Heterogeneous Taxes and Limited Risk Sharing: Evidence from Municipal Bonds

Presentation at 2016 EMF

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Context

- Taxes are one of the most important levers of government policy.
- Taxes on assets often used as an inducement to generate particular types of ownership:
  - In India, taxes on short-term capital gains, but none on longer-term capital gains.
  - U.S. state governments provide exemptions for in-state (domestic) holdings of state debt.
- Perception that such tax policies (especially the latter) can be revenue-neutral:
  - Required rate of return on debt issuance lower, but tax receipts also lower.
  - Ricardian equivalence seemingly holds “by construction”.
- Is this true?

Literature

- Literature has found that taxes do have a significant influence on:
  - Portfolio allocation of investors [Poterba and Samwick (2003)].
  - Investor decisions to locate assets in tax-advantaged accounts [Bergstresser and Poterba (2004); Dammon et al. (2004); Rydqvist et al. (2014)].

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- But, sparse evidence that there are any consequences on asset valuation:
  - Graham (2003): "The profession has made only modest progress documenting whether investor taxes affect asset prices."
  - Longstaff (2011): "there is still much about the effects of taxation on investment values that is not yet fully understood"

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- Famous Modigliani-Miller proposition, reaffirmed by Miller (1977) in his AFA Presidential address:
  - Debt supply adjusts such that all otherwise similar debts are priced by **the same marginal investors**. "**One clientele is as good as the other**."

Our Paper

- Main (new) point:
  - 1. Tax policy affects ownership structure (**tax clienteles**).
  - 2. This effectively **segments the market,** and inhibits perfect risk-sharing.
  - 3. If frictions limit perfect arbitrage, significant consequences for **asset valuation, security issuance**.

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- Simple theory model to show the result, blends Miller (1977) with Merton (1987).
  - For corporate finance, highlight new cost of external finance.
  - For international finance, highlights a neglected issue for domestic sovereign debt holdings.

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- Simple theory model to show the result, blends Miller (1977) with Merton (1987).
  - For corporate finance, highlight new cost of external finance.
  - For international finance, highlights a neglected issue for domestic sovereign debt holdings.
- Empirical tests use US municipal bond market as a laboratory, confirms model predictions.
  - Significant variation in tax privileges for in-state owners.

Background

US municipal bonds exempt holders from federal income tax. In most cases, this exemption also extends to **state income tax** (and even city income tax) for **in-state holders**.

Consider four municipal bonds issued by CA, NC, IL, and TX:

Holder is resident of:	Federal Inc. Tax	State Inc. Tax			
		CA Bond	NC Bond	IL Bond	TX Bond
CA (13%)	Exempt	Exempt	Tax	Tax	Tax
NC (6%)	Exempt	Tax	Exempt	Tax	Tax
IL (5%)	Exempt	Tax	Tax	Tax	Tax
TX (0%)	Exempt	0%	0%	0%	0%

Tax Clienteles

With tax privilege, in-state residents have incentives to hold state bonds.

Quasi-exogenous cross-state variation: Tax privilege determines **ownership structure**.

- **CA** $\longrightarrow$ Privilege = 13% $\longrightarrow$ Bonds held **mostly by CA residents**.

  $\vdots$

- **TX** $\longrightarrow$ Privilege = 0% $\longrightarrow$ Bonds held **mostly by out-of-state residents**, (i.e., proportionally distributed across diversified national investors.)

Consequences implied by the model will follow.

Preview of Results

- Positive association between tax privilege and home-biased ownership using muni bond funds.
  - **Top privilege tercile:** Munis mostly owned by **"state funds."**
  - **Bottom privilege tercile:** Munis mostly owned by **"national funds."**

- **Consequences:** States whose munis are mostly owned by in-state residents are associated with:
  - **Limited cross-state risk sharing** in the muni market.
  - **Higher sensitivity** of bond prices to **demand and supply variation**, and **local political risk**.
  - **Difficulty in raising capital** for public projects when demand is weak.

Roadmap

1. Theory
2. Tax Clienteles
3. Effects on Prices and Capital Raising
4. Conclusions

A Simple Model

Two assets: I (in-state) and M (market) with the following returns.

$$\tilde{r}_I = \bar{r}_I + \tilde{y} + \tilde{\varepsilon}_I \text{ and } \tilde{r}_M = \bar{r}_M + \tilde{y}$$

Same exposure to systematic risk but asset I has idiosyncratic risk $\tilde{\varepsilon}_I$.

Two investors: ι (inside) and g (global) with wealth $W^\iota \ll W^g$ and the state government has positive net worth ($W^\iota > S_I$).

Following Merton (1987), both investors $j \in \{\iota, g\}$ maximize the same mean-variance utility function by choosing portfolio weight ω in asset I:

$$\max_{\omega^j} \mathrm{E}(W^j(1+\tilde{r}^j)) - \frac{\delta}{2W^j}\mathrm{Var}(W^j(1+\tilde{r}^j)) - \lambda^j\omega^j$$

$$\Leftrightarrow \quad \max_{\omega^j} \mathrm{E}(\tilde{r}^j) - \frac{\delta}{2}\mathrm{Var}(\tilde{r}^j) - \lambda^j\omega^j$$

Investor Optimization

Investor ι enjoys tax privilege in asset I but pay tax τ on asset M.

$$\begin{aligned} E(\tilde{r}^{\iota}) &= \omega^{\iota}\bar{r}_I + (1-\tau)(1-\omega^{\iota})\bar{r}_M \\ \text{Var}(\tilde{r}^{\iota}) &= ((1-\tau+\tau\omega^{\iota})\sigma_y)^2 + (\omega^{\iota}\sigma_I)^2 \end{aligned}$$

Optimal weight ω^{ι} illustrates the tradeoff between tax privilege ($\tau\bar{r}_M$) and idiosyncratic risk (σ_I^2):

$$\omega^{\iota} = \frac{\bar{r}_I - (1-\tau)\bar{r}_M - \delta\tau(1-\tau)\sigma_y^2 - \lambda_{\iota}}{\delta(\tau\sigma_y^2 + \sigma_I^2)}$$

Investor g faces the same tax treatment for both assets (wlog, assumed to be zero). Her optimal weight ω^g is given by

$$\omega^g = \frac{\bar{r}_I - \bar{r}_M - \lambda_g}{\delta\sigma_I^2}$$

Market Clearing [1]

To clear market for asset I, $\bar{r}_I$ must solve: $W^\iota \omega^\iota + W^g \omega^g = S_I$
Solution can be in two regions:

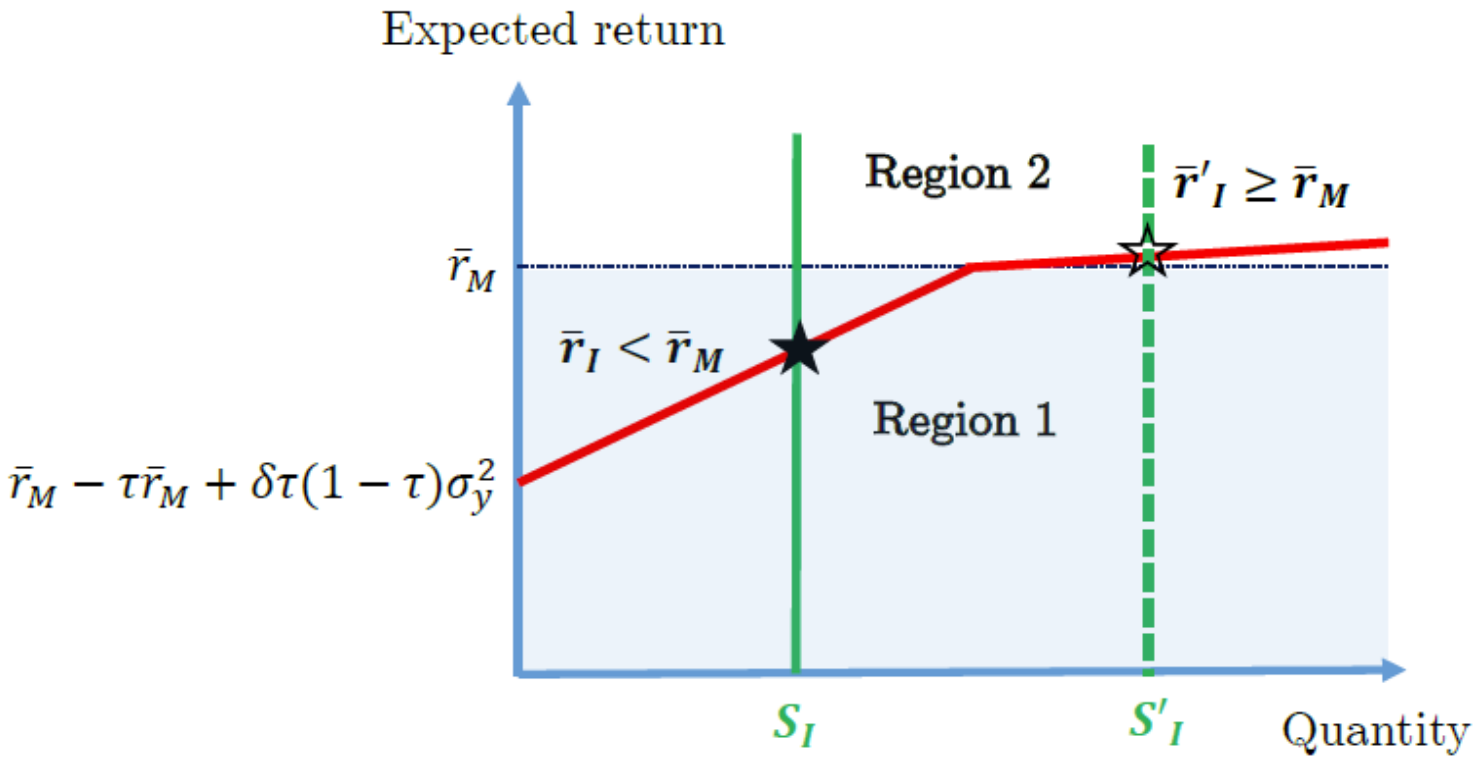
- **Region 1 [likely with LARGE τ]:** Investor ι bears all the idiosyncratic risk: $\bar{r}_I = (1-\tau)\bar{r}_M + \delta\tau(1-\tau)\sigma_y^2 + \frac{\delta\gamma\sigma_I^2 S_I}{W^\iota}$
- **Region 2 [likely with ZERO/SMALL τ]:** Investors ι and g share the idiosyncratic risk: $\bar{r}_I = \bar{r}_M - \frac{W^\iota}{W^\iota + \gamma W^g}\left(\tau\bar{r}_M - \delta\tau(1-\tau)\sigma_y^2\right) + \frac{\delta\gamma\sigma_I^2 S_I}{W^\iota + \gamma W^g}$

In **region 1**, $\bar{r}_I$ is more sensitive (than in **region 2**) to variation in risk (σ_I^2), demand (δ), and net supply (S_I):

$\frac{\partial \bar{r}_I}{\partial \sigma_I^2} = \delta S_I / W^\iota > 0$ and $\frac{\partial \bar{r}_I}{\partial \delta} = \tau(1-\tau)\sigma_y^2 + \gamma\sigma_I^2 S_I / W^\iota > 0$ and
$\frac{\partial \bar{r}_I}{\partial S_I} = \delta\gamma\sigma_I^2 / W^\iota > 0$

Market Clearing [2]

Moreover, the differential sensitivities between **region 1** and **region 2** increase as the in-state asset I accounts for a bigger fraction of the inside investor's portfolio (i.e., as $\frac{S_I}{W^\iota}$ increases).



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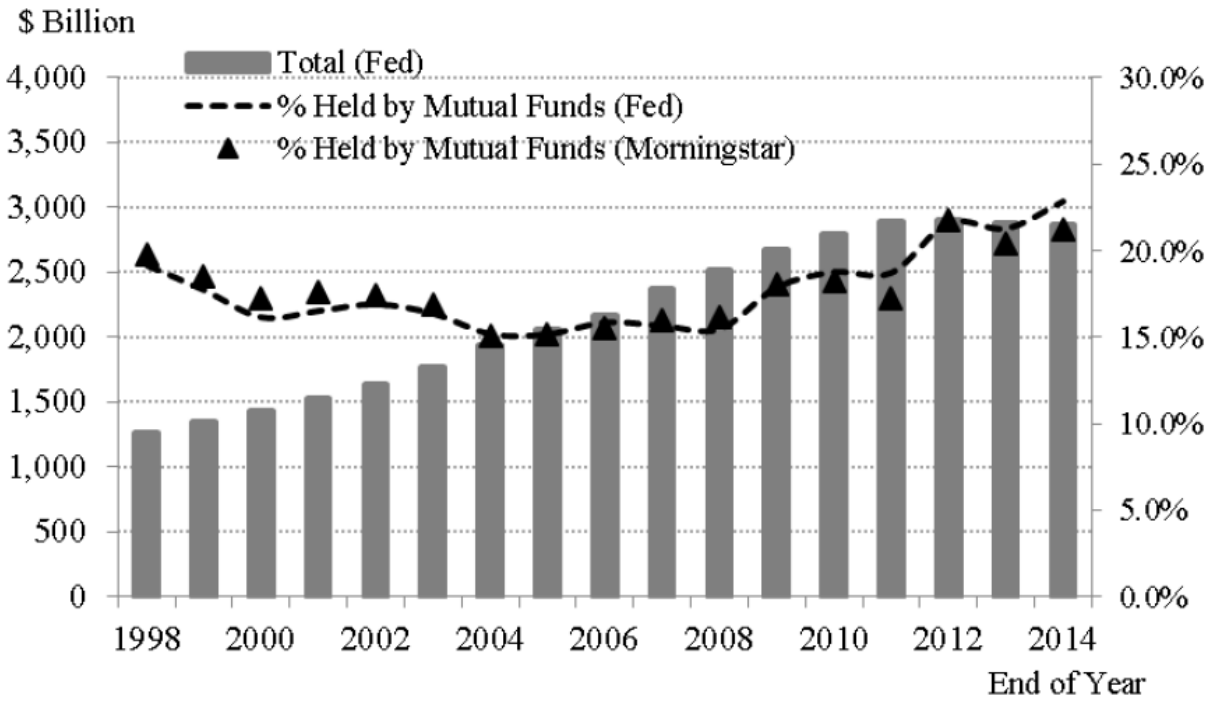
Municipal Bond Funds

Our tests rely on the cross section of states w/ different local ownership measured using **Morningstar's mutual fund data**.

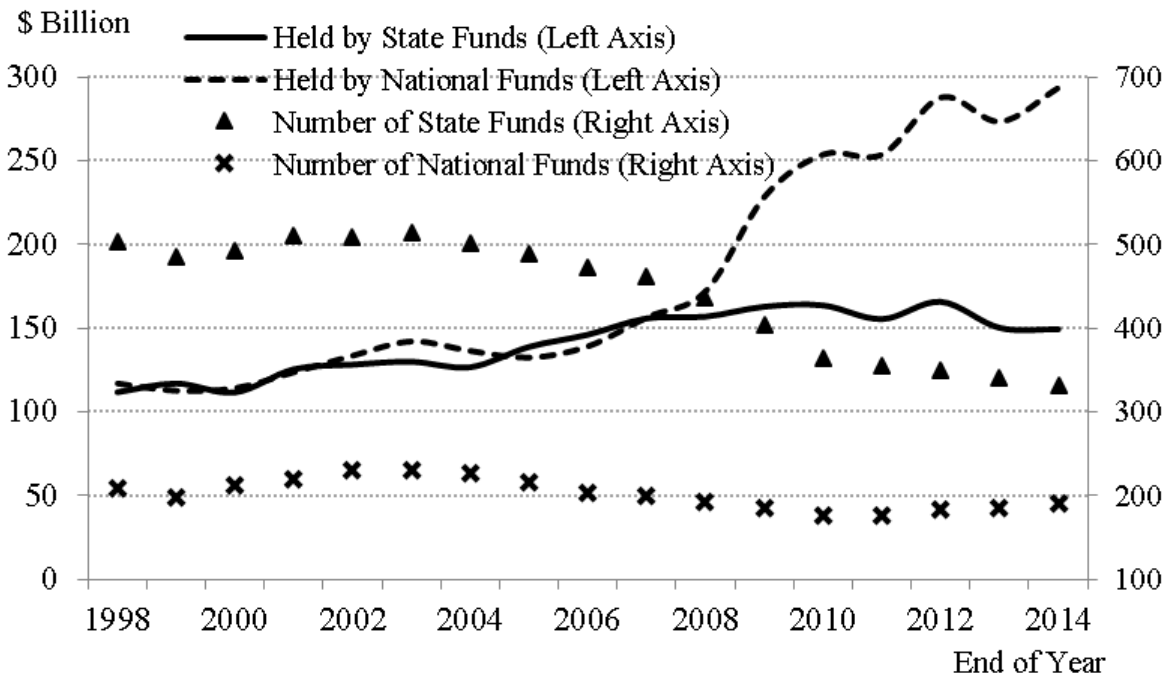
- **983 muni funds** (and 1,341 other funds holding muni bonds).
- Represent about **15-23% of ownership**, in line with Flow of Funds data.



State vs. National Funds

Morningstar classifies muni funds into three types.

- **State funds (615)** – invest almost exclusively in a state.
- **National funds (318)** – invest in a diversified manner across several states.
- High-yield funds (50) – invest in speculative-grade munis.



Who Holds State Funds?

Vanguard California Intermediate-Term Tax-Exempt Fund Shares (VCAIX)

Product summary

This low-cost municipal bond fund seeks to provide federally tax-exempt and California state tax-exempt income and typically appeals to investors in higher tax brackets who reside in California. The fund typically has an average duration of about 5–6 years and invests in high-quality California municipal bonds across the yield curve. Risks of the fund include the fact that changes in interest rates, both up and down, can affect the fund by resulting in lower bond prices or an eventual decrease in income for the fund. Investors who are looking for a fund that may provide federal and California state tax-exempt interest income and can tolerate moderate price and income fluctuations may wish to consider this fund.

Tax Privilege and State Fund Holding [1]

State Fund Holding (*SFH*, bonds held by state funds as % of bonds held by all muni funds) is **positively associated with tax privilege**.

State	Tax Status of Bonds Issued by: State	Tax Status of Bonds Issued by: Other States	State Tax (%)	Privilege (%)	Debt/Hi Tax Inc. (%)	State Fund Holding (%): All	State Fund Holding (%): 0-7 Year	State Fund Holding (%): 8-15 Year	State Fund Holding (%): 15+ Year
Top Privilege Tercile (States with Highest Average State Tax Privilege)									
NJ	Exempt	Taxable	8.16	8.16	72.62	45.99	29.76	43.34	56.99
MN	Exempt	Taxable	7.99	7.99	107.85	61.31	41.29	68.27	66.33
NY	Exempt	Taxable	7.72	7.72	109.67	61.75	39.17	56.03	71.84
OH	Exempt	Taxable	6.72	6.72	122.49	49.01	29.53	50.30	55.83
Average			**7.95**	**7.95**	**112.26**	**50.58**	**35.35**	**50.88**	**57.23**
Bottom Privilege Tercile (States with Lowest Average State Tax Privilege)									
IL	Taxable	Taxable	3.47	0.00	103.02	0.61	0.44	0.64	0.71
WI	Taxable	Taxable	7.10	0.00	131.82	4.26	1.42	4.87	5.92
FL	Exempt	Taxable	0.00	0.00	85.11	35.83	24.16	33.99	42.06
TX	Exempt	Taxable	0.00	0.00	102.09	2.10	2.81	2.26	1.80
Average			**3.23**	**0.42**	**110.64**	**15.44**	**9.15**	**15.65**	**18.20**
Top - Bottom			**4.72*** **	**7.52*** **	**1.62***	**35.14*** **	**26.20*** **	**35.24*** **	**39.03*** **

The positive association between *SFH* and **tax privilege** is robust for all years.

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Price Implications

Test theory predictions about **price sensitivity to shocks in the presence of tax clienteles**, by running the following regression:

$$Spread20Y_{it} = \beta X_{it} + \gamma HighSFH_{it} \times X_{it} + Controls + FEs$$

Local risk ($\Delta\sigma_I$)

Demand shock ($\Delta\delta$)

Supply shock (ΔS_I)

Are the effects of X indeed bigger for states with concentrated ownership?

National- and state-level economic variables

Rating, state, year, month dummies

Further, test whether γ **is bigger for states with high debt to wealth ratio** ($\frac{S_I}{W^i}$).

Pricing of Local Risk (Y = 20Y Spread)

	(1)	(2)	(3)	(4)	(5)
[A] = High SFH	-0.085***	-0.086***	-0.079***		
	(0.011)	(0.011)	(0.011)		
[B] = [A] x High privilege				-0.073***	-0.076***
				(0.009)	(0.012)
Close election	**0.090****	**0.062**	**0.040**	**0.034**	**0.031**
	(0.040)	**(0.039)**	**(0.042)**	**(0.042)**	**(0.063)**
[A] x Close election		**0.083*****	**0.092****		
		(0.031)	**(0.039)**		
[B] x Close election				**0.124***	**0.028**
				(0.065)	**(0.068)**
High Debt/Hi. tax income x Close election					0.013
					(0.071)
[B] x High Debt/Hi. tax income x Close election					**0.196***
					(0.106)

Periods before close Gubernatorial election (margin $< 5\%$) = Periods with high local risk (σ_I^2).

- Political risk is reflected in bond yields $\rightarrow$ **Local risk premium**.
- Such effects are **concentrated among states with high SFH** and **high debt/high-tax income**.

Demand Variation (Y = 20Y Spread)

	(1)	(2)	(3)	(4)	(5)
[A] = High SFH	-0.077***	-0.080***	-0.074***		
	(0.010)	(0.010)	(0.009)		
[B] = [A] x High privilege				-0.072***	-0.075***
				(0.009)	(0.013)
Pressure Q5	**0.126*** **	**0.102** **	**0.097** **	**0.103** **	**0.049**
	(0.044)	**(0.041)**	**(0.045)**	**(0.046)**	**(0.044)**
[A] x Pressure Q5		**0.073** **	**0.070** **		
		(0.031)	**(0.034)**		
[B] x Pressure Q5				**0.060***	**0.040**
				(0.030)	**(0.048)**
High Debt/Hi. tax inc. x Pressure Q5					0.049
					(0.030)
[B] x High Debt/Hi. tax inc. x Pressure Q5					**0.081** **
					(0.040)

- Fire sales increase bond yields → Prices are susceptible to **demand changes**.
- Such effects are **concentrated among states with high SFH**, especially **those with high debt/high-tax income**.

Supply Variation (Y = 20Y Spread)

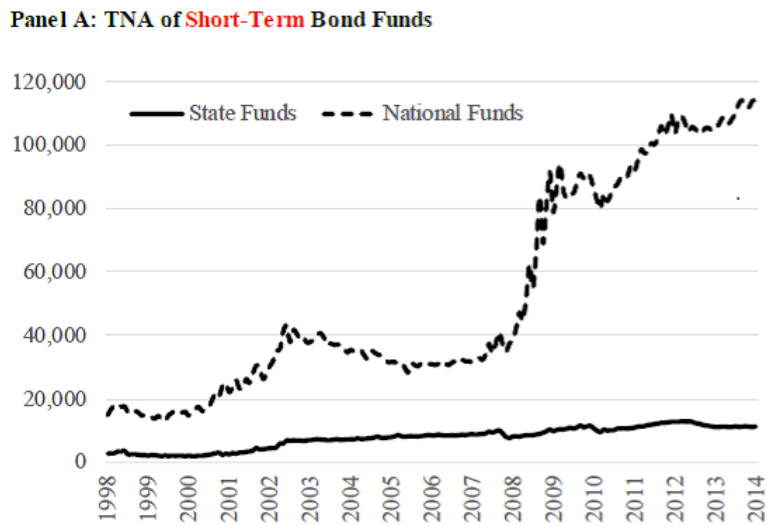
	(1)	(2)	(3)	(4)	(5)
[A] = High SFH	-0.096***	-0.115***	-0.087***		
	(0.008)	(0.010)	(0.010)		
[B] = [A] x High privilege				-0.033**	-0.103***
				(0.015)	(0.009)
Net issuance/Debt	**0.145**	**-0.020**	**0.075**	**0.048**	**-0.018**
	(0.132)	**(0.140)**	**(0.146)**	**(0.138)**	**(0.139)**
[A] x Net issuance/Debt		**0.392*** **	**0.254** **		
		(0.128)	**(0.120)**		
[B] x Net issuance/Debt				**0.473*** **	**0.404*** **
				(0.146)	**(0.147)**
High Debt/Hi. tax inc. x Net issuance/Debt					0.207
					(0.140)
[B] x High Debt/Hi. tax inc. x Net issuance/Debt					**0.352***
					(0.177)

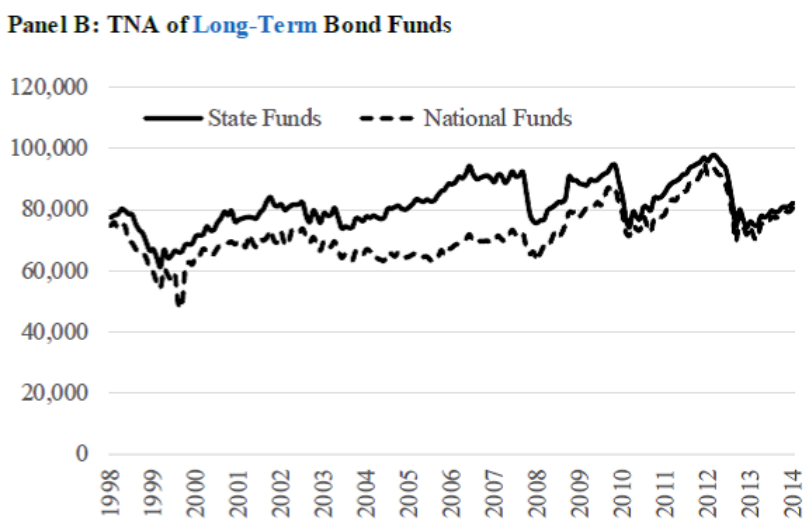
Use demeaned-annualized monthly net issuance as % of outstanding debt as measure of supply change (change in S_I).

- Issuance increases bond yields $\rightarrow$ Susceptibility to **supply changes**.
- Such effects are **significant only in states with high SFH**, especially **those with high debt/high-tax income**.

Experiment 1: Reallocation at Short End

Big decrease in *SFH* for **short-term bonds** after the crisis →
few clientele effects should remain. No such changes for **long-term bonds**.

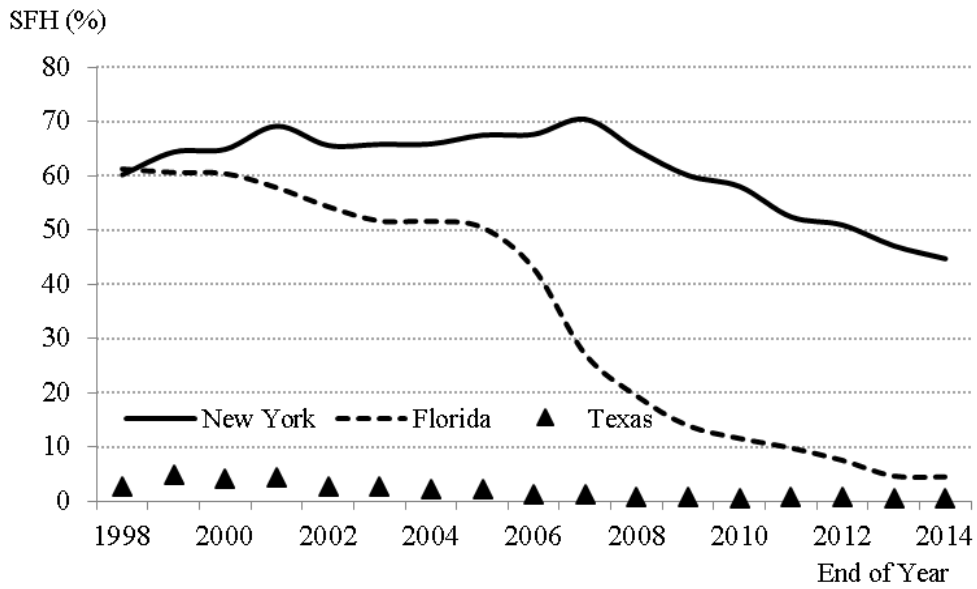




After 2009, the differential effects of local risk, demand, and supply variations **almost disappear for 5-year munis** but **remain the same for 20-year munis**.

Experiment 2: Florida

In Florida, the intangible property tax (IPT) on financial assets was abolished in 2007. State residents enjoyed IPT privilege **before** but **NOT after 2007**.



Before 2007, FL munis are sensitive to **demand and supply variation**. After 2007, these **effects disappear**, and FL munis behave pretty much like those of TX.

Summary of Price Implications

States whose munis are mostly locally held exhibit **higher sensitivity to local political risk**.

- State residents have concentrated portfolio of locally issued bonds, thus demanding greater compensation for local risk.

Concentrated in-state ownership also segments the state, making its debt prices **susceptible to demand and supply variations**.

- State residents have limited wealth, demanding larger return from absorbing state-specific shocks.
- Similar to liquidity effects– capital moves slowly to take advantage of price dislocations [Mitchell et al. (2007)].

Capital Raising

- General Obligation (GO) new money is not sensitive to demand conditions, potentially because GO issues must be approved by the legislature and often also by the voters.
- **GO refunding is reduced** when faced with **weak demand**, especially **in states with high SFH**.

- States issue **more (less) Revenue (REV) bonds** when faced with **+ (-) demand shocks**, and the effects are **2X for refunding** than for new money.
- Such effects are **concentrated in states with high SFH**.

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Conclusions

We use municipal bond funds' ownership to confirm the **positive association between tax privilege and home-biased ownership.**

- **Top privilege tercile:** Munis mostly owned by **"state funds."**
- **Bottom privilege tercile:** Munis mostly owned by **"national funds."**

Consequences: States whose munis are **mostly owned by in-state residents** are associated with:

- **Limited cross-state risk sharing** in the muni market.
- **Higher sensitivity** of bond prices to **demand and supply variations**, and **local political risk**.
- **Difficulty in raising capital** for public projects in stress periods.

Implications for asset pricing and corporate finance.