The Real Effects of Debt Relief: Evidence from Independent School Districts in Texas

Thomas S. Lee

UT-Austin

July 22, 2026

Roadmap

Overview

Empirical Specification

Results

Conclusion

Not Every District Can Maintain Their Facilities

- Total deferred maintenance nearly tripled ($200B→$570B) over the last decade (IWBI (2021))

Not Every District Can Maintain Their Facilities

- Total deferred maintenance nearly tripled ($200B$\rightarrow$$570B) over the last decade (IWBI (2021))

- Substantial disparities in districts' ability to raise capital funding
  - Funded by debt and repaid through local property taxes
  - Often capped by tax rates or revenue limits

Not Every District Can Maintain Their Facilities

- Total deferred maintenance nearly tripled ($200B→$570B) over the last decade (IWBI (2021))

- Substantial disparities in districts' ability to raise capital funding
  - Funded by debt and repaid through local property taxes
  - Often capped by tax rates or revenue limits

- Consequences
  - Short-term: Learning losses during K-12
  - Long-term: Widening education gap & rising lifetime earnings inequality (e.g., Card et. al(2022))

This Paper

- ***Research Question: Does capital spending improve student outcomes?***
  - Specifically, among debt-strapped school districts

This Paper

- ***Research Question: Does capital spending improve student outcomes?***
  - Specifically, among debt-strapped school districts

- ***Research Design: State debt assistance programs in Texas***
  - Key intuition: Existing debt positions lead to differential debt relief, helping some districts raise more capital expenditures
  - Focus on marginal projects neglected by debt-strapped school districts

This Paper

- ***Research Question: Does capital spending improve student outcomes?***
  - Specifically, among debt-strapped school districts
- ***Research Design: State debt assistance programs in Texas***
  - Key intuition: Existing debt positions lead to differential debt relief, helping some districts raise more capital expenditures
  - Focus on marginal projects neglected by debt-strapped school districts
- ***Results***
  - Capital spending improves student outcomes in the long run
  - Consistent with improvement in school facilities

Roadmap

Overview

Empirical Specification

Results

Conclusion

Natural Experiment: Debt Assistance Programs in Texas

- In 1998, Texas launched a series of debt programs to provide debt subsidies
- Covered % of both principal and interest payments

Natural Experiment: Debt Assistance Programs in Texas

- In 1998, Texas launched a series of debt programs to provide debt subsidies

- Covered % of both principal and interest payments

1. Instructional Facilities Allotment (IFA) (1998-)
   - Assists *newly issued* bonds
   - *Must apply* for funding at each award cycle
   - Covers throughout the lifetime of eligible bonds

Natural Experiment: Debt Assistance Programs in Texas

- In 1998, Texas launched a series of debt programs to provide debt subsidies

- Covered % of both principal and interest payments

1. Instructional Facilities Allotment (IFA) (1998-)
   - Assists *newly issued* bonds
   - *Must apply* for funding at each award cycle
   - Covers throughout the lifetime of eligible bonds

2. Existing Debt Allotment (EDA) (2000-)
   - Helps pay for *existing* bonds
   - *Automatically eligible* each year
   - Covers districts with property wealth $<$ threshold

Intuition: ↑ Pre-existing Debt Burdens → ↑ Capital Spending

- Subsidized only if *a district issues new debt* (IFA) or *has outstanding debt* (EDA)
  - Funding increases in debt burdens, given the same property wealth
  - Districts with mounting debt more likely to apply due to greater need for infrastructure improvements

Intuition: ↑ Pre-existing Debt Burdens → ↑ Capital Spending

- Subsidized only if *a district issues new debt* (IFA) or *has outstanding debt* (EDA)
  - Funding increases in debt burdens, given the same property wealth
  - Districts with mounting debt more likely to apply due to greater need for infrastructure improvements

- Debt relief frees up resources for additional capital projects
  - Districts can borrow more without increasing debt financing costs
  - By law, debt relief can't be reallocated to other purposes (e.g., hiring more teachers)

Instrument for $Cap_{i,t}$: $DTL\ High_i \times Post_t$

- $DTL\ High_i = \begin{cases} 1, & \text{if average } DTL \geq \text{median (1987-1991)} \\ 0, & \text{if average } DTL < \text{median (1987-1991)} \end{cases}$
  - *Debt-to-Tax Levied Ratio (DTL)* = $\frac{\text{outstanding long-term debt}}{\text{property tax revenues}}$

Instrument for $Cap_{i,t}$: $DTL\ High_i \times Post_t$

- $DTL\ High_i = \begin{cases} 1, & \text{if average } DTL \geq \text{median (1987-1991)} \\ 0, & \text{if average } DTL < \text{median (1987-1991)} \end{cases}$
  - *Debt-to-Tax Levied Ratio (DTL)* = $\frac{\text{outstanding long-term debt}}{\text{property tax revenues}}$
- $Post_t = \begin{cases} 1, & \text{if year} \geq 1998 \\ 0, & \text{otherwise} \end{cases}$
  - Multiple funding rounds since 1998

Instrument for $Cap_{i,t}$: $DTL\ High_i \times Post_t$

- $DTL\ High_i = \begin{cases} 1, & \text{if average } DTL \geq \text{median (1987-1991)} \\ 0, & \text{if average } DTL < \text{median (1987-1991)} \end{cases}$
  - *Debt-to-Tax Levied Ratio (DTL)* = $\frac{\text{outstanding long-term debt}}{\text{property tax revenues}}$
- $Post_t = \begin{cases} 1, & \text{if year} \geq 1998 \\ 0, & \text{otherwise} \end{cases}$
  - Multiple funding rounds since 1998
- Assumptions:
  - Strong predictor: F-stat ≈ 17
  - Robust to alternative explanations: unanticipated shock, local economic growth, concurrent events, ...

Identification: Regression Equations

- First stage: $\underbrace{Cap_{i,t}}_{\text{Endogenous Regressor}} = \pi \underbrace{DTL\ High_i \times Post_t}_{\text{Instrument}} + \Pi C_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t},$

- Second stage: $\underbrace{\bar{Y}_{i,t}}_{\text{Outcomes}} = \beta_{IV} \underbrace{\widehat{Cap}_{i,t}}_{\text{Predicted Value}} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}\ ,$

  where *i* denotes district and *t* year.
  - $Cap_{i,t}$: 3-year cumulative capital spending ($1,000 per pupil)
  - $\bar{Y}_{i,t}$: outcome variables in [$\underbrace{t,t+4}_{\text{Short-term}}$] or [$\underbrace{t+5,t+9}_{\text{Long-term}}$]

Data

- Texas Education Agency
  - Individual panel data on students in Texas: K-12, college, employment records
  - District's detailed income statement information
- National Center for Educational Statistics
  - Common Core of Data $\sim$ Compustat for school districts
- Sample: 873 Texas school districts in the 1994-2004 period

Roadmap

Overview

Empirical Specification

Results

Conclusion

1st Stage: 3-Yr Capital Spending ($1,000)

$$\overline{\text{Cap}}_{i,t} = \beta \textit{DTL High}_i \times \textit{Post}_t + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	(1)	(2)
DTL High × Post	0.610***	0.569***
	(0.143)	(0.138)
Controls	No	Yes
District FE	Yes	Yes
Year FE	Yes	Yes
Adj R^2	0.32	0.35
Obs	9590	9590
F-stats	18	17

1st Stage: 3-Yr Capital Spending ($1,000)

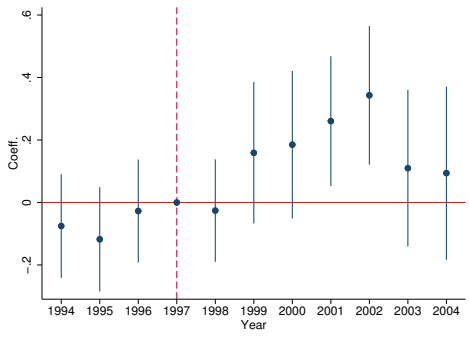
$$\overline{\text{Cap}}_{i,t} = \beta \textit{DTL High}_i \times \textit{Post}_t + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	(1)	(2)
DTL High × Post	0.610***	0.569***
	(0.143)	(0.138)
Controls	No	Yes
District FE	Yes	Yes
Year FE	Yes	Yes
Adj R^2	0.32	0.35
Obs	9590	9590
F-stats	18	17

Higher pre-existing debt burdens → more capital spending ($570 per pupil)

1st Stage: Dynamic, Annual Capital Spending

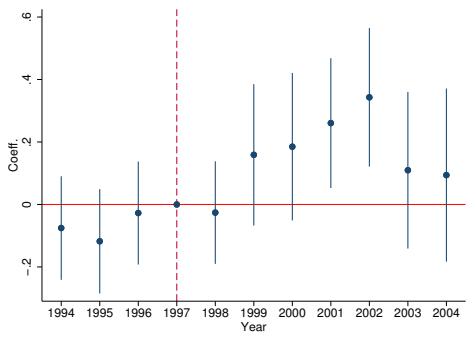
$$\text{Cap}_{i,t} = \sum_{year=1994}^{2004} \pi_{year} DTL\ High_i \times \mathbb{1}_{t=year} + \Pi C_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}$$



- $Cap_{i,t}$: Annual capital spending ($1,000 per pupil)

1st Stage: Dynamic, Annual Capital Spending

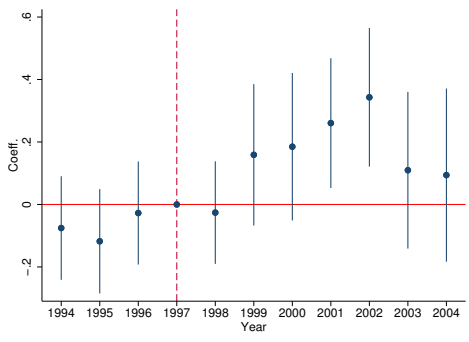
$$\text{Cap}_{i,t} = \sum_{year=1994}^{2004} \pi_{year} DTL\ High_i \times \mathbb{1}_{t=year} + \Pi C_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}$$



- $Cap_{i,t}$: Annual capital spending ($1,000 per pupil)
- Debt-laden districts allocate more to capital expenditures

1st Stage: Dynamic, Annual Capital Spending

$$\text{Cap}_{i,t} = \sum_{year=1994}^{2004} \pi_{year} DTL\ High_i \times \mathbb{1}_{t=year} + \Pi C_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}$$



- $Cap_{i,t}$: Annual capital spending ($1,000 per pupil)
- Debt-laden districts allocate more to capital expenditures
- No discernible differences in spending patterns before 1998

2nd Stage: Standardized 8th-Grade Test Scores

$$\overline{\text{Std. Score}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Reading (σ)		Math (σ)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9
Capital Spending($1,000)	-0.025	0.057***	0.018	0.121***
	(0.015)	(0.020)	(0.019)	(0.034)
Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	9590	9589	9590	9589
F-stat	17	17	17	17

2nd Stage: Standardized 8th-Grade Test Scores

$$\overline{\text{Std. Score}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Reading (σ)		Math (σ)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9
Capital Spending($1,000)	-0.025	0.057***	0.018	0.121***
	(0.015)	(0.020)	(0.019)	(0.034)
Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	9590	9589	9590	9589
F-stat	17	17	17	17

Positive effects on educational outcomes

2nd Stage: Standardized 8th-Grade Test Scores

$$\overline{\text{Std. Score}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Reading (σ)		Math (σ)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9
Capital Spending($1,000)	-0.025	0.057***	0.018	0.121***
	(0.015)	(0.020)	(0.019)	(0.034)
Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	9590	9589	9590	9589
F-stat	17	17	17	17

Positive effects on educational outcomes

0.05-0.12σ improvement per additional $1,000 capital spending after 5 years

2nd Stage: Non-test Outcomes

$$\overline{\text{Outcomes}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Attendance (%)		Graduation (%)		College Exam Tested (%)		College Enrollment (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9	(5) Yr 0-4	(6) Yr 5-9	(7) Yr 0-4	(8) Yr 5-9
Capital Spending($1,000)	0.060	0.123**	0.553	1.938***	0.248	1.290	-0.042	0.942
	(0.048)	(0.052)	(0.536)	(0.686)	(0.916)	(1.011)	(0.551)	(0.625)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9590	9590	9590	9590	9557	9575	9590	9590
F-stat	17	17	17	17	19	18	17	17

2nd Stage: Non-test Outcomes

$$\overline{\text{Outcomes}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Attendance (%)		Graduation (%)		College Exam Tested (%)		College Enrollment (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9	(5) Yr 0-4	(6) Yr 5-9	(7) Yr 0-4	(8) Yr 5-9
Capital Spending($1,000)	0.060	0.123**	0.553	1.938***	0.248	1.290	-0.042	0.942
	(0.048)	(0.052)	(0.536)	(0.686)	(0.916)	(1.011)	(0.551)	(0.625)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9590	9590	9590	9590	9557	9575	9590	9590
F-stat	17	17	17	17	19	18	17	17

+1.9 pp graduation rates, +0.12 pp attendance rates per $1,000 per pupil

2nd Stage: Earnings (Age 24-26)

$$\text{Log } \overline{\text{Earnings}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Age 24-26 Wage		Age 24-26 Emp. (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9
Capital Spending($1,000)	-0.030***	0.020**	0.425	0.070
	(0.010)	(0.009)	(0.402)	(0.307)
Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	6974	6974	6974	6974
F-stat	22	22	22	22

2nd Stage: Earnings (Age 24-26)

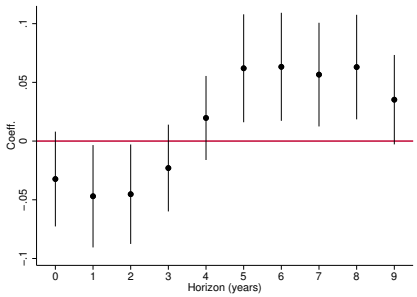
$$\text{Log } \overline{\text{Earnings}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

	Age 24-26 Wage		Age 24-26 Emp. (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9
Capital Spending($1,000)	-0.030***	0.020**	0.425	0.070
	(0.010)	(0.009)	(0.402)	(0.307)
Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	6974	6974	6974	6974
F-stat	22	22	22	22

Improved labor market outcomes for later cohorts

Mechanism: Facility Improvement

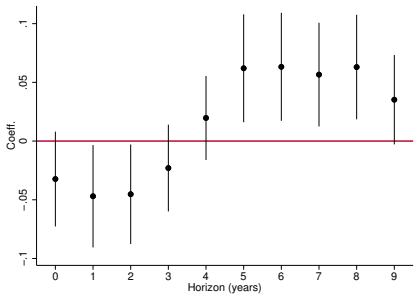
$$\text{Std. Reading Score}_{i,t+h} = \beta^h_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma^h C_{i,t} + \delta^h_i + \delta^h_t + u_{i,t+h},\ \forall h = 0, ..., 9$$



- h years after a district spends on capital projects
  - Assumes additional capital spending leads to another project

Mechanism: Facility Improvement

$$\text{Std. Reading Score}_{i,t+h} = \beta^h_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma^h C_{i,t} + \delta^h_i + \delta^h_t + u_{i,t+h}, \ \forall h = 0, ..., 9$$



- h years after a district spends on capital projects
  - Assumes additional capital spending leads to another project

Consistent with the benefits of facility upgrades (e.g., Jackson and Mackevicius (2021))

Alternative Mechanism: Composition Effects

$$\overline{\text{Outcomes}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

Sample: Students who have stayed in current district within the last 2 years

	Reading		Math		Graduation (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9	(5) Yr 0-4	(6) Yr 5-9
Capital Spending($1,000)	-0.028	0.073**	0.043	0.135**	0.964	2.277**
	(0.021)	(0.032)	(0.030)	(0.055)	(1.034)	(1.059)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	7852	7850	7852	7850	7853	7853
F-stat	8	8	8	8	8	8

Alternative Mechanism: Composition Effects

$$\overline{\text{Outcomes}}_{i,t} = \beta_{IV}\widehat{\text{Cap}}_{i,t} + \Gamma C_{i,t} + \delta_i + \delta_t + \bar{u}_{i,t}$$

Sample: Students who have stayed in current district within the last 2 years

	Reading		Math		Graduation (%)	
	(1) Yr 0-4	(2) Yr 5-9	(3) Yr 0-4	(4) Yr 5-9	(5) Yr 0-4	(6) Yr 5-9
Capital Spending($1,000)	-0.028	0.073**	0.043	0.135**	0.964	2.277**
	(0.021)	(0.032)	(0.030)	(0.055)	(1.034)	(1.059)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	7852	7850	7852	7850	7853	7853
F-stat	8	8	8	8	8	8

Gains from existing students primarily drive the results

Robustness

- Can't be explained by OPEX and teacher quality
- Possibly driven by differential pre-policy trends in local economic growth
  - Control for 1990 Census variables $\times$ linear trends
- Concurrent events around the debt programs
  - Fracking booms: exclude districts with high reliance on property taxes from oil fields
  - I&S revenue retention: exclude districts with high property wealth
- Others
  - Use debt subsidies as endogenous regressor
  - Use log(enrollment) instead of quartile dummies

Roadmap

Overview

Empirical Specification

Results

Conclusion

Conclusion

- Deteriorating school facilities carry real costs for students, but not every district can afford to fix them

Conclusion

- Deteriorating school facilities carry real costs for students, but not every district can afford to fix them

- Highlights significant gains from marginal capital projects that were previously neglected due to heavy debt burdens
  - Substantial long-term educational improvement across various dimensions
  - Consistent with the benefits from improved facilities

Conclusion

- Deteriorating school facilities carry real costs for students, but not every district can afford to fix them

- Highlights significant gains from marginal capital projects that were previously neglected due to heavy debt burdens
  - Substantial long-term educational improvement across various dimensions
  - Consistent with the benefits from improved facilities

- Debt capacity: a key factor in school capital finance policy
  - Directly informs ongoing discussions on school district debt financing (e.g., recent TX proposals)
  - Relevant for other local governments financing property-tax-supported infrastructure

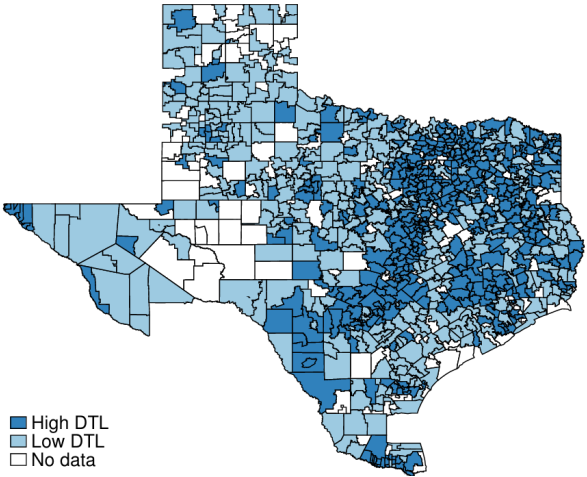
Appendix

Contrasting School Building Conditions

(a) Modernized classroom

(b) Leaking Ceiling

Geographic Distribution of DTL in 1987-1991



Debt Support % of Debt Service Costs (1994 - 2004)