Financing Infrastructure with Inattentive Investors: The Case of US Municipal Governments

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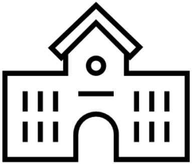
Financing of infrastructure in the US



Municipal
Governments

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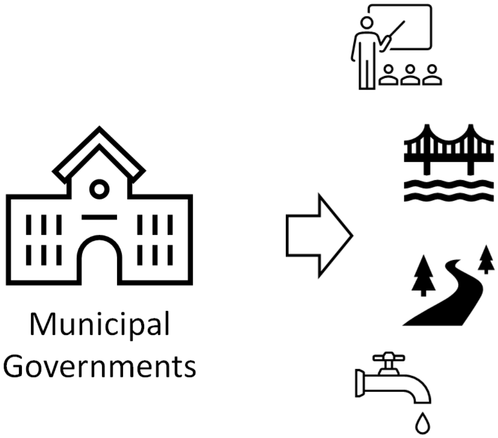

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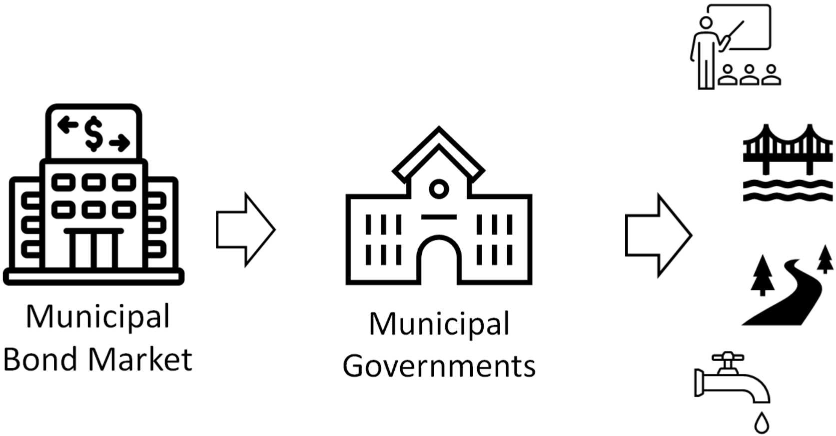

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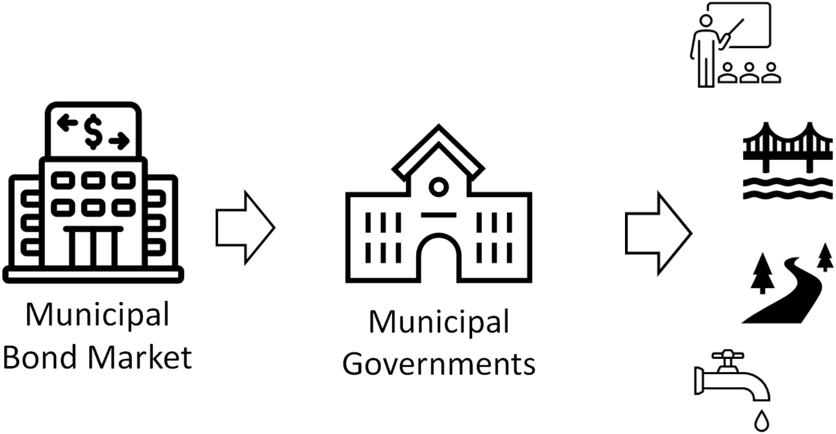
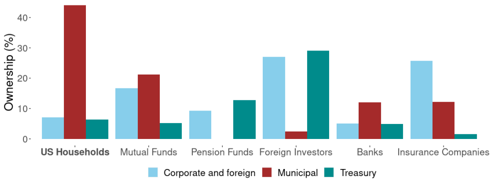


A Puzzle: Municipal governments are credit-constrained, despite being among the safest borrowers in the US. (Adelino et al. 2017; Dagostino, 2018; Yi, 2021) Evidence

An explanation: Dominance of retail investors

- Households are the primary holders of muni bonds.
- However, they might not closely monitor new bond issues. Evidence on investor inattention
- **Implication:** Borrowing capacity is limited to the capital available to attentive investors and intermediaries, since they hold the bonds first.



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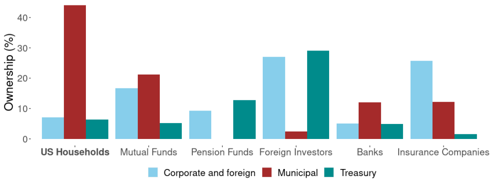
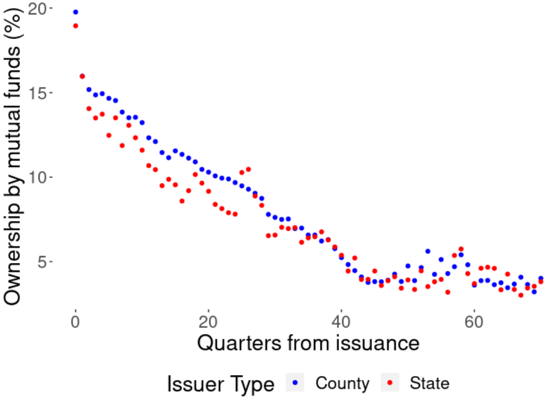


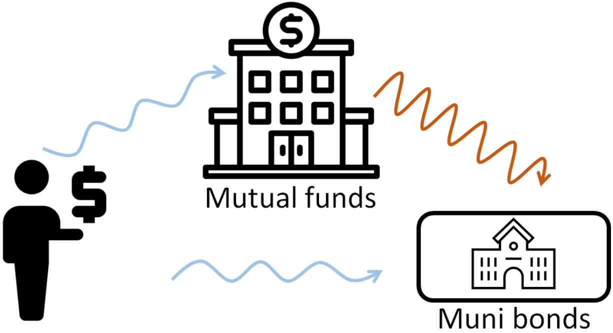
Municipal mutual funds as market makers



- Mutual funds disproportionately buy newly issued bonds
- Bond transition takes more than 10y to complete

By rating | By maturity | By maturity at origination | Trade size by Q after issuance

Mechanism



Friction: Investors are slow to respond to new bond issues

→ **Empirical hypothesis:** Capital flows in and out of mutual funds impact the governments' borrowing behavior

→ **Theoretical microfoundation:** Slow investors + Fast intermediaries

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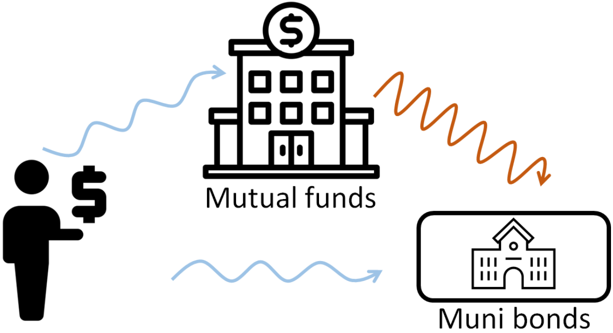

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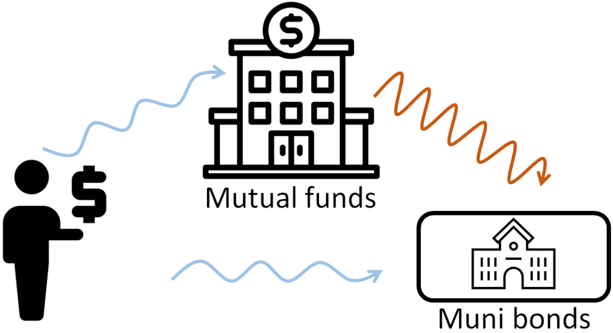

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Data

- **Bloomberg:** bond issuance data of **262 selected county governments** and their subsidiaries Map of the selected counties
  - $\rightarrow$ population of at least 100K
  - $\rightarrow$ issued bonds at least in 5y between 2009-2019
- **CRSP:** holding data of municipal mutual funds (2009-2019)
  - $\rightarrow$ covers $\geq$ 95% of municipal bond holding by mutual funds

Summary statistics of debt issuance

	Selected counties (58952 bonds)				
	Mean	SD	10th	50th	90th
Deal size ($M)	59.9	11.6	3.4	24.6	150
Overall issuance in a quarter ($M)	**82.3**	**148.3**	**5.0**	**33.7**	**194.2**
Quarters with issuance (Percentage)	12.3 (27.9%)	6.3 (14.2%)	6 (13.6%)	11 (25%)	21 (47.7%)
Yield at issuance (%)	2.4	1.2	0.9	2.3	3.9
Years to maturity	9.3	6.2	2	8.4	18
Coupon	3.7	1.2	2	4	5
Insured ($Y = 1$)	0.073	0.260	0	0	0
Federally taxable ($Y = 1$)	0.101	0.301	0	0	1

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Summary statistics for mutual funds

Year	# of funds	TNA ($ Million)		Cash holding	Municipal bond holding		
		Mean	Median	% of all assets	Total ($ Billion)	% of all assets	**% of all outstanding**
2009	1799	262.7	35.5	Not Avail.	Not Avail.	Not Avail.	Not Avail.
2010	1804	267.6	36.8	0.4	476.9	98.8	**12.5**
2011	1745	291.1	42.1	1.3	498.8	98.3	**12.4**
2012	1733	342.8	51.7	0.9	582.8	98.2	**14.1**
2013	1769	289.5	40.8	0.9	501.9	98.2	**13.0**
2014	1780	325.8	45.3	1.2	566.6	97.9	**14.0**
2015	1820	337.3	47.5	1.5	593.4	97.3	**14.6**
2016	1822	350.1	50.0	0.8	624.9	98.4	**15.4**
2017	1905	365.7	45.9	1.0	678.4	98.0	**16.4**
2018	1892	380.0	47.8	0.7	691.8	98.0	**17.3**
2019	1841	463.4	62.0	0.6	830.9	98.3	**20.2**

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Mutual funds' exposure to county governments

	Mean	SD	10th	50th	90th
Number of holdings at quarter-ends	299.8	458.5	60	164	663
Overall exposure to the selected county governments (%)	**5.9**	**7.1**	**1.4**	**4.0**	**11.7**
Max exposure to a selected county government (%)	0.8	1.6	0.0	0.34	2.14

Takeaway: Mutual funds have a small exposure to the selected county governments

Flow-performance relationship | Flow persistence

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Takeaway: Mutual funds have a small exposure to the selected county governments

Flow-performance relationship | Flow persistence

Empirical strategy

- **Empirical hypothesis:** Fund flows impact the borrowing behavior of the county governments.
- **Problem:** Fund flows are endogenous.
- **Resolution:** Exploit heterogeneities among the county governments in their exposure to mutual funds.
- Standard methodology in the empirical literature (e.g., Lou (2013), Li (2021))

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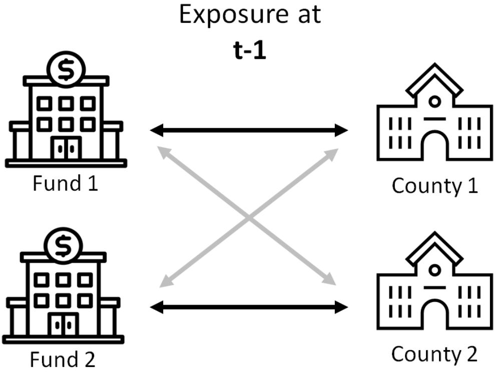
Illustration of the empirical strategy



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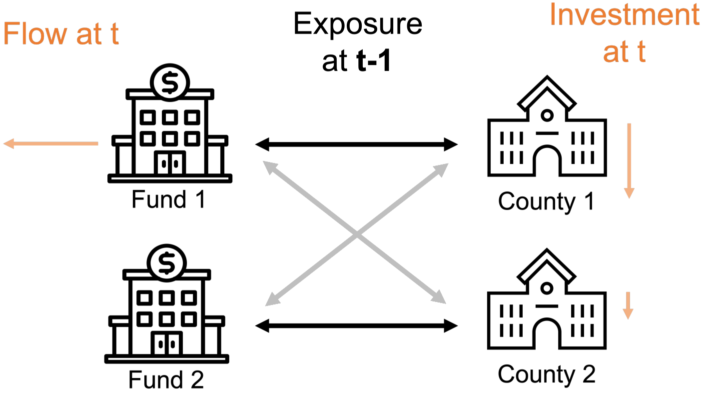

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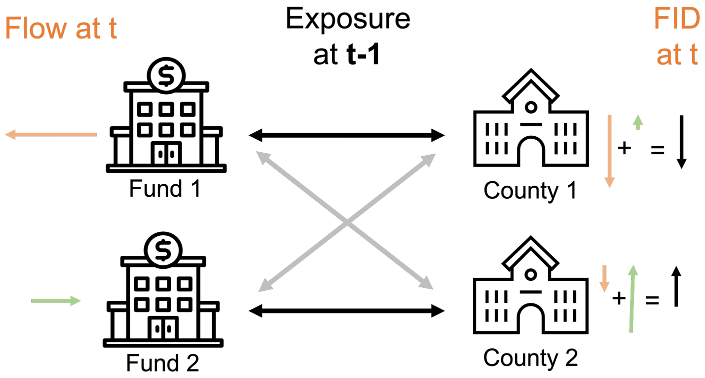

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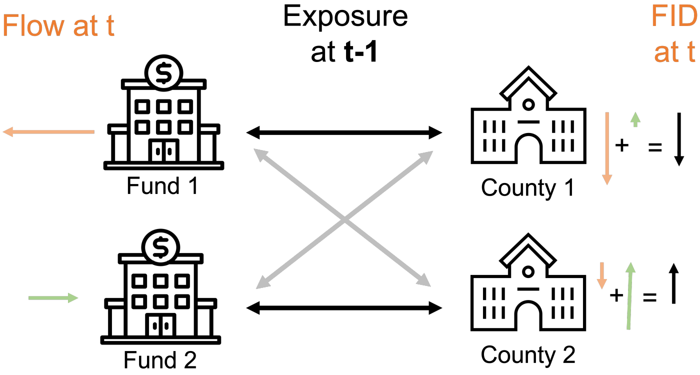


Exclusion restriction: Cross-section of fund flows is uncorrelated with the governments' funding needs.

- Plausible, since most funds are not overly exposed to any single county government.

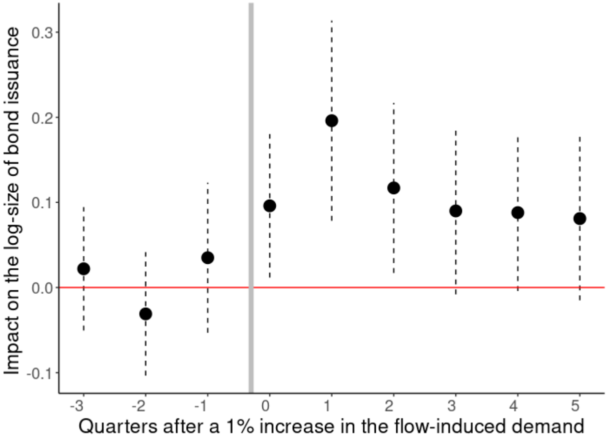
Flow-induced demand and the size of issuance

	log(Issue Size$_{c,t+1}$)				
	(1)	(2)	(3)	(4)	(5)
FID$_{c,t}$	0.197***	0.196***	0.224***	0.245***	0.196***
	(0.060)	(0.060)	(0.068)	(0.081)	(0.075)
Observations	2,590	2,590	2,590	2,273	2,119
County FE	Y	Y	Y	Y	Y
Season FE	N	Y	Y	Y	Y
Year-State FE	N	N	Y	Y	Y
Additional Controls	N	N	N	Revenue gr. + lag Expenditure gr. + lag Liability gr. + lag	Income gr. + lag House pr gr. + lag
SE-clustered	State-Year	State-Year	State-Year	State-Year	State-Year
R^2	0.601	0.601	0.643	0.656	0.669

Mechanism

LR and SR effects of FID on borrowing size

$$\log\left(\text{Issue Size}\right)_{c,t+j} = \beta_0 + \beta_1^j FID_{c,t} + \beta_2 X_t + \varepsilon_{c,t+j}$$



Results in table format | Timing of issuance

Flow-induced demand and interest rate at issuance

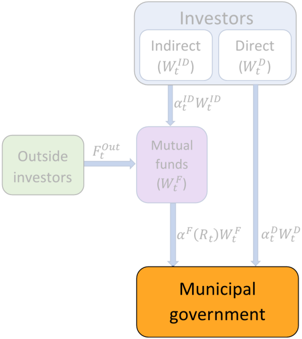
$$\text{yield-spread}_{c,t+1,bond} = \beta_0 + \beta_1 FID_{c,t} + \cdots + \varepsilon_{c,t,bond}$$

	Tax-adjusted yield-spread (%)	
	(1)	(2)
FID$_{c,t}$	**-0.002^{**}**	**-0.002^{*}**
	(0.001)	**(0.001)**
log-size	0.026^{***}	0.026^{***}
	(0.004)	(0.004)
YTM	0.137^{***}	0.135^{***}
	(0.001)	(0.001)
log-size × FID$_{c,t}$	0.0001^{**}	0.0001^{**}
	(0.00005)	(0.00005)
YTM × FID$_{c,t}$		-0.00005^{***}
		(0.00001)
Observations	33,705	33,705
County FE	Y	Y
Coupon rate	Y	Y
quarter-rating FE	Y	Y
Insured-status dummy	Y	Y
Maturity-option FE	Y	Y

Takeaway: Fund flows mostly impact the size of borrowing, not the interest rate!

Setup: Supply side

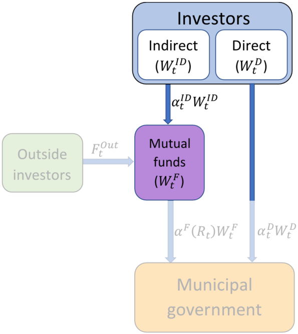
- A representative muni gov't
- Bond is risky: Gov defaults with prob δ



Setup: Demand side

- Residents invest either **directly** or **indirectly**
- **Infrequent rebalancing:** reoptimize portfolio with i.i.d prob $1-\lambda \in (0,1)$
  $$\alpha_t^J = \lambda \underbrace{\alpha_{t-1}^J}_{\text{Legacy port.}} + (1-\lambda) \underbrace{\alpha_t^{J-Reb}}_{\text{Reoptimized port.}}$$
- Funds invest fraction $\alpha^F(R_t)$ in

Optimal portfolios of the rebalancers



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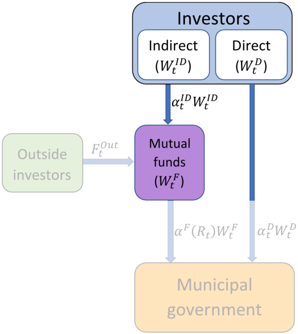

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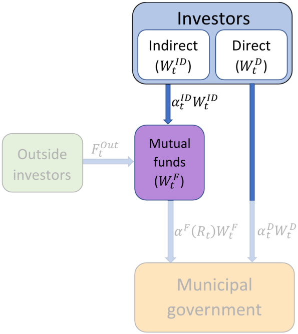

Calibration

Parameters	Symbol	Value
Mutual funds' market share	S^F	0.16
Dividend-price ratio (Quarterly)	dp	1.68×10^{-2}
Bond supply elasticity	$\boldsymbol{\gamma^{-1}}$	**19**
Portfolio inertia	λ	0.924
Survival rate	x	0.994
Funds' demand elasticity	$\eta^F dp$	0
Default probability	δ	3.75×10^{-5}
Long-run demand elasticity	ηdp	158.4
Short-run demand elasticity	$((1-\lambda)\eta + \lambda\eta^F S^F)dp$	11.6

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- To match the data, the elasticity of demand should be one order of magnitude smaller in the shot-run and than in the long-run

Concluding remarks

- **Puzzle:** Why are muni governments credit-constrained?
- **Explanation:** Because retail investors are slow in responding new bond issues.
- **Implication:** Capital available to institutional investors (mutual funds) determines the borrowing capacity
  - Consistent with data
  - Has theoretical support
- **Policy implication:** Muni bond market is not resilient against shocks
  → The federal government needs to intervene in times of crisis, especially when mutual funds face massive outflows.
- The model can be used to determine how much financial assistance to provide based on the capital flow from mutual funds.

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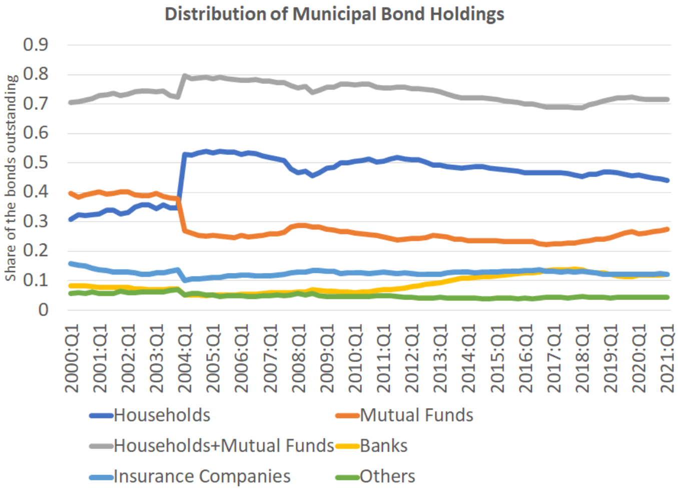
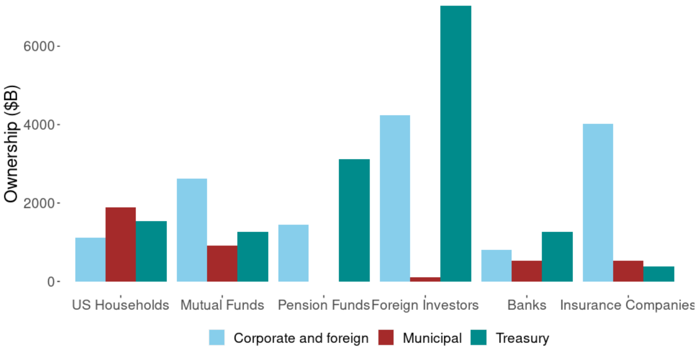


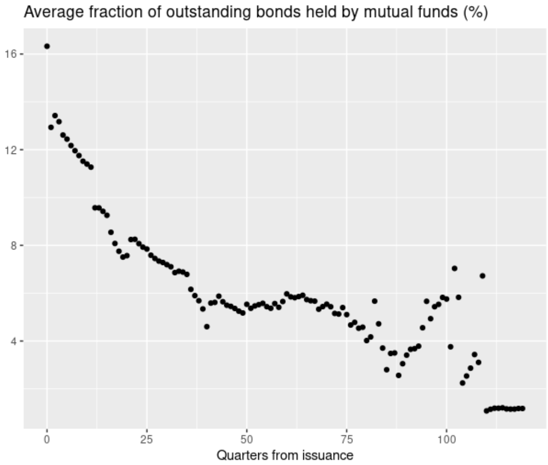
Municipal bond holdings by category

Ownership of investor categories in dollar



Back

Mutual funds' ownership of corporate bonds by quarter after issuance



Back

Mathematical illustration for flow-induced demand

The following heuristic calculations elucidate the intuition Had we defined $SIG = OWN$:

$$
\begin{aligned}
FID_{c,t} &\simeq \frac{1}{MV_{c,t-1}} \sum_{f \in \text{Fund}} MV_{f,c,t-1} \times Flow_{f,t-1} \times PSF \\
&= \frac{1}{MV_{c,t-1}} \sum_{f \in \text{Fund}} \frac{MV_{f,c,t-1}}{AUM_{f,t-1}} \times Flow^{\$}_{f,t-1} \times PSF
\end{aligned}
$$

Obstacles in the process of bond issuance

- Many municipalities need to hold public elections and obtain super-majority approval (2/3 support from the residents)
- They need to prepare documents on the purpose and revenue prospect of projects they aim to finance
- After obtaining authorization, there are additional financial and legal costs before bond issuance; They are expensive for smaller municipalities
- The long and costly process makes it difficult for governments to respond quickly to transitory demand changes.

Back

Why do bond issues respond to demand condition?

Two common ways to sell bonds to underwriters

- Negotiated deals
  - An underwriter is selected by the issuing municipality.
  - The underwriter directly negotiates on the issue size and interest rate with the municipality.
  - The underwriter's perception about the market condition is reflected in the deal.
- Competitive deals
  - The issue is auctioned to a set of underwriters; They compete on the interest rate.
  - The issuer sets the deal size with the help of its financial advisors.
  - The deal terms, including the size, impact the set of underwriters willing to participate in the auction.
  - The financial advisor's perception of the market demand impact the deal terms.

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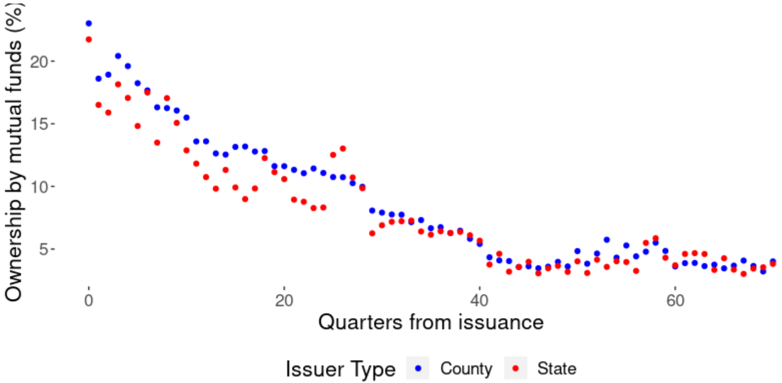
Evidence on household inattention

- Cornaggia, Hund, and Nguyen (2021)
  - information in equity and CDS markets about bond insurers impact the price of insured muni bonds with a long delay.
- Ameriks and Zeldes (2004)
  - Over a 10-year period, 44% made no change to their portfolio allocation
  - 17% made a single transaction

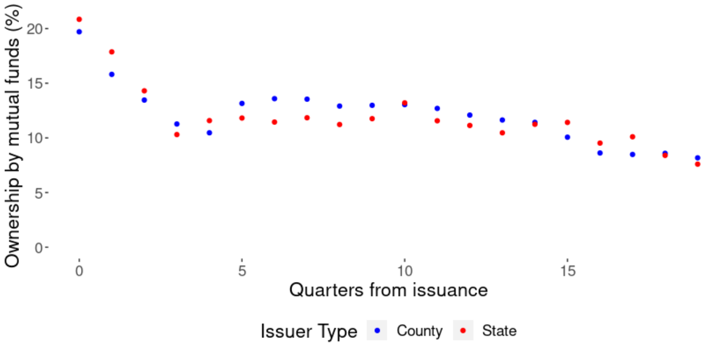
Back

Ownership of long-term bonds (years-to-maturity $\geq$ 15)



Back

Ownership of short-term bonds (years-to-maturity $\leq$ 5)



Back

Steady state

- Bond supply

$$q_{SS} = \phi^{-\gamma^{-1}} P_{SS}^{\gamma^{-1}}$$

- Market clearing

$$\alpha^*(\frac{D + P_{SS}}{P_{SS}}) = P_{SS} q_{SS}$$

- **Observation:** The infrequent rebalancing has no long run effect

Dynamics of bond price and quantity

- Let hatted values be deviations from the system's steady state (e.g., $\hat{p}_t = \frac{P_t}{P_{SS}} - 1$)
- Bond supply:

$$\hat{q}_t = \gamma^{-1}\hat{p}_t + \gamma^{-1}u_t \quad (1)$$

Solution

- Market clearing:

$$\alpha^F W^F + \alpha^H W^H = PQ$$

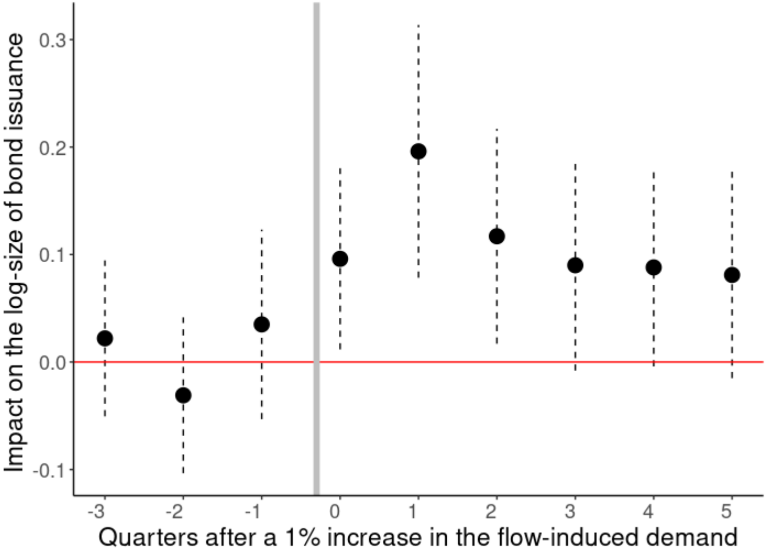
$$\Rightarrow \underbrace{S^F f}_{\text{FID}} - \underbrace{S^F \eta^F p}_{\text{F price reaction}} - \underbrace{S^H \eta^H p}_{\text{HH price reaction}} = \underbrace{q}_{\text{Muni Q adjustment}} + p$$

- Demand curve:

$$p = -\frac{1}{S^F\eta^F + S^H\eta^H + 1} q + \frac{S^F}{S^F\eta^F + S^H\eta^H + 1} f$$

- Supply curve (By solving the muni government's problem):

$$q = \gamma^{-1} p + \gamma^{-1} u$$



Impact on the log-size of bond issuance
0.3
0.2
0.1
0.0
-0.1
-3
-2
-1
0
1
2
3
4
5
Quarters after a 1% increase in the flow-induced demand

Back

Optimal portfolios

Optimal portfolios when get to rebalance ($\nu = \lambda x(1-\delta)$)

$$\alpha_t^{D-Reb} = \underset{\alpha}{\operatorname{argmax}} \quad \frac{\delta}{1-\nu} \log\{R^F + \alpha(R^D - R^F)\} + (1-\delta)\sum_{s=0}^{\infty} \nu^s \log\{R^F + \alpha(R_{t+s} - R^F)\}$$

$$\alpha_t^{ID-Reb} = \underset{\alpha}{\operatorname{argmax}} \quad \delta \sum_{s=0}^{\infty} \nu^s \log\{R^F + \alpha\alpha^F(R_{t+s})(R^D - R^F)\} + (1-\delta)\sum_{s=0}^{\infty} \nu^s \log\{R^F + \alpha\alpha^F(R_{t+s})(R_{t+s} - R^F)\}$$

Back

$$\alpha^*(R_{SS}) = \underset{\alpha}{\text{argmax}} \quad (1-\delta)\log\{R^F+\alpha(R_{SS}-R^F)\}+\delta\log\{R^F+\alpha(R^D-R^F)\}$$

Back

Specification of η and η^F

$$\eta^F \equiv \frac{\partial \log \alpha^F(R_t)}{\partial R_t}\Big|_{R_t=R_{SS}}$$

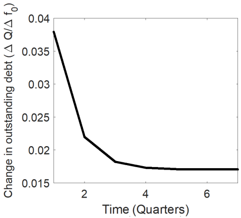
$$\eta \equiv \frac{\partial \log \alpha^*(R_t)}{\partial R_t}\Big|_{R_t=R_{SS}}$$

$$r_t \equiv R_t - R_{SS} \simeq \hat{p}_{t+1} - (1+dp)\hat{p}_t, \qquad dp \equiv \frac{D}{P_{SS}}$$

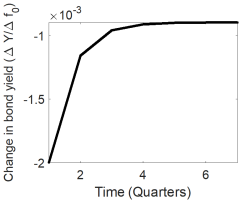
Back

Response to a 1% permanent inflow

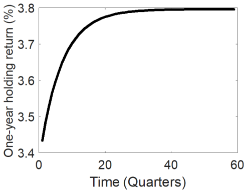
(a) Quantity



(b) Yield



(c) One-period return



Back

Are governments constrained due to the tax rules?

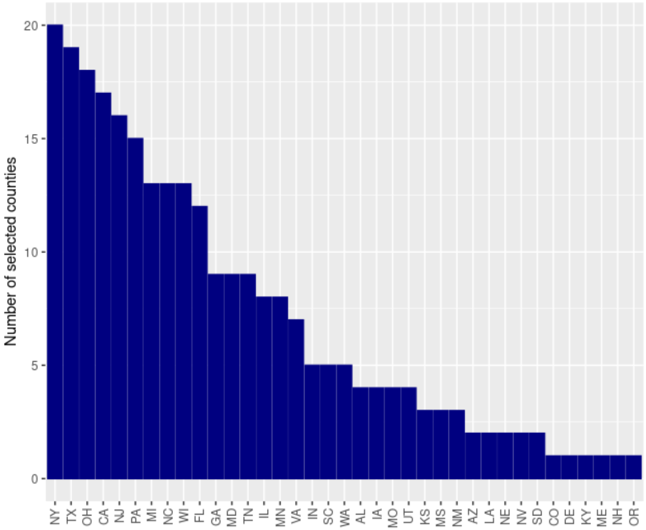
- Interest incomes on municipal bonds are typically tax-exempt for in-state investors, but not for out-of-state investors.
  - → It causes market segmentation along the state borders.
  - → Many funds are only active in one state. (Babina et al., 2021)
- Are governments borrowing-constrained because of the tax-induced segmentation?
- Testing two implications:
  - Flow-induced demand should be more impactful in states with larger degree of segmentation (California vs. Texas)
  - Governments should benefit equally from inflows to funds active in its state

Are governments constrained due to the tax rules? (2)

	$\log(\text{Issue Size})_{c,t}$	
	(1)	(2)
$FID_{c,t}$	0.328^{***}	0.180^{**}
	(0.119)	(0.088)
$FID_{c,t}$ × In-state tax privilege	−0.027	
	(0.022)	
State-level $FID_{c,t}$		0.020
		(0.019)
Observations	2,542	2,549
Type	OLS	OLS
County FE	Y	Y
Year-State FE	Y	Y
Season FE	Y	Y
SE-clustered	State	State
R^2	0.642	0.643

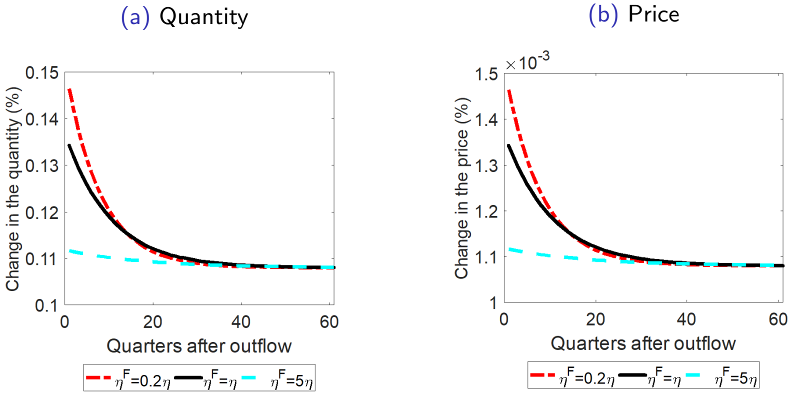
Back

Distribution of the selected counties



Back

Comparative statics: Funds' demand semi-elasticity (η^F)



Two forces impacting the funds' demand:

- Inflow $\Rightarrow$ Demand $\uparrow$
- Bond return $\downarrow$ $\Rightarrow$ Demand $\downarrow$

$\rightarrow$ $\eta^F \uparrow \Rightarrow$ 2nd force gets stronger $\Rightarrow$ Less overshooting

Other evidence on municipalities being credit-constrained

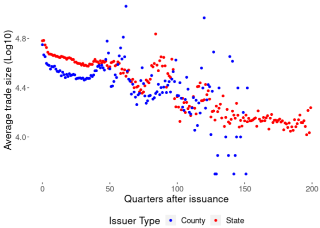
Evidence 2 (Adelino et al. (2017), Cornaggia et al. (2018)): After the recalibration of the credit ratings by Moody's

$$\Delta Q^{\text{upgraded}} - \Delta Q^{\text{not-upgraded}} \simeq 18\%$$
$$\Delta r^{\text{upgraded}} - \Delta r^{\text{not-upgraded}} \simeq -0.20\%$$

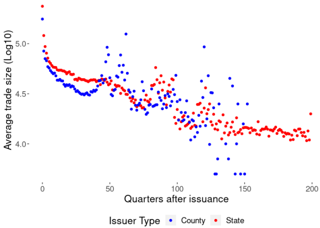
Back

Trade size by quarters after issuance

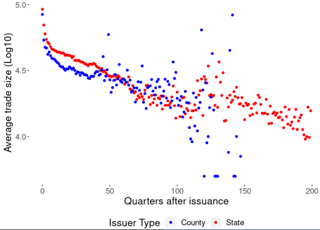
(a) Dealer-to-client



(b) Client-to-dealer



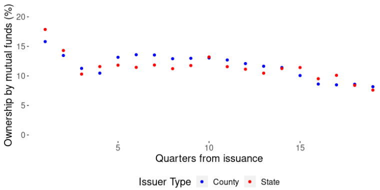
(c) Dealer-to-dealer



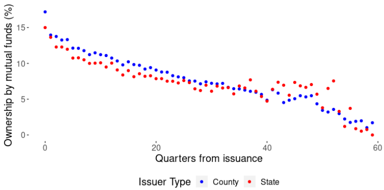
Back

Bond maturity at origination and mutual fund ownership

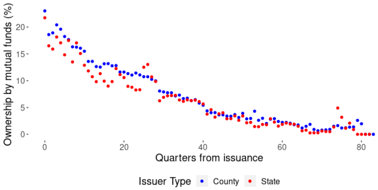
(a) YTM less than 5y



(b) YTM btw. 5y and 15y

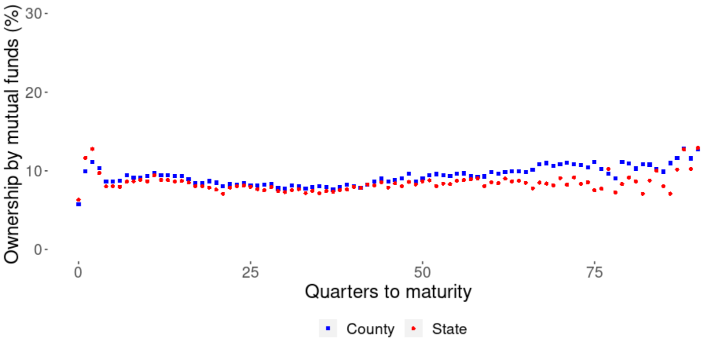


(c) YTM more than 15y



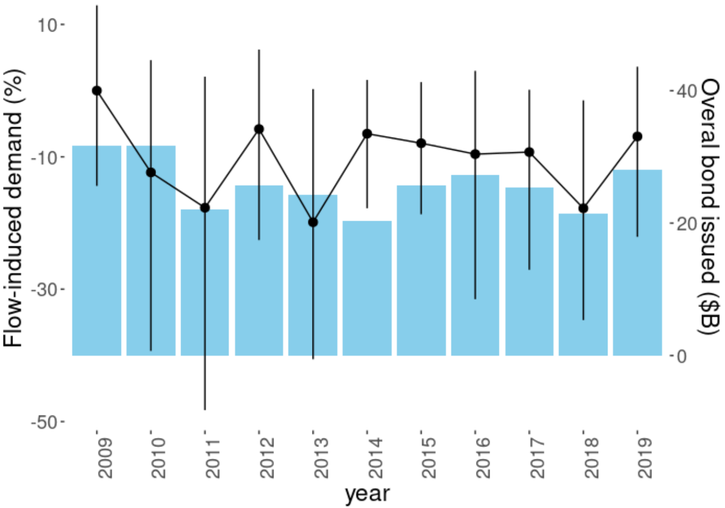
Back

Bond maturity and mutual fund ownership



Back

Flow-induced demand and overall bond issuance



Dist. of FID for states

Past ownership and investment-flow relationship

	$\Delta Inv^{Par}_{f,c,t}$ (Inflow Sample)	$\Delta Inv^{Par}_{f,c,t}$ (Outflow Sample)
$Flow_{f,t}$	-0.002	0.002
	(0.001)	(0.190)
$\text{SIG}_{f,c,t-1}$	-1.360^{***}	-1.136^{***}
	(0.073)	(0.078)
$\text{SIG}_{f,c,t-1} \times Flow_{f,t}$	-0.257	1.962^{**}
	(0.195)	(0.823)
$\mathbb{I}\{\text{SIG}_{f,c,t-1} > \text{OWN}_{f,c,t-1}\}$	-0.066^{***}	-0.030
	(0.025)	(0.027)
$\mathbb{I}\{\text{SIG}_{f,c,t-1} > \text{OWN}_{f,c,t-1}\} \times Flow_{f,t}$	0.278^{***}	0.980^{***}
	(0.081)	(0.283)
Observations	155,274	165,712
R^2	0.035	0.033
Quarter FE	Y	Y
Fund FE	Y	Y

Back

Flow-induced demand and the timing of issuance

	Prob($Issue_{c,t+1}$)		
	(1)	(2)	(3)
$\text{FID}_{c,t}$	0.135^{***}	0.105^{***}	0.044
	(0.040)	(0.040)	(0.039)
Observations	7,882	7,882	7,882
Type	Probit	Probit	Probit
County FE	Y	Y	Y
Season FE	N	Y	Y
Year-State FE	N	N	Y
Log Likelihood	−4,347.091	−4,306.712	−4,201.933

Back

Flow-performance relationship

	$Flow_{f,t}$		
	(1)	(2)	(3)
$Ret_{f,t-1}$	-0.951	-1.309	-0.177
	(2.518)	(2.508)	(4.149)
$Ret_{f,t-2}$	0.624	0.294	-1.261
	(2.401)	(2.349)	(4.005)
$Ret_{f,t-3}$	-1.752	-1.885	0.046
	(2.472)	(2.401)	(4.247)
$Ret_{f,t-4}$	-1.005	-1.044	-2.615
	(2.472)	(2.419)	(4.142)
Observations	84,887	84,887	84,887
Projected R^2	0.00001	0.00001	0.00001
Fund FE	N	Y	Y
Quarter FE	N	N	Y

Back

Persistence of the fund flows

	$Flow_{f,t}$			
	(1)	(2)	(3)	(4)
$Flow_{f,t-1}$	-0.0001	0.001	-0.0002	0.001
	(0.002)	(0.003)	(0.002)	(0.003)
$Flow_{f,t-2}$		0.001		0.001
		(0.001)		(0.001)
$Flow_{f,t-3}$		0.00001		0.00003
		(0.0002)		(0.0002)
$Flow_{f,t-4}$		0.00000		-0.00000
		(0.0001)		(0.0001)
Constant	0.414**	0.041***		
	(0.163)	(0.011)		
Observations	77,542	74,285	77,542	74,285
R^2	0.000	0.00001	0.001	0.001
Quarter FE	N	N	Y	Y

Back

LR and SR effects of FID on the borrowing size

	$\log(\textit{Issue Size}_{c,t+j})$							
	$j=-3$	$j=-2$	$j=-1$	$j=0$	$j=1$	$j=2$	$j=3$	
$\text{FID}_{c,t}$	0.022	-0.031	0.035	0.096^{**}	0.196^{***}	0.117^{**}	0.090^{*}	
	(0.037)	(0.037)	(0.045)	(0.043)	(0.060)	(0.051)	(0.050)	
Observations	2,381	2,449	2,520	2,610	2,590	2,526	2,446	
County FE	Y	Y	Y	Y	Y	Y	Y	
Season FE	Y	Y	Y	Y	Y	Y	Y	
SE-Clustered	State-Year	State-Year	State-Year	State-Year	State-Year	State-Year	State-Year	S

Back

Flow-induced demand and the timing of issuance (Continued)

	Prob($Issue_{c,t+1}$)		
	(1)	(2)	(3)
$FID_{c,t}$	0.128***	0.093**	0.026
	(0.037)	(0.037)	(0.037)
Observations	8,661	8,661	8,661
Type	Probit	Probit	Probit
County FE	Y	Y	Y
Season FE	N	Y	Y
Year-State FE	N	N	Y
Log Likelihood	−4,815	−4,753	−4,646

Back

Are governments constrained due to the tax rules?

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  $\rightarrow$ to receive exemption from state taxes
- Governments are limited to capital inside their state
  $\rightarrow$ Is it the reason behind the constraint?

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Testing two implications:

- Flow-induced demand should be more impactful in states with larger state taxes (California vs. Texas)
- State-level demand shocks should absorb the effects

	log(Issue Size)$_{c,t}$ (1)	log(Issue Size)$_{c,t}$ (2)
FID$_{c,t}$	**0.328*****	0.180**
	(0.119)	(0.088)
FID$_{c,t}$ $\times$ In-state premium	**−0.027**	
	(0.022)	
State-level FID$_{c,t}$		0.020
		(0.019)
Observations	2,542	2,549
Type	OLS	OLS
County FE	Y	Y
Year-State FE	Y	Y
Season FE	Y	Y
SE-clustered	State	State
R^2	0.642	0.643

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Steady-state solution

- Suppose initially $F_{0-}^{Out} = 0$
- No friction matters at SS
  - Intuition: The bond return is i.i.d $\Rightarrow$ the optimal port. doesn't change $\Rightarrow$ no need to reoptimize Characterization of the optimal portfolio
- Optimal port. characterization + Market clearing + Bond supply at SS:

  $\rightarrow$ P_{SS} ✓

  $\rightarrow$ q_{SS} (SS bond-to-wealth ratio) ✓

Back

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Back

Price dynamics

$$-S^F\eta^f\nu\hat{\boldsymbol{p}}_{t+3}+\Big(\nu(1+\gamma^{-1})+\lambda\nu S^F\eta^F+S^F\eta^F+M+(1+dp)S^F\eta^F\nu\Big)\hat{\boldsymbol{p}}_{t+2}$$
$$-\Big((1+\lambda\nu)(1+\gamma^{-1})+\lambda S^F\eta^F+(1+dp)(\lambda\nu S^F\eta^F+S^F\eta^F+M)\Big)\hat{\boldsymbol{p}}_{t+1}$$
$$+\Big(\lambda(1+\gamma^{-1})+(1+dp)\lambda S^F\eta^F\Big)\hat{\boldsymbol{p}}_{t}=0.$$
$$M=(1-\lambda)(1-\nu)(\eta-S^F\eta^F)$$

- The characteristic polynomial has one stable root: $\kappa\in(0,1)$
- Solution:

$$\hat{p}_t=(A+B\kappa^t)f_0$$
$$A=\frac{S^F}{\eta dp+\gamma^{-1}+1}$$
$$B=\frac{\lambda(\eta-\eta^F S^F)S^F}{(1+\gamma^{-1}+dp)(1+\gamma^{-1}+(1+dp-\kappa)(\frac{M\nu}{1-\nu\kappa}+M+S^F\eta^F))}$$

Back

Setup: Assets

- A risk-free asset is available with return R^F
- The government defaults with i.i.d probability δ
- The default arrival time is the only source of uncertainty
  - Upon default, the bond return is $R^D < R^F$
  - The government never defaults again $\rightarrow$ The bond return will be R^F afterwards.
- The sequence of prices and returns before the default: $\{P_t\}_{t=0}^{\infty}$ and $\{R_t\}_{t=0}^{\infty}$, $R_t \equiv \frac{P_{t+1}+D}{P_t}$

$\rightarrow$ **Remark:** The bond return is binary: either R_t or R^D

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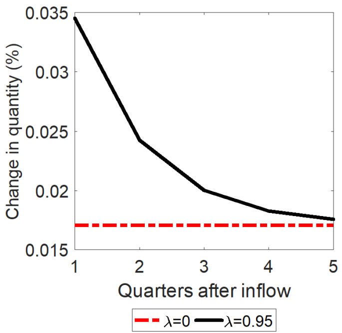
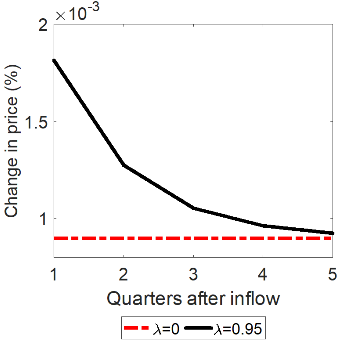
Comparative statics: Portfolio sluggishness (λ)

(a) Quantity



(b) Price



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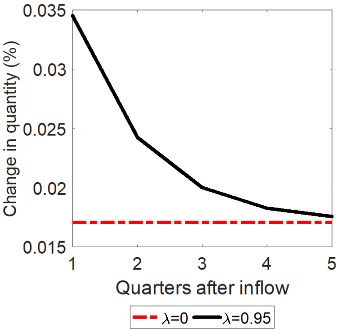

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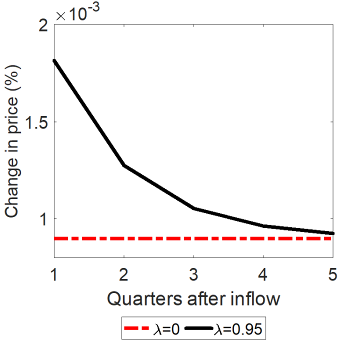
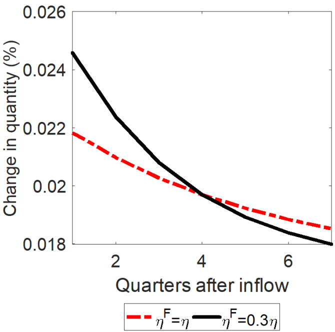


Mechanism:

- Inflow $\Rightarrow$ Funds need to buy more bonds
- Direct investors are sleepy $\Rightarrow$ Both P and Q spike

Impact of investment mandates

(a) Quantity



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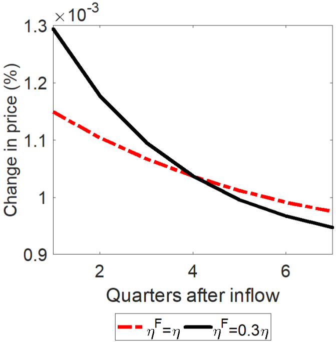

- $\eta^F = \eta \rightarrow$ Funds invest optimally on behalf of their investors
- $\eta^F < \eta \rightarrow$ Funds are less flexible
  - More overshooting
  - Faster dynamics

Flow-induced demand and the timing of issuance

	$Prob(Issue_{c,t+j})$							
	$j=-3$	$j=-2$	$j=-1$	$j=0$	$j=1$	$j=2$	$j=3$	$j=4$
$FID_{c,t}$	-0.010	-0.050	-0.047	0.065^{*}	0.093^{**}	0.103^{***}	0.030	0.028
	(0.038)	(0.038)	(0.038)	(0.037)	(0.037)	(0.038)	(0.038)	(0.038)
Observations	7,973	8,218	8,465	8,714	8,661	8,414	8,169	7,925
County FE	Y	Y	Y	Y	Y	Y	Y	Y
Season FE	Y	Y	Y	Y	Y	Y	Y	Y
Log Likelihood	$-4,374$	$-4,503$	$-4,640$	$-4,788$	$-4,753$	$-4,623$	$-4,492$	$-4,338$

Takeaway: No pre-trend in FID!

Additional results Back

A puzzle

- Municipal governments are credit-constrained.
- Example (Yi, 2021): In response to a credit shock from the banking sector
  - many municipalities drastically cut the quantity of borrowing and expenditure
  - despite the modest impact on the borrowing interest rate:

$$\Delta Q^{\text{most affected}} - \Delta Q^{\text{least affected}} \simeq -20\%$$

$$\Delta r^{\text{most affected}} - \Delta r^{\text{least affected}} \simeq 0.1\%$$

  - Why can't borrow from other investors?

More evidence

- **Puzzle:** Why are municipal governments credit-constrained despite being among the safest borrowers?

Back

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  - Why can't borrow from other investors?

More evidence

- **Puzzle:** Why are municipal governments credit-constrained despite being among the safest borrowers?

Back

Literature

- **Municipal government finances and access to credit:** Adelino, Cunha, and Ferreira (2017), Dagostino (2018), Yi (2021), Agrawal and Kim (2021)
  - $\rightarrow$ New evidence + A theory explaining the findings
- **Demand-based asset pricing**: Lou (2013), Koijen and Yogo (2019), Li (2021)
  - $\rightarrow$ Studying the real impact of demand shocks + Examining the role of investor inattention in the low demand elasticity
- **Investor inattention and asset prices:** Duffie (2010), Chien, Cole, Lusting (2012,2016), Abel, Eberly, Panageas (2013), Gabaix (2019)
  - $\rightarrow$ A theory with attentive intermediaries and inattentive investors + Empirical evidence

Solving for the impact of fund flows

- In the empirical part, we estimated the impact of uninformative fund flows on the governments' borrowing behavior.
- To imitate the empirical analysis, suppose the funds receive an inflow of 1% of their market share S^F at $t = 0$ from the outside investors
- Log-linearization to solve for the dynamics induced by the inflow.

Steady-state solution

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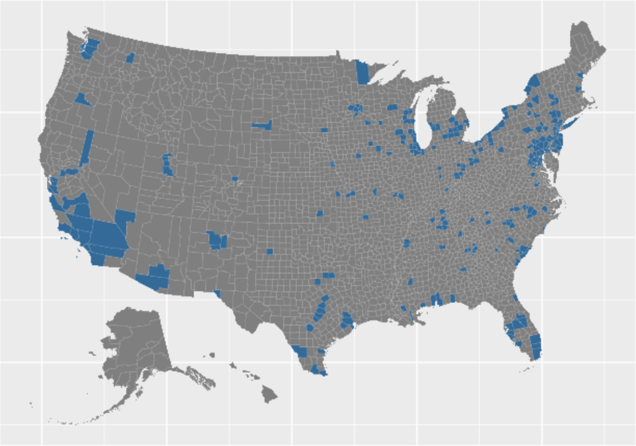
Map of the selected counties



Dist. across states Back

Dynamic equations

- Governments' bond supply: $\hat{q}_t = \gamma^{-1}\hat{p}_t$
- Market clearing ($S^D \equiv 1 - S^F$):

$$\underbrace{S^F f_0}_{\text{Exog. Inflow}} + S^F \underbrace{\hat{\alpha}_t^F}_{\text{Funds' portfolio adj.}} + S^F \underbrace{\hat{\alpha}_t^{ID}}_{\text{IDs' allocation adj.}} + S^D \underbrace{\hat{\alpha}_t^D}_{\text{Ds' portfolio adj.}} = \hat{p}_t + \hat{q}_t$$

- Funds' portfolio adjustment: $\hat{\alpha}_t^F = \eta^F r_t$
- Investors' portfolio adjustment ($\nu \equiv x\lambda(1-\delta)$):

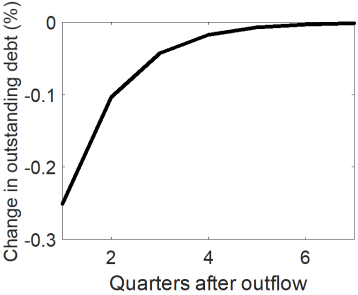
$$\hat{\alpha}_{t+1}^D = \lambda\hat{\alpha}_t^D + (1-\lambda)\underbrace{(1-\nu)\eta\sum_{s=0}^{\infty}\nu^s r_{t+s}}_{\hat{\alpha}_t^{D-Reb}}$$

$$\hat{\alpha}_{t+1}^{ID} = \lambda\hat{\alpha}_t^{ID} + (1-\lambda)\underbrace{(1-\nu)(\eta-\eta^F)\sum_{s=0}^{\infty}\nu^s r_{t+s}}_{\hat{\alpha}_t^{ID-Reb}}$$

characterization of $\hat{p}_t$

How did the massive outflows in March and April 2020 impact the municipal borrowing?

- In March and April 2020, municipal funds experienced an outflow of about 5% of their AUM.



- The model implies **10.5$B** less issuance in the first quarter.
- It explains **46%** of the decline in bond issuance in March and April 2020.

Definitions

Define the significance of a fund for a county government as:

$$\boldsymbol{SIG_{f,c,t} = \max_{t-11 \leq t' \leq t} OWN_{f,c,t'}}$$

,where

$$OWN_{f,c,t} = \frac{\text{Par-value investment of fund } f \text{ in gov } c \text{ at } t}{\text{Total par-value investment of mutual funds in gov } c \text{ at } t}.$$

Investment-flow relationship

$$\log Inv^{Par}_{f,c,t} - \log Inv^{Par}_{f,c,t-1} = \beta_0 + \beta_1 Flow_{f,t} + \gamma_2 X_{f,c,t-1} + \gamma_3 Flow_{f,t} \times X_{f,c,t-1} + \varepsilon_{f,c,t}$$

	Dependent variable: $\Delta \log Inv^{Par}_{f,c,t}$					
	Inflow Sample			Outflow Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
$Flow_{f,t}$	-0.002	-0.002^{*}	-0.002	0.524^{***}	0.501^{***}	0.360^{**}
	(0.001)	(0.001)	(0.001)	(0.153)	(0.154)	(0.157)
$OWN_{f,c,t-1}$		-4.562^{***}			-4.381^{***}	
		(0.140)			(0.121)	
$OWN_{f,c,t-1} \times Flow_{f,t}$		0.209			5.716^{***}	
		(0.199)			(1.451)	
$SIG_{f,c,t-1}$			-0.176^{**}			-0.286^{***}
			(0.069)			(0.073)
$SIG_{f,c,t-1} \times Flow_{f,t}$			**0.489^{***}**			**2.229^{***}**
			(0.156)			(0.775)
Observations	144,312	144,312	144,312	151,088	151,088	151,088
Quarter FE	Y	Y	Y	Y	Y	Y
Fund FE	Y	Y	Y	Y	Y	Y
R^2	0.031	0.043	0.032	0.029	0.044	0.032

Defining flow-induced demand

- Define "Flow-induced demand" (FID) for county c as below:

$$FID_{c,t} = \sum_{f \in \text{Funds}} \text{SIG}_{f,c,t-1} \times \text{Flow}_{f,t-1} \times \text{PSF}$$

  - PSF is the coefficient estimates
  - *FID* is a demand shifter measured as a fraction of the market value of debt held by the mutual funds Illustration