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ABSTRACT

School district consolidation is one of the most widespread education reforms of the last century, but surprisingly little research has directly investigated its effectiveness. To examine the impact of consolidation on student achievement, this study takes advantage of a policy that requires the consolidation of all Arkansas school districts with enrollment of fewer than 350 students for two consecutive school years. Using a regression discontinuity model, we find that consolidation has either null or small positive impacts on student achievement in math and English Language Arts (ELA). We do not find evidence that consolidation in Arkansas results in positive economies of scale, either by reducing overall cost or allowing for a greater share of resources to be spent in the classroom.

INTRODUCTION

District consolidation has been one of the most prevalent education reforms over the last century. As a result of consolidation efforts, the number of public school districts in the U.S. declined from 117,108 to 13,551 between 1940 and 2018.[1] Despite the scale of this reform effort, relatively little rigorous research explores the effect of district and school consolidation on student achievement. For example, a 2002 literature review by Andrews, Duncombe, and Yinger shows most prior research focuses on the financial costs and benefits of consolidation, rather than student achievement. The studies included in this review find some evidence that district consolidation results in positive economies of scale.

While much of the early research exploits existing variation on school or district enrollment to estimate the effects of district size, several recent papers have looked more specifically at consolidation as an intervention. Here too, many authors have chosen to focus on outcomes other than achievement such as costs, housing prices, and teacher reactions (see Hu & Yinger, 2008; Duncombe & Yinger, 2007; and Nitta, Holley, & Wrobel, 2010). The few papers that investigate the impact of consolidation on student achievement have found mixed results regarding the direction, magnitude, and longevity of effects (see Bross et. al., 2010; Engberg et. al., 2012; Cooley & Floyd, 2013; Brummet, 2014; Humlum & Smith, 2015; De Hann, Lueven, & Oosterbeek, 2016; and Beuchert, et. al., 2016).

Unfortunately, the majority of these studies, both those examining existing variation in district and school size as well as those examining consolidation-induced changes in size, are susceptible to endogeneity issues. Existing variation in district and school enrollment is not randomly assigned. For example, some districts and schools are larger or smaller as a function of

[1] Table 214.10 in NCES's 2019 Digest of Education Statistics

their academic quality, a correlation implying biased estimation of the impacts of scale on achievement. In addition, districts and schools are rarely selected at random for consolidation. In such cases, unobserved characteristics associated with their academic quality are likely to be associated with the probability that a district or school is consolidated.

This paper leverages a natural experiment to understand the effects of consolidation on student achievement. Arkansas Act 60, passed in 2004, requires the consolidation of all districts with enrollment of less than 350 students for two consecutive years. We leverage the exogenous variation created by this policy change and the policy's clear enrollment threshold to learn about the effects of consolidation on student outcomes and district finances.

The remainder of this paper proceeds as follows. Section 2 provides some of the history and important details about Arkansas Act 60, which implemented mandatory district consolidation. Section 3 outlines the data used in this study. Section 4 describes our empirical method and Section 5 provides our results. Section 6 concludes.

ARKANSAS ACT 60

The latest wave of school consolidation in Arkansas arose in response to school finance litigation that occurred throughout the late 1990s and early 2000s. The decade-long litigation culminated in 2003 with the Arkansas Supreme Court ruling that the state's school funding system was unconstitutional in *Lake View School District vs. Huckabee*.[2]

Governor Mike Huckabee responded to the court's decision by convening the State Legislature in the Second Extraordinary Session of 2003. Governor Huckabee proposed large-scale school district consolidation to reduce district administrative costs and provide greater

[2] https://encyclopediaofarkansas.net/entries/lake-view-school-district-no-25-v-huckabee-4167/

educational opportunity for students. Governor Huckabee's original proposal would have resulted in three-fold reduction in the number of school districts in Arkansas. Compromise legislation was passed in early 2004. The Public Education Reorganization Act, Arkansas Act 60, required the consolidation of any district with average daily attendance of fewer than 350 students for two consecutive school years.[3]

The final enrollment threshold of 350 students, while not as drastic as the Governor's original proposal, did result in a substantial number of district consolidations in the years that followed. Table 1 presents the number of district consolidations occurring each year beginning with the 2004-05 school year. In the first year the law was in effect, 59 school districts were required to consolidate. Although Act 60 continues to have an impact as enrollments decline in rural districts, only a few districts have been required to consolidate since the initial wave in 2005.

Table 1: Districts Affected by Act 60

First Year After Consolidation	Number of Consolidated Districts	Number of Consolidated and Receiving Districts
2005	59	99
2006	2	4
2007	4	14
2008	--	--
2009	--	--
2010	1	2
2011	4	15

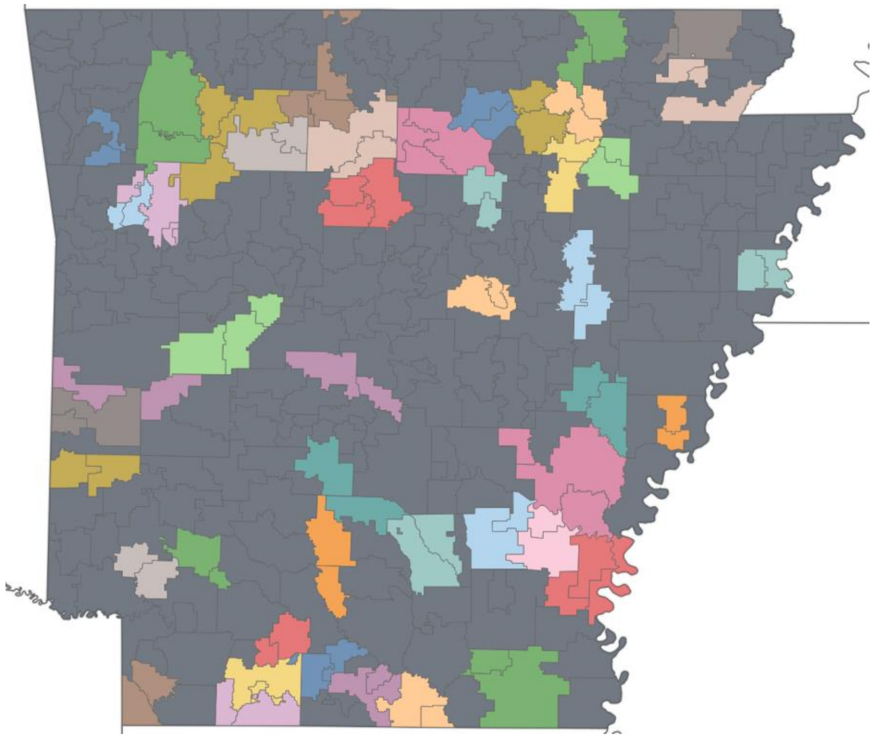
Source: Arkansas Department of Education

Figure 1 shows the geographic location and district borders of the 99 districts that were either a consolidated or receiving district in the 2004-05 school year. The map depicts district borders in the year prior to consolidation and districts are color-coded to indicate which districts combined due to Act 60. The initial round of consolidations was relatively widespread across the state, affecting districts in every region. Districts subject to Act 60 enjoy some autonomy in

[3] For the remainder of this paper, when we refer to Act 60 or an enrollment level of 350, we are specifically referring to a district's enrollment in the two years prior to the enactment Act 60.

determining which other district to merge with; however, the overwhelming majority have merged with adjoining district.

Figure 1: Map of Districts Consolidated due to Act 60



While Act 60 does not specifically require school closure following a consolidation, closures often occur to eliminate redundant course offerings and take advantage of potential economies of scale. Table 2 presents the number of school closures that occurred following a district consolidation. Unsurprisingly, consolidation has had a non-trivial impact on school closures. In total there 105 school closures occurred between 2005 and 2011.

Table 2: School Closures in Consolidated Districts

First Year Since Consolidation	Number of Schools Closed			
	Elementary	Middle	Secondary	Total
2005	5	--	11	16
2006	8	--	13	21
2007	16	4	15	35
2008	2	--	4	6
2009	8	--	1	9
2010	5	1	3	9
2011	4	--	5	9

Source: Arkansas Department of Education

DATA

Our analysis uses a rich panel of demographic and performance data for all students who took the Arkansas mathematics and English Language Arts (ELA) Benchmark exams between the 2001-04 and 2007-08 school years. We also have data on district and school enrollment collected from the Arkansas Department of Education (ADE) as well as information on district consolidation and school closure compiled with the help of ADE and district officials. We merge these data to create a master panel that includes roughly 200,000 records per year across grades three through eight, with multiple records for students across school years.

While consolidation occurs at the district level, our analysis is conducted using student-level data. We identify students as effected by consolidation if they were in a district that was forced to consolidate due to Act 60 in the 2004-05 school year, the first year the law was in effect, and continue to identify them as such for the remainder of their appearance in the data.

Arkansas did not begin testing third grade students until the 2004-05 school year. Since our empirical model, described in the section below, controls for previous year's test score, students in the fourth grade in 2003-04 are the youngest cohort in our analysis. Our study sample includes data from the 2003-04 school year through the 2007-08 school year, allowing us to follow all consolidation affected students through their last year of testing (i.e., 8th grade).[4]

EMPIRICAL MODEL

Endogeneity concerns prevent us from directly examining the effects of consolidation on student outcomes. In most cases, district consolidation occurs through selection - districts voluntarily choose to consolidate for any number of reasons such as perceived cost benefits or to take advantage of state financial incentives. Unfortunately, the very nature of this selection makes it likely that results in simple models comparing consolidated districts to unaffected districts will be biased. For example, if a poor performing district consolidates with a larger, higher performing district to take advantage of fiscal incentives, one might expect a decline in the overall average performance in the resulting district. This decline will be reflected in the estimated coefficients from a standard ordinary least squares (OLS) model but cannot be attribute to the causal effects of the consolidation itself. Fortunately, the natural experiment created by Act 60 allows us to use a regression discontinuity (RD) model to mitigate endogeneity concerns.

Estimating the achievement impacts of consolidation via regression discontinuity design

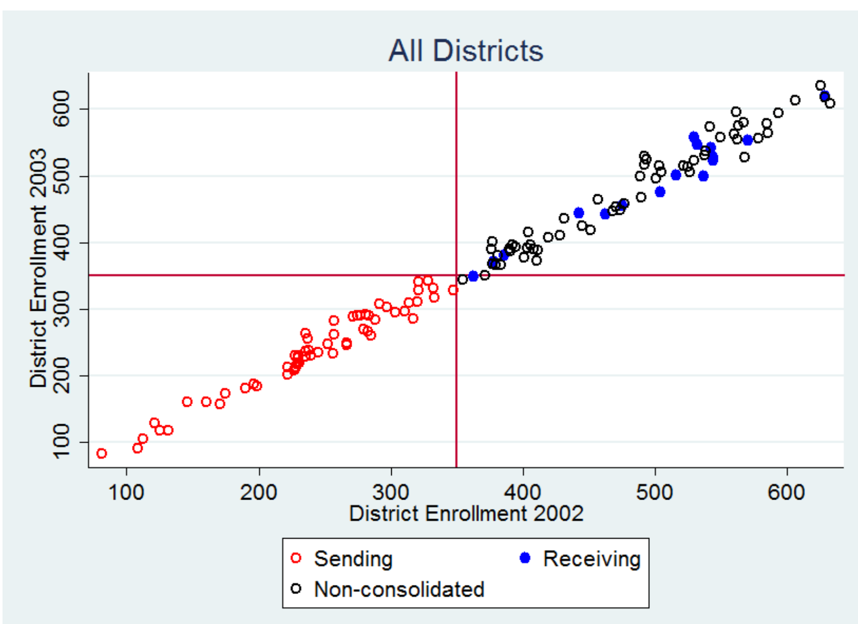
We examine the impacts of consolidation on student performance using a standard RD approach.[5] The explicit enrollment cut-off designated by Act 60 allows us to employ a sharp RD model whereby students in districts with enrollment of less than 350 in the two years immediately prior to the passage of Act 60 are assigned to the treatment group and students in the remaining

[4] Ending our study sample in 2007-08 drops a small number observations for students who appear in the data in subsequent years for various unknown reasons (e.g., grade repeaters). However, including these observations does not affect our results.
[5] For a more general treatment of regression discontinuity models, see Imbens, G.W. & Lemieux, T. (2008). Regression Discontinuity Designs: A Guide to Practice. *Journal of Econometrics*, 142.

districts represent the control group. If districts were able to game the forcing variable by either purposely avoiding or making themselves subject to the consolidation mandate, then it would undermine the sharp RD design. By limiting our analysis to consolidations that occurred in 2005, we eliminate the possibility of gaming because these consolidations were determined shortly after the law passed in 2004 and were based on 2002 and 2003 enrollment data, which districts had no ability to alter.

Figure 2 shows district assignment to treatment (i.e., consolidation) based on enrollment in the 2001-02 and 2002-03 school years. Three types of districts are represented in Figure 2: red circles represent districts forced to consolidate by Act 60 ("sending" districts); blue dots represent larger districts that merged with the consolidated districts ("receiving" districts); and black circles represent districts that were not affected by Act 60 consolidations. Districts in the lower left quadrant were below the Act 60 enrollment cutoff in both 2002 and 2003, and all of the red circles are in this quadrant. The clear division between the red circles and the other two types of districts in Figure 2 illustrates our ability to implement a sharp RD design.

Figure 2: Consolidation Treatment Assignment by Two-Year Enrollment



We estimate the achievement impacts of consolidation via RD using the following model:

$$Y_{it} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 C_{it} + \boldsymbol{E\theta} + \boldsymbol{X\gamma} + \rho + \epsilon_{it} \quad (1)$$

In this equation, *Y* represents student *i*'s standardized scale score on a state exam, C is an indicator variable for district consolidation due to Act 60, ***X*** is a vector of individual level controls (ethnicity, gender, etc.), ρ contains a set of grade and year indicators, and ε is random error. ***E*** is the "forcing" or "assignment" variable that determines whether or not one is subject to the treatment (Imbens & Lemieux, 2008; Reardon & Robinson, 2012). In our model, ***E*** is Euclidean distance based on student *i*'s district enrollment in the two years prior to the passage of Act 60 (i.e., 2001-02 and 2002-03) where the zero point is defined as enrollment of 350 in both years.[6] In order to fully capture any potential curvature in the relationship between district enrollment and achievement, ***E*** includes both linear and quadratic terms. β_2 represents our estimate of the effect of consolidation on student achievement. We estimate this model using a multilevel analysis in which students are nested within districts.

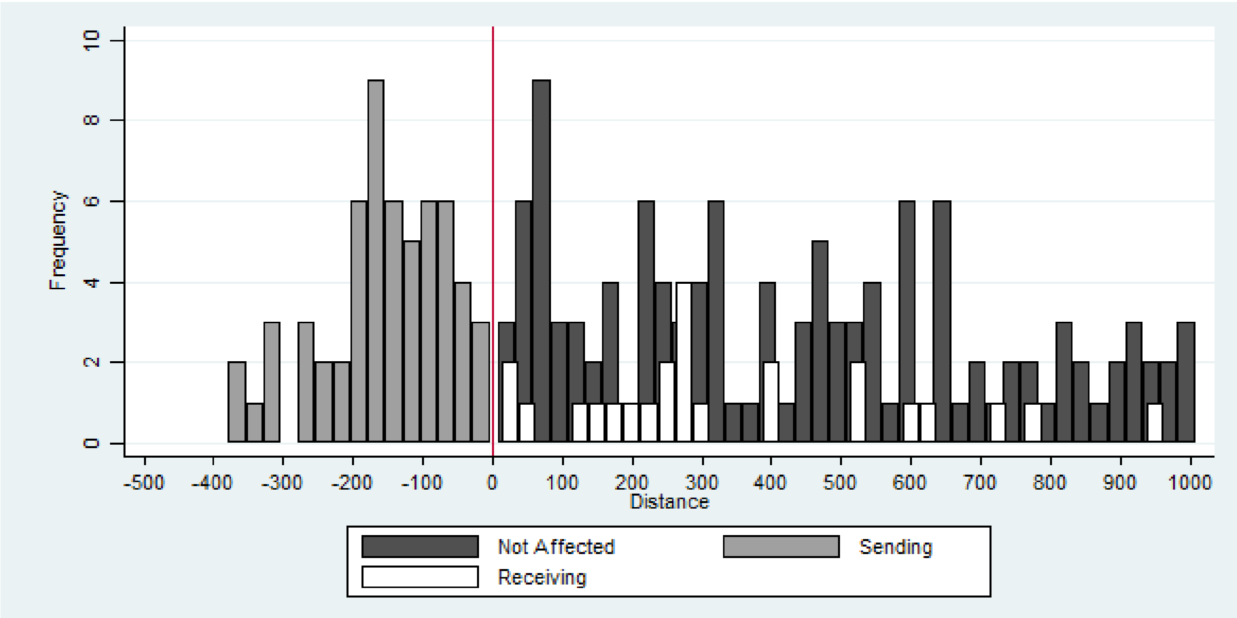
A key component of RD models is defining the local neighborhood around the cut-off within which we can reasonably assume local randomization. We face an important trade-off when setting the enrollment band that will define our sample: the wider the chosen band, the less appropriate the control group; the smaller the band, the less generalizable the results. We employ two mechanical bandwidth selection procedures to help inform our decision.[7] Based on the results, our preferred bandwidth is a distance of ± 380. Figure 3 presents the distribution of districts by values of the forcing variable, *E*. The mechanical bandwidth selection recommendation of 380

[6] Specifically, $E = \sqrt{(Enroll_{02} - 350)^2 + (Enroll_{03} - 350)^2}$. See Reardon and Robinson (2012) for more information on this method.

[7] We performed mechanical bandwidth selection calculations based on Calonico, Cattaneo, and Titiunik (2014a, b) and Ludwig and Miller (2007). Calculation results available upon request.

includes most of the districts affected by Act 60 in 2005. As a robustness check, we also provide results for distances of ± 60 and ± 120.

Figure 3: Distribution of Forcing Variable (E) by District Types



Note. Figure presents histograms of forcing variable, E, for three district types: [1] districts that were not affected by Act 60 in 2005 (dark gray), [2] districts forced to consolidate (i.e., "Sending districts") (light gray), and [3] districts who accepted sending districts in mergers (i.e., "Receiving districts") (white). Histogram bar width = 25.

Study sample

Using an RD procedure requires that we assume the exogenous Act 60 enrollment cut-off approximates random assignment of districts to the consolidation treatment in the immediate neighborhood of the cut-off. If this assumption is accurate, districts just above the Act 60 enrollment cut-off should be essentially the same as the consolidated districts just below the cutoff. We test this hypothesis, presenting averages for several key demographic variables for students in both the treatment and control groups for the ± 60 and ± 380 bandwidths in Table 3. The table also provides differences and the standard errors for those differences.

Table 3: Descriptive Statistics for Students in Consolidated and Non-Consolidated Districts

	Distance ≤ |60|				Distance ≤ |380|			
	Consolidated districts (N=599)	Other districts (N=1137)	Diff	*s.e.*	Consolidated districts (N=2932)	Other districts (N=7140)	Diff	*s.e.*
	Avg.	Avg.			Avg.	Avg.		
Female	0.53	0.51	0.02	0.02	0.51	0.49	0.02*	0.01
Ethnicity								
Black	0.02	0.24	-0.22**	0.08	0.17	0.13	0.04	0.05
Hispanic	0.00	0.02	-0.02***	0.01	0.01	0.03	-0.02**	0.01
White	0.98	0.74	0.24***	0.08	0.80	0.83	-0.03	0.05
Other	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01
Grade								
Fourth	0.31	0.30	0.01	0.02	0.31	0.32	-0.01	0.01
Sixth	0.36	0.36	0.00	0.02	0.35	0.33	0.01	0.01
Eighth	0.33	0.34	-0.01	0.01	0.34	0.35	0.00	0.01
Standardized achievement								
Math	0.10	-0.08	0.18	0.13	-0.04	0.01	-0.06	0.06
ELA	0.00	-0.05	0.05	0.11	-0.12	0.01	-0.13**	0.05
Forcing variable: *E*	-34.04	39.74	-73.78***	5.72	-126.05	186.91	-312.96***	15.22

Note. Analysis restricted to students in the 2003-04 school year. s.e. = standard errors that account for clustering of students within districts. Achievement is standardized within grade and year across all students in the testing data. *** - p<.01, ** - p<.05, * - p<.10

White students represent the majority in both samples and bandwidths, but for the smaller bandwidth, the treatment group has significantly fewer minority students compared to the control group. Both the treatment and control groups are relatively similar on the remaining variables for the ± 60 bandwidth. For the larger, preferred bandwidth, the treatment group has significantly fewer Hispanic students relative to the control group, and notably, has significantly lower ELA performance than the control group as well.

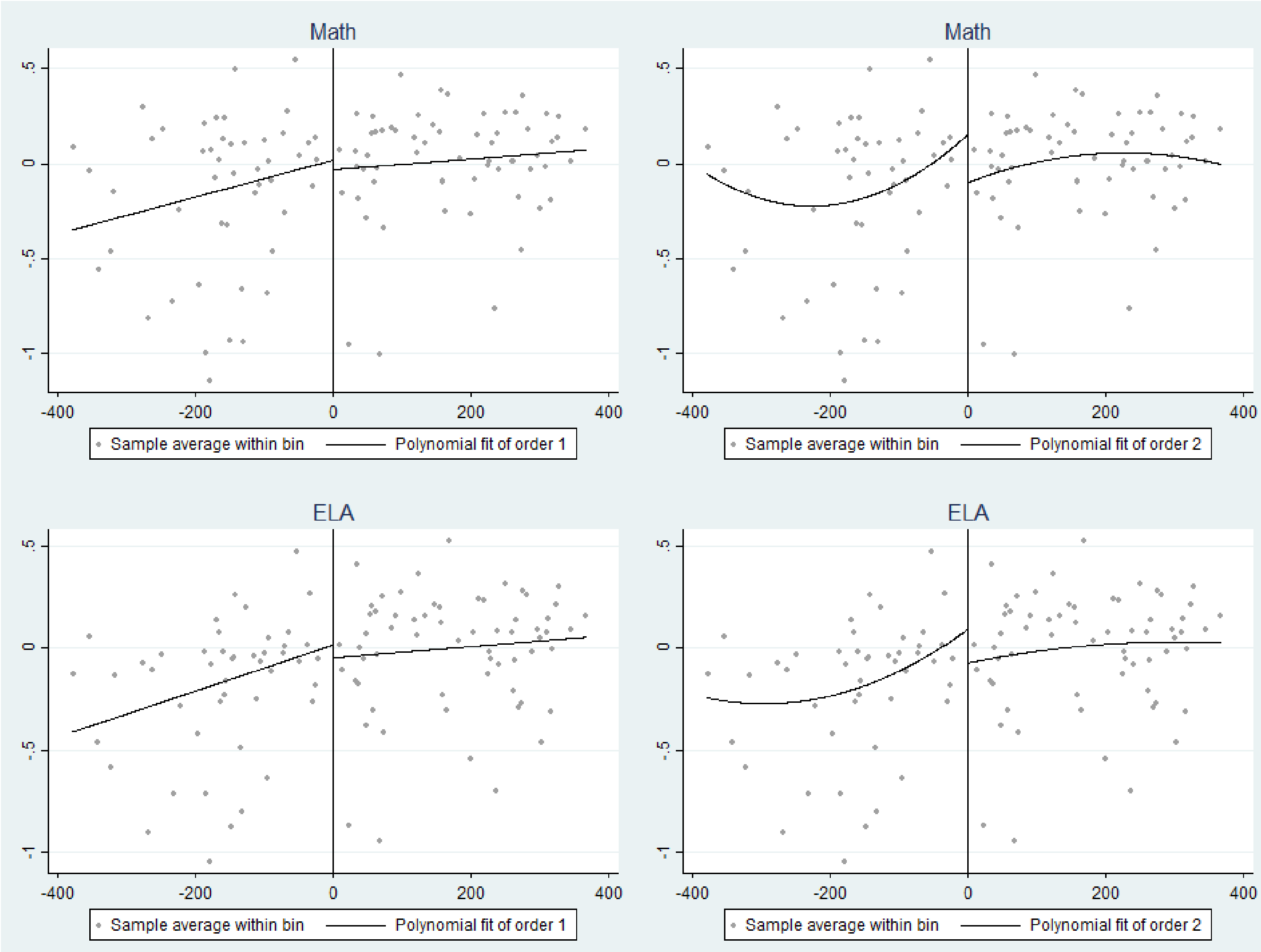
Even if our particular RD approximates random assignment at the level of school districts, it may not necessarily do so at the student level. Each district has a particular demographic profile and those just above and below the consolidation threshold may differ in important ways. While the differences between treatment and control group documented in Table 3 suggest caution in interpreting the RD results, they are not large enough to undermine the entire analysis.

RESULTS

Achievement impacts

First, we investigate if there is graphical evidence of a discontinuity in student achievement around the enrollment threshold one year after consolidation was implemented. Figure 3 displays both linear and quadratic fits of 2005 district-level Math and ELA achievement by our forcing variable. We generated similar plots for 2004-05 achievement gains that were quite similar to these plots (see Appendix Figure A1). While Figure 4 shows some evidence of a slight positive discontinuity at the enrollment threshold for both subjects, the difference in all cases appears relatively modest (i.e., less than 0.2 standard deviations).

Figure 4: District Achievement by Forcing Variable



Note. Figure presents distribution of standardized achievement in 2005 (i.e., one year post consolidation) by forcing variable, *E*.

To investigate the magnitude of these discontinuities, we use a multilevel mixed-effects model which allows students to be nested within districts. Table 4 presents estimates of the average impact of consolidation on student mathematics and ELA achievement, respectively. Coefficient estimates are presented with standard errors in parentheses. For each bandwidth, we include three separate models: 1) a simple model that only includes a consolidation indicator and linear version of the forcing variable, *E*, 2) a more complex model that adds lagged achievement and student level controls, and 3) a preferred specification which also adds the quadratic form of the forcing variable. Each of the regressions presented in Table 4 include grade and year fixed effects to control for systematic differences in student performance across these domains.[8] Table 4 includes students attending receiving districts (those that merged with Act 60 consolidated districts). As a robustness check, we estimated models that exclude students from receiving districts and find substantively similar results (see Appendix Table A2).

Table 4: Impacts of District Consolidation on Student Achievement

	Distance ≤ |60|			Distance ≤ |120|			Distance ≤ |380|		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Impacts on standardized math scores									
Consolidated	-0.784***	-0.239***	-0.304	0.024	-0.007	-0.011	-0.032	0.017	0.042*
	(0.156)	(0.090)	(0.306)	(0.074)	(0.039)	(0.076)	(0.030)	(0.016)	(0.025)
Unique students	4,369	3,597	3,597	9,053	7,452	7,452	26,057	21,288	21,288
Unique districts	198	191	191	248	242	242	261	260	260
Panel B. Impacts on standardized ELA scores									
Consolidated	-0.696***	-0.085	0.035	-0.023	0.015	0.058	-0.030	0.009	0.063***
	(0.158)	(0.071)	(0.245)	(0.076)	(0.033)	(0.065)	(0.032)	(0.014)	(0.023)
Unique students	4,369	3,597	3,597	9,053	7,452	7,452	26,057	21,288	21,288
Unique districts	198	191	191	248	242	242	261	260	260
Student characteristics		X	X		X	X		X	X
Linear forcing variable	X	X		X	X		X	X	
Quadratic forcing variable			X			X			X

Note. Unit of analysis is student-year. All models include grade and year fixed effects. Multi-level standard errors account for nesting within student and district. *** - P<.01, ** - p<.05, * - p<.10. *Source*: Authors' calculations.

[8] The estimated coefficients have been omitted from our reported results for the sake of space and are available upon request. Estimated coefficients for demographic variables and forcing variables are available in Appendix Tables A1a and A1b.

The estimated effect of consolidation on math is positive and marginally significant for the preferred 380 student bandwidth. Despite being marginally significant, the point estimate is relatively small (0.04 standard deviation units). A similar pattern is exhibited for the ELA results - insignificant results for smaller bandwidths and statistically significant, albeit practically small, positive effects (0.06 standard deviation units) for the preferred bandwidth of 380 students. Results are generally similar when we restrict the *E* bandwidth to ± 120; however, we observe statistically significant negative results in math for some models in the smallest bandwidth of $E \leq \pm 60$. We recommend caution in interpreting the latter results given the number of statistically significant differences in student characteristics presented in Table 3 for the smallest bandwidth.

It is possible that the impacts of consolidation vary over time especially if students require several years to adjust to their new surroundings. In Table 5, we examine how time impacts the estimated consolidation coefficient using a series of dummy variables that allow us to examine the non-linear impacts of time. As the results in Table 5 show, the consolidation impacts do not vary much over time. The results for math are mostly insignificant, except in the second year after consolidation in the largest bandwidth specification. For ELA, however, the coefficient is consistently positive and significant in the largest bandwidth and preferred model, which includes the quadratic form of the forcing variable. Here too, however, the coefficients are modest, ranging between 0.05 and 0.08 standard deviation units.

Table 5: Results Over Time

	Distance ≤ |60|		Distance ≤ |120|		Distance ≤ |380|	
	Linear model	Quadratic model	Linear model	Quadratic model	Linear model	Quadratic model
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Impacts on standardized math scores						
First year of consolidation	-0.2901***	-0.3498	-0.0530	-0.0557	-0.0269	-0.0018
	(0.0971)	(0.3082)	(0.0455)	(0.0791)	(0.0218)	(0.0288)
Second year of consolidation	-0.2438***	-0.3034	0.0021	-0.0009	0.0452**	0.0705***
	(0.0926)	(0.3074)	(0.0414)	(0.0770)	(0.0180)	(0.0262)
Third year of consolidation	-0.2433***	-0.3029	-0.0155	-0.0186	-0.0028	0.0225
	(0.0924)	(0.3070)	(0.0413)	(0.0770)	(0.0181)	(0.0262)
Fourth year of consolidation	-0.2046**	-0.2639	0.0118	0.0087	0.0257	0.0510*
	(0.0934)	(0.3075)	(0.0414)	(0.0772)	(0.0181)	(0.0262)
Panel B. Impacts on standardized ELA scores						
First year of consolidation	-0.0398	0.0778	0.0190	0.0627	0.0333*	0.0864***
	(0.0777)	(0.2459)	(0.0400)	(0.0686)	(0.0202)	(0.0266)
Second year of consolidation	-0.0970	0.0210	-0.0044	0.0396	0.0086	0.0618**
	(0.0730)	(0.2449)	(0.0359)	(0.0664)	(0.0166)	(0.0241)
Third year of consolidation	-0.1045	0.0132	0.0049	0.0491	0.0093	0.0624***
	(0.0730)	(0.2445)	(0.0359)	(0.0665)	(0.0167)	(0.0241)
Fourth year of consolidation	-0.0638	0.0540	0.0412	0.0855	0.0003	0.0535**
	(0.0739)	(0.2449)	(0.0360)	(0.0666)	(0.0167)	(0.0241)
Unique students	3,597	3,597	7,452	7,452	21,288	21,288
Unique districts	191	191	242	242	260	260

Note. Unit of analysis is student-year. All models include lagged student performance, student demographics, and grade and year fixed effects. Multi-level standard errors account for nesting within student and district. *** - P<.01, ** - p<.05, * - p<.10. *Source*. Authors' calculations.

In general, our preferred models—which include controls for student demographics—indicate impacts that are either null or small and positive. We find small positive statistically significant results, especially for ELA, when using the largest bandwidth and including the quadratic form of the forcing variable.

Economies of Scale

The primary motivation that policymakers articulated for consolidating smaller school districts in Arkansas was to achieve cost savings through economies of scale. Even if consolidation only had null-to-small positive effects on achievement, Act 60 would still be considered a success if consolidation reduced administrative and other spending outside of the classroom, freeing up resources for additional classroom spending or to be redirected toward other important public purposes.

Unfortunately, we cannot leverage the sharp enrollment threshold used in the previous analysis because districts subject to Act 60, in many cases, merged with districts above the threshold, and it is impossible to disentangle the finances of one from the other after consolidation. A difference-in-difference analysis has the potential to help us estimate causal impacts, but we need to secure better pre-consolidation finance trend data before that is feasible.

Instead, to investigate whether districts affected by consolidation experienced positive economies of scale we descriptively compare district-level spending trends before and after consolidation occurred. Table 6 presents a summary of financial information for districts affected by consolidation and Arkansas averages for even numbered school years between 2004 and 2008.

Table 6: Summary of District Financial Information

	2004			2006		2008	
	Act 60	All Affected	AR Avg	All Affected	AR Avg	All Affected	AR Avg
	(1)	(2)	(3)	(6)	(7)	(10)	(11)
Number of Districts	59	99	308	46	252	46	245
Median Area	115	148	147	343	166	351	171
Total Enrollment	13,370	63,712	422,787	62,885	432,371	62,139	433,333
Median Enrollment	232	288	678	911	891	909	924
Expenditures/Pupil	$7,573	$6,363	$6,475	$7,575	$7,687	$8,057	$8,256
Certified Teachers Share	40.9%	44.5%	45.4%	42.6%	42.4%	42.4%	42.1%
Other Certified (e.g., administration) Share	7.7%	6.3%	5.6%	6.0%	5.7%	6.2%	6.1%

In 2004, prior to consolidation, districts that would be forced to consolidate by Act 60 spent more on average, a lesser share on classroom teachers, and a greater share on other certified staff like administrators than did other school districts in Arkansas (see Columns 1-3 of Table 6). On the surface, this supports the argument that consolidation had the potential to deliver improvements through greater economies of scale.

The appropriate counterfactual, however, is to compare expenditure trends for districts affected by consolidation (both consolidated and receiving) to unaffected districts to see if affected districts exhibit substantial changes after consolidation that deviate from broader state trends. Columns 4-11 of Table 6 shows that Act 60 affected districts exhibit consistent resource allocation over time to both classroom staff and other certified staff (see last two rows of Table 6). While affected districts experienced increased spending per pupil, that trend did not deviate meaningfully from the overall state trend. Based on this simple, descriptive analysis we do not find evidence that Act 60 resulted in substantial positive economies of scale for affected districts.

CONCLUSION

This paper adds to our understanding of the effects of consolidation on student achievement and district finances by taking advantage of a natural experiment in Arkansas which occurred when policymakers required the consolidation of all districts with fewer than 350 students for two consecutive years. We find that consolidation had either null or small positive effects on the achievement of students whose districts were consolidated. In addition, we find no evidence that Act 60 resulted in positive economies of scale for affected districts. Overall, Act 60 does not appear to have helped Arkansas students much, but on the other hand, it did not harm them either.

It is important to note that our analysis treats all consolidations as homogenous, rather than heterogeneous, events. This is largely because our paper offers an analysis of the effect of a statewide mandatory consolidation policy rather than a study of individual district mergers. Nevertheless, we note that the evidence presented in this paper largely focuses on the average effect of consolidation on different types of students; and that these effects may certainly differ across district mergers.

It is possible that reducing the number of administrative units will pay dividends in the future, but it is also possible that larger districts are less responsive to the needs of individual communities, harming students down the line. These longer-term effects are as of yet unknown and could be a fruitful area for future study.

Other areas for future work include building out a causal analysis around cost, investigating the effect of consolidations on receiving districts, and investigating the impact of school closures that result from consolidation.

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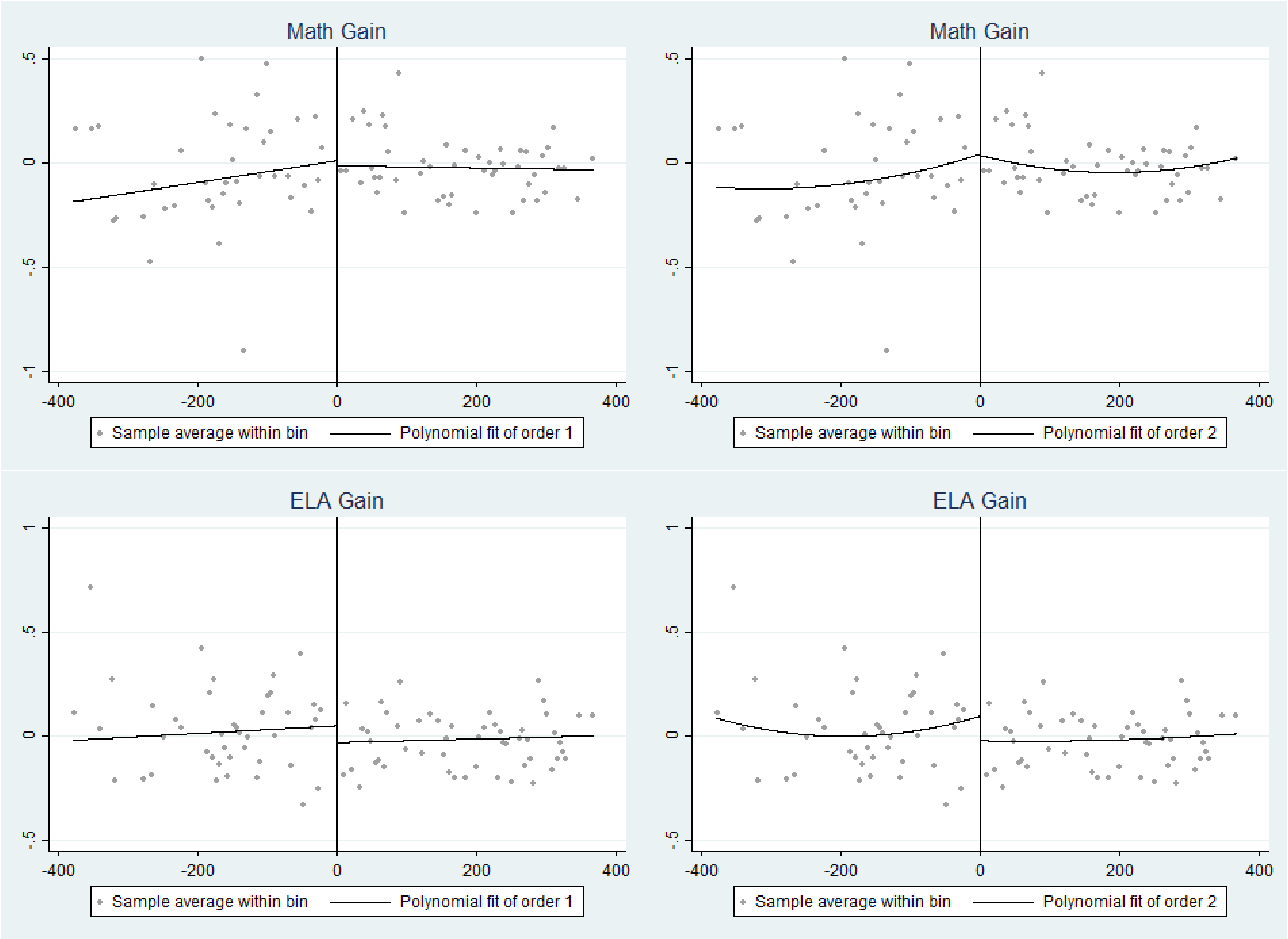
APPENDIX

Figure A1. *District Achievement Gains by Forcing Variable*



Note. Figure presents distribution of standardized achievement gains in 2005 (relative to 2004) by forcing variable, *E*.

Table A1a. *Impacts of District Consolidation on Student Standardized Math Scores*

	$E \leq \|60\|$			$E \leq \|120\|$			$E \leq \|380\|$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Consol.	-0.784***	-0.239***	-0.304	0.024	-0.007	-0.011	-0.032	0.017	0.042*
	(0.156)	(0.090)	(0.306)	(0.074)	(0.039)	(0.076)	(0.030)	(0.016)	(0.025)
Lagged achieve.		0.729***	0.728***		0.729***	0.729***		0.735***	0.735***
		(0.008)	(0.008)		(0.005)	(0.005)		(0.003)	(0.003)
Female		0.032**	0.033**		0.037***	0.037***		0.036***	0.036***
		(0.013)	(0.013)		(0.009)	(0.009)		(0.005)	(0.005)
Black		-0.105***	-0.105***		-0.099***	-0.098***		-0.105***	-0.104***
		(0.025)	(0.026)		(0.016)	(0.016)		(0.010)	(0.010)
Hispanic		0.091	0.088		0.042	0.043		0.066***	0.066***
		(0.059)	(0.059)		(0.040)	(0.040)		(0.019)	(0.019)
Other		0.040	0.041		-0.011	-0.010		0.016	0.017
		(0.038)	(0.038)		(0.027)	(0.027)		(0.014)	(0.014)
FRL		-0.106***	-0.106***		-0.112***	-0.112***		-0.095***	-0.095***
		(0.015)	(0.015)		(0.010)	(0.010)		(0.006)	(0.006)
ELL		0.036	0.031		0.025	0.025		-0.037	-0.036
		(0.154)	(0.155)		(0.093)	(0.093)		(0.034)	(0.034)
E	-0.003*	-0.002*	0.008	0.002**	0.001	0.000	0.000	0.000	0.000
	(0.002)	(0.001)	(0.005)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Consol. X *E*	-0.014***	-0.002	-0.022	-0.002*	-0.001*	0.000	0.000**	0.000**	0.001**
	(0.004)	(0.002)	(0.017)	(0.001)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)
E^2			0.000*			0.000			0.000
			(0.000)			(0.000)			(0.000)
Consol. X *E*^2			0.000			0.000			0.000
			(0.000)			(0.000)			(0.000)
Unique students	4,369	3,597	3,597	9,053	7,452	7,452	26,057	21,288	21,288
Unique districts	198	191	191	248	242	242	261	260	260

Note. Unit of analysis is student-year. All models include grade and year fixed effects. Multi-level standard errors account for nesting within student and district. *** - p<.01, ** - p<.05, * - p<.10
Source. Authors' calculations

Table A1b. *Impacts of District Consolidation on Student Standardized ELA Scores*

	$E \leq \|60\|$			$E \leq \|120\|$			$E \leq \|380\|$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Consol.	-0.696***	-0.085	0.035	-0.023	0.015	0.058	-0.030	0.009	0.063***
	(0.158)	(0.071)	(0.245)	(0.076)	(0.033)	(0.065)	(0.032)	(0.014)	(0.023)
Lagged achieve.		0.775***	0.776***		0.773***	0.773***		0.782***	0.782***
		(0.007)	(0.007)		(0.005)	(0.005)		(0.003)	(0.003)
Female		0.106***	0.106***		0.094***	0.094***		0.097***	0.097***
		(0.013)	(0.013)		(0.009)	(0.009)		(0.005)	(0.005)
Black		-0.102***	-0.103***		-0.111***	-0.112***		-0.099***	-0.098***
		(0.022)	(0.022)		(0.015)	(0.015)		(0.009)	(0.009)
Hispanic		0.109**	0.108**		0.051	0.051		0.042**	0.042**
		(0.054)	(0.054)		(0.038)	(0.038)		(0.018)	(0.018)
Other		-0.010	-0.009		-0.007	-0.009		0.005	0.006
		(0.034)	(0.034)		(0.025)	(0.025)		(0.013)	(0.013)
FRL		-0.097***	-0.097***		-0.093***	-0.093***		-0.083***	-0.083***
		(0.014)	(0.014)		(0.009)	(0.009)		(0.006)	(0.006)
ELL		-0.159	-0.163		-0.044	-0.045		-0.102***	-0.101***
		(0.140)	(0.140)		(0.087)	(0.087)		(0.032)	(0.032)
E	0.000	0.001	0.003	0.002**	0.001	0.002	0.000	0.000	0.001***
	(0.002)	(0.001)	(0.004)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Consol. X *E*	-0.018***	-0.004**	-0.002	-0.003***	-0.001*	-0.002	0.000*	0.000	0.000
	(0.004)	(0.002)	(0.014)	(0.001)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
E^2			0.000			0.000			0.000**
			(0.000)			(0.000)			(0.000)
Consol. X *E*^2			0.000			0.000			0.000***
			(0.000)			(0.000)			(0.000)
Unique students	4,369	3,597	3,597	9,053	7,452	7,452	26,057	21,288	21,288
Unique districts	198	191	191	248	242	242	261	260	260

Note. Unit of analysis is student-year. All models include grade and year fixed effects. Multi-level standard errors account for nesting within student and district. *** - p<.01, ** - p<.05, * - p<.10

Source. Authors' calculations

Table A2. *Robustness Check: Exclude Students in Receiving Districts*

	Distance ≤ |60|		Distance ≤ |120|		Distance ≤ |380|	
	With Receiving Districts	Receiving Districts Omitted	With Receiving Districts	Receiving Districts Omitted	With Receiving Districts	Receiving Districts Omitted
	(1)	(2)	(3)	(4)	(7)	(8)
Panel A: Math results						
Linear model	-0.2392***	-0.1283*	-0.0071	-0.0185	0.0167	0.0109
	(0.0900)	(0.0748)	(0.0388)	(0.0336)	(0.0156)	(0.0147)
Quadratic model	-0.3044	-0.4359*	-0.0114	0.0042	0.0418*	0.0201
	(0.3062)	(0.2489)	(0.0756)	(0.0655)	(0.0245)	(0.0229)
Unique students	3,597	3,219	7,452	7,211	21,288	18,755
Unique districts	191	198	242	247	260	261
Panel B: ELA results						
Linear model	-0.0846	-0.0667	0.0145	0.0139	0.0094	0.0141
	(0.0705)	(0.0641)	(0.0333)	(0.0296)	(0.0143)	(0.0134)
Quadratic model	0.0349	-0.181	0.0575	0.0278	0.0627***	0.0452**
	(0.2445)	(0.2143)	(0.0651)	(0.0576)	(0.0225)	(0.0209)
Unique students	3,597	3,219	7,452	7,211	21,288	18,755
Unique districts	191	198	242	247	260	261

Note. Unit of analysis is student-year. Linear model controls for forcing variable with a linear specification. Quadratic model controls for forcing variable with a quadratic specification. All models include grade and year fixed effects. Multi-level standard errors account for nesting within student and district. Source. Authors' calculations.