Private Activity Bonds as Investment Subsidy: Evidence from the 1986 Cap on Bond Volumes

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Motivation

- U.S. state and local governments can issue tax-exempt private activity bonds (PABs) on behalf of firms to foster investment and employment ▸ Structure ▸ Yield
- In 2019, PAB issuance accounted for about 25% of the overall municipal bond

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- In 2019, PAB issuance accounted for about 25% of the overall municipal bond
- The tax-subsidization of PABs is frequently subject to political debates

THE BOND BUYER

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TAX REFORM

Industry groups come out swinging to save tax-exempt PABs

By Brian Tumulty   November 03, 2017, 4:40 p.m. EDT   4 Min Read

WASHINGTON – Muni market supporters of tax-exempt private activity bonds were marshalling forces Friday to fight the House Republicans attempt to do away with them in their tax reform bill.

The New York Times

A Stealth Tax Subsidy for Business Faces New Scrutiny

Source: The Bond Buyer (2017); The New York Times (2013)

Research questions

1. How does the supply of PAB financing affect firms' investment?

2. What is the employment effect of this capital subsidy?

Identification challenges and empirical approach

1. Differences in PAB issuance might reflect different local investment opportunities

2. Demand of firms for PAB issuance is endogenous

3. States have the power to set up their own allocation scheme for PABs (IRC Section 146)

1. Differences in PAB issuance might reflect different local investment opportunities

    $\rightarrow$ Bordering county analysis

2. Demand of firms for PAB issuance is endogenous

    $\rightarrow$ Analysis of PAB eligible firms

3. States have the power to set up their own allocation scheme for PABs (IRC Section 146)

    $\rightarrow$ Analysis of a lottery-based random allocation mechanism

- The **1986 Tax Reform Act** introduced new state-level volume caps for PABs: ▸ Cap ▸ Reaction

$$PAB\ volume_{s,1988} = \begin{cases} \$150m, & if\ population_s < 3m \\ \$50\ x\ population_s, & if\ population_s \geqslant 3m \end{cases}$$

- The **kink** in the cap formula creates variation across states in the **per cap PAB supply limit**
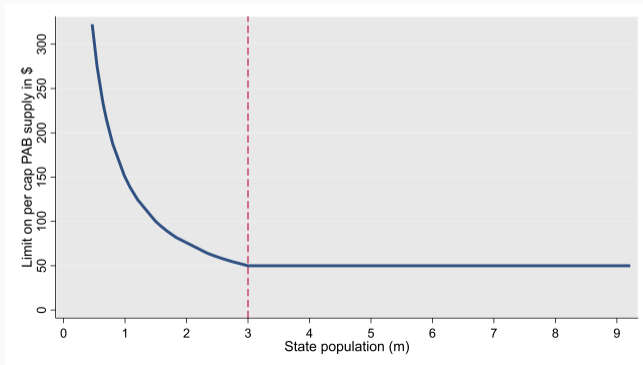
I use a DiD approach exploiting variation in per cap PAB supply limits around state borders:

$$Y_{i,t} = \alpha + \beta \text{Post 1986}_t \cdot \text{Per cap PAB supply}_{s,1988} + \phi_i + \xi_t + \chi_{b,p} + \epsilon_{i,t}$$

- where I control for border region's common economic trends before and after the Tax Reform using state-border pair-post fixed-effects ($\chi_{b,p}$)
- The analyzed real effects ($Y_{i,t}$) are at the county- or firm-level
- *Post* 1986 equals one in the four years after the new volume caps have been introduced

- The sample period is from 1983 to 1990
- The sample comprises counties with any PAB issuance in the 10 years prior to the reform (Census of State and Local Government Finances)
- PAB eligible firms from Compustat, based on historic sic2 codes for manufacturing, transportation and utilities, mining and construction, real estate, and higher education
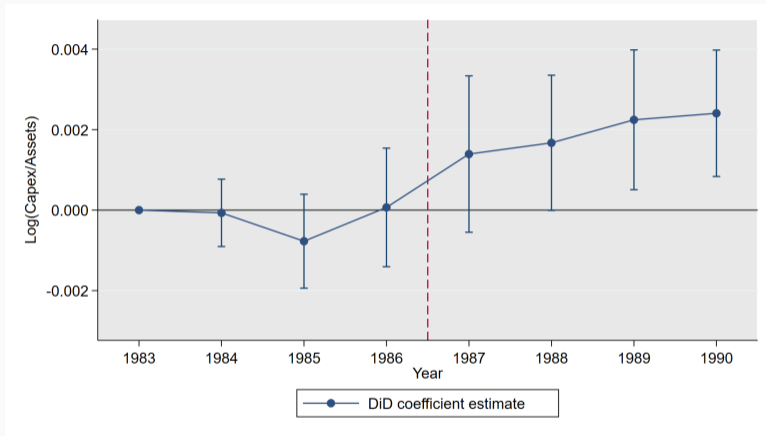- PAB deal data from SDC Platinum to identify PAB beneficiaries

▸ Data
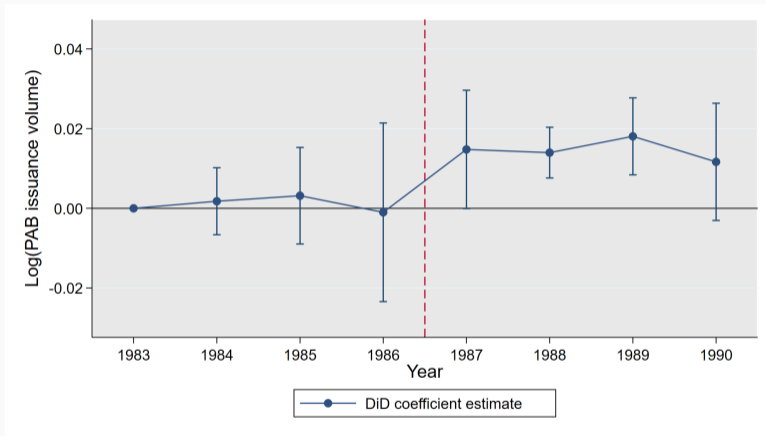
- A one dollar increase in the state-level cap for PABs is associated with a 1.37% increase in counties' PAB issuance after the 1986 Tax Reform ▸ Regression results ▸ Deal-level

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- A one-standard-deviation increase in per cap PAB supply limit (46 USD) leads to an increase in the capex-to-assets ratio for eligible firms of about 9.76%.
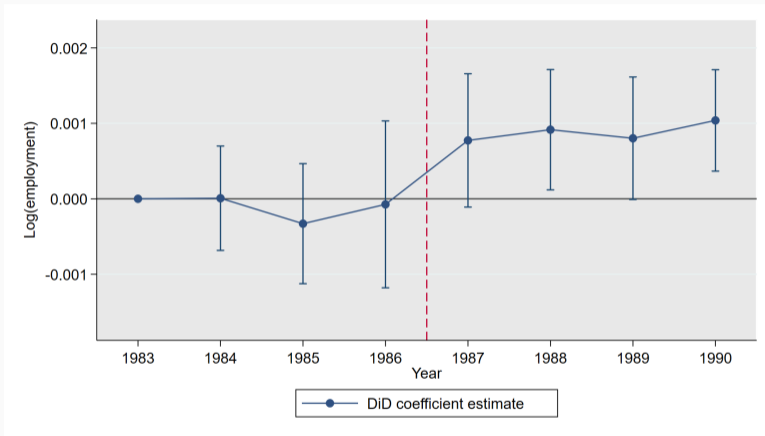
▸ Regression results   ▸ Mean plot   ▸ Other investment measure   ▸ Other PAB supply measure   ▸ Alternative issuer sample

	(1)	(2)	(3)	(4)
	Log(Capex/Assets) for			
	Post-beneficiaries		Pre- and post-beneficiaries	
Per cap PAB supply x Post-1986	0.0021**	0.0029	0.0035**	0.0055***
	(2.221)	(1.400)	(2.113)	(3.030)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
Industry-Post FE	No	Yes	No	Yes
Number of observations	844	843	424	424
Adjusted R^2	0.474	0.488	0.530	0.566

· A one-standard deviation increase in the per cap PAB supply limit (46 USD) leads to an increase in firm investment of post-reform PAB recipients by 9.66% (column 1).

Result 3: Effect of per cap PAB supply limit and firm employment

- A one-standard-deviation increase in the per cap PAB supply limit (46 USD) leads to an increase in firm employment for eligible firms of about 4.56%.

Regression results   Sample of PAB beneficiaries

States' selection of PAB beneficiaries: The State of Texas lottery for PABs

Sample of lottery winning and losing firms

- The State of Texas employs a lottery-based—*random*—distribution mechanism for PABs
- I analyse a sample for the program years 1996 to 2001 in which I both observe Compustat lottery winning firms and losing firms in the same program year, respectively
- I consider lottery-winning firms only in the first successful lottery year
- The control group consists of firms which never received any PAB between 1996 and 2001

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Regression framework

- I estimate the real effects of receiving PAB funding through the lottery as follows:

$$\Delta Y_{i,t} = \alpha + \beta Lottery\ allocated\ PAB\ volume_i + \xi_{lottery\ year} + \epsilon_{i,t}$$

- where $\Delta Y_{i,t}$ is the change in firm investment between year t and the pre-lottery year.

Result 4: Effect of lottery-based PAB allocation on firm investment in Texas

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Capex/Assets) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Log(Lottery-allocated bond volume)	0.009	0.021**	0.020*	0.011	0.021*	0.024*
	(1.192)	(2.298)	(2.011)	(1.119)	(1.813)	(2.108)
$Size_{Pre\text{-}lottery\ year}$	-0.193***	-0.201***	-0.158***	-0.201***	-0.209***	-0.179***
	(-4.133)	(-4.492)	(-4.284)	(-4.449)	(-4.181)	(-3.935)
Lottery year FE	No	No	No	Yes	Yes	Yes
Number of observations	29	25	24	29	25	24
Adjusted R^2	0.491	0.504	0.372	0.465	0.389	0.294

- A 10% increase in the lottery allocated PAB volume, equivalent to about USD 1.1m for the average lottery participation, increases firm investment by 20% to 24% over a 3 year horizon.

▸ Lottery win dummy ▸ Employment

Conclusion

I analyze how state-level changes in the supply of tax-exempt private activity bonds affect firm investment and employment.

1. Higher PAB supply stimulates firm investment
2. While subsidizing capital relative to labor, my results do not provide any evidence for an input factor substitution effect
3. States' project selection does not seem to drive the effects

My findings highlight the potentially stimulative role of tax-subsidized debt for private sector development.

▶ Literature

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The private activity bond financing framework

- Municipalities as conduit issuers
- Private sector entities as conduit borrowers
- Bonds are only secured by the private entity
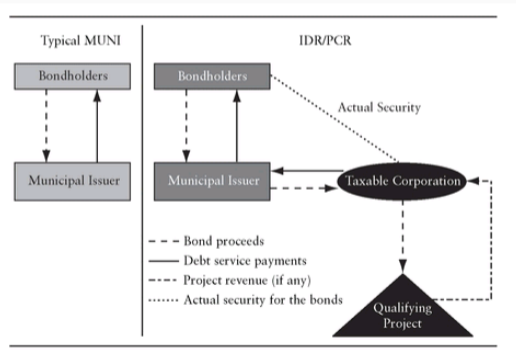
Source: Taken from Feldstein and Fabozzi (2008).

Tax-exempt bond yield and corporate bond yield
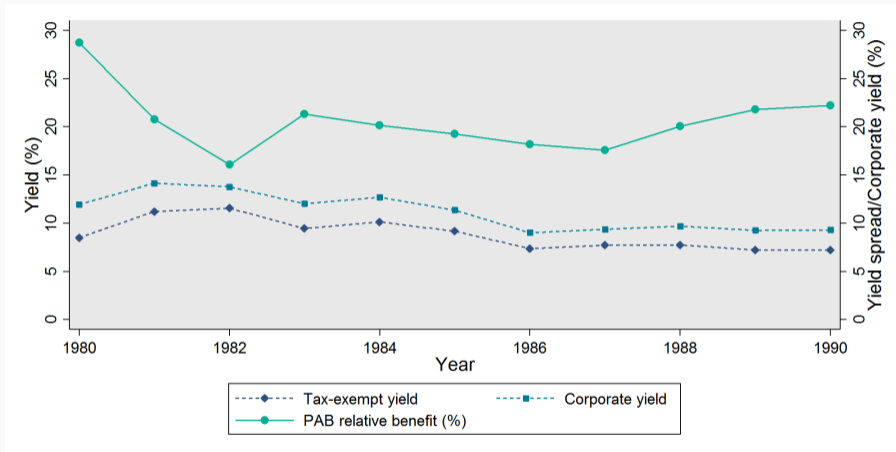
Source: Yield data from Maguire (2006).

PAB volume caps over time
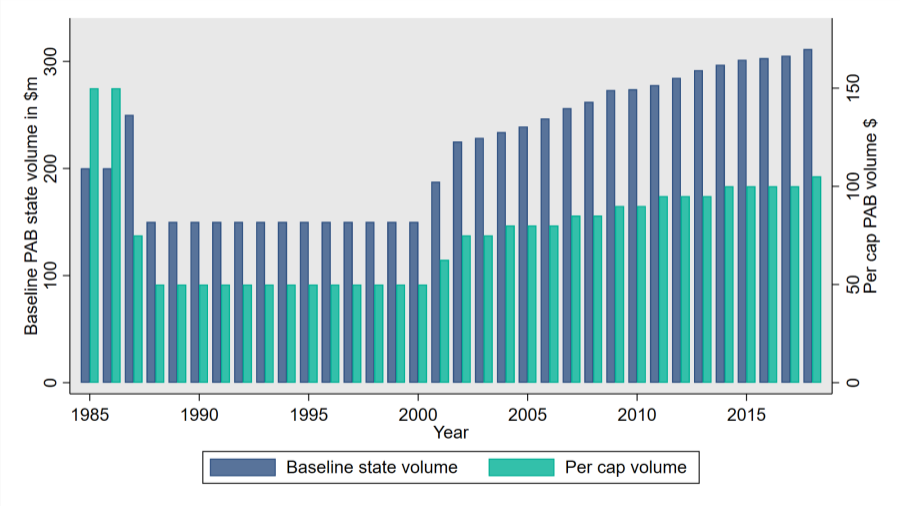
Anecdotal reaction to new volume cap limits

"Last year, we had $1 billion more in requests than we had cap"
—Theresa Steffan, executive secretary to the California Debt Limit Allocation Committee

"Increasingly, we are straining under the volume cap"
— Steve Zecher, executive director of Pennsylvania's Economic Development Financing Authority

"We don't know how much we suppress everybody." (...) "They know what's available and what's not available, (and) they'll suppress the request before we even find out about it."
— Tom Berkshire, aide to Gov. James R. Thompson of Illinois

Source: The Bond Buyer (1990)

Data

Per cap PAB supply limit
- Calculated using data from the Internal Revenue Service's revenue bulletin, IRC Section 146, and the U.S. Bureau of the Census' Population and Housing Unit Estimates series

Firm-level data
- Firm headquarter and financial data from Compustat
- PAB deal data from SDC Platinum, beneficiaries hand-matched to Compustat ► SDC
- Bordering regions are identified using the U.S. Bureau of the Census' County Adjacency File

PAB eligible industries
- IRC Section 141 and 146 determine the type of bonds that qualify for tax-exempt PAB financing
- Whitaker (2011) notes that PAB projects thus only comprise five types: "industrial development, utilities, mortgage revenue bonds, multifamily housing bonds, and student loan bonds"
- I map eligibility to five broad industry groups based on historic SIC2 codes: manufacturing, transportation and utilities, mining and construction, real estate, and higher education

Local government financial data
- U.S. Bureau of the Census' Annual Survey of State and Local Government Finances

- SDC covers about 4,200 new-money PAB deals between 1977 and 1990
- The top issuer states are Ohio, New York, Texas, Pennsylvania, and Michigan

▸ Data
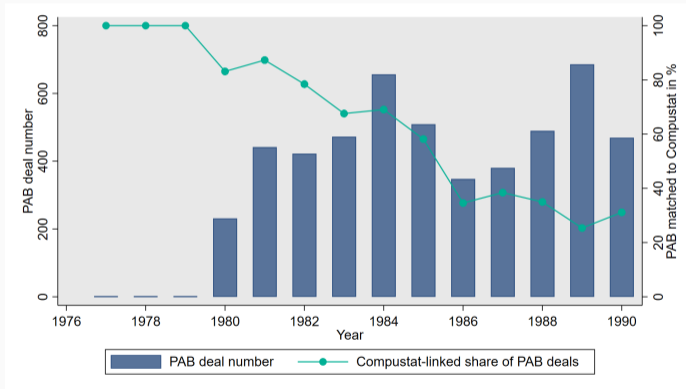
- The average deal size between 1983 and 1990 is USD 15.5m (median USD 5.6m)
- The average deal size over this period linked to Compustat firms is USD 24m (median USD 8m)

Data
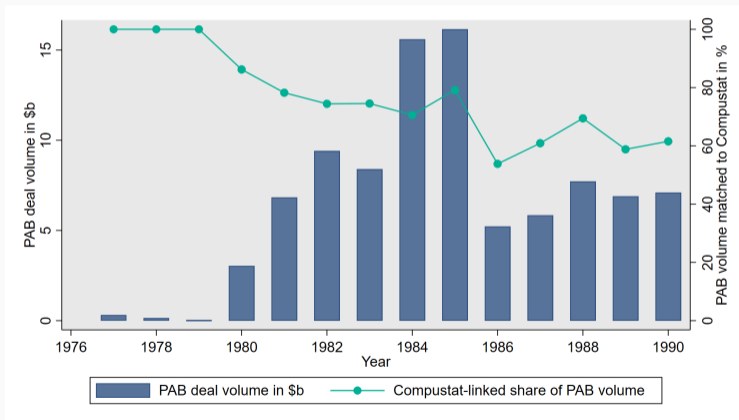
Result 1: Effect of per cap PAB supply limits on county PAB issuance volumes

	(1)	(2)	(3)	(4)
	Log(PAB issuance volume)			
	PAB issuing counties		PAB issuing border counties	
Per cap PAB supply x Post-1986	0.0048*	0.0045*	0.0120***	0.0137***
	(1.811)	(1.895)	(3.039)	(3.534)
House price index control	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
County size decile-Year FE	No	Yes	No	Yes
State border pair-Year FE	No	No	Yes	Yes
Number of observations	7150	7142	2295	2295
Adjusted R^2	0.376	0.376	0.375	0.373

▸ Coefficient plot

Result 1: Effect of per cap PAB supply limits on PAB deal volumes

- A one-standard-deviation increase in per cap PAB supply (40 USD) corresponds to a relative increase in the PAB deal volume of 8.4%
- This is equivalent to an increase in average deal volume by about USD 1.3 million `▸ County-level`

	(1)	(2)	(3)	(4)
	Log(PAB deal volume)			
Per cap PAB supply x Post-1986	0.0029**	0.0032***	0.0027**	0.0021*
	(2.376)	(2.815)	(2.591)	(1.737)
Rated dummy		0.7799***	0.3951***	0.3734***
		(11.057)	(7.386)	(7.337)
Credit enhancement dummy		-0.0153	0.1752***	0.0879**
		(-0.295)	(4.277)	(2.347)
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Usage type FE	No	No	Yes	Yes
Beneficiary FE	No	No	No	Yes
Number of observations	2876	2876	2876	2033
Adjusted R^2	0.159	0.270	0.448	0.606

Result 2: Mean plot for effect of per cap PAB supply limit on firm investment

Per cap PAB supply > 50 —•— Per cap PAB supply = 50 —•—
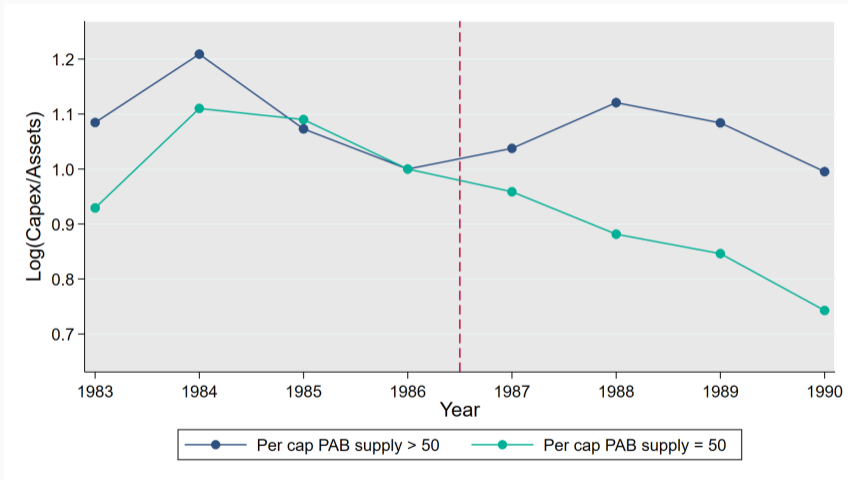
▸ Coefficient plot

Result 2: Effect of per cap PAB supply limit on firm investment

- A one-standard-deviation increase in per cap PAB supply limit (46 USD) leads to an increase in the capex-to-assets ratio for eligible firms of about 8.36% to 9.76%.

	(1)	(2)	(3)
	Log(Capex/Assets)		
Per cap PAB supply x Post-1986	0.0018***	0.0017***	0.0021***
	(5.089)	(4.977)	(3.359)
Lag of Size	-0.4144***	-0.4788***	-0.4808***
	(-6.299)	(-7.621)	(-9.973)
Lag of RoA		1.1047***	1.0546***
		(7.294)	(7.291)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
Stateborder-Pair-Post FE	Yes	Yes	Yes
Industry-Year FE	No	No	Yes
Number of observations	4094	4073	4059
Adjusted R2	0.488	0.507	0.525

▸ Coefficient plot

Robustness: Effect of per cap PAB supply limit on firm investment – Alternative firm investment measures

	(1)	(2)	(3)
	Log (Capex)	Capex/Assets	PPE growth
Per cap PAB supply x Post-1986	0.0024***	0.0002**	0.0004
	(4.837)	(2.246)	(1.014)
Firm controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Stateborder-Pair-Post FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Number of observations	4157	4157	4211
Adjusted R^2	0.954	0.380	0.107

▸ Coefficient plot

Robustness: Effect of per cap PAB supply limit on firm investment – 1987 PAB volume allocation formula

	(1)	(2)	(3)
	Log (Capex/Assets)		
Per cap PAB supply$_{1987}$ x Post-1986	0.0011***	0.0010***	0.0012***
	(4.883)	(4.773)	(3.300)
Lag of Size	-0.4144***	-0.4788***	-0.4807***
	(-6.297)	(-7.619)	(-9.972)
Lag of RoA		1.1046***	1.0545***
		(7.294)	(7.291)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
Stateborder-Pair-Post FE	Yes	Yes	Yes
Industry-Year FE	No	No	Yes
Number of observations	4094	4073	4059
Adjusted R^2	0.488	0.507	0.525

▸ Coefficient plot

Robustness: Effect of per cap PAB supply limit on firm investment
– Alternative PAB issuing county sample definition

	(1)	(2)	(3)
		Log (Capex/Assets)	
	Pre-period issuer	Pre- and post-period issuer	Non-issuer 1976-1985
Per cap PAB supply x Post-1986	0.0022***	0.0027***	0.0047
	(3.640)	(4.490)	(0.415)
Firm controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Stateborder-Pair-Post FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Number of observations	3487	2766	2590
Adjusted R^2	0.521	0.518	0.483

▸ Coefficient plot

Result 2: Effect of per cap PAB supply limit on investment for PAB beneficiaries

Firm investment
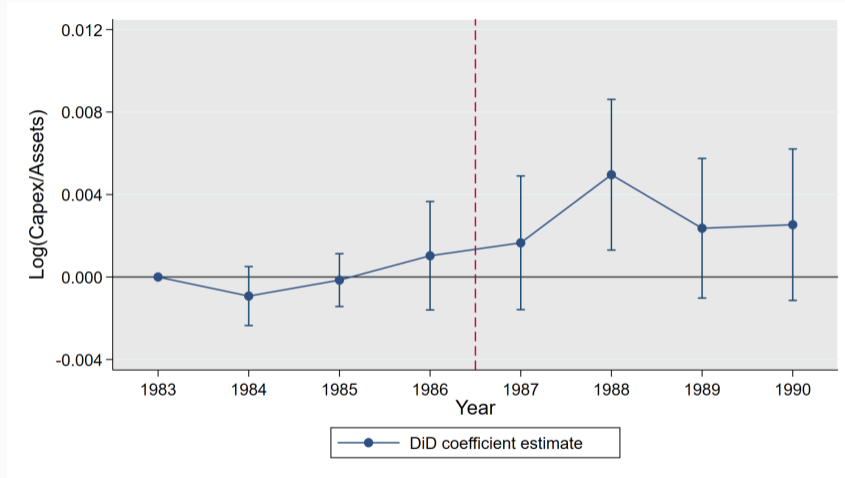
Characteristics of PAB beneficiary firms compared to PAB eligible industry peers

- Comparing average firm characteristics of PAB beneficiary firms with PAB eligible industry peers, PAB recipients are relatively larger, more profitable and with lower financial constraints

  ▸ Investment effect of PABs

Difference between PAB beneficiary firms and industry peers
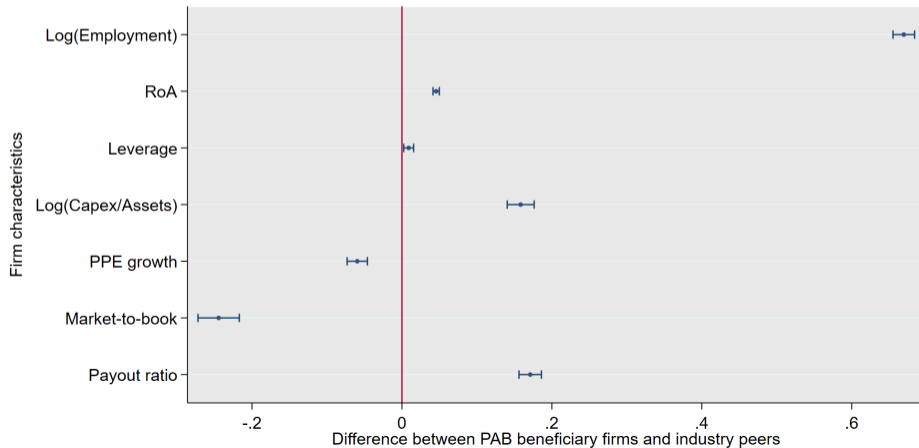
Result 3: Effect of per cap PAB supply limit on firm employment

- A one-standard-deviation increase in the per cap PAB supply limit (46.48 USD) leads to an increase in firm employment for eligible firms of about 4.56% to 4.83%. ▸ Coefficient plot

	(1)	(2)	(3)
	Log (employment)		
Per cap PAB supply x Post-1986	0.00104***	0.00103***	0.00098***
	(9.806)	(9.779)	(6.252)
Firm controls	Size	Size, RoA	Size, RoA
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
Stateborder-Pair-Post FE	Yes	Yes	Yes
Industry-Year FE	No	Yes	Yes
Number of observations	4067	4051	4027
Adjusted R^2 (within)	0.157	0.161	0.169

Result 3: Effect of per cap PAB supply limit on employment for PAB beneficiaries

	(1)	(2)	(3)	(4)
	Log (employment)			
Per cap PAB supply x Post-1986	0.0007 (1.554)	0.0011** (2.610)	0.0011** (2.266)	0.0017*** (2.935)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
Industry-Post FE	No	Yes	No	Yes
Number of observations	841	840	428	428
Adjusted R^2 (within)	0.284	0.289	0.226	0.262

▸ PAB eligible firms

Result 4: Effect of lottery-based PAB allocation on firm investment in Texas

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Capex/Assets) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Lottery win dummy	0.138	0.336**	0.320*	0.165	0.345*	0.391*
	(1.137)	(2.226)	(1.933)	(1.051)	(1.756)	(2.019)
Size$_{\text{Pre-lottery year}}$	-0.193***	-0.201***	-0.158***	-0.201***	-0.209***	-0.179***
	(-4.102)	(-4.431)	(-4.215)	(-4.371)	(-4.093)	(-3.829)
Lottery year FE	No	No	No	Yes	Yes	Yes
Number of observations	29	25	24	29	25	24
Adjusted R^2	0.488	0.498	0.363	0.459	0.381	0.279

▸ Lottery allocated volume

Result 5: Effect of lottery-based PAB allocation on firm employment in Texas

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Employment) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Log(Lottery-allocated bond volume)	0.004	0.005	0.009	0.005	0.007	0.011
	(1.318)	(1.272)	(1.440)	(1.497)	(1.292)	(1.439)
$Size_{Pre\text{-}lottery\ year}$	-0.002	-0.019	-0.039	-0.007	-0.023	-0.042
	(-0.235)	(-0.936)	(-1.035)	(-0.583)	(-1.246)	(-1.202)
Lottery year FE	No	No	No	Yes	Yes	Yes
Number of observations	29	25	25	28	24	24
Adjusted R^2 (within)	-0.00143	0.0205	0.0524	0.0250	0.0576	0.0629

▸ Lottery and firm investment

Result 5: Effect of lottery-based PAB allocation on firm employment in Texas

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Employment) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Lottery win dummy	0.066	0.083	0.144	0.085	0.114	0.185
	(1.329)	(1.241)	(1.453)	(1.490)	(1.258)	(1.464)
$Size_{Pre\text{-}lottery\ year}$	-0.002	-0.019	-0.039	-0.007	-0.023	-0.042
	(-0.241)	(-0.953)	(-1.043)	(-0.581)	(-1.263)	(-1.212)
Lottery year FE	No	No	No	Yes	Yes	Yes
Number of observations	29	25	25	28	24	24
Adjusted R^2 (within)	-0.00164	0.0152	0.0530	0.0216	0.0477	0.0643

▸ Lottery and firm investment

Contribution

I contribute to different strands of the literature:

(1) **Municipal financing and its real effects** (e.g., Adelino, Cunha and Ferreira, 2017; Dagostino, 2019; Rossi and Yun, 2023), by showing that private activity bond issuance has direct real effects for the beneficiaries

(2) **Government incentives for private sector investment** (e.g., Kim and Nguyen, 2020; Hebous and Zimmermann, 2021; Chava, Malakar and Singh, 2023), by providing insights on a positive private sector reactions to a stimulus on the local level

(3) **Policy debate on private activity bonds** (e.g., Zimmerman, 1989; Osterberg, 1991; Congressional Budget Office, 2010), by adding insights on the corporate reaction to the subsidy beyond a public sector perspective