BROOKINGS

AUGUST 2025

SUPPLEMENTARY APPENDIX

DECLINING PUBLIC SCHOOL ENROLLMENT

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Data

Our analysis uses data from the Common Core of Data of the National Center for Education Statistics ("CCD"), the Small Area Income and Poverty Estimates of the Census Bureau ("SAIPE"), the Population Division of the Census Bureau ("Census"), and the Private School Universe Survey of the National Center for Education Statistics ("PSS"). The CCD data includes detailed school-by-year data from the 2011-12 school year and continuing through the 2023-24 school year (NCES, nda). Each school has location information, status indicators, operational status, and enrollment disaggregated by race and sex. The SAIPE data includes district-level student-age population and student poverty counts from 2011-12 through 2023-24 (Census, ndb). The Census data from the Population Division projects the expected school-age population in the United States every 5 years from 2025 through 2100 (Census, nda). Finally, the PSS data reports national (NCES, ndb) and state (NCES, ndc) private school enrollment in odd-numbered years from 2011 through 2021.

Methodology

Analytical Sample

Our analysis focuses exclusively on trends in K-12 education in the United States. However, CCD data is also reported for adult education and pre-K, as well as US territories. We filtered out non-K-12 grade levels and excluding entries from non-state jurisdictions. We then recompute total enrollment on a school level with only K-12 grade levels to ensure our analysis reflects only the relevant population of interest.

Variable Construction

The following variables were constructed for the analysis:

- *Enrollment.* The total number of K-12 students in a school.
- *Permanent School Closure.* Schools that experienced a permanent school closure are those that had non-zero enrollment and were flagged as open in the previous year and were flagged as closed in the current year.

- *Locale.* CCD data reports one of twelve urbanicity codes for each school locale. We refactored these codes such that 11, 12, and 13 are "urban", 21, 22, and 23 are "suburban", 31, 32, and 33 are "town", and 41, 42, and 43 are "rural".

- *School Level.* Schools serving exclusively grade spans within Kindergarten and grade 5 were classified as elementary. Schools serving grade spans between 6 and 8 were classified as middle schools. Schools serving grade spans between 9 and 12 were classified as high schools. Any school with a grade span overlapping between multiple categories were classified as multi-grade schools.

- *School Sector.* CCD schools were classified as virtual if they were "primarily" or "exclusively" virtual, alternative if the school type code was not 1, charter according to the charter indicator, and traditional otherwise.

- *District Poverty Level.* The district poverty level is low if the district has a proportion of students in poverty among the lowest third of districts, high if its proportion is among the highest third, and medium otherwise.

- *Single-Year Enrollment Change.* Single-year enrollment change is the proportional difference in enrollment change in a prior year. We define five such quantities, from the previous year through five years prior. The previous year is defined as follows: $\Delta\text{Enrollment}_{t-1} = \frac{\text{Enrollment}_{t-1} - \text{Enrollment}_{t-2}}{\text{Enrollment}_{t-2}}$

- *Cumulative Enrollment Change.* Cumulative enrollment change is the proportional difference in enrollment in the current year compared to two or five years prior. The two-year enrollment change is defined as follows: $\text{Two-Year}\Delta\text{Enrollment}_{t-1} = \frac{\text{Enrollment}_{t-1} - \text{Enrollment}_{t-3}}{\text{Enrollment}_{t-3}}$.

Regression Analysis

To evaluate the effect of enrollment declines on permanent school closures, we estimate two types of logistic regression models. We estimate a baseline model that includes only $\Delta\text{Enrollment}_{t-1}$ as a predictor. We then augment the specification by progressively adding year-over-year enrollment changes for $t-2$, $t-3$, $t-4$, and $t-5$ to capture longer-term enrollment trends. The full specification for

school i in year t is as follows:[1]

$$Y_{it} = \beta_0 + \sum_{j=1}^{5} \beta_j \Delta\text{Enrollment}_{t-j} + \varepsilon_{it}$$

The second type of logistic regression model examines the effect of longer-term enrollment declines. We examine two- and five-year changes in enrollment at time $t-1$ on the likelihood of school closure at time t. The specification for the two-year estimate for school i at time t is as follows:

$$Y_{it} = \beta_0 + \beta_1 \text{TwoYear}\Delta\text{Enrollment}_{t-1} + \varepsilon_{it}$$

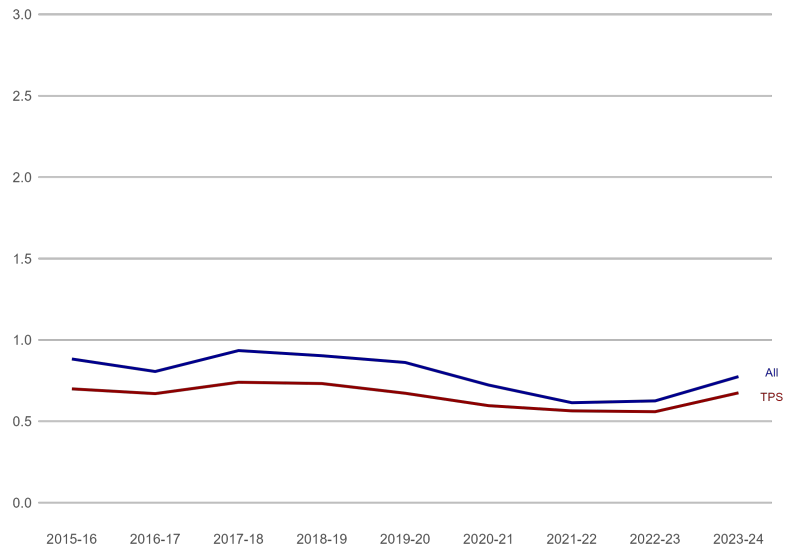
The five-year estimate takes the same form. To ensure consistency of estimates and to avoid confusing changes in enrollment due to changes in grade level served for changes in enrollment due to actual enrollment decline, we consider only schools that served the same grade level in the starting and ending period for the calculation of a variable. We use heteroskedasticity robust standard errors throughout, and exclude each regressor's top and bottom half-percent to minimize the impact of outliers on estimates.

Additional Figures and Tables

The following tables include additional figures and tables produced in the process of our analysis. Figure S1 plots the trend of the school closure rate for both TPS and charter and TPS. Figure S2 shows the school closure rate over the same period for schools with different characteristics, including sector, grade-level, and locale. Table S1 reports the student-age population and number of students in different types of schools nationally from 2015-16 through 2023-24. Table S2 reports the number and percentage of unknown students and the school closure rates for each state. Table S3 reports the proportion of students outside of TPS in districts serving greater than 90 percent of a single race. Table S4 reports the proportion of students outside of TPS in districts with different socioeconomic characteristics. Figure S3 plots the distribution of school enrollment changes by closure status charter schools, respectively. Table S5 reports descriptive statistics for enrollment change variables for TPS. Table S6 and Table S7 report regression results for TPS and charter schools.

[1] Note that $Y = \ln\left(\frac{p}{1-p}\right)$ and p is the probability of closure.

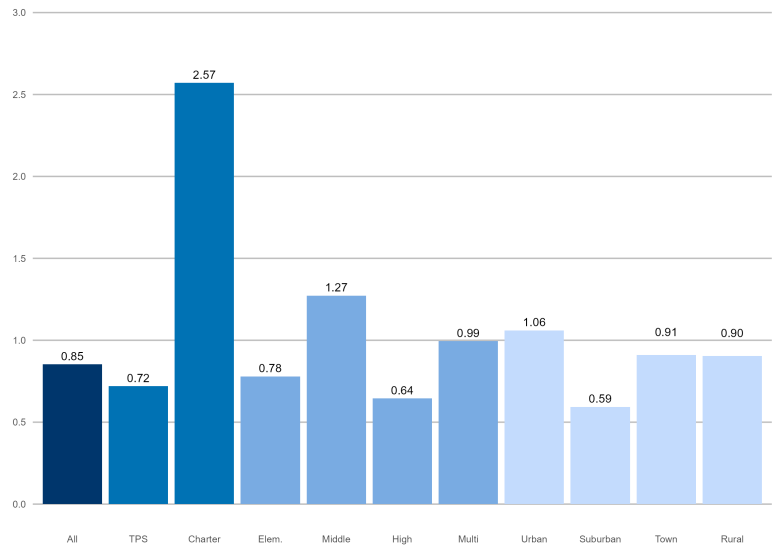
Figure S1: ANNUAL SCHOOL CLOSURE RATE



Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: Yearly closure rates calculated as $\frac{\text{\# Closed Current Year}}{\text{\# Open Previous Year}}$ using CCD data. Schools closed in the current year are those that were open in the previous year and reported status 2 (permanently closed) in current year.

Figure S2: SCHOOL CLOSURE RATE BY CHARACTERISTICS



Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: Schools closed in the current year are those that were open in the previous year and reported status 2 (permanently closed) in current year. Closure rate characteristics were calculated by considering only the subset of data with a given characteristic and computing the number of closures from 2012-13 through 2023-24 divided by the number of schools open from 2011-12 through 2022-23 (the previous years).

Table S1: NUMBER OF STUDENTS BY SCHOOL TYPE, IN THOUSANDS

Year	Pop.	TPS	Charter	Alt.	Virtual	Private	Unknown
2015-16	54,174	45,304	2,556	728	211	4,903	470
2016-17	54,225	45,279	2,708	730	227	4,721	557
2017-18	54,290	45,174	2,830	722	241	4,898	423
2018-19	54,133	44,960	2,886	720	341	4,747	477
2019-20	54,077	44,887	2,976	731	375	4,652	453
2020-21	54,106	43,358	3,098	731	673	4,773	1,471
2021-22	54,997	43,169	3,116	808	671	4,731	2,500
2022-23	54,274	43,255	3,189	790	632	4,799	1,606
2023-24	54,694	43,055	3,263	805	659	4,812	2,097

Source: Common Core of Data (CCD), National Center for Education Statistics; Small Area Income and Poverty Estimates (SAIPE), Census Bureau; Private School Universe Survey (PSS), National Center for Education Statistics; Author Calculations

Notes: Population reported in SAIPE data. TPS, charter, alternative, virtual enrollment are reported in CCD data. Virtual schools are those classified as fully virtual or virtual with face-to-face options. Private school totals are based on PSS data. Unknown is the difference between population and the sum of all CCD and PSS enrollment types.

Table S2: STATE UNKNOWN STUDENT AND CLOSURE STATISTICS

State	Unknown	Unknown (%)	Closed	Closure Rate
AL	63,865	7.49	115	0.72
AK	13,404	9.25	13	0.24
AZ	34,792	2.86	226	1.01
AR	33,943	6.39	206	1.65
CA	183,293	2.78	674	0.64
CO	44,977	4.75	210	1.04
CT	13,744	2.49	97	0.81
DE	0	0.00	15	0.64
DC	0	0.00	52	2.06
FL	0	0.00	327	0.82
GA	55,185	2.90	229	0.85
HI	14,012	6.32	2	0.06
ID	32,529	8.99	25	0.33
IL	117,048	5.58	392	0.85
IN	70,785	5.93	227	1.03
IA	24,963	4.50	204	1.31
KS	34,919	6.55	128	0.82
KY	59,157	7.85	117	0.82
LA	33,683	4.25	201	1.30
ME	3,103	1.70	91	1.32
MD	29,957	2.97	77	0.49
MA	30,462	3.00	194	0.93
MI	119,395	7.33	508	1.44
MN	67,763	6.84	213	1.07
MS	45,776	8.86	194	1.81
MO	74,920	7.30	133	0.51
MT	17,156	9.75	18	0.19
NE	16,386	4.53	116	1.02
NV	25,729	4.94	6	0.08
NH	8,810	4.53	28	0.49
NJ	87,996	5.83	162	0.58
NM	31,673	8.77	60	0.61
NY	222,751	7.40	346	0.63
NC	77,021	4.51	166	0.55

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Table S2 – *Continued from previous page*

State	Unknown	Unknown (%)	Closed	Closure Rate
ND	9,082	6.75	67	1.18
OH	94,730	4.89	600	1.46
OK	34,809	4.78	213	1.01
OR	82,147	12.33	91	0.63
PA	106,651	5.35	496	1.43
RI	4,317	2.78	40	1.15
SC	14,143	1.71	129	0.92
SD	12,439	7.59	82	1.06
TN	78,283	6.83	211	1.01
TX	204,775	3.63	618	0.65
UT	28,968	4.05	54	0.49
VT	7,484	8.43	24	0.68
VA	58,704	4.22	99	0.45
WA	97,160	7.74	119	0.50
WV	20,412	7.55	80	1.01
WI	53,434	5.54	246	1.01
WY	8,167	8.01	42	1.02

Sources: Common Core of Data (CCD), National Center for Education Statistics; Private School Universe Survey (PSS), National Center for Education Statistics; Small Area Income and Population Estimates (SAIPE), Census Bureau; Author Calculations

Notes: Data for unknown for students are for 2021-22, the most recent year of PSS data. Closed reports the number of closed schools from 2012-13 to 2023-24 and the closure rate refers to the proportion of all schools that were closed in the observed period.

Table S3: PROPORTION OF NON-TPS ENROLLMENT BY RACE/ETHNICITY

School Year	Black	Hispanic	White
2011-12	23.10	9.16	12.86
2012-13	23.15	8.78	12.83
2013-14	24.27	8.14	13.30
2014-15	24.20	8.09	13.28
2015-16	25.38	8.52	13.17
2016-17	26.83	9.25	13.34
2017-18	27.52	10.73	13.60
2018-19	29.19	12.03	13.74
2019-20	30.86	13.26	13.85
2020-21	33.28	15.45	15.85
2021-22	32.54	17.38	16.75
2022-23	32.29	16.46	15.89
2023-24	34.08	17.57	17.51

Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: For each column we select districts with greater than 90 percent of a given race in 2016 and evaluate the trend in those districts over time. Students outside TPS include those in private, charter, virtual, alternative, and unknown.

Table S4: PROPORTION OF NON-TPS STUDENTS BY DISTRICT POVERTY

School Year	Low Poverty	Medium Poverty	High Poverty
2016-17	12.33	14.60	19.32
2017-18	12.03	14.95	19.93
2018-19	11.74	15.32	20.53
2019-20	11.18	15.28	20.97
2020-21	14.06	18.49	23.81
2021-22	16.85	19.87	26.04
2022-23	15.22	18.65	24.91
2023-24	15.92	19.85	26.00

Source: Common Core of Data (CCD), National Center for Education Statistics; Small Area Income and Poverty Estimates (SAIPE), Census Bureau; Author Calculations

Notes: Low-poverty districts are those with fewer than 11.47 percent of students in those districts living in poverty, reported in SAIPE data. Medium-poverty districts had between 11.47 percent and 19.22 percent of students in poverty, and high-poverty districts had greater than 19.22 percent of students in poverty. District poverty rate was calculated as a weighted average of district poverty rate from 2016 to 2019.

Table S5: DESCRIPTIVE STATISTICS FOR ENROLLMENT CHANGE VARIABLES

Variable	Mean	Std. Dev.	N
Permanent Closure	0.678	8.205	5,560
ΔEnrollment$_{t-1}$	-0.639	6.789	731,580
ΔEnrollment$_{t-2}$	-0.642	6.726	710,554
ΔEnrollment$_{t-3}$	-0.664	6.535	622,819
ΔEnrollment$_{t-4}$	-0.230	6.254	540,399
ΔEnrollment$_{t-5}$	-0.194	6.236	461,464
Two-Year ΔEnrollment	-1.309	9.681	710,578
Five-Year ΔEnrollment	-3.291	14.980	462,586

Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: Values multiplied by 100. Due to difficulty disentangling enrollment changes due to actual enrollment declines and changes in grade levels served, we compute each enrollment change variable only for schools who had the same grade levels served at the start and end of the period. Observations limited to traditional public schools.

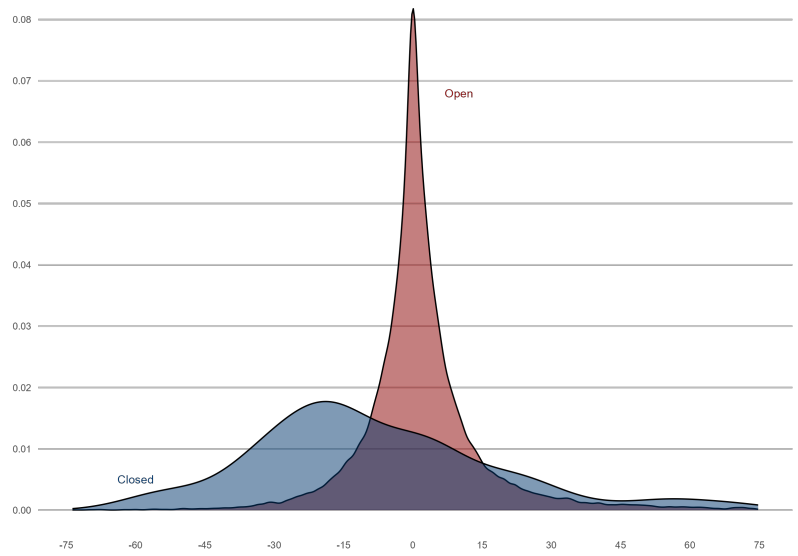
Table S6: LOGISTIC REGRESSION RESULTS, TPS

	Dependent variable:				
	Closure				
	(1)	(2)	(3)	(4)	(5)
Δ Enrollment$_{t-1}$	-0.041^{***}	-0.039^{***}	-0.037		
	(0.016)	(0.015)	(0.024)		
Δ Enrollment$_{t-2}$		-0.056^{***}	-0.055^{**}		
		(0.016)	(0.024)		
Δ Enrollment$_{t-3}$			-0.029		
			(0.020)		
Δ Enrollment$_{t-4}$			-0.012		
			(0.022)		
Δ Enrollment$_{t-5}$			-0.018		
			(0.021)		
Δ Two-Year				-0.031^{***}	
				(0.012)	
Δ Five-Year					-0.032^{***}
					(0.010)
Observations	657,122	628,265	371,574	637,534	394,715

Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: *p<0.1; **p<0.05; ***p<0.01. Results reported for logistic regression model predicting closure by various enrollment change variables. Fixed effects for school year included. Excluded the top and bottom half-percent of each regressor to minimize the effect of extreme outliers.

Figure S3: DENSITY OF Δ ENROLLMENT$_{t-1}$ BY CLOSURE STATUS, CHARTER



Source: Common Core of Data (CCD), National Center for Education Statistics; Small Area Income and Poverty Estimates (SAIPE), Census Bureau; Author Calculations

Notes: $\Delta\text{Enrollment}_{t-1} = \frac{\text{Enrollment}_{t-1} - \text{Enrollment}_{t-2}}{\text{Enrollment}_{t-2}}$. Schools are defined as closed if they were open in the previous year and reported permanent school closure (status 2) in CCD data. This figure is limited to charter schools.

Table S7: LOGISTIC REGRESSION RESULTS, CHARTER SCHOOLS

	Dependent variable:				
	Closure				
	(1)	(2)	(3)	(4)	(5)
Δ Enrollment$_{t-1}$	-0.045^{**}	-0.078^{***}	-0.099^{***}		
	(0.019)	(0.014)	(0.025)		
Δ Enrollment$_{t-2}$		-0.006	-0.040		
		(0.014)	(0.028)		
Δ Enrollment$_{t-3}$			0.006		
			(0.020)		
Δ Enrollment$_{t-4}$			-0.013		
			(0.019)		
Δ Enrollment$_{t-5}$			0.030^{***}		
			(0.007)		
Δ Two-Year				-0.035^{***}	
				(0.012)	
Δ Five-Year					-0.007
					(0.012)
Observations	34,056	28,858	9,258	29,403	12,904

Source: Common Core of Data (CCD), National Center for Education Statistics; Author Calculations

Notes: *p<0.1; **p<0.05; ***p<0.01. Results reported for logistic regression using enrollment change variables to predict closure. School year fixed effects are included. The top and bottom half-percent of each regressor were excluded to minimize the effect of extreme outliers.

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