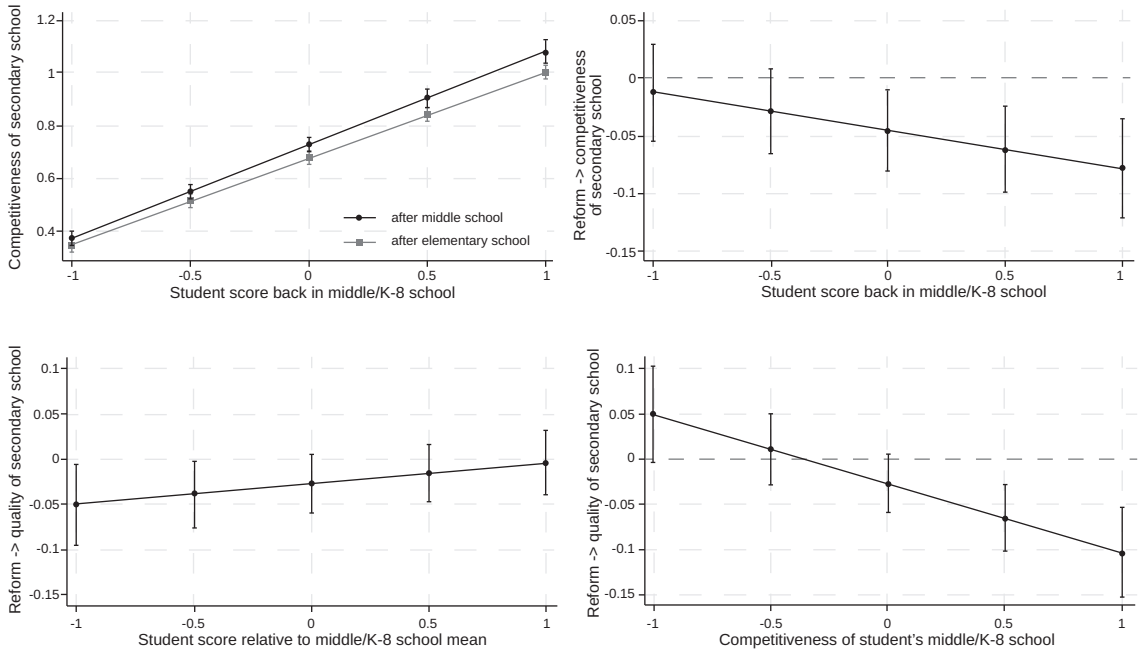

Figure 4. Marginal effects of the reform on the competitiveness of secondary school by which the student was accepted

Chances of getting to the top preferred school

In 2019, the average candidate to Warsaw secondary schools was admitted to their fourth most preferred school. However, this value was driven by a few candidates with many applications who were rejected from many schools before finally being accepted to one. Conversely, the median orderly number of accepted applications was two – both for candidates who graduated from middle schools and those from K-8 schools.

Compared to middle school leavers, the average student graduating from a K-8 school had a similar chance of acceptance by their most desired secondary school (see Figure 5). The predicted probability of success for an average student was about 42%, and the difference between K-8 graduates and middle school leavers – in favour of the latter cohort – was below two percentage points. This gap remained stable whether we considered students graduating from mediocre or very competitive K-8/middle schools.

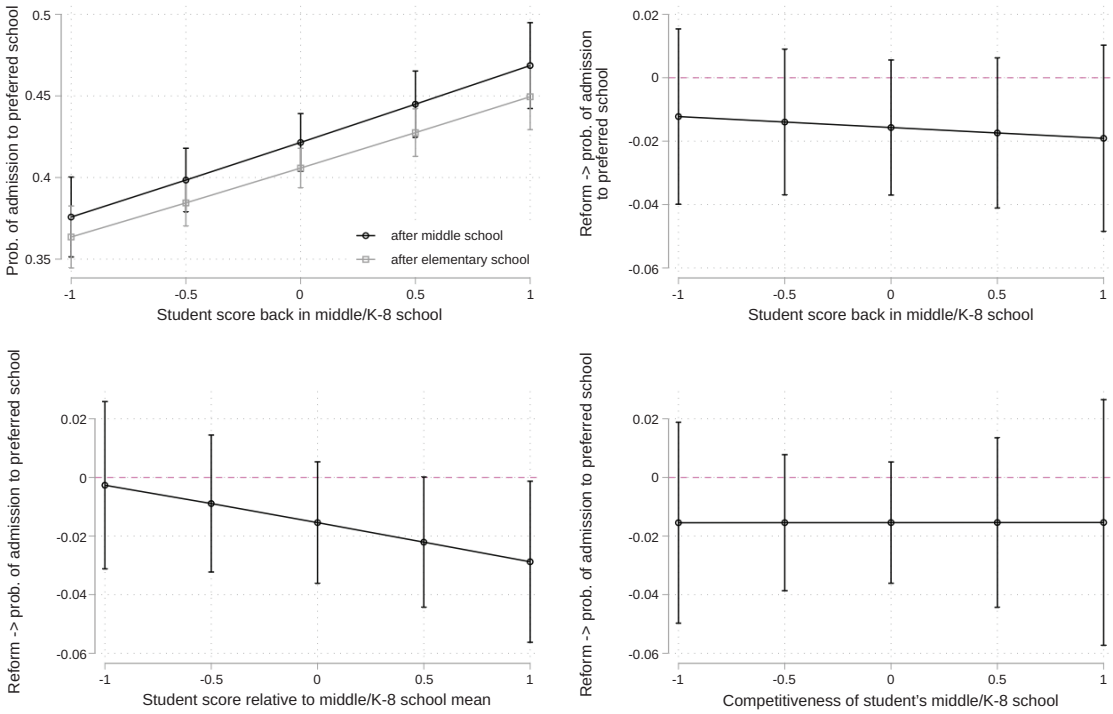

Figure 5. Marginal effects of the reform on the probability of admission to the most preferred school

Discussion and conclusions

The reform has achieved one of its goals, since it has resulted in reduced between-school stratification among students aged 13 to 14, which is now equivalent to seventh and eighth grades. This was possible due to the abolishment of sorting at entry to middle school.

Less satisfactorily, students graduating from K-8 schools typically have less ambitious goals when selecting their most preferred upper secondary school than middle school graduates. This is particularly applicable to those with above-average test scores, who may be less likely to aim for highly competitive secondary schools compared to middle school graduates. This result aligns with Schneeweis and Zweimüller's (2014) findings in regard to the Austrian schooling system. As these authors note, the reduced age for tracking students may affect their academic self-concept and downgrade their educational goals. On a more positive note, graduates from low-performing K-8 schools typically set more ambitious goals than their peers from poorly performing middle schools. This indicates that educational prospects after K-8 school may be less determined by the competitiveness of the school attended compared to the case under the old system.

Regardless of changes in student preferences, those graduating from the new K-8 schools appear to have similar chances of acceptance into their most preferred high schools as those of middle school graduates.

Overall, the reform appears to have resulted in reduced school segregation in the early stages of education. This may have benefited students who experienced learning difficulties in the early grades but had the potential to catch up and improve their performance in subsequent years. In the absence of segregation in middle schools, these students are able to continue their education in a more favourable environment, eventually gaining access to better upper secondary schools.

However, from a broader systemic perspective, K-8 graduates enter a secondary education system that remains as stratified as it was before the reform. This is demonstrated by the variance decomposition of test scores among students admitted to secondary schools. While the ultimate level of academic segregation remains similar under both systems, there is one key difference: middle school graduates experienced academic stratification earlier, beginning at their entry to middle school. Thus, the new K-8 structure has not achieved its goal of creating more equitable access to high-quality secondary education.

As with any academic work assessing an ongoing policy reform, our analysis has limitations. Firstly, we analysed the results of a complex reform comprising many simultaneous changes to the educational system. We were unable to fully isolate the effects of the reform's individual elements, although we expressed some evidence-based intuitions about the detailed mechanisms of change. Secondly, we benefited from the quasi-experimental setting of a transition year in which two student cohorts simultaneously entered secondary school. However, the focus on 2019 was restricted by the ability to observe only early responses to new circumstances. The situation in which the two cohorts of graduates transition to secondary schools may have somewhat affected students' choices. Once the new arrangements have "settled down", these choices may differ slightly. The analysis would require continuation to determine whether the observed patterns will be stable or will adjust in the longer term in successive cohorts of graduates. Additionally, focusing on the transitory year also implied that we were observing the behaviour of students and schools in conditions of unusual stress. Not only were the programmatic and logistic changes challenging for all stakeholders but the fact that the two cohorts transitioned to secondary school simultaneously increased competition between students – even if the admission procedure was formally split. Finally, the standardised examinations after middle and K-8 schools differed and were not comparable. Using standardised values, we could compare the relative situation of students in the distribution within a cohort but we were unable to draw analogies scores and variations between cohorts. Although the K-8 curriculum for the last grades was drawn from the educational material of middle schools (Karwowski & Milerski, 2020), there were also other curricular changes made. Moreover, the format and content of exams also changed, which may have affected students' motivation to study specific content and affected their test results.

Future analyses would benefit from more detailed information on schools, the characteristics of school neighbourhoods and students, which may affect the choices of parents and pupils, and, consequently, the stratification of the school system. Since we were only able to use data collected during the actual recruitment of students, we missed many variables that are known to affect both students' choices and achievements, including information on socioeconomic status or gender. We assumed that all unobservables had similar means and distribution for the two cohorts. Although it is likely to be true, additional characteristics would undoubtedly help to more comprehensively evaluate the outcomes of the reform.

Annexe: Results of logit regressions

Table A1. Results of logit regressions and OLS regressions with clustered standard errors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method of estimation	**Logit**	**Logit**	**Clust. OLS**	**Clust. OLS**	**Logit**	**Logit**	**Clust. OLS**	**Clust. OLS**
Dependent variable	**Gen. sec. school as preferred secondary**		**Competitiveness of most preferred secondary school**		**Admitted to most preferred secondary school**		**Competitiveness of ultimate secondary school**	
Individual characteristics								
Full family	0.044	0.029	0.0045	-0.000	0.0218	0.0294	0.0192*	0.016*
	(0.042)	(0.042)	(0.008)	(0.008)	(0.032)	(0.042)	(0.008)	(0.007)
Average school grades	1.012***	1.051***	0.324***	0.334***	0.226***	1.051***	0.416***	0.424***
	(0.041)	(0.038)	(0.00777)	(0.007)	(0.03)	(0.038)	(0.006)	(0.006)
Number of classes on preference list (log)	0.480***	0.450***	0.145***	0.137***	-0.745***	0.450***	0.089***	0.082***
	(0.031)	(0.031)	(0.006)	(0.005)	(0.0240)	(0.0305)	(0.005)	(0.004)
SEN	0.290*	0.335*	-0.184***	-0.171***	0.721***	0.335*	-0.031	-0.021
	(0.145)	(0.141)	(0.024)	(0.0235)	(0.103)	(0.143)	(0.027)	(0.027)
Test score	0.284***		0.265***		0.179***		0.320***	
	(0.054)		(0.0129)		(0.039)		(0.0106)	
Student's deviation from mean test score in previous school		0.124**		0.199***		0.124**		0.271***
		(0.042)		(0.008)		(0.044)		(0.009)
Previous school characteristics								
Previous school: outside Warsaw	-0.421	-0.186	-0.075	-0.025	-0.068	-0.186	-0.221**	-0.181**
	(0.537)	(0.549)	(0.0627)	(0.053)	(0.342)	(0.534)	(0.070)	(0.060)
Non-public	1.215***	0.978***	0.238***	0.148***	-0.324***	0.978***	0.128***	0.0575***
	(0.151)	(0.160)	(0.0170)	(0.0215)	(0.073)	(0.161)	(0.014)	(0.017)
K-8 (vs. middle school)	-0.145*	-0.192**	-0.0418**	-0.0478***	-0.062	-0.192**	-0.0771***	-0.081***
	(0.0681)	(0.064)	(0.0151)	(0.013)	(0.045)	(0.061)	(0.0120)	(0.010)
School mean test score		0.994***		0.488***		0.994***		0.490***
		(0.122)		(0.025)		(0.122)		(0.0216)
Interactions								
K-8 * Test score	-0.0045		0.003		-0.012		0.00422	
	(0.0533)		(0.011)		(0.0405)		(0.0110)	
K-8 * Previous school mean score		-0.319		-0.141***		-0.319*		-0.100***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method of estimation	**Logit**	**Logit**	**Clust. OLS**	**Clust. OLS**	**Logit**	**Logit**	**Clust. OLS**	**Clust. OLS**
Dependent variable	**Gen. sec. school as preferred secondary**		**Competitiveness of most preferred secondary school**		**Admitted to most preferred secondary school**		**Competitiveness of ultimate secondary school**	
		(0.163)		(0.028)		(0.152)		(0.025)
K-8 * Student's deviation from school mean		0.0810		0.052***		0.081		0.041***
		(0.0450)		(0.00904)		(0.046)		(0.010)
_cons	-3.879***	-3.875***	-1.702***	-1.706***	0.597***	-3.875***	-1.926***	-1.929***
	(0.174)	(0.176)	(0.0363)	(0.0322)	(0.133)	(0.172)	(0.029)	(0.029)
N	25,722	25,722	25,722	25,722	25,722	25,722	25,722	25,722
Pseudo R-sq/ R-sq	0.227	0.234	0.635	0.646	0.055	0.234	0.752	0.757
AIC	22,310.6	22,117.2	30,980.0	30,251.6	33,068.9	22,117.2	25,796.4	25,275.2
BIC	22,392.2	22,215.0	31,061.6	30,349.4	33,150.4	22,215.0	25,878.0	25,373.1

Standard error statistics adjusted for clustering at school (calculated using sandwich estimator) in parentheses
* p<0.05, ** p<0.01, *** p<0.001

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