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

Lisa Knauer[1]

[1]Rotterdam School of Management, Erasmus University

February 9, 2025

Abstract

I examine firms' investment response to the supply of private activity bonds (PABs) – a subsidy tool that provides corporate beneficiaries access to the tax-exempt municipal bond market. I leverage the variation in PAB supply limits across states introduced by the 1986 Tax Reform. By documenting an economically large positive investment effect, I show that higher PAB supply stimulates firm investment. Although PABs subsidize capital over labor, my results do not support input factor substitution, as I find a positive effect on employment. I exploit the random outcome of a lottery-based PAB distribution mechanism to show that states' project selection does not drive the results.

JEL classification: G32, H25, H32, H71, G18, D22

Keywords: Tax-exempt bond financing, business subsidy, firm investment, employment

*I am deeply grateful to Daniel Bias, Christoph Kaserer, and Stefano Rossi for their very helpful comments. I further thank Igor Cunha (discussant), Jean Helwege, Marco Pagano, Norman Schürhoff, as well as conference participants at the AFFECT Workshop 2025, the Franco-German Fiscal Policy Seminar 2024, the 12th Brookings Municipal Finance Conference, the AFA Poster Session 2024, the NextGen Economics Session at the 7th Lindau Nobel Laureate Meeting on Economic Sciences, and the German Finance Association's doctoral workshop for helpful discussions and suggestions. Please send comments to knauer@rsm.nl

Recent industrial policies highlight the strong interest in mobilizing private sector investment (see, e.g., Evenett et al., 2024). In the United States, tax-exempt Private Activity Bonds (PABs) are an important subsidy tool that state and local governments can use to stimulate corporate investment and, ultimately, foster local economic development. By providing firms with access to the tax-exempt municipal bond market, PABs substantially lower the cost of capital for qualified private sector projects. In particular, the yields on tax-exempt municipal bonds have historically been about 20 percent lower than the yields on comparable corporate bonds (Council of Economic Advisers, 2023).[1] With total PAB issuance currently accounting for roughly one quarter of the entire tax-exempt market (Internal Revenue Service, 2019),[2] this tax subsidy is often the subject of political debate, questioning whether the subsidized investment projects would have been realized regardless of the availability of PAB funding (Congressional Budget Office, 2018).[3] Yet, the corporate response to PAB funding remains largely unexplored.

In this paper, I examine how corporate investment and employment respond to the supply of PAB funding.[4] PABs, which are only secured by the benefiting corporate entity, could stimulate firm investment by enabling projects that might not be realized, or at least not to the same extent, without the capital subsidy. The subsidy might have no investment effect if PABs are merely used to substitute for conventional financing (Mulcahy and Guszkowski, 1974; Zimmerman, 1989). Regarding the impact of PAB supply on corporate employment, the subsidy to capital as an input factor could have two opposing effects (Moore and Squires, 1988): If PAB funding leads to an increase in firm investment and output in the first place, then PABs could also induce a rise in firm employment, thus generating a "scale effect". However, the supply of PABs could also have a negative effect on employment if firms substitute labor with tax-subsidized capital.

[1]The figure is based on the average yield difference between high-grade municipal bonds and Aaa-rated corporate bonds over the period 1980-2010, calculated using data from the Council of Economic Advisers (2023), Table B–42.

[2]The reported PAB issuance share includes projects for all types of non-governmental beneficiaries, such as non-profit organizations besides private businesses.

[3]For example, the tax exemption for PABs was in question throughout the 2017 tax reform discussions and was preserved only in the final phase (Pierog, 2017).

[4]PABs are also referred to as conduit bonds. I use the term private activity bonds throughout this paper. Further, taxable PABs exist. I only consider qualified PABs that are tax-exempt.

Analyzing the corporate response to PAB supply is empirically challenging for three major reasons. First, PAB issuance may primarily focus on regions with favorable local investment opportunities. Second, even within regions characterized by similar investment opportunities, the demand of firms for PAB funding is endogenous, so that firms may request PAB funding on the basis of various observable and unobservable factors. Third, states have discretionary power in the allocation of PABs, adding another dimension of selection complexity to PAB funding.

To identify the effect of PAB supply on firm investment and employment, I exploit new state-level volume caps for PABs introduced as part of the 1986 Tax Reform Act. These limits to the supply of PABs were intended to combat the previous growth in PAB issuance (Livingston, 1989), since PABs accounted for more than half of total issuance in the tax-exempt bond market in 1982 (Zimmerman, 1990). The 1986 Tax Reform Act imposed a population-dependent limit to a state's aggregate PAB supply volume: From 1988 to 2000, each state was allowed to issue the greater of i) \$150 million in baseline PAB volume and ii) \$50 per cap multiplied by the state's population figure (H.R.3838 - Tax Reform Act of 1986, 1986). This PAB allocation formula generates plausibly exogenous variation in PAB supply on a *per cap* level: Because of the population-based kink in the formula, states with smaller population figures can supply relatively higher per capita volumes of PABs to firms, whereas larger states with a population of 3 million or more are restricted to a maximum of 50 USD PAB supply per cap. 23 states can provide more than 50 USD of PABs per cap.

I exploit the state-level variation in per cap PAB supply after the 1986 Tax Reform in a difference-in-differences framework. For some of my analyses, I use a sample of state border counties. This allows me to control for common economic trends and investment opportunities in border regions before and after the 1986 Tax Reform, thereby mitigating concerns that these trends drive my results (see, e.g., Gustafson and Kotter, 2023). To account for the endogenous demand of firms for PAB funding, I analyze two samples of firms: First, I adapt the idea of Bonfim, Custódio and Raposo (2023) and compare firms that are eligible for PAB funding. Second, I use a sample of firms that receive PAB funding before and after the tax reform. In additional analyses, I leverage results from a lottery-based—therefore random—PAB

distribution mechanism, implemented to allocate a state's volume cap among firms seeking PAB funding. This allows me to isolate firm responses to PAB supply from potential distortions due to states' project selection.

I start by showing that higher state-level caps for PABs lead to higher PAB supply and, consequently, to higher PAB allocation to firms after the 1986 Tax Reform Act. I do this in two steps. First, I focus on local governments as PAB issuers and examine changes to PAB issuance when different state-level per cap PAB supply limits apply. I show that a one standard deviation increase in the per cap PAB supply limit corresponds to a relative increase in PAB issuance at the county level by about 17.9%. Second, I document that firms that benefit from PAB funding before and after the reform receive considerably higher PAB allocations after the introduction of new volume caps if they are located in states with higher per cap PAB supply.

With the per cap PAB supply shock in hand, I turn to the corporate perspective and examine firms' investment response to PAB supply. I therefore leverage two firm samples. First, I compare PAB eligible firms headquartered in border counties of states that have different per cap PAB supply limits. Conducting the analyses at state borders allows for estimating differences in firms' investment responses while taking into account time-varying changes in border areas' economic conditions, particularly regarding local investment opportunities. The use of eligible firms helps to address the endogeneity inherent in firms' request for PAB funding, thus providing an intention-to-treat effect of the program (see also Bonfim, Custódio and Raposo, 2023). To define eligibility, I map the definition of PAB types by the Internal Revenue Code's (IRC) sections 141 and 146 to five broad beneficiary industry groups: manufacturing, transportation and utilities, mining and construction, real estate, and higher education.

I find a statistically significant and positive effect of PAB supply on the investment of eligible firms: Increasing the per cap PAB supply by 50 USD—equivalent to roughly one standard deviation—is associated with an increase of the capex-to-assets ratio by 10.5%. The higher PAB supply capability takes time to fully materialize in the investment response. The positive effect on firm investment starts in 1987, the year after the tax reform, and steadily increases until the end of the four-year horizon that I analyze.

Second, I analyze how firms with persistent demand for PAB funding react to differences in PAB supply. To investigate the investment effect for recurring PAB program beneficiaries, I employ a sample of firms that received PAB funding both before and after the tax reform. My estimates show that PAB beneficiaries have an economically large investment response to PAB funding: An additional 25 USD in per cap PAB supply increases investment by 12.3%. Taken together, these results provide evidence that the supply of tax-subsidized private activity bonds stimulates firm investment.

While the documented positive investment response to PABs could lead to increased hiring of labor, it could also have a negative effect on employment if firms substitute labor with tax-subsidized capital. I test how PAB supply affects the employment of PAB eligible firms and PAB beneficiary firms. I find evidence for a scale effect of PAB supply on employment: Employment significantly increases with PAB supply for both samples of firms. Even after controlling for common economic trends at state borders, an additional 50 USD in per cap PAB supply is associated with an increase in employment of PAB-eligible firms by about 4.9%. Together, these findings show that subsidizing capital relative to labor through PABs is not associated with an input factor substitution.

A potential threat to my identification is yet that PAB allocation committees in states with higher and lower per cap PAB supply systematically pick projects with better and worse investment prospects, respectively. To rule out that states' project selection is the main driver of my results, I utilize PAB program data from the State of Texas, which employs a lottery system to allocate its PAB volume among PAB funding applicants. The Texas PAB allocation program is also relevant due to its economic size, as the state had the second largest PAB volume among all states (Texas Bond Review Board, 1997) during the lottery period I analyze.

I leverage a sample of PAB applicant firms for the program years 1996 to 2001, of which only a subset received PAB funding randomly by lot. I find a sizeable positive investment effect of receiving PAB funding through the lottery. This strongly supports my previous finding that PAB financing directly stimulates corporate investment. For firm employment, while all point estimates on receiving PAB funding are positive, they are statistically not significant. Hence,

while not providing evidence for a scale effect of PAB supply, these estimates align with the earlier finding that PAB funding is not associated with a substitution of input factors.

My paper relates to several strands of the literature. First, I contribute to the growing literature stream on municipal finance and its real effects. Specifically, Adelino, Cunha and Ferreira (2017), Dagostino (2022), Agrawal and Kim (2022), and Amornsiripanitch (2022), among others, provide insights on the impact of conventional municipal bond supply on the local economy. The real effects arise from adjustments to municipal expenditures in response to shocks on the municipal bond market. Different to these papers, I examine a change in the supply of private activity bonds, which directly expose the private sector to the market for tax-exempt financing. Rossi and Yun (2024) examine the use of conduit financing in the regulatory context of the introduction of Chapter 9 bankruptcy. My focus is on the role of PAB supply, and I provide novel evidence on its stimulating impact on private-sector investment.

Second, I contribute to the literature that examines governmental incentive programs and subsidies for private-sector investment and employment. Much work has been devoted to the assessment of place-based policies (see Kline and Moretti, 2014, for an overview). Juhász, Lane and Rodrik (2024) provide an overview on industrial policies, highlighting the more favorable assessment of these programs in more recent research that pays close attention to identification methods. In this regard, Criscuolo et al. (2019) conduct a micro-econometric assessment of an investment subsidy scheme for firms in the United Kingdom and find a comparably large effect of the assessed program on employment. In the U.S. context, Zwick and Mahon (2017) analyze an accelerated depreciation policy as a tax incentive for investment and document a positive investment response. Garrett, Ohrn and Serrato (2020) examine the local labor market effects of accelerated depreciation and find a positive effect on local employment. While accelerated depreciation reduces the cost of investment by lowering a company's taxable income early in the asset's life, tax-exempt PABs as a type of municipal bonds accomplish this by exempting the interest earned on the bond from taxation (see, e.g. Cestau et al., 2019). Overall, by showing that the PAB program has a positive effect on investment and employment of beneficiary firms, my findings align well with more contemporary assessments of different government incentives.

Third, my work relates to the broader literature on financing of corporate investment. In particular, prior literature studies credit supply related to conventional external financing and its impact on corporate investment (e.g., Zarutskie, 2006; Lemmon and Roberts, 2010; Alfaro, García-Santana and Moral-Benito, 2021). I provide novel evidence on the corporate reaction to the supply of tax-subsidized external financing in the form of private activity bonds.

Fourth, my findings contribute to the literature that studies the 1986 Tax Reform Act and its effects on firms. Auerbach and Slemrod (1997) provide a comprehensive overview of the provisions that directly targeted firms. I provide insights on a corporate effect of the tax reform that works indirectly through novel provisions for the private activity bond market.[5]

Finally, my findings contribute to the policy debate on private activity bonds (e.g., Zimmerman, 1989, 1990; Osterberg, 1991; Congressional Budget Office and Joint Committee on Taxation, 2009). The debate on PABs focuses primarily on federal revenue losses and thus takes on a public sector perspective. I present novel insights on the micro-level by directly investigating real effects for firms.

The remainder of the paper is structured as follows. Section 1 provides background information on state-level PAB caps. Section 2 describes the data. Section 3 presents results for the effect of PAB supply on PAB issuance. Section 4 presents results for the effect of PAB supply on firm investment, and Section 5 for the effect on firm employment. In Section 6, I examine the corporate real effects of the Texas PAB lottery program. Section 7 concludes.

1. State-level caps for private activity bond supply

1.1. Introduction of PAB volume caps

The 1984 Deficit Reduction Act introduced the first state-level caps for PABs to address the booming issuance of these bonds in the years beforehand (see, e.g., Driessen, 2022). These initial caps were set at the greater of i) \$150 multiplied by the state population, and ii) \$200 million

[5]Zimmerman (1990) and Whitaker (2014) provide insights on how the private activity bond caps mandated by the tax reform affected private activity bond issuance. However, they do not provide insights on corporate real effects and, consequently, the potential benefits of the PAB program.

baseline volume. However, for instance as noted by The Bond Buyer (1984), these initial volume caps did not impose a major restriction for states regarding their PAB issuance capability. Likewise, Livingston (1989) indicates that the initial caps aimed to align PAB issuance with pre-year levels rather than to actively restrict it.

With the 1986 Tax Reform Act, new restrictive state ceilings for issuing tax-exempt PABs were introduced. In contrast to the caps imposed in 1984, these new caps were reported as a sharp reduction in the volume of PABs that states could issue (see, e.g., Kawecki, 2002). Taking California as an example, the newly enacted cap denoted a 50% reduction from the state's 1985 limit (Business Wire, 1986). Figure 1, Subfigure (a) provides an overview of the cap over time.

For the transition year 1987, each state was allowed to issue the greater of i) \$250 million in baseline PAB volume and ii) \$75 multiplied by the state's population. According to IRC Section 141, a bond issue is generally classified as a PAB if more than 10% of its proceeds are used by a nongovernmental entity, and this nongovernmental entity also directly or indirectly secures at least 10% of the bond's principal or interest.[6] From 1988 through 2000, the PAB cap remained constant, and each state could supply the greater of i) \$150 million in baseline PAB volume and ii) \$50 multiplied by the state's population figure. [7]

$$PAB\ volume_{s,1988} = max \begin{cases} \$150m \\ \$50 \cdot\ population_s \end{cases} \tag{1}$$

The two-part formula in the allocation schedule disproportionately favors smaller states (Livingston, 1989): States with lower population figures possess relatively larger per cap PAB volumes. I illustrate this property in Subfigure (b) of Figure 1. In particular, for the year 1988 onward, states with populations below 3 million had relatively higher per cap volumes, with values ranging up to about \$322 for the least populous state. On the contrary, states with a

[6]These tests are referred to as private business use test, and private security or payment test. See IRC Section 141 for further details.

[7]See https://www.congress.gov/bill/99th-congress/house-bill/3838/text for details on the 1986 Tax Reform.

population of 3 million and above could only distribute $50 in PAB volume per person:[8]

$$Per\ cap\ PAB\ supply_{s,1988} = \begin{cases} \$150m \div population_s\ , if\ population_s < 3m \\ \$50\ , if\ population_s \geq 3m \end{cases} \tag{2}$$

1.2. Characteristics of PAB beneficiary firms

To provide a comprehensive background for the assessment of the PAB program, I compare firm characteristics of PAB beneficiary firms relative to their industry peers, i.e., relative to PAB eligible firms that do not receive a PAB allocation. Therefore, I use Compustat-matched data from SDC Platinum for the period from 1981 to 1990. 1981 is the first year of comprehensive PAB coverage in SDC, and 1990 marks the end of the sample period in later analyses. Manufacturing firms (about 49% of deals) and firms in the transportation and public utilities industry (38%) are the industry groups that receive the highest shares of PAB bonds matchable to Compustat firms.

In Figure 2, I display the mean values and 90% confidence intervals for the difference between PAB beneficiary firms and their industry peers. Focusing on the simple difference shown in Subfigure (a), PAB recipients are significantly larger as measured by the logarithm of employment.[9] I also find that PAB beneficiaries are more profitable as measured by a higher return on assets. While PABs themselves constitute a source of debt financing, PAB beneficiary firms are also generally more leveraged. The group of PAB beneficiary firms shows higher firm investments as measured by the natural logarithm of capex divided by assets. However, PAB beneficiares have lower average PPE growth rates and relatively lower market-to-book values than their industry peers. Finally, PAB beneficiary firms have significantly higher payout ratios than their peers.

[8] I focus on the per cap supply denoted by the more restrictive 1988 allocation schedule, which is also binding for the majority of the post-reform period of interest and even thereafter. In my analyses, I consider the 1987 PAB limits in robustness tests, which leads to similar results.

[9] PAB recipients are also larger in terms of total assets, which for displayability reasons is not captured in the figure above.

As the differences in firm characteristics displayed in Subfigure (a) may to some extent be driven by the size difference between PAB beneficiaries and non-beneficiaries, I additionally show differences in means after controlling for firm size-quintile-by-industry fixed effects. Results are presented in Subfigure (b). Even after controlling for these differences, PAB beneficiaries are characterized by larger employment, higher profitability, and higher investment than their industry peers.

In line with this, Giloth (1991) finds that PAB beneficiaries are larger than non-recipients when looking at a sample of PAB beneficiaries in Chicago. The Michigan Economic Development Corporation (2021) specifically mentions that its PAB program focuses on profitable firms. Several features of the PAB program could cause the selection effect. In this regard, two noteworthy provisions include (i) a restriction on the intended use of tax-exempt PABs, and (ii) a limit on PAB issuance costs. IRC Section 147(c) only allows for a maximum of 25% of the bond proceeds to be spent on the acquisition of land.[10] Besides, PABs usually cannot be used to finance working capital or inventory (see, e.g., Mississippi Business Finance Corporation, 2006; Utah Department of Workforce Services Housing & Community Development Division, 2023). Consequently, firms need to use other funds for these purposes. Further, as denoted by IRC Section 147, PABs can only use two percent of the bond proceeds for issuance costs.

Overall, the PAB program seems to favor firms that are relatively larger, more profitable, and that display higher investment.

2. Data and descriptive statistics

2.1. Data sources

To calculate the per cap PAB supply limit for each state, I collect information on the annual allocation schedule from IRC Section 146 and the Internal Revenue Service's (IRS) statistics of income bulletin. State and county population data is obtained from the U.S. Bureau of the Census Population and Housing Unit Estimates series.

[10]The restriction on land acquisition expenditures might also be a reason why PABs are primarily used to expand existing facilities (Thompson, 1968).

Company financial data and headquarter locations come from the Compustat database. All continuous financial variables are winsorized at the 1st and 99th percentiles. Firms in border counties are identified using the U.S. Bureau of the Census' County Adjacency File.

Based on historic SIC code in Compustat, I map firms to broad PAB eligibility categories. I use the 1987 historic SIC code if available, and current SIC codes otherwise. The types of bonds that qualify for tax-exempt issuance and are subject to the PAB volume cap are determined by IRC Sections 141 and 146. As noted by Whitaker (2011), this limits the use of PABs to projects from five categories: "industrial development, utilities, mortgage revenue bonds, multifamily housing bonds, and student loan bonds". I map these use cases to SIC industry groups. I then review the SIC codes of actual PAB beneficiaries and compare them to the industry-based eligibility definition.[11] The following industries are defined as eligible for PAB financing: manufacturing (SIC2 20-39), transportation and utilities (SIC2 40-49), mining and construction (SIC2 10-17), real estate (SIC2 65), and higher education industry (SIC2 82).[12]

To construct a sample of PAB issuing counties, I use local government PAB issuance data from the U.S. Bureau of the Census's Annual Survey of State and Local Government Finances. I aggregate this data on the county level to identify counties with any PAB issuance in the 10-year period prior to the 1986 Tax Reform. I also employ this PAB issuance data for county-level tests on PAB issuance trends.

I identify PAB beneficiary firms using data from the Municipal New Issues Database in SDC Platinum.[13] The deal data is structured around the conduit issuers. I hand-match PAB beneficiary names to Compustat using (historic) company names. I only use new money PAB deals, as current refunding deals are not subject to the PAB caps (see IRC Section 146).

Data on the Texas PAB lottery comes from the Texas Bond Review Board (BRB). The BRB annually provides information on PAB requests through the lottery, as well as on lottery

[11] PAB beneficiaries are identified by hand-matching PAB deal data from SDC Platinum to Compustat firms, which allows me to observe the (historic) beneficiary SIC codes.

[12] The vast majority of Compustat-linked PAB deals in SDC are issued for the benefit of firms in the manufacturing as well as the transportation and utilities industry group.

[13] 1977 is the first year for which a limited set of PAB deals is available. More comprehensive coverage begins in 1981. After the 1986 Tax Reform, Compustat firms account for about 25% of the PAB deals in SDC, but they account for an aggregate bond volume share of about 50%. See Appendix B for an overview of data coverage.

outcomes. Data from 2001 onward is available from the BRB's website. Data from 1996 to 2000 is directly obtained from the BRB. I keep two types of lottery attempts: i) those that have been allocated an amount, i.e., lottery winning attempts, and ii) those that are in line for funding, i.e., unsuccessful lottery losing attempts. I hand-match beneficiary names of projects to Compustat and aggregate lottery attempts on the firm-lottery program year level. Appendix C provides further information on the Texas PAB lottery.

2.2. Descriptive statistics

I use three samples of firms for the analyses. The sample of PAB-eligible firms headquartered in border counties covers 682 firms in 38 states, of which 126 firms are located in 14 states with a PAB cap larger than 50 USD. I cover 140 PAB beneficiary firms of which 14 are located in a state that can supply more than 50 USD in PABs per cap. Finally, the lottery sample consists of 29 firm lottery attempts. 16 applicants receive some PAB allocation, i.e., *Lottery win dummy* takes a value equal to one, and 7 applicants lose all lottery attempts.

Table 1 shows summary statistics for PAB issuance, as well as for the three firm-level samples used in the empirical analyses. Appendix A provides a detailed description of all variables. For firms that receive PAB funding in a given program year, the average volume allocated is USD 56.85m (median: USD 25m).[14] The average (median) capex-to-assets ratio is 9% (6%) for PAB eligible firms, and 9% (8%) for PAB beneficiaries.

Table 2 presents pre-tax reform and pre-lottery summary statistics for firms in the respective treatment and control groups. The pre-tax reform period covered in Panel A and B is from 1983 to 1986. Both PAB eligible and PAB beneficiary firms have broadly similar financial characteristics in states with higher and lower per cap PAB supply. One notable exception is the logarithm of capex divided by assets in the sample of eligible firms. I additionally calculate an adjusted difference in means that controls for industry-by-year fixed effects (Panel A), or industry-by-post-1986 dummy fixed effects (Panel B). The adjusted mean difference for eligible

[14] As noted by the U.S. Bureau of the Census (2006), the item public debt for private purposes in the Census has historically been subject to some reporting difficulties. Therefore, the displayed volumes for county-level issuance might rather represent a lower bound of the actual volumes.

firms' logarithm of capex divided by assets is close to zero, and statistically not significant.

Panel A further shows that PAB eligible firms in states with higher PAB supply are on average located in counties that are less populated. If investment opportunities are positively correlated with county size and thus would be better in states with low PAB supply, the distribution of county population should rather bias me against finding an effect.

3. PAB volume caps and their impact on PAB issuance

I first examine the effect of the state-level per cap PAB supply limits on PAB issuance after the 1986 Tax Reform. Although my primary focus is on the corporate real effects of the PAB volume caps, it is critical to establish that the corresponding per cap PAB supply limits are a constraining factor. The empirical prediction is that states with higher per cap PAB supply limits should be less affected by the new volume caps and thus should show comparably higher PAB issuance after the tax reform.

I examine the effect of PAB volume caps on aggregate county-level PAB issuance, as well as on PAB volumes allocated to firms. My treatment measure *Per cap PAB supply* is the per person PAB amount in USD that a state can supply according to the 1988 allocation schedule. Because of the kink in the per cap PAB allocation schedule (illustrated in Figure 1, Subfigure b), the per cap PAB supply is larger than 50 USD for states with a population of less than 3 million, and is limited to 50 USD for states with a population of 3 million and more.

I run difference-in-differences regressions at the county and the firm level. I analyze a window of plus/minus four years around the introduction of new PAB volume caps.[15] At the county level, the regression specification is as follows:

$$\begin{aligned} PAB\ issuance\ volume_{c,t} = \alpha + \beta Post\ 1986_t \cdot Per\ cap\ PAB\ supply_s \\ +\gamma Post\ 1986_t + \delta Per\ cap\ PAB\ supply_s + \phi_c + \xi_t + \epsilon_{i,t} \end{aligned} \tag{3}$$

whereby c denotes a county, t a fiscal year, and s a state. ϕ_c are county fixed effects, and

[15]The sample period begins in 1983 to ensure that it predates the introduction of any PAB volume cap. See section 1.1 for details.

ξ_t are year fixed effects. *Post* 1986 equals one in the four years after the introduction of new PAB volume caps, i.e., for the years 1987 to 1990. The sample period is from 1983 to 1990.

The variable of interest is the coefficient on the interaction term between the Post-dummy and the per cap PAB supply limit. I include the county-level house price index as a control variable in all regressions.[16] I add county size-decile-by-year fixed effects in some specifications. For the sample of counties at state borders, I include state border pair-by-year fixed effects. Standard errors are clustered at the state level. In the empirical estimation, the variables *Post* 1986_t and *Per cap PAB supply*$_s$ are absorbed by year and county fixed effects, respectively. For the firm-level regressions, I conduct the analyses within beneficiary firm instead of within county. I control for lag of firm size and lag of return on assets in these regressions.

Table 3 presents results for the effect of the per cap PAB supply on actual PAB issuance. The main finding is that higher limits to the per cap PAB supply on the state level lead to higher issuance at the county level, as well as to higher PAB volumes for firms. These findings are consistent with my prediction that the per cap supply limits for PABs effectively restrict beneficiaries' access to the tax-exempt bond market.

Panel A presents results for the county level. The dependent variable is the natural logarithm of the county-level sum of PAB issuance across all local governments in the county. In columns (1) and (2), the sample consists of counties that issued any PAB in the ten years before the tax reform. The coefficient on the interaction term *Per cap PAB supply x Post 1986* is positive and statistically significant, indicating that a one standard deviation increase in the per cap PAB supply (39.81 USD) is associated with a relative increase in PAB issuance at the county-level of about 19.1% or 17.9%, respectively. In columns (3) and (4), I limit the sample to border counties and include state border pair-year fixed effects in the regressions. The point estimates for the effect of per cap PAB supply are larger in magnitude for this sample.

I illustrate the time dynamics of the effect of per cap PAB supply on PAB issuance in Figure 3. The figure shows the coefficient estimates and the 90% confidence interval on the Per cap PAB supply measure interacted with year dummies over the event period. The regression

[16]Data are obtained from the Federal Housing Finance Agency, and imputed with state-level values if missing.

specification follows the one in Table 3, Panel A, column (4). Until 1986, I do not observe statistically significant differences in the development of PAB issuance for counties depending on the respective per cap PAB supply limit. Beginning with 1987, a relatively higher per cap PAB supply has a positive effect on county PAB issuance. The effect reaches its maximum in 1989 and slightly declines thereafter.

In Panel B of Table 3, I present results for the effect of per cap PAB supply on the natural logarithm of firm-level PAB volume. Across all specifications, higher per cap PAB supply has a positive and statistically significant effect on PAB volume after the tax reform. Focusing on the effect within beneficiaries (column 4), i.e., at the intensive margin, a one standard deviation increase in per cap PAB supply, equivalent to 24.02 USD for the beneficiary sample, is associated with a relative increase in the allocated PAB volume by 23.3%. This corresponds to an additional USD 13.2m for the average PAB allocation.[17] In Appendix D.1, I additionally show that the relative increase in firm PAB volumes begins after the tax reform.

4. Private activity bond supply and firm investment

4.1. PAB supply and investment of PAB eligible firms

I now examine the effect of PAB supply on firm investment, given the demonstrated positive effect of higher per cap PAB limits on PAB supply after the 1986 Tax Reform. To investigate the investment response of firms, I first analyze firms eligible for PAB financing. These analyses yield an intention-to-treat effect of PAB supply, addressing that the demand for PAB funding is endogenous.

The sample for these analyses consists of PAB eligible firms located in border counties, which allows me to additionally control for the overall local economic trend as well as the development of investment opportunities in these regions. Furthermore, broadly following the approach of Adelino, Cunha and Ferreira (2017), my sample comprises firms located in counties with any PAB issuance in the ten years before the 1986 Tax Reform.

[17] As all analyses on the firm-level are conducted within firm, looking at all beneficiaries in columns (1) and (2) instead of at pre- and post-beneficiaries leads to very similar results.

The dependent variable, firm investment, is calculated as the natural logarithm of capital expenditures divided by the beginning of period total assets. I run the following difference-in-differences regression at state borders:

$$\begin{aligned} Investment_{i,t} = \alpha + \beta Post\ 1986_t \cdot Per\ cap\ PAB\ supply_s + \gamma Post\ 1986_t \\ + \delta Per\ cap\ PAB\ supply_s + \phi_i + \xi_t + \chi_{b,p} + \epsilon_{i,t} \end{aligned} \tag{4}$$

whereby i denotes a firm eligible for PAB financing, t a fiscal year, and s a state. ϕ_i are firm fixed effects, ξ_t are year fixed effects, and $\chi_{b,p}$ are border region-by-post-dummy fixed effects. *Per cap PAB supply* is the limit to the per capita amount of private activity bonds in USD that a state may distribute per calendar year, according to the allocation schedule valid for 1988 to 2000. The sample period is from 1983 to 1990. The variable of interest is the coefficient on the interaction term between the Post-dummy and Per cap PAB supply. As before, standard errors are clustered at the state level.

As all specifications include firm fixed effects, the estimates correspond to within-firm changes in firm investment for firms located in states with higher per cap PAB supply relative to firms in states with lower supply. I include lagged firm size measured as the natural logarithm of total assets as control variable in all regressions. I also use the lag of return on assets as additional control. Finally, to capture potentially different investment trends of industries over time, I include industry-by-year fixed effects in further analyses.

4.1.1. Baseline results

Table 4 presents the results for the effect of PAB supply on investment of PAB eligible firms. The main finding is that a higher per cap supply of PABs positively affects firm investment. The point estimate for the interaction term *Per cap PAB supply x Post 1986* ranges from 0.0018 to 0.0021 and is statistically significant in all specifications. This indicates that after the 1986 Tax Reform, a one standard deviation increase in per cap PAB supply, equivalent to 46.48 USD, leads to an increase in the capex-to-assets ratio of eligible firms of about 8.37% to 9.76%. This

corresponds to a relative increase in the capex-to-assets ratio of 0.75 to 0.88 percentage points for the average PAB eligible firm in the sample. This intention-to-treat effect of PAB supply may capture both direct effects for firms that receive PAB funding, and any potential spillover effects.[18]

The time dynamics of the effect of per cap PAB supply on firm investment are illustrated in Figure 4. Subfigure (a) shows the development of average investment for firms in states with the minimum PAB supply of 50 USD per cap, as well as for firms located in states with higher per cap PAB supply. Until 1986, both firm groups display a similar investment trend. In 1987, firms in states with a per cap PAB supply of more than 50 USD show a slight increase in firm investment, while firms in states limited to the baseline 50 USD per cap PAB supply continue the downward investment trend. In the mean plot, the investment gap increases until 1988 and remains constant thereafter.

Subfigure (b) shows the coefficient estimates and the 90% confidence interval on the Per cap PAB supply measure interacted with year dummies over the event period. The regression specification follows equation 4, and includes the full set of control variables as in Table 4, column (3). I do not observe statistically significant differences in the development of firm investment for firms located in states with higher and lower per cap PAB supply until 1986. The positive effect of higher per cap PAB supply on firm investments starts in 1987, the first year after the 1986 Tax Reform, and continues to rise in magnitude over the remainder of the post-period. However, the point estimates are statistically significant only for 1989 and 1990.

Overall, my results are consistent with a stimulating effect of PAB supply on firm investment.

4.1.2. Placebo and robustness tests

Appendix Figure D.2 presents results for a placebo test that uses the PAB volume caps set by the 1984 Deficit Reduction Act to calculate the per cap PAB supply. These initial caps did

[18]Spillover effects could be both positive and negative: On the one hand, a direct stimulating effect of PABs could spur investment of local non-recipients (see, e.g., Dougal, Parsons and Titman, 2015). On the other hand, PABs might give beneficiaries a competitive advantage over other firms (Moore and Squires, 1988), which could dampen non-beneficiaries investment behavior.

not restrict the supply of PABs, but merely aimed to maintain it at the level of previous years (The Bond Buyer, 1984; Livingston, 1989).[19] I adjust the specification as described by equation 4 and analyze the effect of the 1985 placebo per cap PAB supply limit on firm investment over the period 1981 to 1988. As shown in Figure D.2, a higher per cap PAB supply limit implied by the 1984 Deficit Reduction Act has no differential effect on firm investment overall. In 1985, as the only exception, higher PABs even have a negative effect on firm investment.

I conduct a series of robustness tests to support my baseline finding that higher per cap PAB supply positively affects firm investment. The results are presented in Appendix Table E.1 and Appendix Table E.2. In the first test, I show that the investment effect is robust to using the 1987 transition year per cap PAB supply limit as the treatment measure. The 1987 per cap PAB limit is higher for all states, but relative to 1988 especially so for the least populous ones.[20] In terms of magnitude, a one standard deviation increase in per cap PAB supply according to the 1987 formula—equivalent to 81.41 USD—is associated with an increase in the capex-to-assets ratio of about 9.77% for the most restrictive specification. This effect is similar to my baseline estimate.

Second, I show that the effect of PAB supply on firm investment is independent of the definition of the sample of PAB issuing counties.[21] As an additional placebo test, I analyze firms located in counties with no PAB issuance in the ten years prior to the tax reform. Column (3) of Table E.1, bottom panel, presents the results. If the availability of PAB funding positively affects investment, I should find no effect of per cap PAB supply on firm investment for these non-issuing counties. Consistent with this, the point estimate is statistically not significant.

Finally, I use three alternative measures for firm investment, as several common measures exist (see Bai et al., 2022, for an overview): the natural logarithm of capital expenditures (Table

[19]Section 1.1 provides more information on the volume caps associated with the 1984 Deficit Reduction Act.

[20]The relative decrease between the 1987 and the 1988 per cap supply is not the same for all states for two reasons: (i) states with populations less than 3.3 million have higher per cap PAB limits in 1987, while states with less than 3 million do so according to the 1988 formula, and (ii) because of (minor) changes in state populations. The relative reduction in PAB supply for 1988 compared to 1987 ranges from about 33% to about 43%, and is most pronounced for the least populous states.

[21]My baseline specification considers firms that are located in counties with any PAB issuance in the ten years before the 1986 Tax Reform Act.

E.2, column 1), capex divided by the beginning of period total assets (column 2), and the growth rate for net property, plant, and equipment (column 3). Consistent with my baseline results, I find a positive effect of per cap PAB supply on firm investment when using these alternative investment measures, which is statistically significant for the logarithm of capex and the capex-to-assets ratio, but not for PPE growth.

4.2. Investment of PAB beneficiary firms

How do firms that receive PAB funding respond to the supply of PABs? To examine the investment effect for PAB beneficiaries, I focus on a sample of firms that receive PAB funding both before and after the tax reform, i.e., on firms with a likely persistent demand for PABs.

I define post-reform PAB beneficiaries as firms that receive any PAB allocation in the four years after the tax reform, and consider a narrower definition for robustness. Pre- and post-reform beneficiaries are firms that receive any PAB allocation in the four years after the reform, and any allocation in the four-year window before.

I run the following difference-in-differences regression:

$$\begin{aligned} Investment_{i,t} = \alpha + \beta Post\ 1986_t \cdot Per\ cap\ PAB\ supply_s + \gamma Post\ 1986_t \\ + \delta Per\ cap\ PAB\ supply_s + \phi_i + \xi_{t,a} + \epsilon_{i,t} \end{aligned} \tag{5}$$

whereby i denotes a PAB beneficiary firm, t a fiscal year, and s a state. ϕ_i are firm fixed effects, and $\xi_{t,a}$ corresponds to year-by-PAB allocation dummy fixed effects.[22] I add industry-by-post-dummy fixed effects to control for industry-specific trends around the tax reform.[23] The sample period is from 1983 to 1990. I include lagged firm size and lagged return on assets as control variables in all regressions. Standard errors are clustered at the state level.

The design compares firms that all receive some PAB allocation after the reform (or before and after the reform in my preferred specification), but are located in states with different per

[22]PAB allocation dummy takes a value of one if the firm receives any PAB funding allocation in the respective year, and zero otherwise.

[23]I use industry-by-post dummy fixed effects instead of industry-by-year fixed effects as in previous regressions to avoid singleton observations.

cap PAB supply due to the new PAB volume caps. I show that post-reform beneficiaries in states with higher and lower per cap PAB supply are similar in terms of observable characteristics prior to the reform. Table 2, Panel B presents differences in means for a range of financial characteristics. Firms in states with more than 50 USD per cap supply and firms in states limited to 50 USD per cap supply are similar in terms of investment, employment, and profitability, amongst others. Firm size is a notable exception, as firms in states limited to 50 USD per cap PAB supply are slightly larger than firms in states with a higher PAB supply.

4.2.1. Baseline results

Table 5 presents results for the effect of PAB supply on investment of PAB beneficiary firms. The main finding is that a higher per cap supply of PABs has a positive and sizable effect on investment of PAB beneficiaries. For firms that receive any PAB allocation in the four years following the 1986 Tax Reform, shown in columns (1) and (2) of the table, increasing per cap PAB supply by 24.02 USD—equivalent to one standard deviation—is associated with an increase in the capex-to-assets ratio by 7.21%, or by 8.41% when controlling for industry-specific trends before and after the tax reform. For beneficiaries that receive a PAB allocation both after and before the tax reform, shown in columns (3) and (4), the point estimates are more pronounced compared to the post-beneficiary sample: An additional 24.02 USD in per cap PAB supply increases the capex-to-assets ratio by 9.85% in the baseline specification, and by 11.77% when industry-by-post-dummy fixed effects are included. For the average PAB beneficiary firm, the latter two estimates correspond to an increase in the capex-to-assets ratio by 0.89 or 1.06 percentage points, respectively.

Figure 5 shows the time dynamics for the effect of per cap PAB supply on investment of eligible firms, utilizing the most restrictive specification as presented in Table 5, column (4). Before the 1986 Tax Reform, I do not observe a significant difference in beneficiary firms' investment depending on the per cap supply of PABs. Starting with 1987, a relatively higher per cap PAB supply has a statistically significant positive effect on firm investment. The effect reaches its maximum in 1988. In 1989 and 1990, the effect remains large and positive, but

slightly smaller than for 1988.

As firms that receive a PAB allocation before and after the tax reform likely have a persistent demand for PAB funding, these firms may in turn also be most affected by changes in PAB supply. Thus, I consider these estimates to rather be an upper bound of the direct effect of PAB supply. The significant positive results with respect to PAB beneficiaries support my previous finding that PAB supply has a stimulative effect on corporate investment.

Taken together, I find a sizeable positive effect of PAB supply on investment for both PAB beneficiary firms and PAB eligible firms. I suggest that the magnitude of the effect may be influenced by specific features of the PAB program. Notably, there are several restrictions on the designated use of tax-exempt PABs. According to IRC Section 147(c), only 25% of PAB bond proceeds can be used for the acquisition of land. In addition, PABs usually cannot be used to finance working capital or inventory (see, e.g., Mississippi Business Finance Corporation, 2006; Utah Department of Workforce Services Housing & Community Development Division, 2023). Consequently, firms must use other funds for these purposes, likely resulting in an overall project size that exceeds the PAB funding amount. Consistent with this, Business Wire (1998) reports that the PAB beneficiary Pure H20 Bio-Technologies Inc. uses equity financing for working capital alongside the PAB funds. Similarly, the company Gevo, Inc. (2023) indicates plans to use PABs as part of a financing package for a new project.

4.2.2. Robustness tests

In Appendix Table E.3 and Table E.4, I present robustness tests for the positive effect of PAB supply on investment of PAB beneficiary firms. First, I show that my result is robust to a narrower definition of post-reform beneficiaries. In particular, I define firms as post-reform beneficiaries if they receive any PAB allocation in 1987 or 1988. The results, reported in Table E.3, are slightly larger than my baseline results. Second, I estimate the investment effect over an extended post-reform window of seven years instead of four years. Consistent with the post-reform time dynamics illustrated in Figure 5, I find that the investment effect is larger when examining an extended time period (Table E.4).

5. Private activity bond supply and firm employment

While the established positive investment response to PABs could lead to an increase in the hiring of labor and thus generate a "scale effect", it could also have a negative impact on employment if firms substitute labor with tax-subsidized capital (Moore and Squires, 1988). I test how PAB supply affects employment of PAB eligible firms and PAB beneficiary firms. Therefore, I use the natural logarithm of firm employment as the dependent variable in the regression specification for PAB eligible firms, outlined by equation 4, and for PAB beneficiary firms, outlined by equation 5. To account for potential data errors, I exclude firms that report zero employment at any point in time during the event period.

Table 6 and Table 7 present the results. The main finding is that a higher per cap supply of PABs has a positive effect on employment of PAB eligible and PAB beneficiary firms. For the sample of PAB eligible firms analyzed in Table 6, the point estimate for the interaction term *Per cap PAB supply x Post-1986* is positive and statistically significant in all specifications (with the smallest t-statistic being 6.252). In terms of magnitude, after the 1986 Tax Reform, a one standard deviation increase in per cap PAB supply, equivalent to 46.48 USD, leads to a 4.83% increase in employment of PAB eligible firms (column 1). In the most restrictive specification (column 3), a one standard deviation increase in PAB supply is associated with an increase in employment by 4.56%. As the sample comprises PAB eligible firms, these estimates can be interpreted as an intention-to-treat effect of PAB supply on employment.

Figure 6 illustrates the time dynamics of the effect of per cap PAB supply on employment of eligible firms. The regression specification corresponds to column (3) of Table 6, but uses an interaction of Per cap PAB supply with year dummies instead of the post-dummy. Prior to the 1986 Tax Reform, I do not observe a significant difference in firm employment depending on the per cap supply of PABs. Starting in 1987, firm employment relatively rises with higher per cap PAB supply, but the effect only becomes statistically significant as of 1988. The effect reaches its maximum in 1990.

In Table 7, I present results for the effect of per cap PAB supply on employment of PAB

beneficiary firms. For firms that receive any PAB allocation in the four years after the 1986 Tax Reform, displayed in the first two columns of the table, increasing per cap PAB supply by 24.02 USD—equivalent to one standard deviation—is associated with a 2.11% increase in employment, or a 1.95% increase when controlling for industry-specific trends before and after the tax reform. For beneficiaries that receive a PAB allocation both after and before the tax reform, shown in columns (3) and (4) of the table, the point estimates are more pronounced compared to the post-beneficiary sample: An additional 24.02 USD in per cap PAB supply increases employment by 3.12% in the baseline specification, and by 2.98% when industry-by-post-dummy fixed effects are included.

Taken together, my results show that in addition to the stimulative effect on firm investment, a higher supply of PABs also has a positive effect on firm employment. Hence, I my findings do not support the notion of input factor substitution with respect to PAB funding after the 1986 Tax Reform.

Anecdotally, the Washington State Department of Commerce (2018) reports that its PAB allocation for small issue bonds as well as exempt facility bonds created 191 new jobs and retained 150 jobs in 2016 and 2017. Some states explicitly require job creation or retention when allocating PAB funding. The state of Pennsylvania, for instance, requires the net creation of at least one job, or retention of one full-time job, for every 50,000 USD in PAB volume allocated (see 12 Pa. Code Chapter 61.3). Thus, these specific features of the PAB program could be a reason for the scale effect on employment that I document.

6. Real effects of the Texas PAB lottery

So far, I have disregarded that states have discretion in allocating their PAB volume caps to projects and thus to firms. If states with higher per cap PAB supply limits systematically select projects with higher investment and employment potential than states with lower supply limits, this would bias my results. To strengthen my identification, I use PAB program data from the State of Texas, which uses a lottery system to allocate its PAB volume among PAB

funding applicants (see Appendix C for more details).[24] This allows me to compare real effects for firms that all apply for PAB allocation, but only a random subset of firms, determined by lottery, actually receives PAB funding through the program.

As the PAB lottery data is on the project level, I aggregate the lottery outcomes at the firm-year level. Accordingly, I define a "Lottery winning firm" as a lottery-participating firm that wins any lottery (project) attempt in the respective program year. A "Lottery losing firm" is a lottery-participating firm that does not receive any PAB allocation in the respective program year. I leverage a sample of PAB applicant firms for the program years 1996 to 2001, for which I observe both at least one lottery winning and one lottery losing firm per program year. To reduce any potential bias due to the staggered nature of the lottery data, I only consider lottery winning firms in the earliest program year with a successful lottery attempt. Lottery losing firms never receive any PAB allocation over the entire 1996 to 2001 period, and are included in the sample in all years in which they apply for an allocation.

I estimate the effect of receiving PAB funding through the Texas PAB lottery as follows:

$$\Delta Outcome_{i,t} = \alpha + \beta Lottery\ win\ dummy_i + \xi_{lottery\ program\ year} + \epsilon_{i,t} \tag{6}$$

whereby $\Delta Outcome_{i,t}$ is the change in firm investment or employment between year t and the pre-lottery year (year 0). $Lottery\ win\ dummy_i$ is a dummy variable equal to one if a lottery-participating firm wins any lottery (project) attempt in the respective program year, and zero otherwise. I use the natural logarithm of the bond volume allocated through the lottery as an alternative treatment measure. $\xi_{lottery\ program\ year}$ are lottery program year fixed effects. I control for firm size measured in the year before the lottery in all regressions.

I show that lottery winning and losing firms are similar in terms of observable characteristics prior to their respective lottery attempts. Panel C of Table 2 provides an overview. In particular, lottery winning and losing firms have similar size, return on assets, and PPE growth prior to the lottery attempt and also do not differ in the levels of the outcome variables. Winning

[24]The Texas PAB allocation program is also relevant due to its economic size, as Texas had the second largest PAB cap among all states (Texas Bond Review Board, 1997) during the lottery period that I analyze.

firms appear to be less leveraged than losing firms before the lottery.

Table 8 presents results for the effect of PAB allocation through the lottery on firm investment. The main finding is that receiving PAB funding through the lottery has a positive effect on investment. For Panel A, I use Lottery win dummy as the treatment measure. The preferred specification is reported in columns (4) to (6) and compares lottery winning and losing firms that apply for PAB funding in the same program year. When looking at the one-year-change in firm investment in column (4), the coefficient for the lottery win dummy is positive, but statistically not significant (t-statistic: 1.051). I observe a statistically significant relative increase in firm investment for Lottery winning firms over a two-year window (t-statistic: 1.756) and a three-year window (t-statistic: 2.019). The magnitude of the effect implies an increase in the capex-to-assets ratio for lottery winning firms relative to losing firms of 34.5% over two years, and 39.1% over three years, respectively. In Panel B of Table 8, I use the natural logarithm of the lottery-allocated bond volume as the treatment measure. Consistent with the analysis using the lottery win dummy, lottery winning firms show a statistically significant relative increase in firm investment over the two- and three-year windows. Overall, these results support my previous finding that PAB supply has a stimulative effect on corporate investment.

Table 9 presents results for the effect of PAB allocation through the lottery on firm employment. While the coefficient on Lottery win dummy and on the logarithm of lottery-allocated bond volume is positive in all specifications, it is not statistically significant. Despite the statistically non-significant point estimates, the time pattern indicates an increase in the size of the coefficient from the one-year to the three-year window. For my preferred specification that includes lottery program year fixed effects, using the lottery win dummy as the treatment measure, I obtain a point estimate of 0.185, with a t-statistic of 1.464 (column 6, top panel). While these estimates do not provide evidence for the scale effect of PAB supply, they align with the earlier finding that PAB funding is not associated with a substitution of input factors.

Taken together, the results from examining the Texas PAB lottery strongly support my previous finding that PAB financing stimulates corporate investment and rule out that states' project selection is the main driver of this effect.

7. Conclusion

This paper examines the effect of private activity bond supply on firm investment and employment. PABs provide firms with access to the tax-exempt bond market, making them a cost-attractive source of financing compared to conventional methods.

For identification, I exploit the introduction of new state-level caps for PABs as mandated by the 1986 Tax Reform Act. Due to the newly enacted allocation formula, less populous states can supply relatively higher per capita volumes of PABs to firms, while larger states are bound to a more restrictive baseline per cap PAB volume. I leverage this variation in per cap PAB supply limits in a difference-in-differences framework. I document that higher per cap PAB supply after the tax reform is positively associated with investment of PAB eligible and PAB beneficiary firms.

I then investigate how the limit on per cap PAB supply affects firm employment. I find that after the 1986 Tax Reform, relatively higher PAB supply is positively associated with employment. This finding suggests that despite the subsidy of capital relative to labor, PAB funding is not linked to an input factor substitution.

To address the potential concern that states' discretion in allocating PAB funding drives my results, I leverage data from the Texas PAB lottery, the PAB distribution mechanism for the State of Texas. By comparing firms that randomly win and lose their requests for PAB allocation in the PAB lottery, I confirm my previous finding that PAB supply positively affects firm investment.

The stimulating effect on PAB beneficiaries, as documented in this paper, is a necessary prerequisite for the PAB program to enhance local economic development. While the positive investment response of beneficiaries may spur investment of local non-recipients, it could also have competitive effects. My findings motivate further research on how PAB funding, through stimulating investment and employment of program beneficiaries, affects local economic development in the aggregate.

References

Adelino, M., Cunha, I., Ferreira, M. A., 2017. The economic effects of public financing: Evidence from municipal bond ratings recalibration. The Review of Financial Studies 30 (9), 3223–3268.

Agrawal, A., Kim, D., 2022. Municipal bond insurance and public infrastructure: Evidence from drinking water. Unpublished working paper.

Alfaro, L., García-Santana, M., Moral-Benito, E., 2021. On the direct and indirect real effects of credit supply shocks. Journal of Financial Economics 139 (3), 895–921.

Amornsiripanitch, N., 2022. The real effects of municipal bond insurance market disruptions. Journal of Corporate Finance 75, 102240.

Auerbach, A. J., Slemrod, J., 1997. The economic effects of the Tax Reform Act of 1986. Journal of Economic Literature 35 (2), 589–632.

Bai, H., Li, E. X. N., Xue, C., Zhang, L., 2022. Asymmetric investment rates. Unpublished working paper.

Bonfim, D., Custódio, C., Raposo, C., 2023. Supporting small firms through recessions and recoveries. Journal of Financial Economics 147 (3), 658–688.

Business Wire, 1986. CA-State-treasurer; Treasurer announces first allocation of 1986 private activity bonds. October 30, 1986.

Business Wire, 1998. Pure H20 Bio-Technologies announces commitment to place industrial revenue bonds, equity financing & completion of patent applications filings for invisible glove and multipurpose soaps. May 22, 1998.

Cestau, D., Hollifield, B., Li, D., Schürhoff, N., 2019. Municipal bond markets. Annual Review of Financial Economics 11, 65–84.

Congressional Budget Office, 2018. Options for reducing the deficit: 2019 to 2028. Revenues: eliminate the tax exemption for new qualified private activity bonds. December 13, 2018. URL `https://www.cbo.gov/budget-options/54793`.

Congressional Budget Office and Joint Committee on Taxation, 2009. Subsidizing infrastructure investment with tax-preferred bonds. Joint CBO/JCT study, October 2009, Pub. No. 4005.

Council of Economic Advisers, 2023. Economic report of the president (2023). Table B-42: Bond yields and interest rates, 1952-2022. U.S. Government Publishing Office, March 2023.

Criscuolo, C., Martin, R., Overman, H. G., van Reenen, J., 2019. Some causal effects of an industrial policy. American Economic Review 109 (1), 48–85.

Dagostino, R., 2022. The impact of bank financing on municipalities' bond issuance and the real economy. Unpublished working paper.

Dougal, C., Parsons, C. A., Titman, S., 2015. Urban vibrancy and corporate growth. The Journal of Finance 70 (1), 163–210.

Driessen, G. A., 2022. Private activity bonds: An introduction. Congressional Research Service, CRS Report RL31457.

Evenett, S., Jakubik, A., Martín, F., Ruta, M., 2024. The return of industrial policy in data. The World Economy 47 (7), 2762–2788.

Garrett, D. G., Ohrn, E., Serrato, J. C. S., 2020. Tax policy and local labor market behavior. AER: Insights 2 (1), 83–100.

Gevo, Inc., 2023. Q1 2023 results earnings conference call. Seeking Alpha - Earnings Call Transcripts. May 11, 2023.

Giloth, R., 1991. Designing economic development incentives: The case of industrial development bonds in Chicago: 1977–1987. Review of Policy Research 10 (2/3), 161–171.

Gustafson, M. T., Kotter, J. D., 2023. Higher minimum wages reduce capital expenditures. Management Science 69 (5), 2933–2953.

H.R.3838 - Tax Reform Act of 1986, 1986. 99th Congress (1985-1986), Conference report filed in House (09/18/1986). URL `https://www.congress.gov/bill/99th-congress/house-bill/3838`.

Internal Revenue Service, 2019. Municipal bonds, Calendar Year 2019. Publication 5439 (Rev. 11-2022).

Juhász, R., Lane, N., Rodrik, D., 2024. The new economics of industrial policy. Annual Review of Economics 16, 213–242.

Kawecki, L., 2002. An historical perspective of small issue bonds. IRS, New Tax Exempt Bonds Technical Topics, Part I B, 9–29.

Kline, P., Moretti, E., 2014. People, places, and public policy: Some simple welfare economics of local economic development programs. Annual Review of Economics 6, 629–662.

Lemmon, M., Roberts, M. R., 2010. The response of corporate financing and investment to changes in the supply of credit. Journal of Financial and Quantitative Analysis 45 (3), 555–587.

Livingston, M., 1989. Reform or revolution? Tax-exempt bonds, the legislative process, and the meaning of tax reform. U.C. Davis Law Review 22 (4), 1165–1238.

Michigan Economic Development Corporation, 2021. Private activity bond program. Fact sheet, August 2021. ULR https://www.michiganbusiness.org/4a8169/globalassets/documents/reports/fact-sheets/privateactivitybondprogramformeridrb.pdf.

Mississippi Business Finance Corporation, 2006. Industrial development revenue bond program guidelines. URL https://www.sos.ms.gov/ACProposed/00013943b.pdf.

Moore, T. S., Squires, G. D., 1988. Industrial revenue bonds: The social costs and private benefits of a public subsidy. Public Administration Quarterly 12 (2), 151–168.

Mulcahy, C. C., Guszkowski, T. P., 1974. The financing of corporate expansion through industrial revenue bonds. Marquette Law Review 57 (2), 201–227.

Osterberg, W. P., 1991. Public subsidies for private purposes. Federal Reserve Bank of Cleveland, Economic commentary, April 15, 1991.

Pierog, K., 2017. U.S. muni market faces challenges, not 'crisis' with tax changes. Reuters, December 21, 2017. URL https://www.reuters.com/article/us-usa-tax-municipals-idINKBN1EF02S.

Rossi, S., Yun, H., 2024. Financial reform and public good provision: Municipal bankruptcy law and the financing of hospitals. Management Science 70 (4), 2209–2235.

Texas Bond Review Board, 1996. Annual Report 1996. Chapter 7, Texas private activity bond allocation program, pp. 36–38.

Texas Bond Review Board, 1997. Annual Report 1997. Chapter 7, Texas private activity bond allocation program, pp. 42–44.

Texas Bond Review Board, 2023a. Private activity bond allocation program 2023 Program Year. https://www.brb.texas.gov/2023-program-year/.

Texas Bond Review Board, 2023b. Private activity bond allocation program overview. https://www.brb.texas.gov/pab-program-overview/.

The Bond Buyer, 1984. Most states find 1984 IDB limits easy going but scurry for reserves. December 18, 1984.

Thompson, A. A., 1968. The social benefits of tax-exempt industrial development bonds. Financial Analysts Journal 24 (6), 99–103.

U.S. Bureau of the Census, 2006. Government Finance and Employment Classification Manual. U.S. Bureau of the Census.

Utah Department of Workforce Services Housing & Community Development Division, 2023. Private activity bond program – policies and procedures. URL `https://jobs.utah.gov/housing/community/pab/pabpp.pdf`.

Washington State Department of Commerce, 2018. Bond cap allocation program. The 2018 biennial policy report and activity summary. Report to the Legislature, June 2018.

Whitaker, S., 2011. Prioritization in private-activity-bond volume cap allocation. Federal Reserve Bank of Cleveland Working Paper No. 11-10.

Whitaker, S., 2014. Adjusting the volume: Private-activity municipal bonds and the variation in the volume cap. Public Budgeting & Finance 34 (1), 39–63.

Zarutskie, R., 2006. Evidence on the effects of bank competition on firm borrowing and investment. Journal of Financial Economics 81 (3), 503–537.

Zimmerman, D., 1989. Tax-exempt bonds: A sacred cow that gave (some) milk. National Tax Journal 42 (3), 283–292.

Zimmerman, D., 1990. The volume cap for tax-exempt private activity bonds: State and local experience in 1989. Advisory Commission on Intergovernmental Relations.

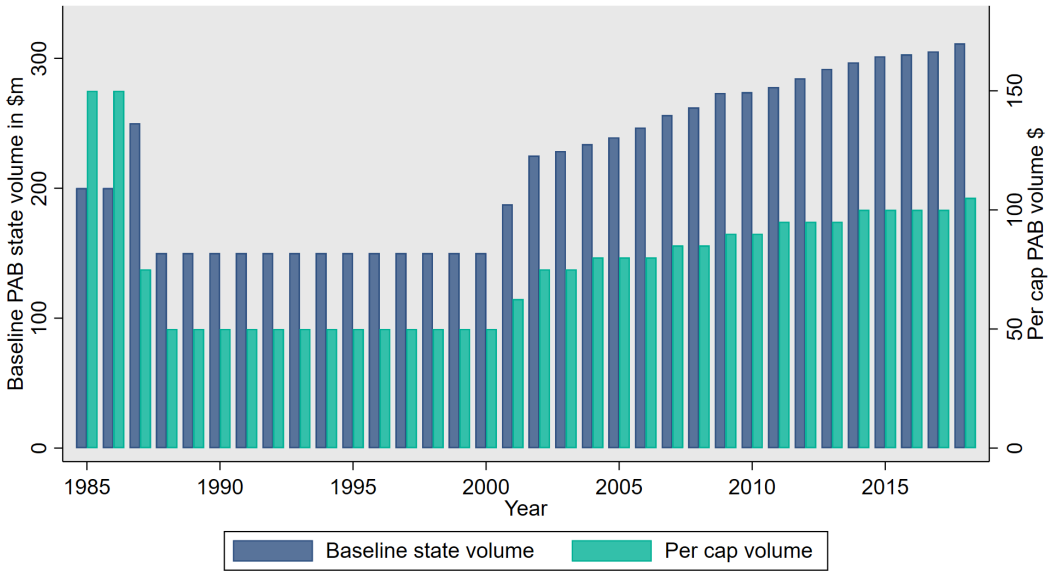
Zwick, E., Mahon, J., 2017. Tax policy and heterogeneous investment behavior. American Economic Review 107 (1), 217–248.

Figure 1

The 1986 Tax Reform Act and state-level PAB volume caps

This figure illustrates properties of the state-level cap on PABs, which is set as the higher value between a baseline PAB state volume, and a per cap volume multiplied by the state's population. Subfigure (a) shows the development of the baseline PAB state volume (■) as well as the allocation schedule's per cap volume (■) over the period from 1985 to 2018. Data comes from the Internal Revenue Code (IRC) Section 146 and the Internal Revenue Service's (IRS) statistics of income bulletin. Subfigure (b) illustrates the limit on per cap PAB supply for the period 1988 to 2000 depending on a state's population figure (▬). Per cap PAB supply is calculated as a state's total PAB cap divided by the respective state's population figure. States with a population below 3 million can supply comparatively higher per cap PAB volumes.

(a) PAB volume caps over time



(b) State population and limit on per cap PAB supply for 1988 to 2000

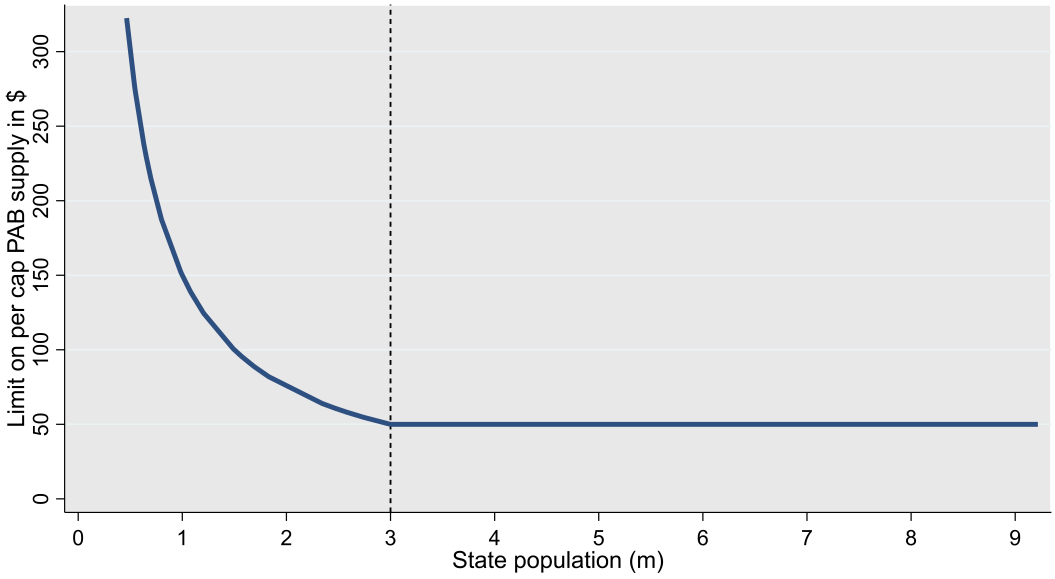
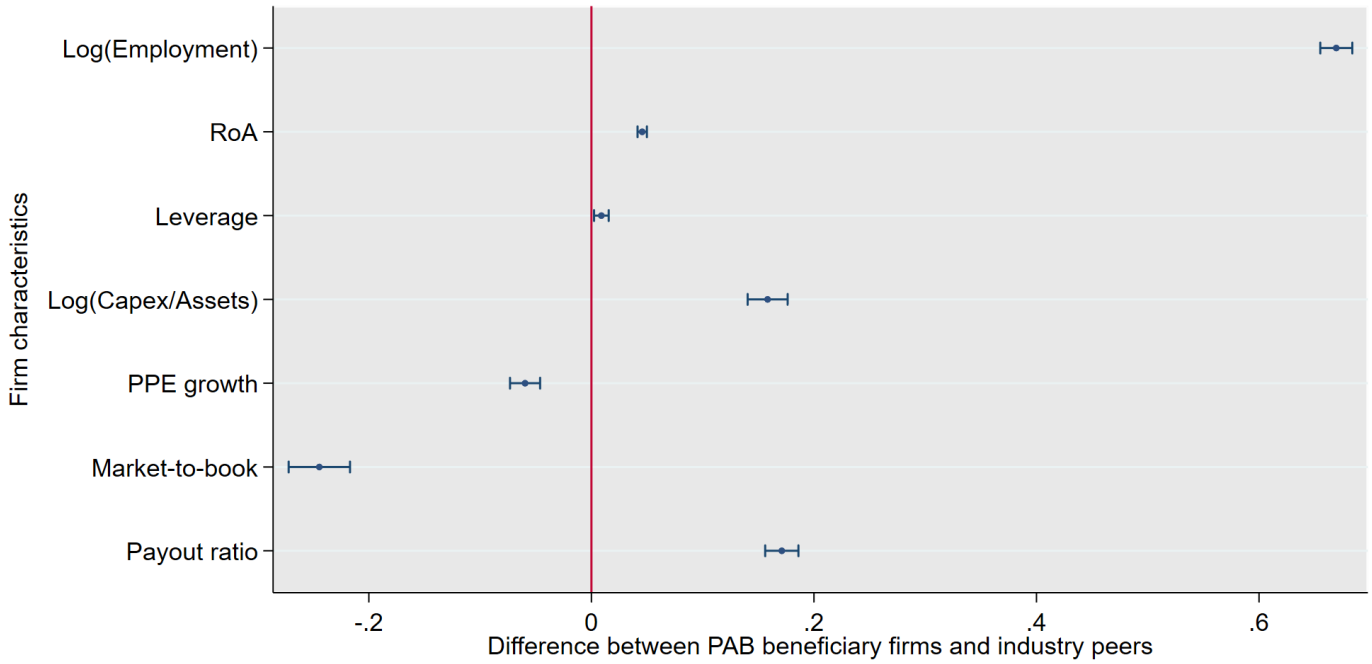


Figure 2
Characteristics of PAB beneficiary firms

This figure illustrates the difference in means of firm characteristics for firms that receive any PAB allocation between 1981 and 1990 compared to their industry peers without PAB allocation, according to data from SDC Platinum. The bars mark the 90% confidence intervals. The comparison period is from 1981 to 1990. Subfigure (a) shows the simple difference in means. In Subfigure (b), the adjusted difference controls for firm-size quintile-by-industry fixed effects when calculating the mean difference. Appendix A provides a detailed description of all variables.

(a) Difference between PAB beneficiaries and industry peers



(b) Size group-by-industry adjusted difference between PAB beneficiaries and non-beneficiaries

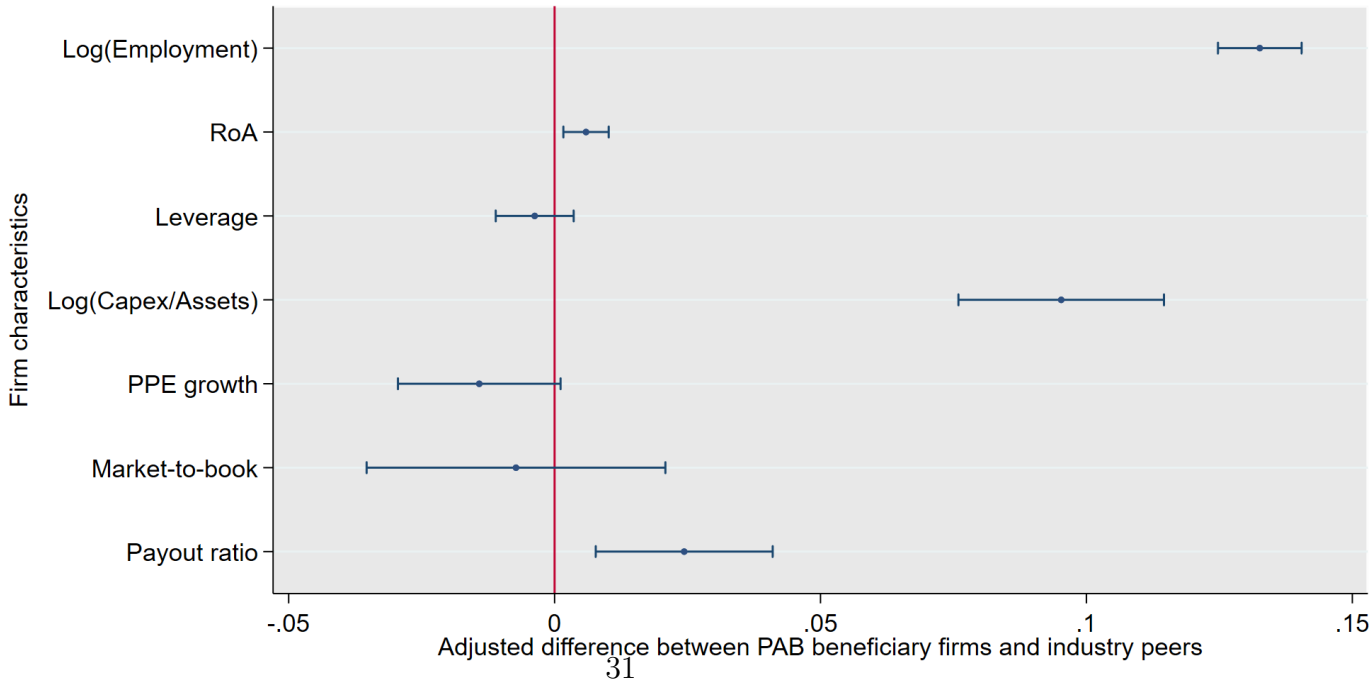


Figure 3

Per cap PAB supply and PAB issuance after the 1986 Tax Reform

This figure illustrates PAB issuance trends around the 1986 Tax Reform Act. The dependent variable is the natural logarithm of the aggregate PAB issuance volume at the county level. The figure shows the coefficient estimates and 90% confidence interval on the Per cap PAB supply measure interacted with year dummies. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. The regression specification corresponds to column (4) in Table 3, top panel. The effective date for the PAB volume caps mandated by the 1986 Tax Reform Act is shown in red (- -). Appendix A provides a detailed description of all variables.

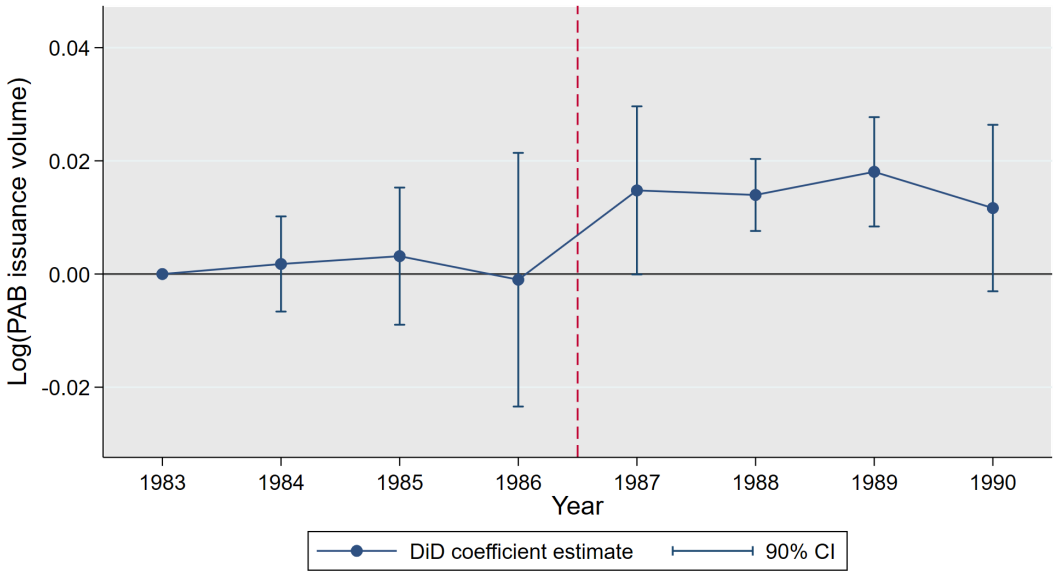
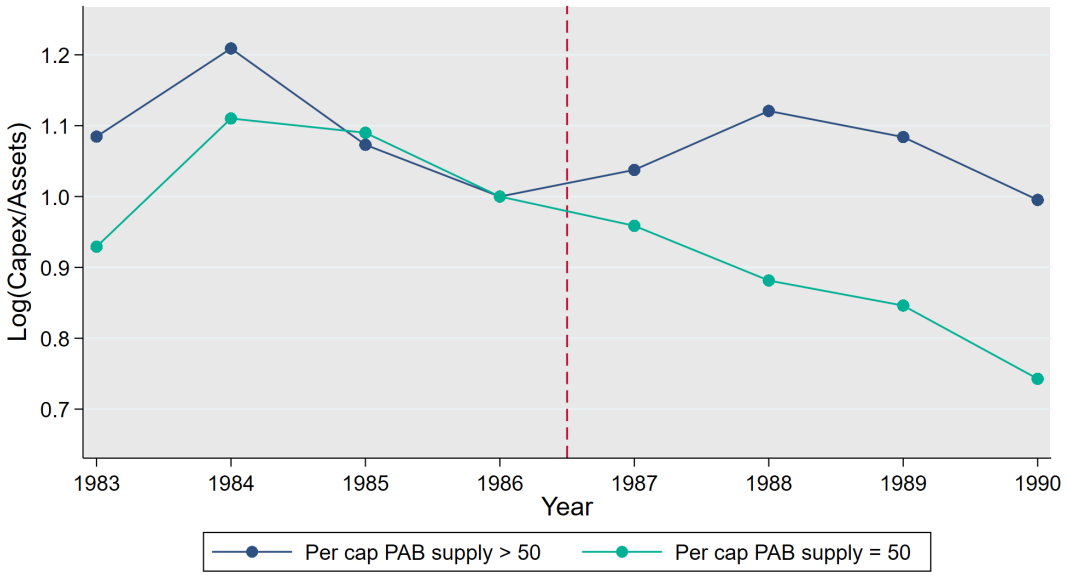


Figure 4

Per cap PAB supply and firm investment after the 1986 Tax Reform

This figure illustrates the development of firm investment for PAB eligible firms located in border counties around the 1986 Tax Reform Act. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Subfigure (a) shows the development of average firm investment in states with more than 50 USD per cap PAB supply (●) compared to firm investment in states restricted to 50 USD per cap PAB supply (●) over the period from 1983 to 1990. The effective date for the PAB volume caps mandated by the 1986 Tax Reform Act is shown in red (- -). For both firm groups, the level of firm investment is set to one in the fiscal year 1986. Firm investment is defined as the natural logarithm of capital expenditures divided by the beginning of period total assets. Subfigure (b) shows the coefficient estimates and the 90% confidence interval on the Per cap PAB supply measure interacted with year dummies over the event period. The regression specification follows column (3) in Table 4. Appendix A provides a detailed description of all variables.

(a) Mean values of firm investment



(b) Difference in firm investment

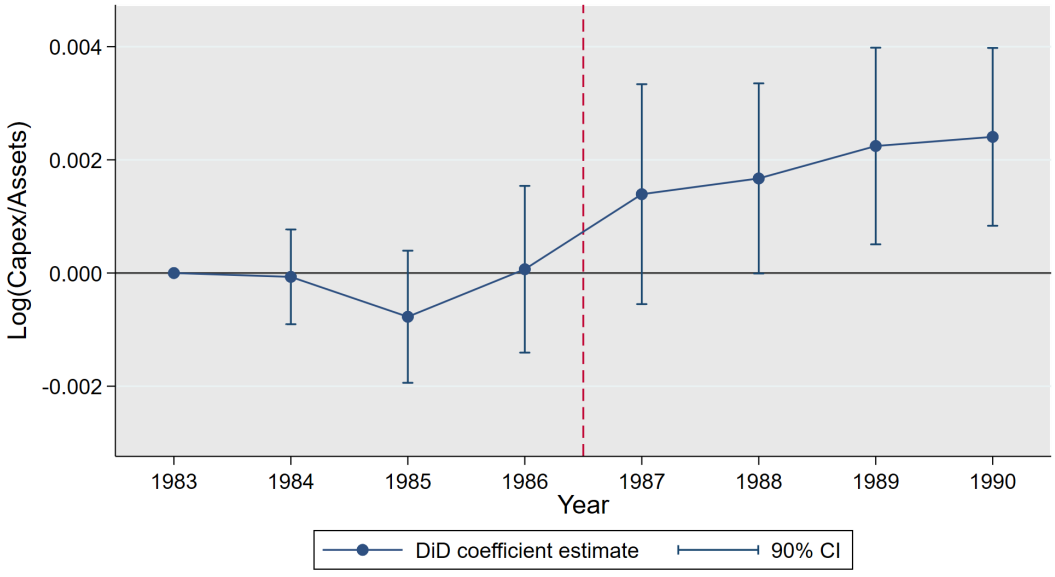


Figure 5

Per cap PAB supply and investment of PAB beneficiary firms after the 1986 Tax Reform

This figure illustrates the development of firm investment, calculated as the natural logarithm of capital expenditures divided by the beginning of period total assets, for firms that benefit from any PAB issuance on their behalf in both the four year pre- and the four year post-period of the 1986 Tax Reform. It shows coefficient estimates and the 90% confidence interval on the Per cap PAB supply measure interacted with year dummies over the event period. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. The regression specification follows column (4) in Table 5. The effective date for the PAB volume caps mandated by the 1986 Tax Reform Act is shown in red (- -). Appendix A provides a detailed description of all variables.

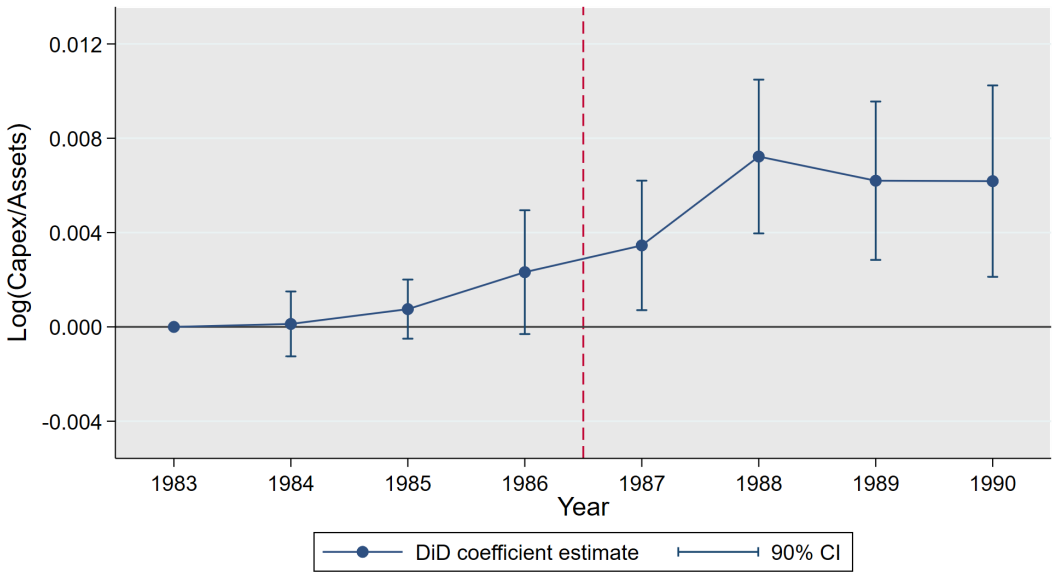


Figure 6

Per cap PAB supply and firm employment after the 1986 Tax Reform

This figure illustrates the development of employment, calculated as the natural logarithm of the number of employees, for PAB eligible firms located in border counties. It shows coefficient estimates and the 90% confidence interval on the Per cap PAB supply measure interacted with year dummies over the event period. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. The regression specification follows column (3) in Table 6. The effective date for the PAB volume caps mandated by the 1986 Tax Reform Act is shown in red (– –). Appendix A provides a detailed description of all variables.

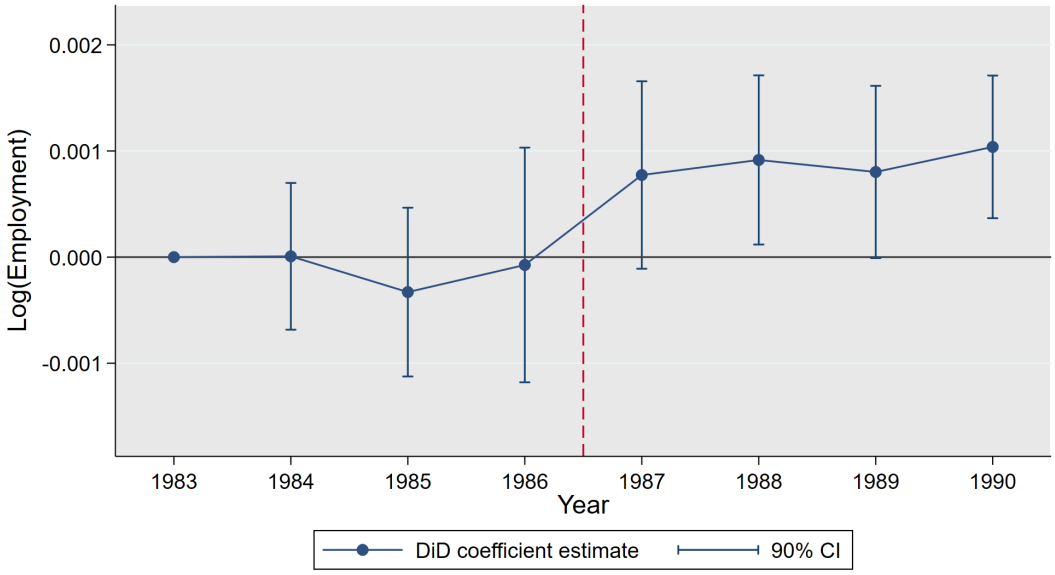


Table 1

Descriptive statistics

This table presents descriptive statistics for PAB issuance and the three firm samples employed in the analyses. Panel A shows descriptive statistics for PAB issuance at the county level and PAB allocation at the firm level. Panel B shows descriptive statistics for the sample of PAB eligible firms in border counties and consists of 682 firms located across 38 states. For Panel C, the sample comprises 140 firms in 34 states that receive any PAB allocation in the four years after the 1986 Tax Reform. Panel D shows pre-lottery-year descriptives for 29 lottery attempts between 1996 and 2001. Appendix A provides a detailed description of all variables.

	N	Mean	SD	10^{th}	50^{th}	90^{th}
Panel A: PAB issuance						
PAB issuance $\text{volume}_{\text{county}}$ ($m)	7150	11.02	48.53	0.00	0.00	20.00
Log (PAB issuance $\text{volume}_{\text{county}}$)	7150	2.88	4.28	0.00	0.00	9.90
Per cap PAB supply	7150	61.38	39.81	50.00	50.00	64.03
Firm-level PAB volume ($m)	363	56.85	82.88	3.3	25	141
Log (Firm-level PAB volume)	363	3.24	1.32	1.46	3.26	4.96
Panel B: PAB eligible firms in border counties						
Per cap PAB supply	4097	66.68	46.48	50.00	50.00	139.53
$\text{Per cap PAB supply}_{1987}$	4097	105.47	81.41	75.00	75.00	244.29
Capex/Assets	4097	0.09	0.11	0.02	0.06	0.18
Log (Capex/Assets)	4097	-2.86	1.04	-4.17	-2.76	-1.72
Employment (k)	3948	6.16	14.23	0.05	1.06	16.05
Log (Employment)	3946	1.10	1.12	0.05	0.72	2.84
Lag of Size	4097	4.48	2.35	1.35	4.51	7.59
Lag of RoA	4079	0.00	0.23	-0.12	0.05	0.12
Panel C: PAB beneficiary firms post-1986						
Per cap PAB supply	1022	55.75	24.02	50.00	50.00	50.00
Capex/Assets	1022	0.09	0.06	0.03	0.08	0.15
Log (Capex/Assets)	1022	-2.59	0.65	-3.40	-2.54	-1.88
Employment (k)	993	18.39	49.65	0.46	3.90	40.20
Log (Employment)	993	1.86	1.27	0.38	1.59	3.72
Lag of Size	1022	6.55	2.09	3.81	6.76	9.12
Lag of RoA	1022	0.05	0.05	0.01	0.05	0.10
Panel D: Firms in Texas PAB lottery						
Lottery win dummy	29	0.55	0.51	0.00	1.00	1.00
Lottery-allocated bond volume ($m)	29	10.96	11.48	0.00	7.50	25.00
$\text{Capex/Assets}_{\text{Pre-lottery year}}$	29	0.08	0.06	0.02	0.07	0.12
$\text{Log(Capex/Assets)}_{\text{Pre-lottery year}}$	29	-2.75	0.65	-3.77	-2.68	-2.25
$\text{Employment (k)}_{\text{Pre-lottery year}}$	28	25.40	25.78	1.40	23.69	59.57
$\text{Log (Employment)}_{\text{Pre-lottery year}}$	28	2.73	1.20	0.88	3.21	4.10
$\text{Size}_{\text{Pre-lottery year}}$	29	8.71	1.73	6.40	9.16	10.53
$\text{RoA}_{\text{Pre-lottery year}}$	29	0.07	0.05	0.00	0.07	0.12

Table 2

Pre-tax reform and pre-lottery characteristics for firms in treatment and control groups

This table presents the mean pre-period characteristics as well as differences in the mean values for firms in the treatment and control groups as indicated in the respective Panel. For Panel A and B, the pre-tax reform period is from 1983 to 1986. For Panel C, the mean values correspond to the pre-lottery year. Difference adjusted controls for industry-by-year fixed effects (Panel A) or industry-by-post$_{1986}$ fixed effects (Panel B) when calculating the mean difference. For the difference calculation in Panels A and B, standard errors are clustered at the state level. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	N	Mean	N	Mean	Diff.	Diff. adj.
Panel A: PAB eligible firms	**Per cap PAB > 50**		**Per cap PAB = 50**			
Log (Capex/Assets)	379	-2.65	1625	-2.81	0.16**	0.01
Log (Employment)	358	1.11	1570	1.12	-0.01	-0.00
Lag of Size	379	4.65	1625	4.31	0.34	-0.02
Lag of RoA	377	-0.01	1623	0.01	-0.02	-0.02
Lag of Leverage	379	0.40	1624	0.37	0.03	-0.02
Lag of PPE growth	349	0.15	1507	0.22	-0.07	-0.04
County population (k)	379	386.04	1625	961.13	-575.09**	n/a
Panel B: PAB beneficiaries	**Per cap PAB > 50**		**Per cap PAB = 50**			
Log (Capex/Assets)	44	-2.65	437	-2.54	-0.11	-0.18
Log (Employment)	44	1.46	422	1.93	-0.47	-0.64*
Lag of Size	44	6.38	437	6.53	-0.16	-0.76
Lag of RoA	44	0.05	437	0.05	-0.00	0.00
Lag of Leverage	44	0.48	437	0.41	0.07	0.06
Lag of PPE growth	41	0.12	429	0.11	0.01	0.02
Panel C: Texas lottery	**Lottery winning firm**		**Lottery losing firm**			
Log (Capex/Assets)	16	-2.8	13	-2.6	-0.21	n/a
Log (Employment)	15	2.76	13	2.7	0.06	n/a
Size	16	8.74	13	8.68	0.06	n/a
RoA	16	0.07	13	0.06	0.00	n/a
Leverage	16	0.41	13	0.51	-0.10**	n/a
PPE growth	16	0.08	13	0.02	0.06	n/a

Table 3

Per cap PAB supply limits and PAB issuance after the 1986 Tax Reform

In Panel A, the dependent variable is the natural logarithm of the PAB issuance volume at the county level, and the sample consists of counties in which any local government issued at least one PAB in the ten years before the 1986 Tax Reform. In Panel B, the dependent variable is the natural logarithm of PAB volume that a firm received in a given year. Firm controls include lag of size, and lag of return on assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Pre and Post beneficiaries are firms that receive a PAB allocation in both the four year tax reform pre-period and the four year post-period. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)
Panel A: County-level PAB issuance volume				
	Log(PAB issuance volume) for			
	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 x Year FE	No	Yes	No	Yes
State border pair x Year FE	No	No	Yes	Yes
Number of observations	7150	7142	2295	2295
Adjusted R^2	0.376	0.376	0.375	0.373
Panel B: Firm-level PAB allocation volume				
	Log(Firm-level PAB volume) for			
	All beneficiaries		Pre and Post_{1986} beneficiaries	
Per cap PAB supply x Post-1986	0.0092***	0.0095**	0.0090***	0.0097***
	(3.554)	(2.680)	(3.227)	(2.908)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry x Post_{1986} FE	No	Yes	No	Yes
Number of observations	363	357	218	207
Adjusted R^2	0.617	0.580	0.582	0.520

Table 4

Per cap PAB supply and firm investment after the 1986 Tax Reform

The sample consists of PAB eligible firms located in border counties in which any local government issued at least one PAB in the ten years before the 1986 Tax Reform. The dependent variable is the natural logarithm of capital expenditures divided by the beginning of period total assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(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
State border pair x Post_{1986} FE	Yes	Yes	Yes
Industry x Year FE	No	No	Yes
Number of observations	4094	4073	4059
Adjusted R^2	0.488	0.507	0.525

Table 5

Per cap PAB supply and investment of PAB beneficiary firms after the 1986 Tax Reform

The dependent variable is the natural logarithm of capital expenditures divided by the beginning of period total assets. In columns (1) and (2), the sample consists of firms that receive any PAB allocation in the four years after the 1986 Tax Reform. Columns (3) and (4) additionally require any PAB issuance in the four years before the reform. Firm controls include lag of size and lag of return on assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)
	Log(Capex/Assets) for			
	Post_{1986} beneficiaries		Pre and Post_{1986} beneficiaries	
Per cap PAB supply x Post-1986	0.0030***	0.0035**	0.0041**	0.0049***
	(3.507)	(2.142)	(2.752)	(3.021)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
PAB allocation dummy x Year FE	Yes	Yes	Yes	Yes
Industry x Post_{1986} FE	No	Yes	No	Yes
Number of observations	1022	1021	524	523
Adjusted R^2	0.549	0.567	0.601	0.627

Table 6

Per cap PAB supply and firm employment after the 1986 Tax Reform

The sample consists of PAB eligible firms located in border counties in which any local government issued at least one PAB in the ten years before the 1986 Tax Reform. The dependent variable is the natural logarithm of firm employment. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)
	Log(Employment)		
Per cap PAB supply x Post-1986	0.00104***	0.00103***	0.00098***
	(9.806)	(9.779)	(6.252)
Lag of Size	0.16262***	0.16609***	0.16914***
	(7.249)	(6.997)	(6.632)
Lag of RoA		0.01730	0.01950
		(0.657)	(0.696)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	No
State border pair x Post_{1986} FE	Yes	Yes	Yes
Industry x Year FE	No	Yes	Yes
Number of observations	4067	4051	4027
Adjusted R^2 (within)	0.157	0.161	0.169

Table 7

Per cap PAB supply and employment of PAB beneficiary firms after the 1986 Tax Reform

The dependent variable is the natural logarithm of firm employment. In columns (1) and (2), the sample consists of firms that receive any PAB allocation in the four years after the 1986 Tax Reform. Columns (3) and (4) additionally require any PAB issuance in the four years before the reform. Firm controls include lag of size and lag of return on assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990 T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)
	Log(Employment) for			
	Post_{1986} beneficiaries		Pre and Post_{1986} beneficiaries	
Per cap supply x Post-1986	0.00088**	0.00081**	0.00130**	0.00124**
	(2.043)	(2.107)	(2.606)	(2.554)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
PAB allocation dummy x Year FE	Yes	Yes	Yes	Yes
Industry x Post_{1986} FE	No	Yes	No	Yes
Number of observations	993	992	512	511
Adjusted R^2 (within)	0.291	0.269	0.165	0.160

Table 8

The Texas PAB lottery and firm investment

The dependent variable is the difference in firm investment over the indicated time window relative to the pre-lottery year (year 0). Firm investment is calculated as the natural logarithm of capital expenditures divided by the beginning of period total assets. The sample consists of firms that participate in the Texas PAB lottery between 1996 and 2001. Lottery win dummy is a dummy equal to one if the firm wins any of its lottery attempts in the respective program year, and zero otherwise. Log(lottery-allocated bond volume) is the natural logarithm of the total USD bond amount won in a lottery year plus one, and is zero for lottery losing firms. T-statistics based on Huber/White robust standard errors are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Capex/Assets) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Panel A: Lottery winning firms						
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)
$\text{Size}_{\text{Pre-lottery year}}$	-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 program 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
Panel B: Lottery-allocated bond volume						
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)
$\text{Size}_{\text{Pre-lottery year}}$	-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 program 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

Table 9

The Texas PAB lottery and firm employment

The dependent variable is the difference in firm employment over the indicated time window relative to the pre-lottery year (year 0). Firm employment is calculated as its natural logarithm. The sample consists of firms that participate in the Texas PAB lottery between 1996 and 2001. Lottery win dummy is a dummy equal to one if the firm wins any of its lottery attempts in the respective program year, and zero otherwise. Log(lottery-allocated bond volume) is the natural logarithm of the total USD bond amount won in a lottery year plus one, and is zero for lottery losing firms. T-statistics based on Huber/White robust standard errors are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in Log(Employment) over					
	1 year	2 years	3 years	1 year	2 years	3 years
Panel A: Lottery winning firms						
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)
$\text{Size}_{\text{Pre-lottery year}}$	-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 program 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
Panel B: Lottery-allocated bond volume						
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)
$\text{Size}_{\text{Pre-lottery year}}$	-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 program 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

A. Variable Definitions

Variable	Description
State-level caps for PABs	
Post-1986	Dummy which equals one in the four years following the 1986 Tax Reform Act, i.e., from 1987 to 1990.
Per cap PAB supply	Limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 to 2000. Source: Own calculation based on data from IRC Section 146, IRS and U.S. Bureau of the Census Population and Housing Unit Estimates.
PAB issuing county	County with any PAB issuance by a local government during the period from 1976 to 1985. Source: U.S. Census Bureau's Annual Survey of State and Local Government Finance.
PAB issuance	
Log (PAB issuance $\text{volume}_{\text{county}}$)	Natural logarithm of one plus the county-level sum of PAB issuance volumes by all local governments in the respective county. Source: U.S. Census Bureau's Annual Survey of State and Local Government Finance.
Log (Firm-level PAB volume)	Natural logarithm of one plus a firm's aggregate PAB volume for the respective year. Source: SDC Platinum.
Post_{1986} beneficiary firm	Firm for which any PAB is issued during the period 1987 to 1990. Source: SDC Platinum.
Pre and Post_{1986} beneficiary firm	Firm for which any PAB is issued during the period 1987 to 1990, and during the period 1983 to 1986. Source: SDC Platinum.
PAB allocation dummy	Dummy which equals one if the firm receives any PAB allocation in the respective year, and zero otherwise. Source: SDC Platinum.
PAB allocation dummy x Year FE	PAB allocation dummy interacted with year fixed effects. Source: SDC Platinum.
House price index	County-level house price index. Missing data points are imputed with the state-level house price index. Source: Federal Housing Finance Agency.
Texas PAB lottery	
Lottery win dummy	Dummy equal to one if a lottery participating firm wins any of its lottery (project) attempts in the respective program year, and zero otherwise. Source: Own calculation based on data from the Texas Bond Review Board.
Log(Lottery-allocated bond volume)	Natural logarithm plus one of the total PAB volume allocated to a firm in the Texas PAB lottery in a program year. Source: Own calculation based on data from the Texas Bond Review Board.
Firm characteristics	
Log (Capex / Assets)	Natural logarithm of capex (item: capx) divided by beginning of period total assets (item: at). Source: Compustat.
Log (Employment)	Natural logarithm of one plus the number of employees (item: emp). Source: Compustat.
Lag of Size	Natural logarithm of one plus total assets (item: at), lagged by one period. Source: Compustat.
Lag of RoA	Net income (item: ni) divided by total assets (item: at), lagged by one period. Source: Compustat.

Continued on next page

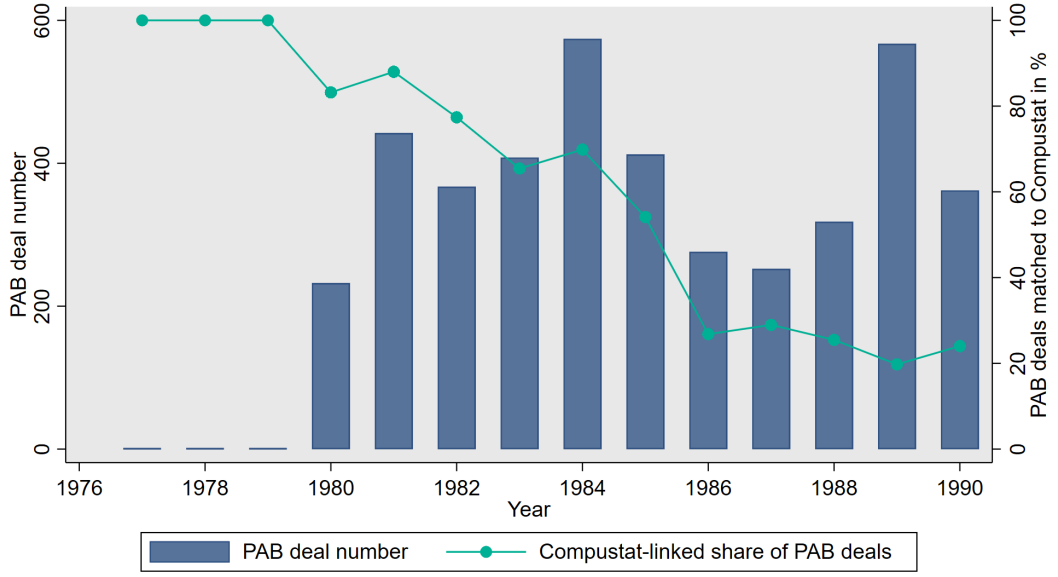
Appendix A continued

Variable	**Description**
Lag of Leverage	Long term debt (item: dltt) plus debt in current liabilities (item: dlc) divided by book value of common equity (item: ceq) plus long-term debt and debt in current liabilities, lagged by one period. Source. Compustat.
Log (Capex)	Natural logarithm of capex (item: capx). Source: Compustat.
Capex/Assets	Capex (item: capx) divided by the beginning of period total assets (item: at). Source: Compustat.
PPE growth	Difference between Property, plant and equipment (item: ppent) of the current year and the pre-year, divided by pre-year value. Source: Compustat.
Market-to-book	Total assets (item: at) minus book value of common equity (item: ceq) plus market value of common equity (items: prcc_f multiplied by csho), divided by total assets (item: at). Source: Compustat.
Payout ratio	Sum of dividends on preferred stock (item: dvp), dividends on common stock (item: dvc) and purchase of common and preferred stock (item: prstkc), divided by income before extraordinary items (item: ib). Source: Compustat.
Industry x Year FE	Historic SIC-level-2- Year Fixed Effect. Source: Compustat.
Industry x Post_{1986} FE	Historic SIC-level-2 interacted with the dummy Post-196 Fixed Effect. Source: Compustat.

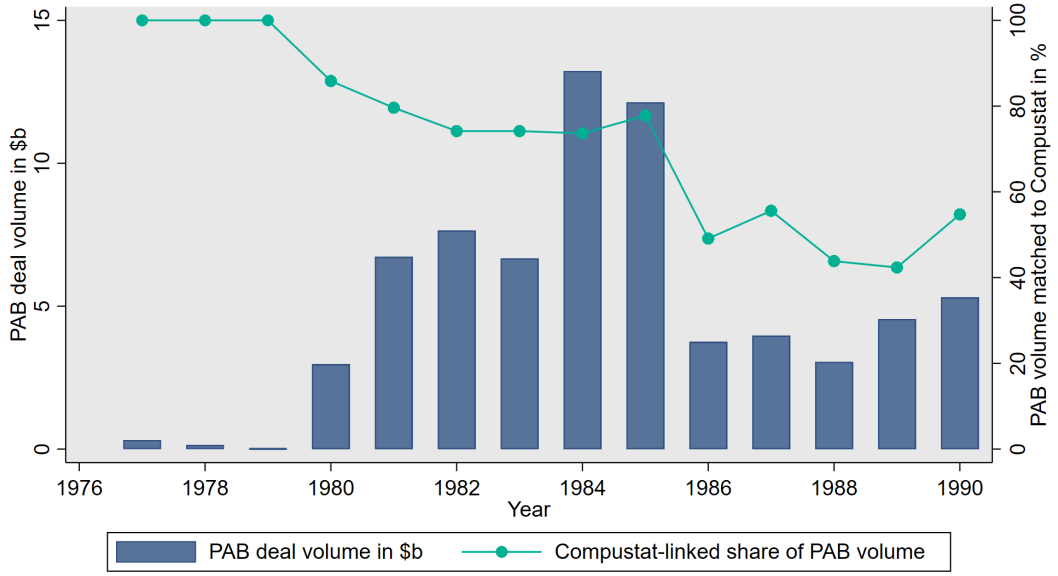
B. PAB beneficiary firms in the SDC database

This figure illustrates the proportion of new-money PABs obtained from SDC Platinum that can be linked to Compustat within the period from 1977 to 1990. Further, it shows SDC's overall coverage of new-money PAB deals during this period. Subfigure (a) illustrates properties for the deal level, while Subfigure (b) captures deal volumes.

(a) PAB deals and Compustat PAB beneficiaries



(b) PAB deal volume and Compustat PAB beneficiaries



C. Allocation of PABs in Texas

As put forward in IRC Section 146, states have the power to set up their own allocation scheme for PABs within their volume limits (see also Internal Revenue Service, 2019), or they can make use of the proposed scheme as described in the respective Section. The latter denotes that 50% of a state's ceiling should be allocated to state issuers, and the remaining 50% to local issuers based on relative local population figures. Zimmerman (1990) provides a comprehensive overview of both the state agencies responsible for the cap allocation and of the allocation priorities within states as of 1989. Allocation priorities vary in terms of the distribution among state and local governments as conduit issuers, and with respect to industry and project types.

For the State of Texas, the Texas Bond Review Board (BRB) administers the private activity bond allocation program since 1992 (Texas Bond Review Board, 2023b). Chapter 1372 of the Texas Government Code is the relevant legal basis. The state volume is allocated to several subceilings for an initial period of about 8 months. The focus of my analyses is on the impact of PABs on corporate beneficiaries from the Compustat universe. Therefore, the relevant sub-ceilings are the one for qualified small issue bonds (formerly industrial development bonds, IDB) and empowerment zone bonds, and the subceiling for any other issues, under which exempt facility bonds fall (Texas Bond Review Board, 1996). The reserved percentage share for the subceilings varies over time. For 1996, the category on any other issues received 42% of the total volume, and small issue bonds received 7.5% (Texas Bond Review Board, 1996). Under the current version of Chapter 1372, the ceiling for any other issues comprises 29.5%, and small issues get a reservation amount of 2%.[25]

Within any of the subceilings, the priority of PAB projects is generally determined based on a lottery. Applicants, therefore, must submit an allocation request before the respective lottery application deadline, which currently is on October 20 before the respective PAB program year starts (see Texas Bond Review Board, 2023a, for a detailed timeline of the lottery program and further details on the distribution mechanism).

The Texas PAB lottery results provide information on the status of the application request, the conduit issuer, and the project, amongst others. Due to the common oversubscription of the program, I can leverage the data from the Texas PAB lottery to compare investment among a set of firms that applied for PAB allocation, but only a sub-set receives an allocation.

[25] As noted by the Texas Bond Review Board (1997), the 29.5% limit for the subceiling "all other issues" category has been introduced with the calendar year 1998.

D. Additional figures

Figure D.1
Per cap PAB supply and firm-level PAB volumes after the 1986 Tax Reform

This figure illustrates trends in firm-level PAB allocation around the 1986 Tax Reform Act. The dependent variable is the natural logarithm of the aggregate PAB allocation volume at the firm level. The figure shows the coefficient estimates and 90% confidence interval on the Per cap PAB supply measure interacted with year dummies. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. The regression specification corresponds to column (4) in Table 3, bottom panel. The effective date for the PAB volume caps mandated by the 1986 Tax Reform Act is shown in red (- -). Appendix A provides a detailed description of all variables.

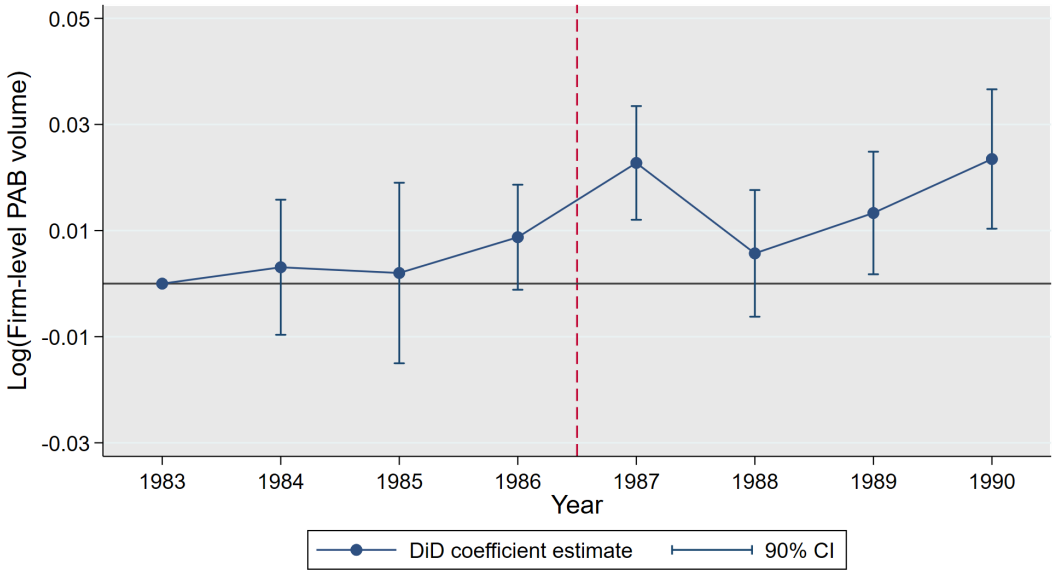
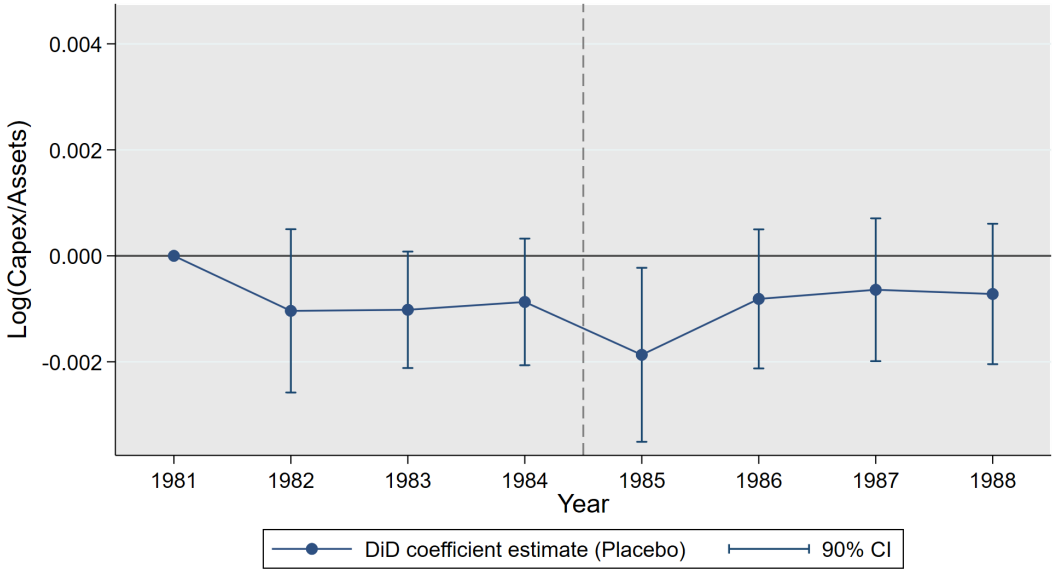


Figure D.2

Placebo test: Per cap PAB supply and firm investment after the 1984 Deficit Reduction Act

This figure shows the results of a placebo test of PAB supply on investment of PAB eligible firms. It illustrates the development of firm investment for firms located in border counties around the 1984 Deficit Reduction Act, using the thereby mandated, non-restrictive PAB volume caps to calculate per cap PAB supply. Section 1.1 provides background information on the 1984 caps on PABs. The figure shows coefficient estimates and the 90% confidence interval on the Per cap PAB supply$_{1985}$ measure interacted with year dummies over the placebo event period from 1981 to 1988. Except for these differences, the regression specification follows column (3) in Table 4. The effective date for the PAB volume caps mandated by the 1984 Deficit Reduction Act is shown in gray (- -). Appendix A provides a detailed description of all variables.



E. Robustness tests

Table E.1

Per cap PAB supply and firm investment: PAB supply measure and county issuer sample definition

The dependent variable is the natural logarithm of capital expenditures divided by the beginning of period total assets. In Panel A, the setup is as in Table 4, but Per cap PAB supply$_{1987}$ is the limit to the per capita amount of private activity bonds in USD that a state may distribute for transition year 1987. In Panel B, the setup is as in Table 4, but alternative definitions for the sample of PAB issuing counties are used. Firm controls are lag of size and lag of return on assets. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)
	Log(Capex/Assets)		
Panel A: PAB supply for transition year 1987			
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
State border pair x Post FE	Yes	Yes	Yes
Industry x Year FE	No	No	Yes
Number of observations	4094	4073	4059
Adjusted R^2	0.488	0.507	0.525
Panel B: PAB issuing county definition			
	Any issuance 1983-1986	Any iss. 1983-1986 and 1987-1990	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
State border pair x Post FE	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes
Number of observations	3487	2766	2590
Adjusted R^2	0.521	0.518	0.483

Table E.2

Per cap PAB supply and firm investment: other firm investment measures

The dependent variable is indicated in each column and represents an alternative firm investment measure. Apart from that, the setup is as in Table 4. The sample consists of firms headquartered in bordering counties in which any local government issued at least one PAB in the ten years before the 1986 Tax Reform. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Firm controls are lag of size and lag of return on assets. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. The sample period is from 1983 to 1990. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(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
State border pair x Post FE	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes
Number of observations	4157	4157	4211
Adjusted R^2	0.954	0.380	0.107

Table E.3

Per cap PAB supply and investment of PAB beneficiary firms after the 1986 Tax Reform: PAB beneficiary firms in 1987 and 1988

The table repeats Table 5, but defines post-reform beneficiary firms as those that receive any PAB in the two years after the reform instead of in the four years after the reform. Hence, in columns (1) and (2), the sample consists of firms that receive any PAB in the two years after the 1986 Tax Reform. Columns (3) and (4) additionally require any PAB issuance in the four years before the reform. The dependent variable is the natural logarithm of capital expenditures divided by the beginning of period total assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. Post is a dummy that equals one from 1987 to 1990, and zero otherwise. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)
	Log(Capex/Assets) for			
	Post_{1986} beneficiaries		Pre and Post_{1986} beneficiaries	
Per cap PAB supply x Post-1986	0.0038***	0.0044*	0.0048**	0.0064***
	(3.489)	(1.905)	(2.690)	(3.405)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
PAB allocation dummy x Year FE	Yes	Yes	Yes	Yes
Industry x Post_{1986} FE	No	Yes	No	Yes
Number of observations	527	527	358	358
Adjusted R^2	0.539	0.568	0.576	0.606

Table E.4

Per cap PAB supply and investment of PAB beneficiary firms after the 1986 Tax Reform: extended post-reform period

The table repeats Table 5, but uses an extended post-reform window of seven years instead of four years. Hence, the sample period is from 1983 to 1993. Post is a dummy that equals one from 1987 to 1993, and zero otherwise. In columns (1) and (2), the sample consists of firms that receive any PAB in the four years after the 1986 Tax Reform. Columns (3) and (4) additionally require any PAB issuance in the four years before the reform. The dependent variable is the natural logarithm of capital expenditures divided by the beginning of period total assets. Per cap PAB supply is the limit to the per capita amount of private activity bonds in USD that a state may distribute for calendar years 1988 onward. T-statistics based on Huber/White robust standard errors clustered by state are presented in parentheses. ***, ** and * indicate significance at the 1%-, 5%- and 10%-levels, respectively. Appendix A provides a detailed description of all variables.

	(1)	(2)	(3)	(4)
	Log(Capex/Assets) for			
	Post_{1986} beneficiaries		Pre and Post_{1986} beneficiaries	
Per cap PAB supply x Post-1986	0.0038***	0.0044**	0.0053***	0.0058***
	(3.779)	(2.564)	(3.292)	(2.955)
Firm controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
PAB allocation dummy x Year FE	Yes	Yes	Yes	Yes
Industry x Post_{1986} FE	No	Yes	No	Yes
Number of observations	1438	1437	714	714
Adjusted R^2	0.579	0.594	0.611	0.629