The Impact of Air Pollution on the Cost of Issuance of Municipal Bonds

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HIGHLIGHTS

- I show that elevated air pollution levels, measured by PM2.5 exposure, lead municipalities to offer higher yields on bonds, reflecting greater financial constraints.
- One-standard deviation increase in PM2.5 is associated with a statistically significant increase in annual yield spread of 2.37 bps.
- Bonds with greater repayment obligations and long-term maturities show more yield increase.
- Air pollution adds to the financial constraints of municipalities through the following: the county's economic conditions and health channels.

Introduction

- Municipalities play a vital role in driving economic development at the local level.
- By the year 2022, the size of the Muni bond market had grown to $4 trillion.

Research Questions

- **How Does Air Pollution Impact the Cost of Issuance of Municipal Bonds?**
- **What are the underlying mechanisms of this relationship?**

Data

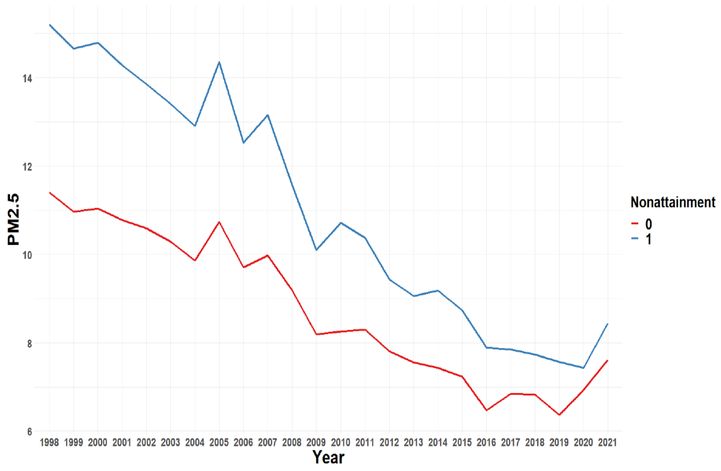
- Muni bonds transactions and characteristics:
  - MSRB
  - Thomson Reuters Refinitive Eikon
  - Bloomberg
- Air Pollution:
  - Atmospheric Composition Analysis Group at Washington University St. Louis (Van Donkelaar et al. (2021))
- County-level Economic & Financial:
  - US Department of Housing and Urban Development
  - US Bureau of Census

$$Yield_{it} = \beta_0 + \beta_1 \cdot PM^{2.5}_{c(t-1)} + \beta_2 \cdot X^1_{it} + \beta_3 \cdot X^2_{ct} + \eta_{st} + \epsilon_{it}$$

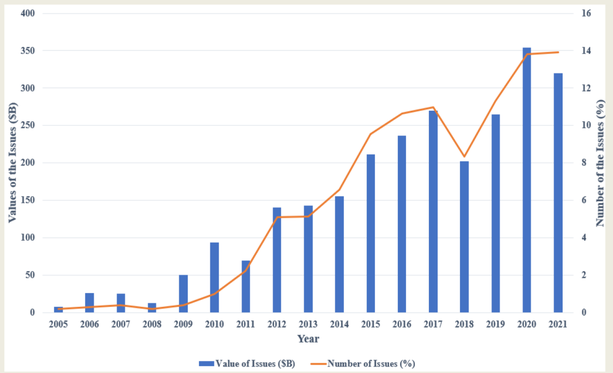
Dependent Variable	Yield	Yield	Yield	Yield Spread	Yield Spread	Yield Spread
Ln($PM2.5_{t-1}$)	0.196**	0.084*	0.118**	0.150**	0.091*	0.116**
	(0.084)	(0.047)	(0.056)	(0.064)	(0.049)	(0.056)
Ln(Size)		-0.011**	-0.019***		-0.011***	-0.020***
		(0.005)	(0.006)		(0.004)	(0.005)
Ln(Maturity)		0.654***	0.770***		0.190***	0.349***
		(0.009)	(0.013)		(0.008)	(0.010)
Callable		0.289***	0.225***		0.241***	0.180***
		(0.008)	(0.011)		(0.007)	(0.009)
Sinkable		0.308***	0.286***		0.225***	0.181***
		(0.012)	(0.015)		(0.011)	(0.013)
GO		-0.141***	-0.147***		-0.130***	-0.144***
		(0.012)	(0.015)		(0.011)	(0.014)
Pre-refunded		0.057***	0.058***		-0.055***	-0.067***
		(0.012)	(0.013)		(0.009)	(0.010)
Competitive		-0.095***	-0.105***		-0.098***	-0.108***
		(0.010)	(0.011)		(0.008)	(0.009)
Tax Exempt		-0.612***	-0.611***		-0.653***	-0.654***
		(0.013)	(0.017)		(0.011)	(0.014)
AMT		-0.362***	-0.348***		-0.394***	-0.381***
		(0.030)	(0.040)		(0.025)	(0.033)
Bank Qualified		-0.158***	-0.178***		-0.157***	-0.185***
		(0.015)	(0.018)		(0.013)	(0.016)
Ln(CUSIPS/Issue)		-0.046***	-0.035***		-0.046***	-0.043***
		(0.005)	(0.005)		(0.004)	(0.005)
Ln (Issuer deals Value)		-0.013***	-0.014**		-0.015***	-0.015***
		(0.004)	(0.005)		(0.004)	(0.005)
ΔIncome Per Capita			-0.003*			-0.004**
			(0.002)			(0.002)
ΔGDP			-0.002			-0.002*
			(0.001)			(0.001)
Ln(Property tax)			-0.012			-0.011
			(0.007)			(0.006)
Ln(Intergov's Rev.)			0.003			0.003
			(0.005)			(0.005)
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	296,343	296,343	213,278	296,343	296,343	213,278
R-squared	0.517	0.816	0.786	0.300	0.597	0.608

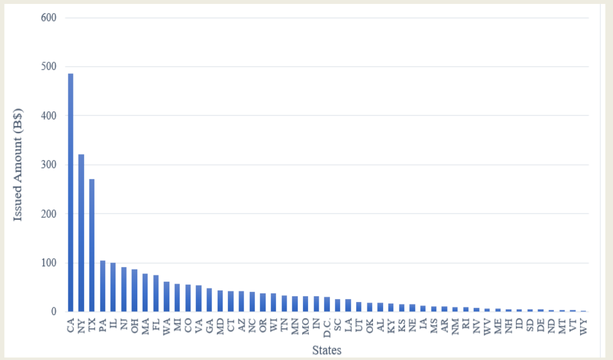
Clean Air Act (CAA) Regulations

- I utilize an instrument variable based on the expansion of Clean Air Act regulations in 2005, which led to a quasi-random variation in the county's subsequent exposures to PM2.5.
- The EPA began to enforce a maximum threshold on PM2.5.
- The regulatory incentives for cleanup were larger in nonattainment counties.



	1st Stage	2nd Stage	
Dependent Variable:	Ln(PM2.5)	Yield	Yield Spread
Ln(PM̂2.5)		1.49*	1.76**
		(0.90)	(0.89)
$Nonattainment^{2005}$	-1.32**		
	(0.65)		
$Ln(PrePM2.5^{2005})$	0.29	-0.47	-0.58
	(0.23)	(0.64)	(0.59)
$Nonattainment^{2005} \times Ln(PrePM2.5^{2005})$	0.49**		
	(0.24)		
Control	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes
Observations	46,759	46,759	46,759
R-squared	0.968	0.806	0.608





Economic Condition Mechanisms

	Total Expenditure Channel		ΔGDP Channel		Property Tax Channel	
Dependent Variable:	Yield	Yield Spread	Yield	Yield Spread	Yield	Yield Spread
Ln($PM2.5_{t-1}$)	0.031	0.030	0.139***	0.173***	0.071	0.067
	(0.054)	(0.045)	(0.053)	(0.047)	(0.052)	(0.046)
Ln($PM2.5_{t-1}$) × High Expenditure	0.108**	0.109***				
	(0.045)	(0.037)				
High Expenditure	-0.219**	-0.206***				
	(0.093)	(0.077)				
Ln($PM2.5_{t-1}$) × High ΔGDP			-0.027	-0.083***		
			(0.037)	(0.029)		
High ΔGDP			0.036	0.152**		
			(0.075)	(0.059)		
Ln($PM2.5_{t-1}$) × High Property Tax					0.061	0.066*
					(0.044)	(0.037)
High Property Tax					-0.134	-0.130*
					(0.088)	(0.076)
Bond Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	213,278	213,278	213,278	213,278	213,278	213,278
R-squared	0.784	0.608	0.785	0.608	0.785	0.584

Healthcare Mechanisms

	Unemployment Channel		Total Hospital Channel		Total Health Channel	
Dependent Variable:	Yield	Yield Spread	Yield	Yield Spread	Yield	Yield Spread
Ln($PM2.5_{t-1}$)	0.072	0.047	0.080*	0.087**	0.039	0.035
	(0.052)	(0.044)	(0.043)	(0.041)	(0.056)	(0.049)
Ln($PM2.5_{t-1}$) × High Unemployment	0.065	0.093***				
	(0.042)	(0.034)				
High Unemployment	-0.156**	-0.201***				
	(0.084)	(0.077)				
Ln($PM2.5_{t-1}$) × High Total Hospital			0.138**	0.119*		
			(0.0.067)	(0.063)		
High Total Hospital			-0.277**	-0.236*		
			(0.137)	(0.131)		
Ln($PM2.5_{t-1}$) × High Total Health					0.102**	0.105**
					(0.048)	(0.041)
High Total Health					-0.195**	-0.199**
					(0.097)	(0.086)
Bond Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	213,278	213,278	213,278	213,278	213,278	213,278
R-squared	0.785	0.608	0.786	0.605	0.784	0.601