School District Borrowing and Capital Spending:
The Effectiveness of State Credit Enhancement

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Context

- School districts spend $80B/year on capital projects (10% of total).
- Districts issue bonds to fund capital projects; interest rates vary.
- Many in need of updating or replacing building system (GAO, 2020)
- Disparity in capital spending: higher per student in more affluent areas (Brunner et al. 2021)
- Although evidence mixed, capital investments $\rightarrow$ increase in academic performance and housing prices

School district borrowing and state credit enhancement

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- Districts may pay for an underlying credit rating
- Districts may seek credit enhancement and an enhanced rating
  - Private bond insurance

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# School district borrowing and state credit enhancement

- District bond yields reflect perceived creditworthiness
- Districts may pay for an underlying credit rating
- Districts may seek credit enhancement and an enhanced rating
  - Private bond insurance
  - State credit enhancement
- Through committing state resources in case districts have trouble repaying debt, 24 states provide an "in-kind" assistance to districts.
  - Intercept of state aid: 14 states
  - State appropriation: 3 states
  - Guaranteed state funding: 6 states
  - Permanent funds: 3 states

Research question

State credit enhancement:

- Is it associated with lower interest rates paid on district bonds?
- Does it in turn increase district capital spending (if yes, does it improve academic outcome)?
- Which districts benefit?

Bond characteristics: distribution of rating

Figure: Ratings of school bonds issued 2009-2019
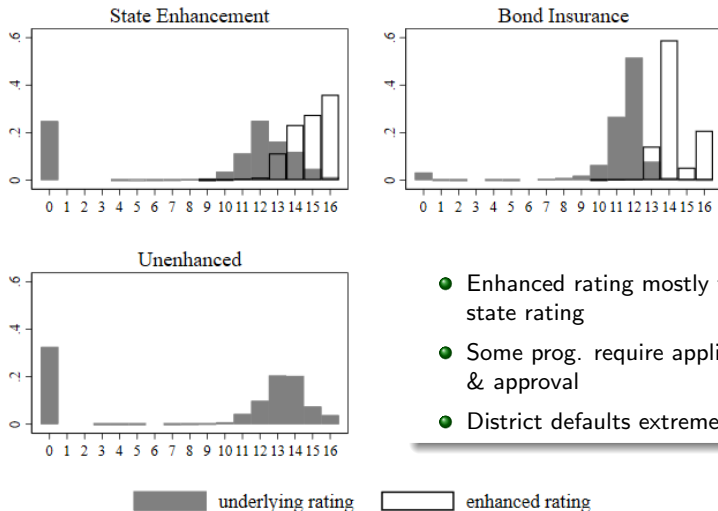
- Enhanced rating mostly tied to state rating
- Some prog. require application & approval
- District defaults extremely rare

District characteristics, baseline (2000)

	All	Issuer	Underlying Rating			
			No	Low	Medium	High
enrollment, logged	7.27	7.44	6.37	7.28	8.06	8.44
Black&Hispanic share	0.17	0.17	0.10	0.19	0.18	0.18
poverty	0.14	0.13	0.16	0.14	0.10	0.08
total revenue	11.98	11.77	10.52	11.56	12.44	13.27
federal transfer	0.77	0.66	0.79	0.73	0.54	0.47
state transfer	6.01	5.85	5.97	6.46	5.34	4.31
own-source revenue	5.21	4.71	3.76	4.37	6.57	8.49
total spending	12.12	12.00	10.51	11.76	12.85	13.62
operational spending	10.81	10.63	9.50	10.45	11.24	11.88
capital spending	1.31	1.38	1.01	1.31	1.61	1.75
debt outstanding	5.12	6.06	3.45	5.86	7.55	7.75
N	11,150	7,406	1,409	3,175	2,175	647

Notes: Baseline from 2000. All financial variables measured on per-pupil $,000 basis.

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Demise of muni bond insurance

- Biasi et al. (2021) shows a narrowing gap in per pupil capital spending between high-low poverty districts after Great Recession
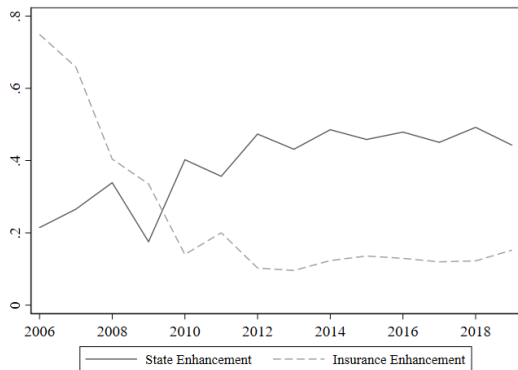- I argue this may be partially attributed to demise of bond insurance

Figure: Percent of School District Bonds Enhanced, by Principal Amount

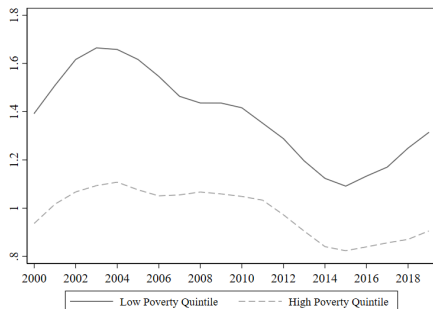# State enhancement ↓ gap in per pupil capital spending
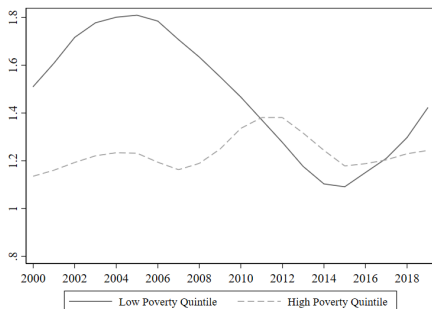

Figure: States without Program

Figure: States with Program

Identification of causal impact on school district

Two sources of variations in state enhancement:

- Between-district (75% of variation) with state-by-year FE
  - Districts with low underlying ratings always-enhanced vs. districts never-enhanced
  - The former likely faces higher interest rates and lower capital spending
  - Thus potential bias on interest rate $\uparrow$, capital spending $\downarrow$

- With-district (25% of variation) with district FE
  - Some bonds are enhanced, while others of the same district not.
  - Likely due to eligibility requirement of low debt outstanding (but cannot measure this).
  - Low debt outstanding: low interest rate on new debt, more ability to incur capital spending
  - Thus potential bias on interest rate $\downarrow$, capital spending $\uparrow$

Effects on school bond interest rate

Bond c issued by district i in state s in year T on date t:

$$yield_{cit} = \theta \, Enhanced_{ct} + \delta X_{ct} + \lambda_T \, insured_{ct} + \rho D_{i,t-1} + \mu_{i/s} + \psi_t + \epsilon_{ct}$$

- $Enhanced_{ct}$: state enhancement
- X_{ct}: bond controls, including underlying rating
- λ_T allows relation with bond insurance $insured_{ct}$ to vary across years
- $D_{i,t-1}$: district controls (info known to investor at time of issuance)
- ψ_t issue date FE

Results on school bond interest rate

	(1)	(2)	(3)	(4)
enhanced	-0.138**	-0.134***	-0.125***	0.022
	(0.039)	(0.011)	(0.015)	(0.017)
enhanced x med poverty			-0.008	
			(0.023)	
enhanced x high poverty			-0.055*	
			(0.025)	
enhanced x rating plus1				-0.047***
				(0.018)
enhanced x rating plus2				-0.160***
				(0.020)
enhanced x rating plus3				-0.253***
				(0.022)
enhanced x rating plus4				-0.302***
				(0.024)
enhanced x rating plus5+				-0.392***
				(0.030)
enhanced x no underlying				-0.275***
				(0.027)
FE	state-by-year	district	district	district

$*p < 0.05$ $**p < 0.01$ $***p < 0.001$

Effect on per pupil capital spending

District i in year T:

$$Y_{iT} = \beta_{T-T_0} Enhanced_{i,T-T_0} + \sum \zeta_\tau Issued_{i\tau} + \nu_i + \pi_{sT} + e_{iT}$$

- T_0: first year the district issued enhanced bonds
- $Enhanced_{i,T-T_0}$: indicators for pre- and post-enhancement
- $Issued_{i\tau}$: whether issued bonds in τ years prior, i.e. issuance history
- ν_i district FE
- π_{sT}: state-by-year FE
- Weighted by each district's average enrollment overtime.

Results on per pupil capital spending
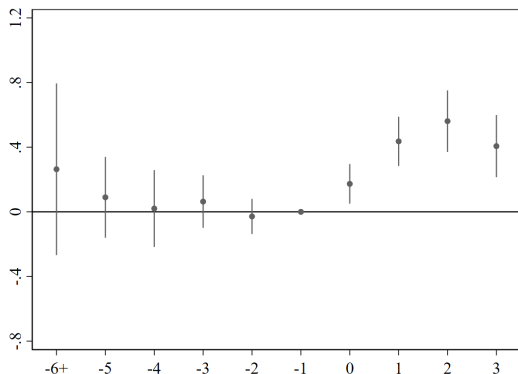
Regression results link

- Total increase in per pupil capital spending $1,300
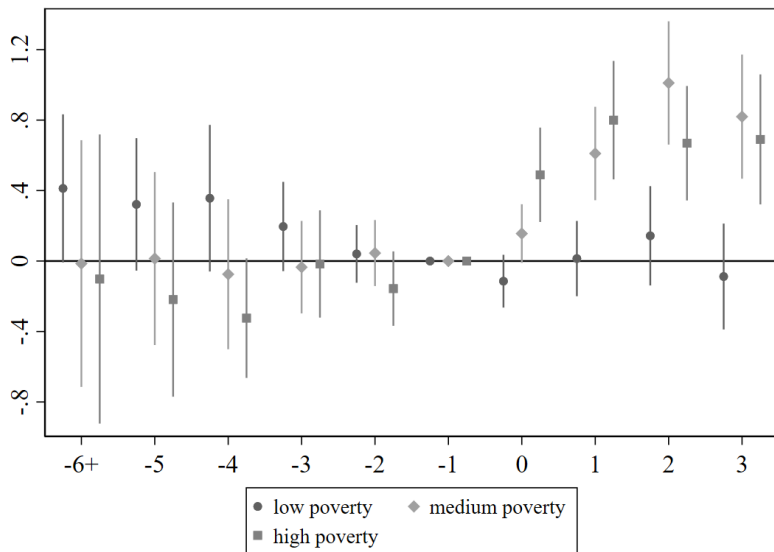- Assume that useful life of capital asset 15 to 50 years (average maturity 15.6 years)
- Spread total increase in capital spending over capital asset's lifespan
- An annual increase of $26 to $87 per pupil, or a 2% to 7% increase.

Results on per pupil capital spending

School district results: robustness

Results are robust to:

- Control for flexible trends in baseline characteristics
- Exclude Texas.
- Issuer district only.
- Limit to only districts experiencing no change in underlying rating.

Two-way fixed effects (TWFE) may be inconsistent when effects are heterogenous over time or across units:

- Goodman-Bacon (2021) decomposition shows 96% of TWFE estimate from comparing never-treated to newly-treated districts.
- Results robust with DID_M estimator by De Chaisemartin and d'Haultfoeuille (2020), which uses only not-yet-treated as the comparison. link

Additional analyses

- No effect on: district enrollment, student composition, or noncapital spending. `link`
- No effect on `math` or `LEA` test scores.
  - Event study results show no pretrends or overtime effects.
  - Similar to the null finding from some studies on capital spending.
  - Robust to long-term effects, high-poverty districts, and large bonds.
- Total amount of school bond enhanced not associated with interest rates on state GO debt `link`
  - First-difference approach: regress change in state GO bond interest rate on change in enhanced school bonds
  - Control for time-varying state characteristics
  - Average enhanced school bond $210 per capita, stand. dev. $520.
  - Able to reject an effect up to 2 basis points for a $100 increase in the per capita enhanced amount.

Potential savings in nonadoptor states, \$M

	S.rating	S.rating-1	S.rating-2	S.rating-2 & GO	S.rating-2 & new money GO
Alabama	48.06	37.09	14.86	14.49	9.31
Arizona	5.60	2.21	0.69	0.69	0.64
California	107.98	98.21	91.89	91.54	58.56
Connecticut	0.52	0	0	0	0
Florida	308.56	305.37	246.41	246.41	107.15
Illinois	86.35	85.07	80.18	68.82	29.69
Iowa	134.43	133.60	115.06	114.62	89.31
Kansas	87.39	66.40	36.45	36.35	11.39
Louisiana	17.98	11.79	3.23	3.23	2.04
Maine	0.50	0.04	0.04	0.04	0
Mississippi	10.45	7.87	6.22	4.59	2.52
Montana	35.56	34.23	28.19	27.26	24.32
Nebraska	72.95	70.62	43.75	37.00	16.34
New Hampshire	1.83	0.91	0.40	0.40	0.40
Oklahoma	37.88	32.63	28.37	28.37	28.24
Tennessee	4.62	4.12	2.90	0.32	0.29
Wisconsin	40.39	23.35	9.27	9.27	2.36
All	1001.04	913.48	707.91	683.41	382.55

Comments and suggestions appreciated.

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District bond summary stats, 2009-2019

	All		Nonprogram State	Program State	
				Unenh.	Enh.
yield, percent	2.348	(1.13)	2.529	2.296	2.211
logged principal	13.269	(1.42)	13.209	13.073	13.446
maturity, years	9.539	(6.15)	9.763	8.537	9.939
whether general obligation	0.935	(0.25)	0.873	0.934	0.993
whether callable	0.830	(0.38)	0.806	0.814	0.864
whether competitively sold	0.354	(0.48)	0.308	0.376	0.385
whether tax exempted	0.950	(0.22)	0.935	0.966	0.953
whether tax credit	0.007	(0.08)	0.005	0.011	0.006
whether refunding	0.487	(0.50)	0.389	0.522	0.557
whether bank qualified	0.508	(0.50)	0.476	0.577	0.496
insured	0.208	(0.41)	0.300	0.410	0.000
state enhanced	0.392	(0.49)			
N	326,438		119,974	78,113	128,351

Pre-enhancement balance in covariates

What factors are correlated with some bonds being enhanced while other bonds of the same district are not?

- Limit sample to district-year observations from the year prior to a bond issuance in districts ever enhanced.
- Regress district characteristic on an indicator of receiving enhancement the year after.
- Control for issuance history, district FE, and state-by-year FE.

	Capital spending (1)	Debt (2)	Logged enroll (3)	Total revenue (4)	Current spending (5)	Poverty (6)	B&H share (7)
enhanced	-0.097	-0.877***	-0.001	-0.004	-0.033	0.000	0.001
	(0.072)	(0.184)	(0.003)	(0.043)	(0.036)	(0.001)	(0.001)

$*p < 0.05$ $**p < 0.01$ $***p < 0.001$

Results on per pupil capital spending

	(1)	(2)	(3)	(4)	(5)
enhanced	0.337**	0.349***	0.325***	0.587***	0.157
	(0.118)	(0.069)	(0.072)	(0.070)	(0.110)
enhanced					0.316*
x medium poverty					(0.159)
enhanced					0.335
x high poverty					(0.182)
FE	SY	dist+SY	dist+SY	dist+SY	dist+SY
all districts	yes	yes	issuer only	yes	yes
weighted	yes	yes	yes	no	yes

$*p < 0.05$ $**p < 0.01$ $***p < 0.001$

back

Results on per pupil capital spending, DID_M estimator

	(1)	(2)
	coefficient estimate	standard error
enhanced, $\tau^* = 0$	0.092	(0.047)
enhanced, $\tau^* = 1$	0.550***	(0.126)
enhanced, $\tau^* = 2$	0.770***	(0.141)
enhanced, $\tau^* = 3$	0.420**	(0.133)
enhanced, $\tau^* = -1$	-0.063	(0.039)
enhanced, $\tau^* = -2$	-0.004	(0.058)
enhanced, $\tau^* = -3$	-0.064	(0.070)

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

back

Results on other district characteristics

	Logged enrollment (1)	Current spending (2)	Poverty rate (3)
enhanced	0.003	0.082	-0.001
	(0.002)	(0.051)	(0.001)
Observations	76,833	76,833	76,501

$*p < 0.05$ $**p < 0.01$ $***p < 0.001$

back

Results on math score

	3	4	5	6	7	8
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Four years following state enhancement						
enhanced	-0.006	0.021	0.018	0.017	0.010	-0.006
	(0.019)	(0.021)	(0.020)	(0.023)	(0.023)	(0.028)
Panel B: Seven years following state enhancement						
enhanced	-0.011	-0.018	0.021	0.005	-0.035	-0.020
	(0.029)	(0.034)	(0.032)	(0.030)	(0.036)	(0.046)

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back

Results on LEA score

	3	4	5	6	7	8
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Four years following state enhancement						
enhanced	0.010	0.003	-0.004	-0.006	0.001	-0.017
	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)	(0.018)
Panel B: Seven years following state enhancement						
enhanced	0.045	0.020	0.038	0.012	-0.052	-0.058
	(0.031)	(0.028)	(0.029)	(0.032)	(0.031)	(0.050)

$^*p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.001$

back

Results on state interest rate

	(1)	(2)	(3)	(4)	(5)
enhanced amount	0.0384	0.0277	0.0971	0.0301	
	(0.1052)	(0.1075)	(0.1635)	(0.1268)	
enhanced amount, range1					-0.4033
					(0.6614)
enhanced amount, range2					0.1075
					(0.1155)
enhanced amount, range3					0.0168
					(0.1597)
state covariates	no	yes	yes	yes	yes
nonenhancement states	yes	yes	no	yes	yes
permenant fund states	yes	yes	yes	no	yes
Observations	1,237	1,237	381	1,191	1,237

$*p < 0.05$ $**p < 0.01$ $***p < 0.001$

back