BEYOND BORDERS

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The Effects of School Consolidation on Student Academic Achievement in High-Resource Urban Schools

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Abstract

School consolidation is often viewed as a strategy for improving educational quality while staying within budget constraints. This paper investigates the impact of school consolidation on student academic achievement in the context of high-resource urban schools, contributing to the ongoing discourse on the interaction between school size and students' socioeconomic status (SES). Using a quasi-experimental approach, the study analyzes data from 6,473 Moscow schools and their consolidations between 2013 and 2019.

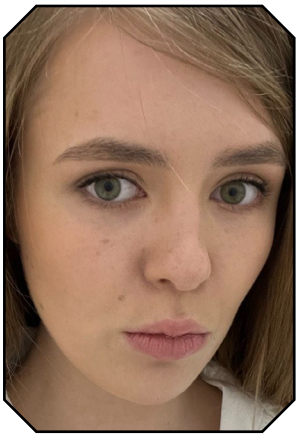
The findings reveal a U-shaped relationship between school size and student performance on the Basic State Examination: the highest achievement is observed in both the smallest and largest schools. The overall effect of consolidation on exam performance is slightly negative, suggesting that further consolidation may not significantly benefit schools with already sufficient resources. The timing of consolidation is critical — earlier consolidations are associated with lower student achievement compared to those implemented later. A negative shock in academic performance is also observed in the year immediately following consolidation; however, no delayed positive effects are detected within the observation period.

These results contribute to the policy debate on the effectiveness of school consolidation and highlight the importance of considering school size, SES, and implementation timing when assessing their influence on student outcomes. Further research is recommended to examine consolidation's effects on elective subjects and to assess its long-term consequences.

Keywords: school consolidation; school merger; student achievement; educational policy; short-term effects; long-term effects.

Introduction

School consolidation policies have garnered significant attention as a means of improving educational quality while operating within budgetary constraints [Zimmer et al. 2009]. The consolidation of schools with limited resource bases is believed to facilitate more efficient use of these resources, ultimately leading to improved educational effectiveness. Conversely, small schools are often regarded as ineffective and unprofessional [Berry, West 2010].



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However, studies investigating the impact of school size on student achievement reveal varying effects depending on students' socioeconomic status. Notably, the findings are contradictory: larger school sizes generally benefit more affluent students, while smaller schools tend to be more advantageous for students from lower socioeconomic backgrounds [Newman et al. 2006].

Within this context, evaluating the effectiveness of school consolidation policies is subject to biased sampling, as most consolidations target rural schools with limited resources and relatively low student socioeconomic status (e. g., [Howley 1996; Bickel, Howley 2000; Bickel et al. 2001; Johnson et al. 2002; Pang 2006; Guo 2007; Mei et al. 2013; Beuchert et al. 2018; Hannum et al. 2021; Hannum, Wang 2022]). Nevertheless, the effects of school consolidation remain contentious, with studies demonstrating both positive and negative impacts on student achievement [Benton 1992; Hall, Arnold 1993; Liu et al. 2010; Chen et al. 2014].

In light of these considerations, it becomes particularly important to examine the effects of merging schools within more advantaged contexts. An example of such a policy is the consolidation of capital schools in Russia, which commenced in 2012. As a result of these policies, the number of schools in Moscow decreased from 1,560 in 2011 to 697 in 2016. Concurrently, the average school size increased from 488 to 1,248 over the same period, while the average class size remained unchanged. Importantly, Moscow schools enjoy a privileged position compared to schools in other parts of the country, benefiting from greater access to resources and higher student socioeconomic status due to their metropolitan location. Nevertheless, the outcomes of this consolidation effort remain understudied.

The aim of this paper is to assess the effects of school consolidation on student educational achievement within the context of high-performing, high-resource urban schools. Our hypothesis posits that in relatively advantaged conditions with ample resources, school mergers yield limited benefit. Furthermore, we anticipate the presence of an initial shock in the years following the reform, associated with the need to restructure organizational processes.

With this in mind, we formulate the following research questions:

— What is the impact of consolidation on high-resource and advantaged urban schools?

— How do these effects vary across different waves of consolidation, and is there a cumulative effect resulting from experience?

— How do the effects of consolidation evolve over time, and is there a delayed emergence of positive effects?

To address these questions, we have assembled an extensive empirical database comprising 6,473 observations for the capital schools over a seven-year period, spanning from 2013 to 2019. Through the implementation of a quasi-experimental methodology, we have obtained robust results and estimated the short- and long-term effects of consolidation, accounting for the year of reform.

Our findings contribute to the ongoing discourse surrounding the efficacy of school consolidation policies by introducing the relatively unexplored context of high-resource urban schools. Additionally, our study underscores the significance of socioeconomic status in interpreting the implications of economies of scale.

School Consolidation Policy: An Overview of International Experience

School consolidation policy, as a practice of merging several small schools into one larger school, is often viewed as a means to improve efficiency through economies of scale. This policy has become common in various countries due to its potential benefits, including: reducing fixed costs, lowering levels of social segregation, and increasing educational opportunities and the overall quality of schooling [Self 2001; Kuziemko 2006; Berry, West 2010; Abalde 2014; Brummet 2014; De Haan et al. 2016].

School mergers are considered an optimal way to provide quality schooling under budget constraints [Zimmer et al. 2009]. Supporters of the consolidation movement view small schools as "inefficient" and "unprofessional" [Berry, West 2010]. This perspective helps explain the trend toward consolidation, especially in rural areas where small community schools are common.

One of the most significant school consolidation reforms in rural areas began in China in 2001, driven by the "A Decision to Reform and Develop Primary School Education" program, which aimed to enhance educational quality nationwide [Liu et al. 2010]. The program was a response to declining student numbers in rural schools, which had resulted from earlier demographic policies [National Bureau of Statistics 2006]. Consolidation involved closing small, remote schools and merging them with larger "central" schools, with the goal of improving resource efficiency and educational quality through economies of scale and budget subsidies.

Before the reform, elementary schools were present in nearly every Chinese village, with substantial variation in teacher qualifications, resources, and student populations [Pang 2006; Guo 2007]. For example, within a single province, some rural schools had fewer than a dozen students, while others had several hundred. The teacher-student ratio also varied widely across schools. Following the program's launch, provincial authorities developed consolidation plans, resulting in significant regional variation in implementation [Pang 2006]. As a result, the number of rural primary schools in China decreased by 24% from 2001 to 2005 [National Bureau of Statistics 2006], with an average of 25,000 school closures per year. Despite its scale, the program's outcomes were mixed and provoked considerable debate.

Large-scale school consolidation has also been a prominent trend in the United States since the 1930s. Initiated by a U. S. Department of Education brochure that outlined 150 school consolidations and their rationales — including increased demand for quality education, enhanced opportunities, and improved efficiency [Self 2001] — the number of U.S. school districts declined from nearly 130,000 in the 1920s to fewer than 15,000 by the early 2000s [Gordon, Knight 2008].

School consolidation efforts have differed in scale and timing across U.S. states. In Arkansas, a 2004 state decree requiring districts with fewer than 350 students to merge led to a contentious process [Richard 2004: 34]. In contrast, Iowa's consolidation was described as a "natural movement," driven by financial incentives. The 1980s farming crisis reduced the tax base and student population, prompting schools to consolidate for financial relief. The state further encouraged mergers by providing extra funding for coeducational programs [Gordon, Knight 2008]. Though these reforms aimed to improve education, results were mixed: while educational and extracurricular opportunities expanded, small-district consolidated schools experienced rising dropout rates.[1]

[1] See: Iowa Department of Education. (2005) *Annual Condition of Education Report*. Available at: https://educate.iowa.gov/media/1828/download?inline (accessed 15 May 2025).

Denmark's experience with school consolidation also offers valuable lessons for policymakers and researchers. Between 2010 and 2011, Denmark saw the closure, expansion, or merger of 312 out of 1,500 schools [Beuchert et al. 2018]. The aim was to improve low-performing schools in need of renovation, with policymakers expecting positive results from economies of scale [Kuziemko 2006; Berry, West 2010; Abalde 2014; Brummet 2014; De Haan et al. 2016]. Although the average size of consolidated schools increased from 70 to 230 students, the effectiveness of the reform remains uncertain.

This consolidation formed part of a broader 2007 reform that reduced the number of municipalities in Denmark. With a government-mandated ceiling on public spending during the financial crisis, schools faced budget constraints [Houlberg et al. 2016]. The assumption was that larger municipalities could better manage demographic shifts by reorganizing schools into larger, more resilient institutions [Bækgaard 2010]. Most consolidations occurred between 2010 and 2011, driven by budget negotiations and a declining number of school-aged children [European Commission… 2013]. Despite increases in average school size, class size, and student-to-teacher ratios, total school expenditures declined by 6.3% from 2009 to 2014, with cost savings largely used to offset mandated salary increases [Blom-Hansen et al. 2016].

While international evidence on school consolidation primarily focuses on rural and under-resourced contexts, the Russian case — particularly the Moscow reform — offers a distinct setting. In Russian academia, several studies have examined the implications of large-scale school consolidation in Moscow. A study by the HSE Institute of Education (2016)[2] revealed that while mergers improved access to high-quality resources and extracurriculars, they also led to growing disparities within newly formed school complexes and increased bureaucratic demands on staff.

Nikolaeva and Kazachkina [2018] explored the social impacts of these reforms, reporting more frequent pedagogical conflicts arising from organizational restructuring and changes in school hierarchies. Sibilev and Suraeva [2016], studying regional efforts, argued that consolidation can improve education quality—but only if supported by strong leadership and sufficient resources. Kukso [2017], examining the formation of territorial education complexes in Moscow, observed that while new institutional ties were formed, they often lacked depth and sustainability, suggesting that consolidation alone does not guarantee meaningful professional collaboration among educators.

Collectively, these studies emphasize the need to evaluate not only academic outcomes but also institutional dynamics and staff relations when assessing the true effectiveness of consolidation policies.

The Effects of School Consolidation Policy

Despite the widespread consolidation movement, the results of research assessing its effectiveness are difficult to describe as unambiguous. In part, this may be due to the predominance of debates in the media, where conclusions about the effectiveness of school consolidation are based on observations and, at best, expert opinion. On the other hand, the influence of political interests in education should not be underestimated, as budgetary concerns are often a primary driver of consolidation. In other words, it is impossible to draw clear conclusions about the success of this reform, despite the substantial body of literature on the topic. This is largely because only a small portion of the existing studies is supported by rigorous empirical evidence and appropriate methodology.

Another difficulty in evaluating the effectiveness of school consolidation policies lies in the presence of a latent factor: school size. The relationship between school size and student achievement has long been a

[2] See: HSE Institute of Education. (2016) *K chemu privelo sliyaniye shkol v Moskve* [What did the School Merger in Moscow Lead to?] Available at: https://ioe.hse.ru/news/195604938.html (accessed 15 May 2025) (in Russian).

subject of study. Research shows that large schools can offer students a wider range of educational and extra-curricular opportunities and support the development of teacher specialization [McGuire 1989]. Moreover, some researchers argue that large schools are more effective in terms of economic efficiency and curricular variety [Fox 1981; Walberg 1992], and that higher teacher turnover and socio-cultural diversity contribute to improved academic and non-academic outcomes [Smith, DeYoung 1988]. At the same time, small schools tend to provide a more personalized learning environment [Darling-Hammond 2000] and greater student and teacher engagement, which is associated with fewer disciplinary and attendance issues [Darling-Hammond et al. 2002]. In general, authors of meta-analyses conclude that the relationship between school size and academic achievement is most often nonlinear and U-shaped [Newman et al. 2006; Colegrave, Giles 2008]. Therefore, it can be assumed that creating overly large schools through consolidation may not only fail to improve educational outcomes, but may in fact worsen them.

Despite these challenges, some countries have attempted to quantitatively assess the effects of school consolidation reforms. For example, studies based on U. S. data have revealed both positive (increased academic performance, teacher salaries, and learning efficiency) [Benton 1992; Hall, Arnold 1993] and negative consequences. In particular, students at consolidated schools began dropping out more frequently — in Iowa, the dropout rate increased by two students per 1,000 following the reform [Gordon, Knight 2008]. The financial benefits were also questionable: accounting for additional organizational costs, the consolidation increased annual per-student spending by an average of $213. Other reported negative effects include increased bureaucracy, more disciplinary problems, and decreased parental involvement in education [Brantley 1983]. At the same time, studies have shown that mergers can be successful when there is responsible planning, effective communication, and engagement with the local community [Link 1971; Moray 1985].

Several studies from China indicate that the impact of school mergers on academic achievement may be moderated by students' age. For instance, consolidation had a negative effect on younger students, but a positive effect on fourth graders and older students [Liu et al. 2010]. Primary schools, in general, have become a scarce resource, and rural families' education expenses have risen due to increased travel time and transportation costs [Chan, Harrell 2009; Cai et al. 2017]. Researchers note that the consolidation program has contributed to increased spatial inequality: rural students now achieve lower academic outcomes compared to their urban peers [Chen et al. 2014; Hannum et al. 2021; Hannum, Wang 2022].

Studies on school consolidation reforms in Denmark also present mixed findings. Several reports indicate that, in the short term, consolidation results in statistically significant declines in student performance in reading and mathematics (e. g., [Beuchert et al. 2018]). However, these negative effects tend to dissipate within four years. Other studies, in contrast, highlight positive impacts on student achievement and reductions in school-level social segregation, attributing these outcomes to economies of scale [De Haan et al. 2016].

Based on the reviewed evidence, it is difficult to draw unequivocal conclusions about the effects of school consolidation reforms. The outcomes of such policies vary depending on a wide range of contextual factors and may change over time. In some cases, effects may only become apparent several years after schools are merged. These complexities make it difficult to assess the overall benefits of consolidation and underscore the need for further research that accounts for different implementation settings.

The review above allows us to formulate the following hypotheses in line with the research questions posed:

H 1. In high-resource and advantaged urban schools, the impact of consolidation may be limited or not clearly observable.

H 2. Consolidations carried out in the initial years of the policy may have been less effective than later ones, which could have benefited from gained experience and policy refinement.

H 3. The early years following consolidation may be associated with a short-term decline in student achievement, while positive effects may emerge in the long term.

Previous studies have employed various methodologies to examine the effects of school consolidation, including regression analysis (e. g., [Benton 1992; Hall, Arnold 1993]) and econometric models to assess academic performance and dropout rates (e. g., [Gordon, Knight 2008]). These studies typically focused on rural or under-resourced schools and relied on district- or county-level data. In contrast, this study uses a comprehensive dataset of over 6,000 Moscow schools (2013–2019) to examine consolidation effects in a high-resource urban context. Furthermore, while much of the literature addresses the overall impact of consolidation, this paper contributes by exploring the U-shaped relationship between school size and academic outcomes, with particular attention to the timing of consolidation events.

Institutional Context of School Consolidation Reform in Moscow City

In 2012, the city of Moscow initiated a large-scale reorganization of educational institutions, which included not only schools but also kindergartens, vocational training centers, and correctional facilities. This political initiative aimed to optimize the educational system and enhance the quality of learning experiences for students.

The scale of the reform was substantial: the number of schools in Moscow was reduced by half within four years, declining from 1,572 in 2012 to fewer than 700 by 2016. The most significant wave of reorganizations occurred between 2013 and 2015.

From a legal standpoint, the reorganization of Moscow's schools could take several forms:

— **Merger**: In this scenario, multiple schools are liquidated, and their assets, resources, and liabilities are transferred to an existing educational institution. One of the original schools becomes the legal successor to the others.

— **Consolidation**: Here, all participating schools are liquidated, and their assets and liabilities are transferred to a newly created legal entity. This entity may be based on one of the former schools and may inherit its legal address.

— **Renaming**: In this type of reorganization, a school is liquidated, and its resources are transferred to a newly established legal entity. No other institutions are involved in the process.

Moscow schools, compared to educational institutions in other regions, exhibit a notably higher level of prosperity, stemming from several factors. First, the city of Moscow benefits from greater access to financial and administrative resources, allowing schools to operate in a more favorable educational environment [World Bank 2018]. Second, the capital city has a higher socioeconomic status (SES) population, which contributes to the affluence and performance of its schools [Roscigno et al. 2006]. Finally, since school funding is allocated from municipal budgets (see: Federal Law no 273-FZ "On Education in the Russian Federation"[3]), per-student funding in Moscow exceeds that of other Russian regions, further boosting the resources available for educational purposes. Taken together, these factors help explain the relatively higher student outcomes observed in Moscow schools.

However, the Great Recession (2007–2012) triggered budgetary cutbacks across various sectors, including education. In response to this economic downturn, the Moscow Department of Education implemented a

[3] Available at: https://www.consultant.ru/document/cons_doc_LAW_140174/ (accessed 15 May 2025) (in Russian).

school financing reform, accompanied by a broader policy aimed at optimizing resource use (see: Decree of the Moscow Government no 86 2011 "On the Implementation of a Pilot Project for the Development of General Education in the City of Moscow"[4]). Nevertheless, during public discussion, another key objective emerged: improving educational outcomes and promoting equity among students across all city schools, a goal articulated in the concept of the Moscow Education Standard [Kaganov 2011]. Notably, the consolidation process was presented as voluntary, subject to the consent and input of parents and teachers from the schools involved. In practice, however, some cases of legal challenges and protests against forced consolidations were reported [Yakoreva 2014].

Despite the scale and importance of this reform, a comprehensive, evidence-based evaluation of its outcomes has not yet been conducted. Nonetheless, the city's mayor publicly praised Moscow schools' performance in the OECD Programme for International Student Assessment (PISA) in 2015 and 2018, attributing these successes in part to the consolidation of schools.[5] The results presented in this paper do not allow us to confirm or refute such claims; however, they do provide causal estimates of the impact of school consolidation policy on student exam performance.

Data and Method

Data and Preprocessing

The empirical basis of this study consists of schools' self-reports submitted as part of the annual statistical reporting between 2013 and 2019. The total sample includes 6,473 observations across seven years.

In studies analyzing school consolidation in the USA, data from 1930 to 1990 are most commonly used (e. g., [Berry, West 2010]). In contrast, this study relies on more recent data and a shorter observation period. However, research has shown that a four-year period is sufficient to assess the primary effects of reform [Eacott, Freeborn 2020].

The outcome variable in this study is the national Basic State Exam scores for 9th-grade students in two compulsory subjects: Russian Language and Mathematics. These scores were standardized to ensure comparability across subjects. The data were aggregated at the school level, which provided certain advantages but also introduced limitations. Aggregation may obscure important within-school variations in student performance, which would be more visible in individual-level data.

The year of school consolidation was used as the treatment variable. As control variables, we included the number of 9th-grade students taking the exam in each subject, as well as the average distance between the merged schools. The latter was calculated using geographic coordinates based on each school's official address.

Data on school consolidation, liquidation, and reorganization were obtained through the Rusprofile[6] counterparty verification service. Using this service, we established the presence of successor and predecessor institutions for each school and determined the year and sequence of consolidations. This method also allowed us to identify repeated consolidations, in which newly established schools later merged with additional institutions.

4 Available at: https://www.mos.ru/authority/documents/doc/10355220 (accessed 15 May 2025) (in Russian).

5 See: *Moskovskie shkoly priznany odnimi iz luchshikh v mire* [Moscow Schools are Recognized as among the Best in the World]. Available at: https://www.mos.ru/mayor/themes/15051/3505050/ (accessed 17 May 2025) (in Russian).

6 Available at: https://www.rusprofile.ru/ (accessed 15 May 2025) (in Russian).

To ensure the validity of our assessments, we transformed the original data and conducted the analysis at the level of synthetic organizations — entities created by averaging the indicators of consolidated schools before and after reform. Similar techniques have been used to evaluate the effects of university mergers [Agasisti, Egorov, Maksimova 2021; Agasisti, Egorov, Zinchenko, Leshukov 2021].

Accordingly, the final sample consists of three groups of schools:

— "Synthetic" schools before consolidation;

— "Synthetic" schools after consolidation;

— Schools not affected by the reform.

The resulting dataset is a panel structured by year, as the dependent variable — average school performance on the Basic State Exam — is recorded annually in accordance with exam frequency. However, a key limitation of this approach is its inability to account for potential variations in the timing of consolidations occurring within the same year. This limitation may overlook important nuances in how consolidation affects student outcomes, suggesting that future research should consider intra-year temporal variation for a more comprehensive analysis.

This approach enables retrospective evaluation of merged organizations as a weighted sum of their predecessor indicators, which helps maintain sample balance. The synthetic organizations method is beneficial for accounting for the complex transformations that occur during consolidation. By merging the characteristics of multiple institutions into a single analytical unit, this method captures the broader institutional effects of reform.

However, the synthetic organizations approach carries the risk of ecological fallacy, wherein conclusions about individual-level behavior are derived from aggregated group-level data. This can introduce bias or obscure important relationships, underscoring the need for caution when interpreting results. While this study focuses on school-level outcomes of consolidation policy, future research could benefit from incorporating student-level data to provide a more detailed and nuanced understanding of the policy's impact on individual academic achievement.

Estimation Strategy

The analysis was conducted in three steps, aligned with our research questions.

Firstly, we evaluated the overall impact of school consolidation on student achievement. To do this, we estimated fixed effects models, where the treated group comprised "synthetic" schools post-consolidation, and the control group included schools not affected by the reform [Allison 2009; Wooldridge 2016]. The fixed effects model accounts for unobserved, time-invariant characteristics that might influence student outcomes, thus providing a more accurate estimate of the treatment effect. For more robust results, we also analyzed the overall ATT (Average Treatment effect on the Treated), based on the year of consolidation [Callaway, Sant'Anna 2021] and the duration of treatment [Sun, Abraham 2021]. The ATT framework allowed us to quantify the average effect of school consolidation for treated organizations, offering key insights into the policy's efficacy. By incorporating both the timing and duration of consolidation into our models, we aimed to detect any temporal patterns influencing student achievement.

Secondly, we examined how the effects of consolidation varied across different years of reform, under the assumption that the effectiveness of mergers may differ by cohort. In this step, we calculated group-time average treatment effects for each consolidation cohort using the Difference-in-Differences with Multiple Time Periods decomposition technique proposed by Callaway and Sant'Anna [2021]. This method estimates causal

treatment effects in settings with multiple periods and staggered adoption of treatment. It compares outcome changes over time between treated and untreated groups, while accounting for heterogeneity in the timing of treatment. The key output of this method is the group-time average treatment effect, denoted ATT(g, t), which represents the average treatment effect in period t for the group treated in period g. Unlike the conventional approach of using a post-treatment dummy variable in two-way fixed effects models, ATT(g, t) provides a well-defined and interpretable causal parameter. These ATT(g, t) values can be aggregated to summarize heterogeneity along a specific dimension (e. g., treatment duration) or combined into a single average treatment effect.

Thirdly, we estimated variation in consolidation effects based on the time elapsed since the merger, under the assumption that short-term negative shocks may be followed by long-term positive effects. For this, we calculated group-time average treatment effects according to exposure length, using the decomposition method proposed by Sun and Abraham [2021]. Since researchers typically aim to estimate average treatment effects across l periods following treatment, it is common to report an average estimate over those l periods. However, this practice may misrepresent the dynamic treatment effect if it includes influence from unrelated periods. To avoid this issue, we applied the "interaction-weighted" (IW) estimator developed by Sun and Abraham. This approach first estimates Cohort ATT(e, l) using a regression model with cohort and relative period indicators. Then, it averages these estimates across cohorts to produce a robust effect size for each relative time period. Importantly, this method assumes parallel trends and no anticipation of treatment. IW estimators are straightforward to implement and are robust to cohort-level heterogeneity in treatment effects. For any relative period l, the IW estimator yields a convex average of Cohort ATT(e, l), weighted by each cohort's sample share. This method allows us to assess the degree of contamination introduced by assuming homogeneous effects when heterogeneity exists.

Overall, the Callaway and Sant'Anna [2021] method assumes that treatment effects are heterogeneous and vary based on the timing of adoption — for instance, reforms in certain years may have more pronounced impacts. The Sun and Abraham [2021] method, by contrast, assumes treatment effects may emerge gradually and depend on exposure duration. Together, these decomposition methods enable us to evaluate both the timing and duration dimensions of consolidation effects.

For both the second and third stages, experimental groups were formed based on the year of consolidation — all schools merged in the same year were grouped into the same experimental cohort. Two types of control groups were defined: (1) schools never affected by the reform ("Not treated"), and (2) schools not yet affected in a given year, but which would be consolidated later ("Not yet treated"). Thus, treatment and control groups were formed dynamically, reflecting both the timing and extent of policy exposure.

An advantage of this approach is its quasi-experimental design, which supports stronger causal inferences and helps mitigate common sources of bias. It also facilitates interpretation of heterogeneous effects across time and treatment intensity. However, the Difference-in-Differences with Multiple Time Periods method comes with limitations. It assumes that treatment is exogenous; if this assumption is violated, the estimates may be biased. Furthermore, the reliability of the estimates depends on the availability of appropriate comparison groups, which may be constrained in applied policy settings.

Results

The Relationship Between School Size and Student Achievement

The pooled data analysis of the relationship between school size and students' exam scores indicates a U-shaped pattern for both Russian Language (Fig. 1) and Mathematics (Fig. 2). In other words, the highest results were observed in both the smallest schools (with only 1–2 classes participating in the exam) and the largest schools (where the number of classes reached 20).

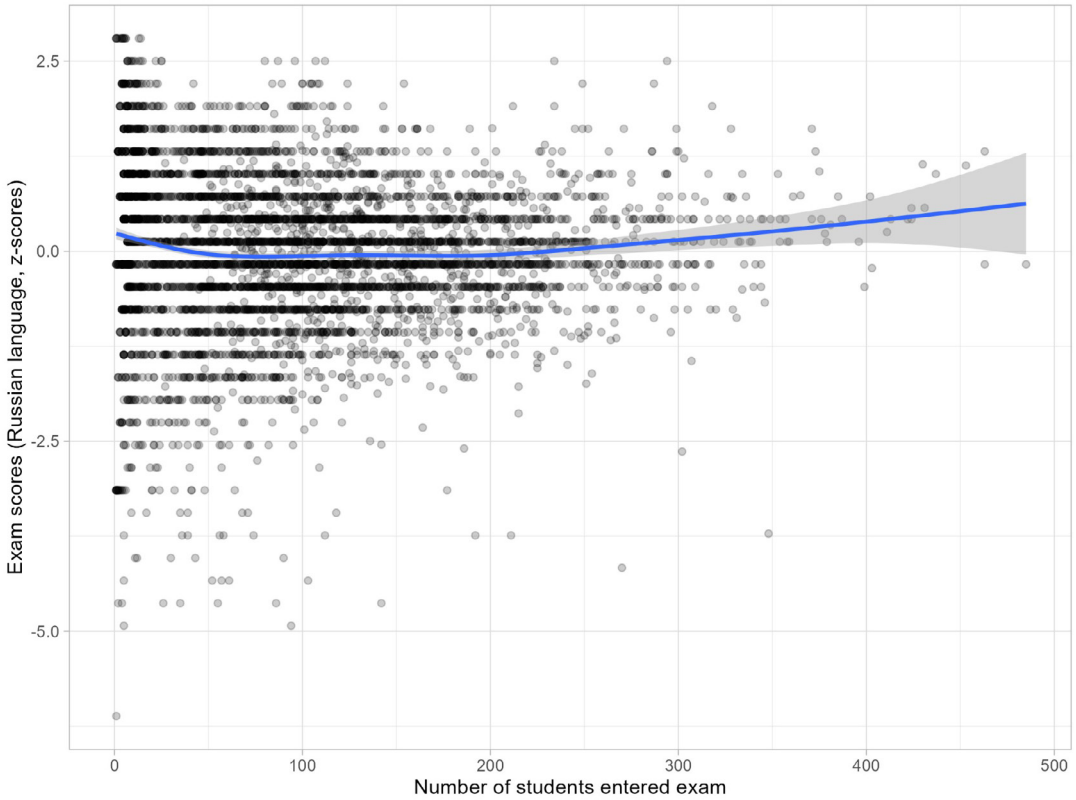

Fig. 1. Relationship between Students' Examination Scores and Number of Students Taking the Exam (Russian Language)

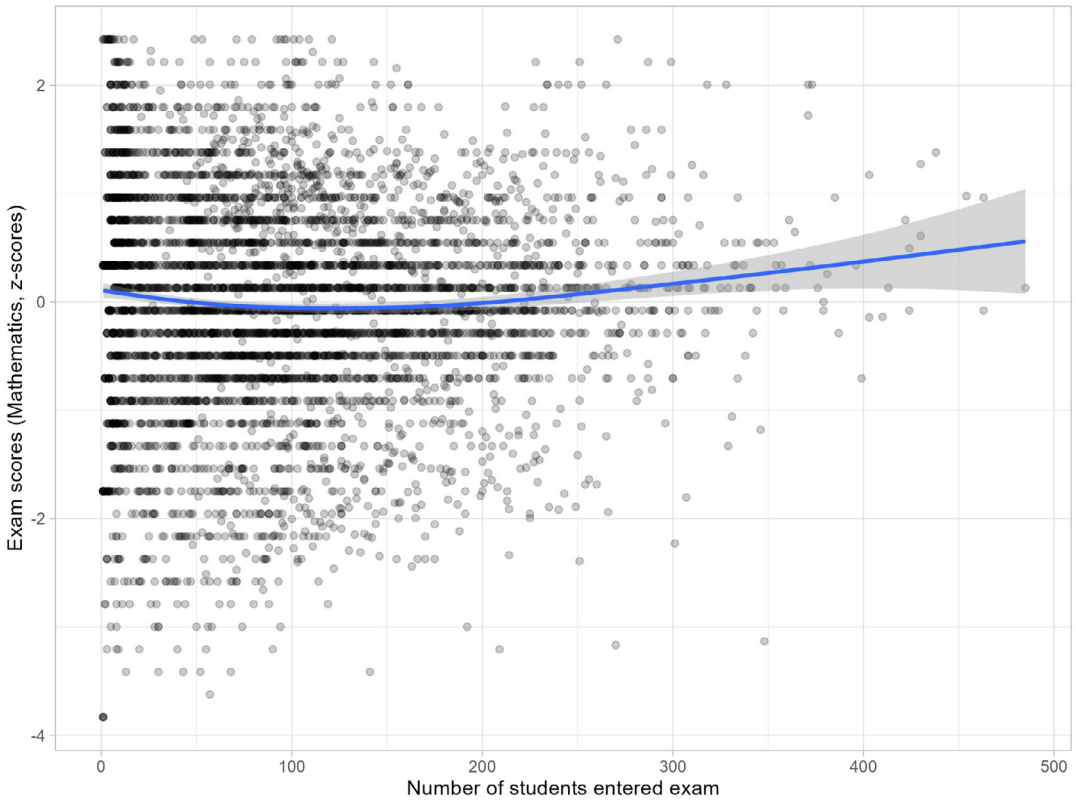

Fig. 2. Relationship between Students' Examination Scores and Number of Students Taking the Exam (Mathematics)

The Effect of School Consolidation Reform on Student Achievement

The fixed effects analysis revealed no statistically significant impact of the consolidation reform on students' standardized scores in either Russian Language or Mathematics (Table 1). However, the analysis of school size and educational outcomes produced weak but statistically significant findings. Specifically, the linear model showed a negative coefficient, suggesting that larger schools tend to have slightly lower average student performance.

Table 1

Results of the Fixed Effects Analysis

	Dependent variable:	
	Russian language Exam	Mathematics Exam
	[1]	[2]
Consolidation effect	0.008	– 0.043
	[0.041]	[0.032]
Number of students entered exam on Russian language	– 0.001***	
	[0.0003]	
Number of students entered exam on Mathematics		– 0.001***
		[0.0003]
Observations	5,115	5,110
n	802	802
Panels	7	7
R^2	0.004	0.002
Adjusted R^2	-0.184	– 0.185
F Statistic	7.586*** [df = 2; 4305]	5.353*** [df = 2; 4300]
Note:	*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$	

The cohort-based decomposition of school consolidation effects suggests a stronger, albeit statistically insignificant, negative impact of the reform when comparing consolidated schools with those that were never affected. However, when comparing early consolidations with later ones, a statistically significant and substantial negative effect was found for Mathematics exam scores (Table 2).

Table 2

Summary of ATT Estimates Based on Cohort Aggregation

Control Group	Subject	ATT	Std. Error	[95% Conf. Int.]	
Never Treated	Russian language	– 0.06	0.07	– 0.19	0.08
	Mathematics	– 0.10	0.05	– 0.20	0.01
Not Yet Treated	Russian language	– 0.17	0.10	– 0.36	0.01
	Mathematics	– 0.27*	0.08	– 0.43	– 0.10

*Signif. codes: * confidence band does not cover 0.*

Finally, the decomposition using dynamic aggregation yielded more robust results (Table 3). These results indicate statistically significant negative effects in the Russian Language exam when using never-treated schools as the control group. Additionally, significant negative effects were observed in both subjects when comparisons were made with schools that consolidated later.

Table 3

Summary of ATT Estimates Based on Dynamic Aggregation

Control Group	Subject	ATT	Std. Error	[95% Conf. Int.]	
Never Treated	Russian language	– 0.06*	0.06	– 0.18	0.06
	Mathematics	– 0.10	0.05	– 0.21	0.01
Not Yet Treated	Russian language	– 0.19*	0.09	– 0.36	– 0.02
	Mathematics	– 0.28*	0.07	– 0.40	– 0.15

*Signif. codes: * confidence band does not cover 0.*

Variations in Consolidation Effects Across Different Waves of Reform

The decomposition analysis showed that the earliest waves of consolidation produced more negative outcomes than the later ones (Table 4). This suggests that experience gained over time may have helped to mitigate, though not reverse, the negative consequences of the reform.

Table 4

Aggregate Group-Time Average Treatment Effects (Cohort Effects)

Treated Cohort	Control Group: Never Treated		Control Group: Not Yet Treated	
	Russian language	Mathematics	Russian language	Mathematics
2014	– 0.07 [0.07]	– 0.12 [0.06]	– 0.19 [0.10]	– 0.30* [0.08]
2015	0.08 [0.14]	0.04 [0.12]	– 0.17 [0.14]	– 0.21 [0.13]
2016	– 0.46 [0.65]	– -0.24 [0.51]	– 0.19 [0.65]	– 0.13 [0.47]
2017	0.21 [0.11]	– 0.20 [0.08]	0.05 [0.12]	– 0.22* [0.07]
2018	0.05 [0.30]	0.03 [0.24]	0.19 [0.25]	0.07 [0.20]
2019	– 0.27 [0.40]	– 0.10 [0.35]	– 0.27 [0.40]	– 0.10 [0.34]

*Signif. codes: * confidence band does not cover 0.*

Specifically, slight negative effects were observed for consolidations in 2014, 2016, and 2019, indicating small declines in exam results compared to schools that were not consolidated. In contrast, consolidations in 2015 and 2018 showed weak positive effects, though these were not statistically significant. For the 2017 cohort, an insignificant positive effect was observed in Russian Language, while Mathematics showed a negative effect.

Furthermore, when comparing early consolidations to those occurring later, the earlier waves generally demonstrated weak negative effects. Notably, statistically significant negative effects for Mathematics were observed in the 2014 and 2017 cohorts, indicating a performance decline compared to schools treated later.

Variations in Consolidation Effects Over Time

The decomposition of treatment effects by exposure duration revealed that early consolidations were associated with a short-term shock in the first year following reform. This effect was statistically significant and negative for both subjects (– 0.49 for Russian Language and – 0.85 for Mathematics).

Moreover, the magnitude of the negative effect increased as the duration of treatment extended, especially when compared to schools that were never consolidated (Table 5). These findings indicate that the most sub-

stantial drop in academic performance occurred during the early stages of reform implementation. Overall, the estimates provide no support for a delayed positive effect, as proposed in Hypothesis 3 (H 3).

Table 5

Aggregate Group-Time Average Treatment Effects (Dynamic Effects)

Years After Treated	Control Group: Never Treated		Control Group: Not Yet Treated	
	Russian language	Mathematics	Russian language	Mathematics
– 5	0.18 [0.38]	– 0.21 [0.37]	0.79 [0.45]	0.32 [0.39]
– 4	0.28 [0.34]	0.14 [0.22]	– 0.11 [0.31]	0.26 [0.27]
– 3	– 0.27 [0.27]	– 0.24 [0.27]	– 0.53 [0.24]	– 0.36 [0.29]
– 2	0.14 [0.37]	0.03 [0.26]	0.10 [0.32]	0.05 [0.27]
– 1	– 0.09 [0.15]	– 0.06 [0.11]	– 0.34 [0.27]	– 0.43 [0.28]
0	– 0.01 [0.09]	– 0.11 [0.07]	0.43 [0.40]	0.14 [0.25]
1	0.02 [0.07]	– 0.07 [0.06]	– 0.49* [0.09]	– 0.85* [0.19]
2	– 0.06 [0.08]	– 0.07 [0.06]	0.07 [0.14]	– 0.20 [0.09]
3	– 0.06 [0.09]	– 0.12 [0.07]	– 0.50* [0.10]	– 0.33* [0.07]
4	– 0.02 [0.08]	– 0.06 [0.06]	– 0.40* [0.06]	– 0.23* [0.04]
5	– 0.25* [0.09]	– 0.18 [0.07]	– 0.25* [0.09]	– 0.18* [0.07]

Signif. codes: `' confidence band does not cover 0.*

Discussion

The findings highlight the inconsistent effects of school consolidation reform in the context of high-performing, high-resource urban schools.

Our results confirm that, in advanced metropolitan schools, the relationship between school size and student outcomes follows a U-shaped curve, with the highest results observed in both the smallest and largest institutions. This finding contributes to the ongoing discussion on the interaction between school size and student SES, supporting the conclusion of Spielhofer et al. [2002], who found that optimal school size tends to be larger for schools serving disadvantaged populations. These findings are also in line with earlier research from the United States and United Kingdom, which shows that larger schools benefit more affluent students, while smaller schools offer advantages to students from lower SES backgrounds [Howley 1996; Bickel, Howley 2000; Bickel et al. 2001; Johnson et al. 2002; Newman et al. 2006].

The results also support Hypothesis 1 (H 1), indicating a slight negative overall effect of consolidation on student exam performance. This finding aligns with prior studies suggesting that consolidation may have more positive outcomes for rural schools than for urban schools [Chen et al. 2014; Hannum et al. 2021; Hannum, Wang 2022]. In high-resource environments, further consolidation may not lead to substantial gains. In fact, merged schools may perform no better—or even worse— than non-merged ones. Smaller schools may be more effective in meeting the specific needs of students by providing a more personalized and supportive learning environment. In contrast, larger schools may offer a broader range of opportunities that smaller schools lack. However, in the case of compulsory subjects, we find no evidence that increased access to resources in larger schools leads to improved achievement. Further research is needed to evaluate this hypothesis in relation to elective subjects.

The findings also lend support to Hypothesis 2 (H 2), revealing ambiguous and cohort-dependent effects of consolidation. Specifically, schools consolidated in the earlier stages of reform performed significantly worse than those merged later. These results correspond with prior research identifying an increase in bureaucracy,

discipline issues, and a decline in parental involvement as possible side effects of school consolidation [Brantley 1983]. At the same time, other studies suggest that mergers can be beneficial if guided by responsible planning, clear communication, and active engagement with the school community [Link 1971; Moray 1985]. Therefore, while the overall effect may not be statistically significant, the variation between early and later waves suggests that implementation processes — particularly pilot phases and accumulated experience — play a pivotal role in shaping reform outcomes.

Finally, we observed a short-term negative shock to student achievement in the first year following consolidation, offering partial support for Hypothesis 3 (H 3). This is consistent with Beuchert et al. [2018], who reported a significant decline in short-term student performance. However, we did not find evidence of a delayed positive effect, which could be due to the limited duration of our observation period — though previous studies have shown that a four-year window may be sufficient for capturing primary reform impacts [Eacott, Freeborn 2020].

Overall, our findings offer several practical implications for the implementation of similar policies elsewhere. The more pronounced negative effects observed during the initial phase of reform suggest that early implementations suffered from insufficient planning and a lack of empirical foundation for urban consolidation strategies. In contrast, as more experience was gained, the effectiveness of school mergers appeared to stabilize. This underscores the importance of pilot testing and gradual policy roll-out in future school consolidation efforts.

Additionally, these results stress the importance of timing when assessing the impact of consolidation. Further research is needed to uncover the underlying mechanisms behind these timing effects and to inform more effective and context-sensitive policy decisions.

Limitations

This study has several limitations, as previously acknowledged. The data were collected over a relatively short timeframe, although prior studies have shown that such a duration is adequate for preliminary evaluations of reform effects. Moreover, this research focused solely on academic outcomes, potentially overlooking other key dimensions of school consolidation.

The study also does not address the variability in student performance within educational complexes, which may exceed differences between schools. Another important limitation is that the research emphasizes the legal fact of merger rather than the sociological dynamics that follow. This focus prevents us from capturing the unique experiences and responses of different schools post-merger.

Future studies should explore the specific social contexts, implementation processes, and institutional consequences that emerge following school consolidation. A more detailed, multi-dimensional approach would allow for a richer understanding of both academic and organizational impacts.

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