

Funding, school staffing practices and duty-to-bargain

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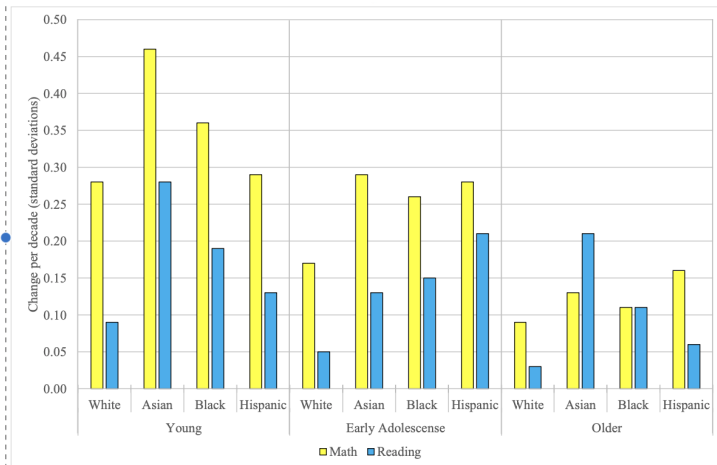
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Student test performance progresses, 1970-2015, especially in math and for non-whites

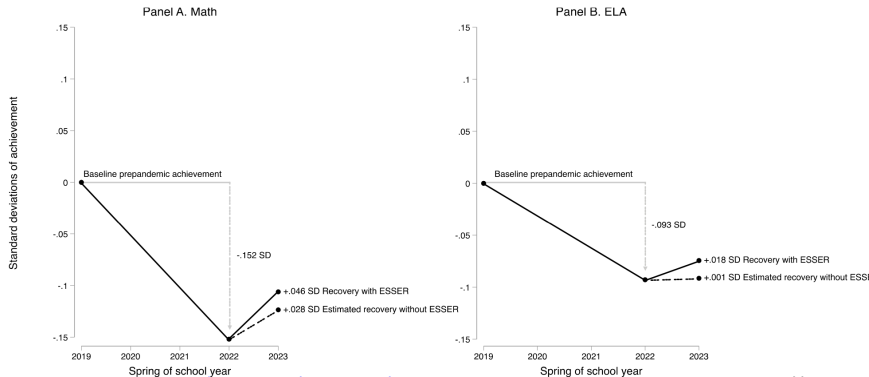
Figure 1: Student achievement trends in the United States, by race and ethnicity, birth cohorts 1954–2007 (Shakeel and Peterson, 2022)



Achievement declined when COVID pandemic closed schools, especially in math

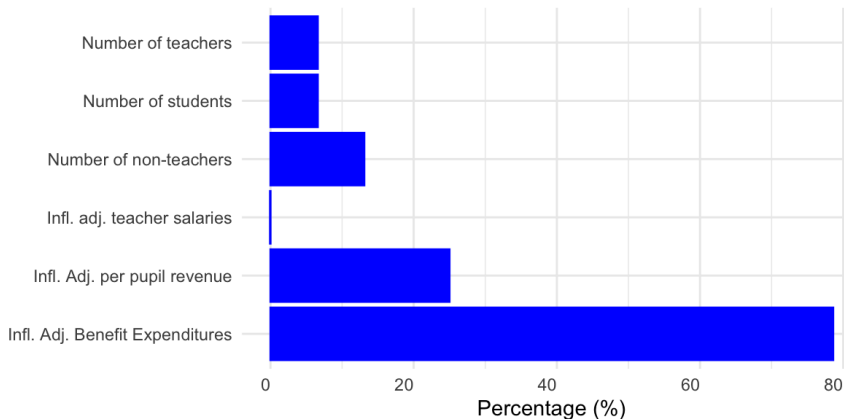
There were modest recoveries in math, even with federal funding; none in reading

Figure 2: Observed changes in achievement over time and estimated impact of ESSER III Funding (Goldhaber and Falken, 2024), see also Dewey et al. (2024)



There have been large increases in expenditure in non-teaching staff

Figure 3: Changes in Expenditure, Enrollment, Salaries, and Staffing, 2002-2020



Theory: how extra money impacts staffing

- ▶ Districts use revenue from own sources to maximize property values. (Lastra-Anadón and Peterson, 2023)
- ▶ School finance reforms provide unanticipated state grants (shocks), which alter spending patterns. Response to grants depends on whether districts are subject to state-mandated collective bargaining requirements—Duty-To-Bargain (DTB).

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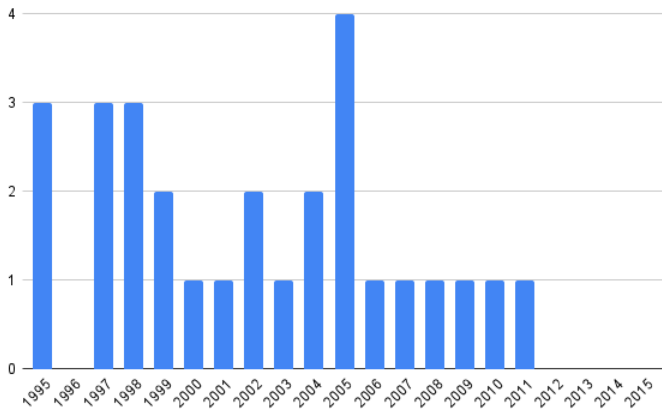
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Data

- ▶ National Center of Education Statistics Common Core of Data staffing and teacher data, self-reported by districts
- ▶ Local revenue share, self-reported via School District Finance Survey (F-33)
- ▶ School finance reforms (Lafortune, Rothstein and Schanzenbach, 2018)
- ▶ State duty-to-bargain (DTB) data (Lovenheim and Willén, 2019)
- ▶ Outcome test data from National Assessment of Educational Progress (NAEP)

We use school finance reforms to estimate the effect of a change in state grants on staffing policies

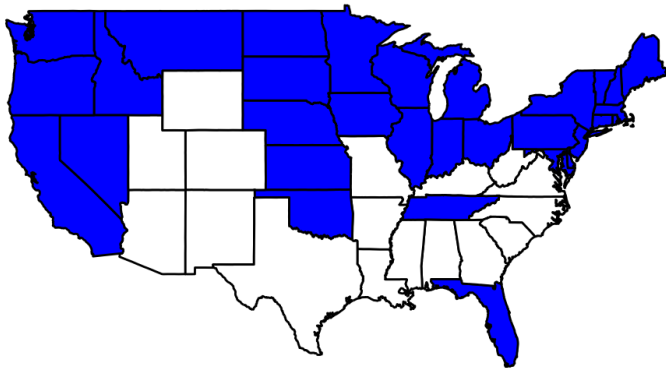
Figure 4: School finance reforms by year



Source: Lafortune, Rothstein and Schanzenbach (2018)

Sixty percent of students are in teacher duty-to-bargain states, since 1987

Figure 5: States with teacher duty-to-bargain laws



Source: Lovenheim and Willén (2019)

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Dependent variables

- ▶ **Teacher/ 100 pupils ratios:** teachers
- ▶ **Paraprofessionals**
- ▶ **Other school staff/ 100 pupils ratios:** School counselors, other guidance counselors, school psychologists, instructional coordinators, Student Support Services Staff, Other support services staff, Librarians and media specialists, School Administrative Support, School Administrators
- ▶ **District staff/ 100 pupils ratios:** LEA Administrative Support, LEA Administrators

Control variables

- ▶ Share with college parents
- ▶ Share disabled
- ▶ Share receiving Free or Reduced Lunches
- ▶ Share nonwhite,
- ▶ NO control current exp. per pupil
- ▶ In Individual level analyses (NAEP), we also include the same variables at the individual level (and current exp. per pupil)

Summary of the NCES data

Table 1: Summary ratios by category, 2015

Variable	Mean	Std. Dev.	Min.	Max.	N
Total revenue per pupil (tsd.usd)	13.265	7.538	0.233	180.745	13319
Teachers per 100 pupils	7.352	3.42	0	93.373	11311
Paraprofessionals per 100 pupils	2.133	3.617	0	131.944	11311
Other school staff per 100 pupils	3.047	4.945	0	162.168	10135
District staff per 100 pupils	0.775	1.219	0	45.612	11743

Excludes the smallest 10% of districts (<83 students). Of reported total staff reported by districts, 1.4 per 100 pupil are unclassified.

Synthetic difference-in-differences strategy

- ▶ Ensures parallel trends by reweighting units and time periods (Arkhangelsky et al., 2021), with staggered treatment (Porreca, 2022)
- ▶ We include units 1998-2015, for an $N=216,07$
- ▶ We use weights ω_i and time periods λ_t in a two-way state and time fixed effects regression to estimate average achievement effect of exposure to a school finance reform
- ▶ *Post* as a binary indicator of having experienced a finance reform, a vector of X time-varying district control variables, T time fixed effects, S , state fixed effect:

$$Y_{ist} = \sum (Post_{it} + \mathbf{X}_{it} + S_s + T_t) \hat{\lambda}_t \hat{\omega}_i \quad (1)$$

School finance reforms result in more teachers, driven by increased hiring in non-DTB states

No significant effect on other staff

Table 2: Effects of School Finance Reforms in staggered synthetic diff-in-diff Models, by DTB States and Non-DTB States

State Type	Teachers/ 100 pupils	Paraprof./ 100 pupils	Other sch. staff/ 100 pupils	District staff/ 100 pupils
<i>All states</i>	0.710* (0.306)	0.0999 (0.2254)	1.0544 (0.8393)	0.060 (0.453)
DTB States	0.204 (0.295)	0.0271 (0.3866)	0.2786 (0.2946)	0.178 (0.382)
Non-DTB States	1.088* (0.382)	0.4147 (0.3693)	1.8366 (1.1757)	0.256 (0.133)

Results are consistent with two-way FE models of the relation between nonlocal revenue share and staffing: **Two way FE** Effects by quartile: **Quartile**

Teachers, other school staff increase math achievement in non-DTB states; district staff does in DTB states

Table 3: 2 year lag Math NAEP SDs, with district, year FEs, and controls

	(1)	(2)	(3)	(4)
DTB × Teachers	-0.00145 (0.00123)			
Teachers	0.00222* (0.000908)			
DTB × Paraprofessionals		0.000716 (0.00207)		
Paraprofessionals		0.00135 (0.00195)		
DTB × Other school staff			-0.00276 (0.00138)	
Other school staff			0.00347*** (0.000941)	
DTB × District staff				0.0154* (0.00637)
District staff				-0.0109* (0.00439)
Observations	849689	849689	668252	781417

Effects of state grants depend on DTB status

1. When districts receive unanticipated grants from the state they spend it on hiring more teachers if collective bargaining is not required.
2. More teachers and other school staff enhance math performance in non-DTB states but not otherwise.
3. More district staff, conditional on DTB, is better for math achievement. Suggests district staff needed to manage collective bargaining process and implement contract.

Conclusion

- ▶ Adverse effects of collective bargaining on long-term outcomes (Lovenheim and Willén, 2019) may be due to staff reductions induced by union demands to use marginal resources for salaries and benefits.
- ▶ Duty-to-bargain seems to be at odds with hiring practices that foster (math) achievement, for teachers and for other school staff

Appendix

In two-way FE models, greater nonlocal revenue share in DTB states is associated with increases in teachers and school staff

Table 5: Effects of Local Revenue Share on Staffing, in models with district and year fixed effects, and district controls by DTB States and Non-DTB States

	Teachers/ 100 pupils	Parap./ 100 pupils	Other sch. staff/ 100 pupils	District staff/ 100 pupils
Panel A: Duty to Bargain States				
Nonlocal share	0.00957** (0.00369)	-0.00360 (0.00449)	0.0152*** (0.00364)	-0.00153 (0.00126)
Observations	9659	9659	9659	9584
Panel B: Non-Duty to Bargain States				
Nonlocal share	0.00211 (0.00170)	-0.00586* (0.00261)	0.00567 (0.00335)	-0.00129 (0.000687)
Observations	10075	10075	10075	10063

Standard errors in parentheses

Not a causal estimate (e.g. reverse causality: places that want to hire more teachers may mobilize more nonlocal sources)

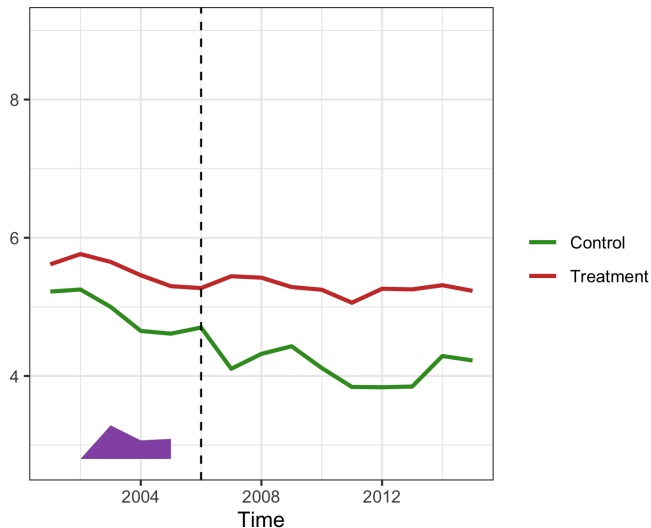
Effects on teacher hiring are greater for districts at all levels of spending in non-DTB states

Table 6: Reform effects are higher for every level of spending in NonDTB states

Qtile.	Teachers/ 100 pupils		School staff/ 100 pupils		District staff/ 100 pupils	
	DTB	NonDTB	DTB	Non DTB	DTB	NonDTB
Q1 Low	0.657* (0.290)	1.605* (0.400)	-0.083 (0.145)	0.008 (0.105)	-0.045 (0.146)	0.315 (0.190)
Q2	0.444 (0.362)	0.701* (0.356)	-0.000 (0.127)	-0.065 (0.140)	-0.057 (0.095)	0.236* (0.113)
Q3	0.047 (0.474)	0.788* (0.348)	0.037 (0.175)	-0.020 (0.183)	0.070 (0.176)	0.271 (0.551)
Q4 High	-0.667 (0.504)	1.405* (0.575)	0.009 (0.422)	-0.099 (0.287)	0.139 (0.421)	0.203 (0.543)

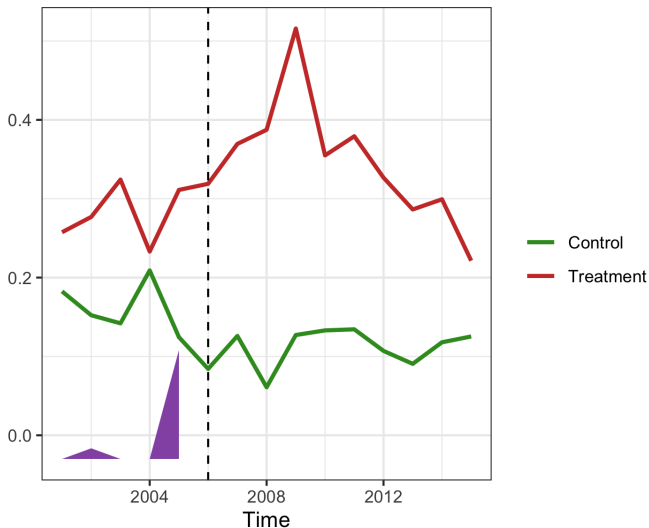
Synthetic difference in difference plot (2006 reform): teachers per 100 pupils

Time adoption: 2006

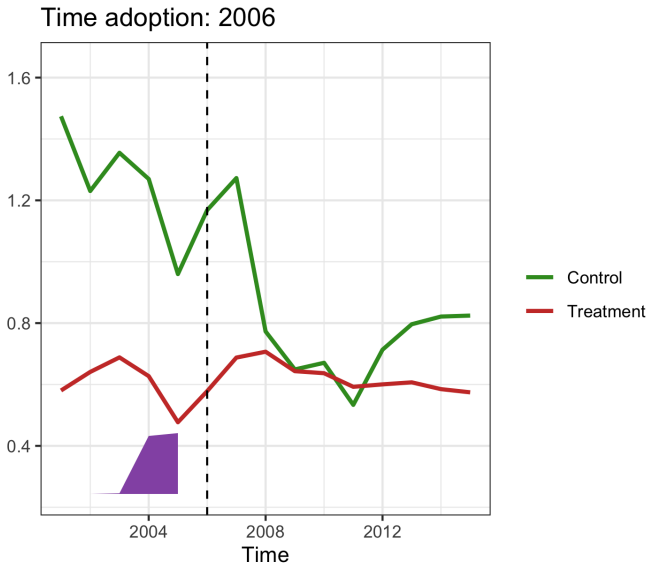


Synthetic difference in difference plot (2006 reform): school staff per 100 pupils

Time adoption: 2006



Synthetic difference in difference plot (2006 reform): district staff per 100 pupils



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