Tax Revenue Risk, Municipal Bond Yields, and Public Investment

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Fiscal Risk Depends on When Tax Revenues fall

- Two states can have **equally volatile** tax revenues but very different fiscal exposure
- Revenue shortfalls are especially costly when they coincide with **economic downturns**
- We call this exposure **Tax Revenue Risk**

Do municipal bond investors price Tax Revenue Risk, and does it affect public investment?

This Paper

- **Tax risk is priced in municipal bond yields**
  - $+3$ bps at issuance and $+7$ bps in secondary markets per 1 s.d. of Tax Risk
- **The premium reflects repayment capacity**
  - Persists across state borders and is larger when fiscal buffers are limited
- **Higher borrowing costs reduce public investment**
  - Tax-Risk-driven borrowing costs predict lower tax-backed spending

Tax Risk Captures Revenue Shortfalls in Bad Economic Times

$$\mathbb{E}[m_t R_t] = \underbrace{\mathbb{E}[m_t]\mathbb{E}[R_t]}_{\text{Certainty Equivalent}} \underbrace{- \left(- \operatorname{Cov}(m_t, R_t)\right)}_{\text{Tax Risk}}$$

- R_t: tax revenue
- m_t: value of revenue across economic states, higher in downturns
- **High Tax Risk**: revenues are low when m_t is high

We Measure Tax Risk Using Tax Revenues and State GDP Growth

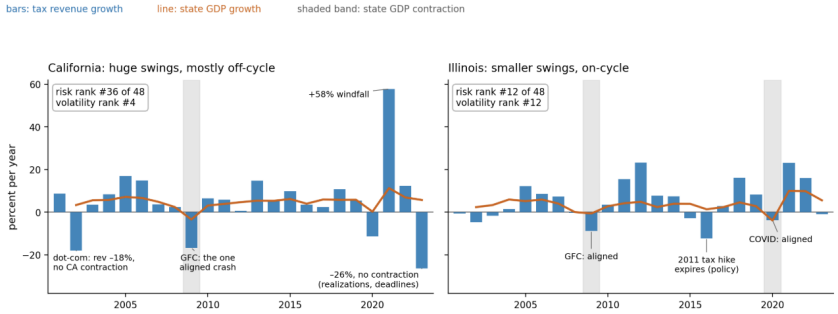
$$\text{Tax Risk}_{s,t} = \frac{-\text{Cov}(\pi_{s,t}, R_{s,t})}{\mathbb{E}[\pi_{s,t} R_{s,t}]}$$

- $R_{s,t}$: personal income, corporate income, and sales tax revenues
- $\pi_{s,t}$: inverse state GDP growth
- Computed over a four-year rolling window
- Scaled by $\mathbb{E}[\pi_{s,t} R_{s,t}]$ to compare states of different sizes

High Volatility Does Not Necessarily Mean High Tax Risk

- Volatility asks: **how much do revenues move?**
- Tax Risk asks: **do revenues fall when the economy is weak?**
- The same revenue swing is more costly if it arrives in a downturn

California and Illinois Illustrate the Difference



California: High volatility, lower Tax Risk

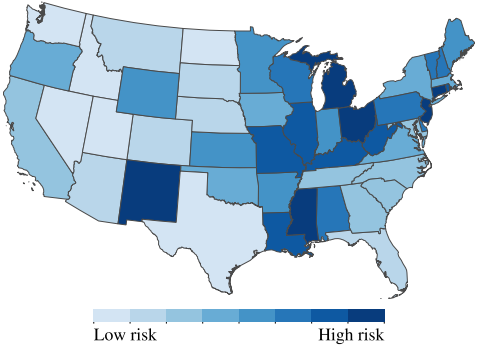
Revenues move a lot, but shortfalls are less tightly concentrated in bad times

Illinois: Lower volatility, higher Tax Risk

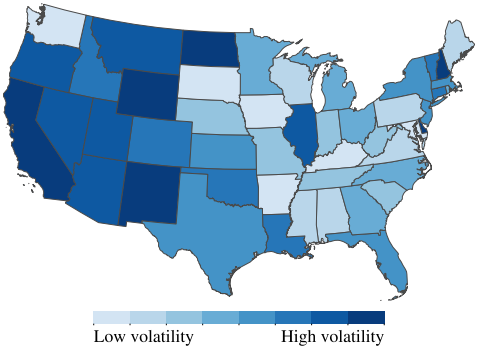
Revenues move less, but shortfalls arrive when the economy is weaker

Tax Risk and Volatility Rank States Differently

Tax Risk



Tax Volatility



States that are volatile are not necessarily risky

Determinants of Tax Risk

Income-tax reliance is associated with higher Tax Risk, sales-tax reliance with lower Tax Risk

	(1)	(2)	(3)
Share of Personal Income Taxes	0.369***		
	(0.122)		
Share of Corporate Income Taxes		0.318***	
		(0.112)	
Share of Sales Taxes			-0.379***
			(0.114)
Year FE	Yes	Yes	Yes
Adjusted R-squared	0.420	0.414	0.422
Observations	1,056	1,056	1,056

Data

- **Tax Revenue and State Economy**
  - Census State Government Tax Collections
  - BEA state GDP growth
- **Municipal Bond Markets**
  - Primary market: Mergent offering yields, **2.9M bonds**
  - Secondary market: MSRB yield-to-worst, **8.2M bond-years**
- **Sample**: U.S. municipal bonds, 2002–2023

Summary Statistics

Tax Revenue Risk Is Priced Into Municipal Bond Yields

$$Yield_{i,t} = \beta_0 + \beta_1 TaxRisk_{s,t-1} + \gamma' X_{i,t} + \delta_c + \delta_t + \varepsilon_{i,t}$$

	Primary Market		Secondary Market	
	(1)	(2)	(3)	(4)
Tax Risk	0.028**	**0.031*** **	0.073***	**0.067*** **
	(0.013)	(0.010)	(0.020)	(0.018)
Bond Controls	No	Yes	No	Yes
State Controls	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.444	0.795	0.245	0.362
Observations	2,887,074	2,885,971	8,195,204	8,194,996

One standard deviation: **+3.1 bps** at issuance, **+6.7 bps** in secondary trading

Full Tables

Border County Pairs Hold Local Conditions Fixed

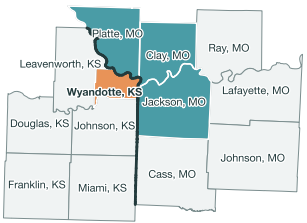
Compare neighboring counties across state borders: same local economy, different state tax systems

Johnson County, KS



Two pairs

Wyandotte County, KS



Three pairs

Jackson County, MO



Two pairs

Tax Risk Premium Persists Across State Borders

$$Yield_{i,t} = \beta_0 + \beta_1 TaxRisk_{s,t-1} + \sum_k \gamma^k X^k_{i,t} + \delta_{cp} + \delta_t + \varepsilon_{i,t}$$

	Primary Market		Secondary Market	
	(1)	(2)	(3)	(4)
Tax Risk	0.035***	0.026*	0.057**	0.029*
	(0.011)	(0.013)	(0.026)	(0.015)
Controls	Yes	Yes	Yes	Yes
County-Pair FE	Yes	No	Yes	No
County-Pair × Time FE	No	Yes	No	Yes
Adjusted R-squared	0.798	0.816	0.339	0.350
Observations	1,873,541	1,873,194	5,066,287	5,065,952

The premium remains when comparing neighboring counties across state borders

Three Measures of Tax Revenue Volatility

Calculate year-over-year tax revenue growth as $g_{s,t}$; Fit fifth-order polynomial revenue trend as $\widehat{R}_{s,t}$

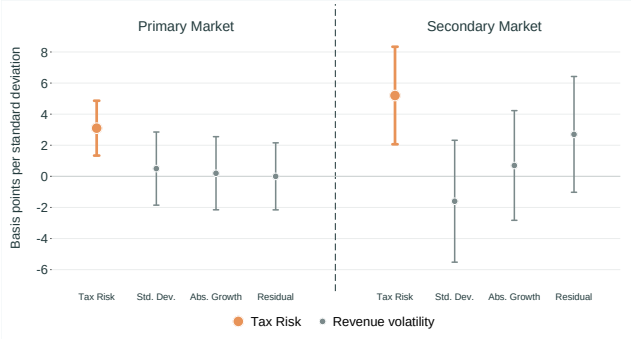
Std. Dev.: $$TaxVolatility^{sd}_{s,t} = \sqrt{\frac{1}{T-1}\sum_{j=t-T+1}^{t}(g_{s,j} - \bar{g}_{s,t})^2}$$

Abs. Growth: $$TaxVolatility^{g}_{s,t} = \frac{1}{T}\sum_{j=t-T+1}^{t}|g_{s,j}|$$

Residual: $$TaxVolatility^{res}_{s,t} = \frac{1}{T}\frac{|R_{s,t} - \widehat{R}_{s,t}|}{R_{s,t}}$$

Tax Risk Wins the Horse Race Against Volatility

$$Yield_{i,t} = \beta_0 + \beta_1 TaxRisk_{s,t-1} + \beta_2 TaxVolatility_{s,t-1} + \gamma' X_{i,t} + \delta_c + \delta_t + \varepsilon_{i,t}$$



Tax Risk is priced, revenue volatility is not

Risk Premium Is Not Explained by Credit Risk

- Ratings strongly predict yields
- Tax Risk remains significant after controlling for ratings and liquidity
- Default losses are too small to explain a 3–7 bp premium

Default Evidence

	(1)	(2)	(3)
Tax Risk	0.043**	0.047**	0.047**
	(0.018)	(0.019)	(0.019)
Credit Ratings			
AAA/Aaa	-0.505***		
	(0.064)		
AA+/Aa1	-0.474***		
	(0.058)		
AA/Aa2	-0.430***		
	(0.056)		
AA-/Aa1	-0.353***		
	(0.048)		
A+/A1	-0.249***		
	(0.036)		
Liquidity			
Log(Number of Days Traded)		0.010	
		(0.010)	
Log(Dollar Trading Volume)			0.005
			(0.008)
Controls	Yes	Yes	Yes
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R-squared	0.499	0.490	0.490
Observations	3,871,739	3,871,739	3,871,738

Tax Risk Premium Follows Repayment Capacity

Repayment source: stronger effect for bonds backed by taxing power than for bonds backed by project revenue

	Backed by Taxing Power			Backed by Project Revenue		
	General	School	Police/Fire/Jail	Housing	Recreation	Transport
Tax Risk	0.031***	0.050**	0.045**	0.006	0.003	0.022
	(0.009)	(0.019)	(0.018)	(0.012)	(0.009)	(0.014)

Fiscal buffers: stronger effect when governments have limited rainy-day funds

	Primary Market		Secondary Market	
	Low	High	Low	High
Tax Risk	0.055***	0.004	0.070***	0.034**
	(0.017)	(0.009)	(0.023)	(0.012)

The premium is strongest when repayment capacity is most exposed to the tax base

Tax Risk Raises Borrowing Costs for Tax-Backed Projects

$$OfferingYield^{p}_{i,t} = \phi_0 + \phi_1 TaxRisk_{s,t-1} + \gamma' X_{i,t} + \delta_c + \delta_t + \varepsilon_{i,t}$$

	Backed by Taxing Power			Backed by Project Revenue		
	General	School	Police/Fire/ Jail	Housing	Recreation	Transport
Tax Risk	0.031***	0.050**	0.045**	0.006	0.003	0.022
	(0.009)	(0.019)	(0.018)	(0.012)	(0.009)	(0.014)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Offering Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Calculate $\widehat{OfferingYield}$ to isolate the Tax-Risk-driven component of borrowing costs

Higher Tax-Risk-Driven Borrowing Costs Reduce Public Investment

$$ExpenditureShare_{c,p,t+f} = \beta_0 + \beta_1 \widehat{OfferingYield}_{c,p,t} + \delta_s + \delta_t + \varepsilon_{c,p,t+f}$$

	Current Year	One Year Later	Two Years Later
Panel A: Spending Backed by Taxing Power			
$\widehat{\text{Offering Yield}}$	-2.608*	-3.036**	-3.077**
	(1.260)	(1.122)	(1.145)
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Panel B: Spending Backed by Project Revenue			
$\widehat{\text{Offering Yield}}$	-0.451**	-0.543***	-0.502***
	(0.161)	(0.164)	(0.162)
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

The spending response is much larger for tax-backed projects

Conclusion

1. **Tax Risk is priced**
   Municipal bond investors price whether tax revenues fall in downturns

2. **The premium reflects repayment capacity**
   It is not explained by volatility, ratings, or expected default losses

3. **Tax Risk has real effects**
   Higher Tax-Risk-driven borrowing costs reduce tax-backed public investment

Tax design affects governments' cost of capital

Summary Statistics

	Mean	StDev	p10	p50	p90	N
State-Level Variables						
Tax Risk	0.04	0.02	0.02	0.04	0.06	1,104
Tax Volatility$_{sd}$	0.07	0.05	0.02	0.06	0.13	1,104
Tax Volatility$_{g}$	0.07	0.04	0.04	0.07	0.12	1,104
Tax Volatility$_{res}$	0.14	0.09	0.05	0.12	0.25	1,104
GDP Growth (%)	4.39	3.49	0.10	4.30	8.50	2,887,087
Personal Consumption Growth (%)	3.68	3.04	1.30	3.40	6.10	2,887,087
Tax Revenue / GDP (%)	5.39	1.25	3.93	5.24	7.01	1,104
Primary-Market Variables						
Offering Yield (%)	2.85	1.31	1.05	2.90	4.50	2,887,087
Maturity (Years)	9.62	6.47	2.00	9.00	19.00	2,887,087
Bond Is Taxable	0.08	0.27	0.00	0.00	0.00	2,887,087
Bond Is Senior	0.38	0.48	0.00	0.00	1.00	2,887,087
Bond Issued at Premium	0.60	0.49	0.00	1.00	1.00	2,887,087
Secondary-Market Variables						
Secondary Market Yield (%)	2.71	2.26	0.89	2.80	4.47	10,001,963
Bond Price ($)	103.12	10.36	97.85	102.40	113.51	10,212,210

Back to Data

Tax Risk and Municipal Bond Yields: Primary Market

	(1)	(2)	(3)	(4)	(5)	(6)
Tax Risk$_4$	0.028**	0.031***	0.035***	0.031***		
	(0.013)	(0.010)	(0.010)	(0.011)		
Tax Risk$_3$					0.031**	
					(0.012)	
Tax Risk$_5$						0.036***
						(0.010)
Bond Controls	No	Yes	Yes	Yes	Yes	Yes
State Controls	No	Yes	Yes	Yes	Yes	Yes
Sample Period	Full	Full	No GFC	No COVID	Full	Full
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Offering Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.444	0.795	0.807	0.780	0.795	0.795
Observations	2,887,074	2,885,971	2,498,397	2,531,361	2,885,971	2,885,971

Back to Main Result

Secondary Market

Tax Risk and Municipal Bond Yields: Secondary Market

	(1)	(2)	(3)	(4)	(5)	(6)
Tax Risk$_4$	0.073***	0.067***	0.065***	0.068***		
	(0.020)	(0.018)	(0.017)	(0.018)		
Tax Risk$_3$					0.067***	
					(0.018)	
Tax Risk$_5$						0.065***
						(0.018)
Bond Controls	No	Yes	Yes	Yes	Yes	Yes
State Controls	No	Yes	Yes	Yes	Yes	Yes
Sample Period	Full	Full	No GFC	No COVID	Full	Full
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.245	0.362	0.383	0.346	0.362	0.362
Observations	8,195,204	8,194,996	6,923,641	7,555,837	8,194,996	8,194,996

Primary Market

Back to Main Result

Backup: Default Evidence

	Tax-Backed	Revenue-Backed	General-Purpose Govts	
	LPM	PPML	LPM	PPML
Tax Risk	0.686	0.198	0.151	0.290
	(0.712)	(0.210)	(0.200)	(0.527)
Controls	Yes	Yes	Yes	Yes
Category FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

- 271,132 issues at risk; 1,108 hard defaults
- Only about 54 true general-government defaults after excluding districts/conduits
- Tax Risk does not significantly predict realized default

Back to Credit Risk