Biased Expectations and Credit Risk in the Municipal Bond Market

Tarun Chordia
Jinoug Jeung
Abinash Pati

Motivation

- Understanding the dynamics of yield spreads / asset prices
  - Variables that should in theory drive credit spread changes have limited explanatory power
    - Collin-Dufresne, Goldstein, and Martin (2001)
  - IO of asset markets – Intermediary based factors (intermediary funding / distress, search & bargaining frictions, dealer inventory) do a better job in explaining the dynamics of yield spread changes
  - Subjective beliefs about fundamentals (long-term inflation, short-term earnings growth), personal experience also better explain variation in prices across asset classes, better than models of covariation with consumption growth
    - Chinco Hartzmark, Sussman (2021)
  - Volatile asset prices better explained by time-varying subjective expectations of fundamental growth than time-varying risk aversion
    - Nagel and Xu (2022)

Motivation

- How are expectations of default risk formed and priced
  - Credit ratings – Yes, but do retail investors focus on information about issuers, other than through credit ratings?

- The muni market presents an interesting setting
  - Direct holdings by households are over 50% of total holdings
  - Limited disclosure of fundamental information
    - In 2009 MSRB established online disclosure service through EMMA
  - Market segmentation because state tax exemption on interest income is generally limited to residents of state

- Behavioral biases could be important in muni bond spreads

Motivation

- Default risk in muni bond market
  - Default risk component drives 70% of variation in yield spreads
    - Schwert (2017)
  - Credit risk determinants
    - State pension investment losses – Novy-Marx & Rauh (2012)
    - Newspaper closures - Gao, Lee, & Murphy (2020)
    - Sea level rise – Painter (2018), Goldsmith-Pinkham et al (2021)
    - State corruption – Butler, Fauver, & Mortal (2009)
    - Opioid crisis – Cornaggia et al (2017)
    - Environmental regulation – Jha, Karolyi, & Muller (2021)
    - Natural Disasters – Auh, Choi, Deryugina, & Park (2022)
  - Bond prices decline due to above - But how much of it is due to rational risk pricing versus investors' biased expectations?

This Paper

- Examine impact of a salient local shock – Public Mass Shootings (at least four people killed excluding shooter)
  - Highly salient as proxied by media coverage
  - Unlike underfunded pensions, natural disasters or epidemics, mass shootings have limited cash flow impacts ➔ relatively easier to check whether biased beliefs are important
  - Could an increase in illiquidity or risk-aversion drive the results?
  - Could mass shootings drive updates to long-run fundamentals?
  - If investors are unbiased in pricing impact of mass shootings, then they should price other non-salient violent crime as well
  - If the impact is due to biased expectations, what are the psychological underpinnings?

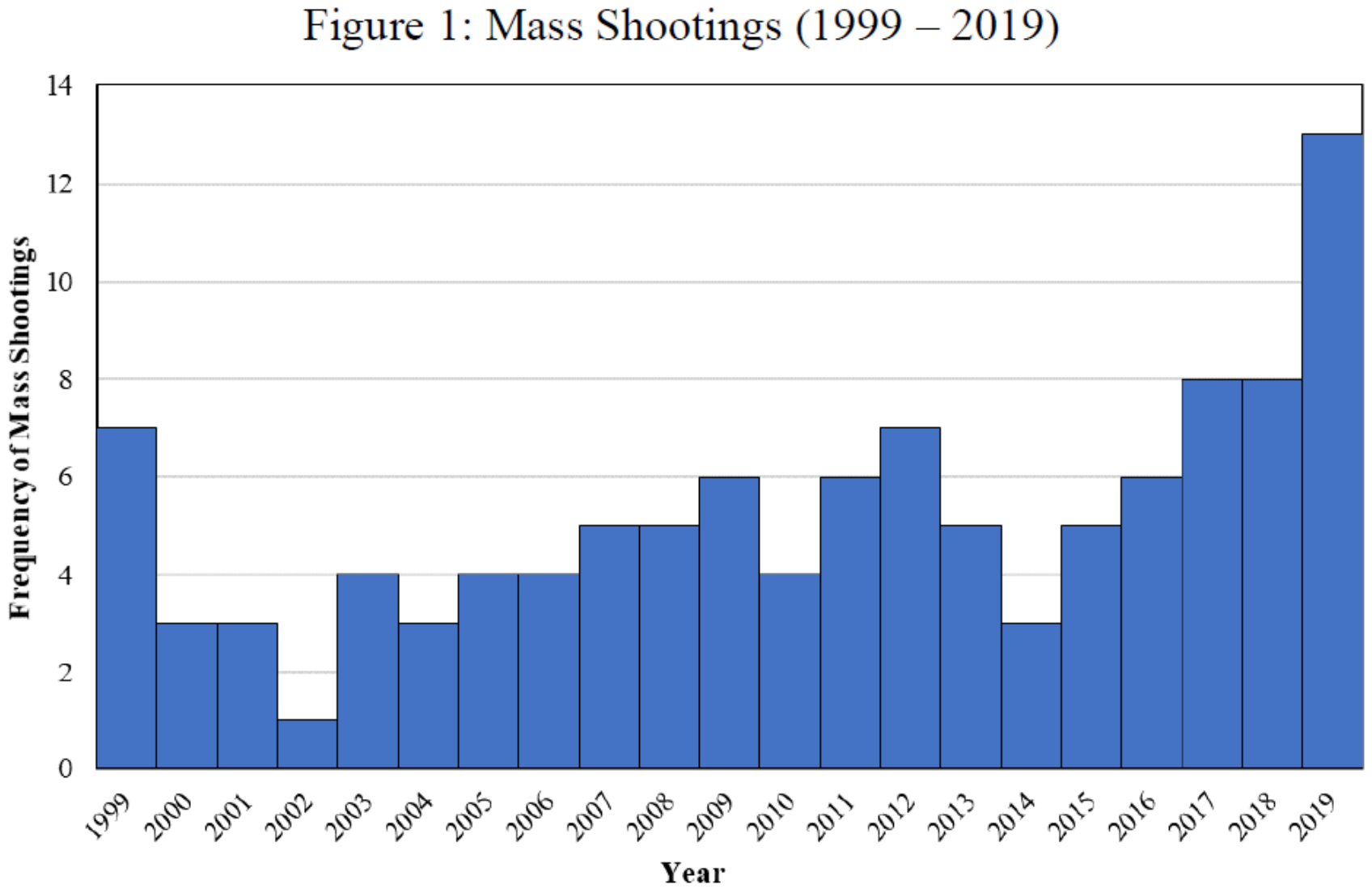
Preview of Results

- Tax-adjusted yield spreads (raw yields) rise by 6.0 (3.9) bps more for bonds issued by treated versus control counties
  - Average spread between AAA and Ba1 (just below investment grade) is 47bps ➔ average increase is 8.3% of default spread
  - Tax-adjusted yield spread differential in primary market is 5.2 bps which is $222,300 in additional funding cost for average issue
  - Yield spread differential lasts for 2 years, disappears by 3rd year
  - No evidence of change in illiquidity or risk-aversion
  - No evidence that investors update expectations about long-run fundamentals
  - Local government balance sheets are not affected ➔ harder to reconcile with rational default risk story
  - Also, other violent crime is not priced ➔ media driven salience?

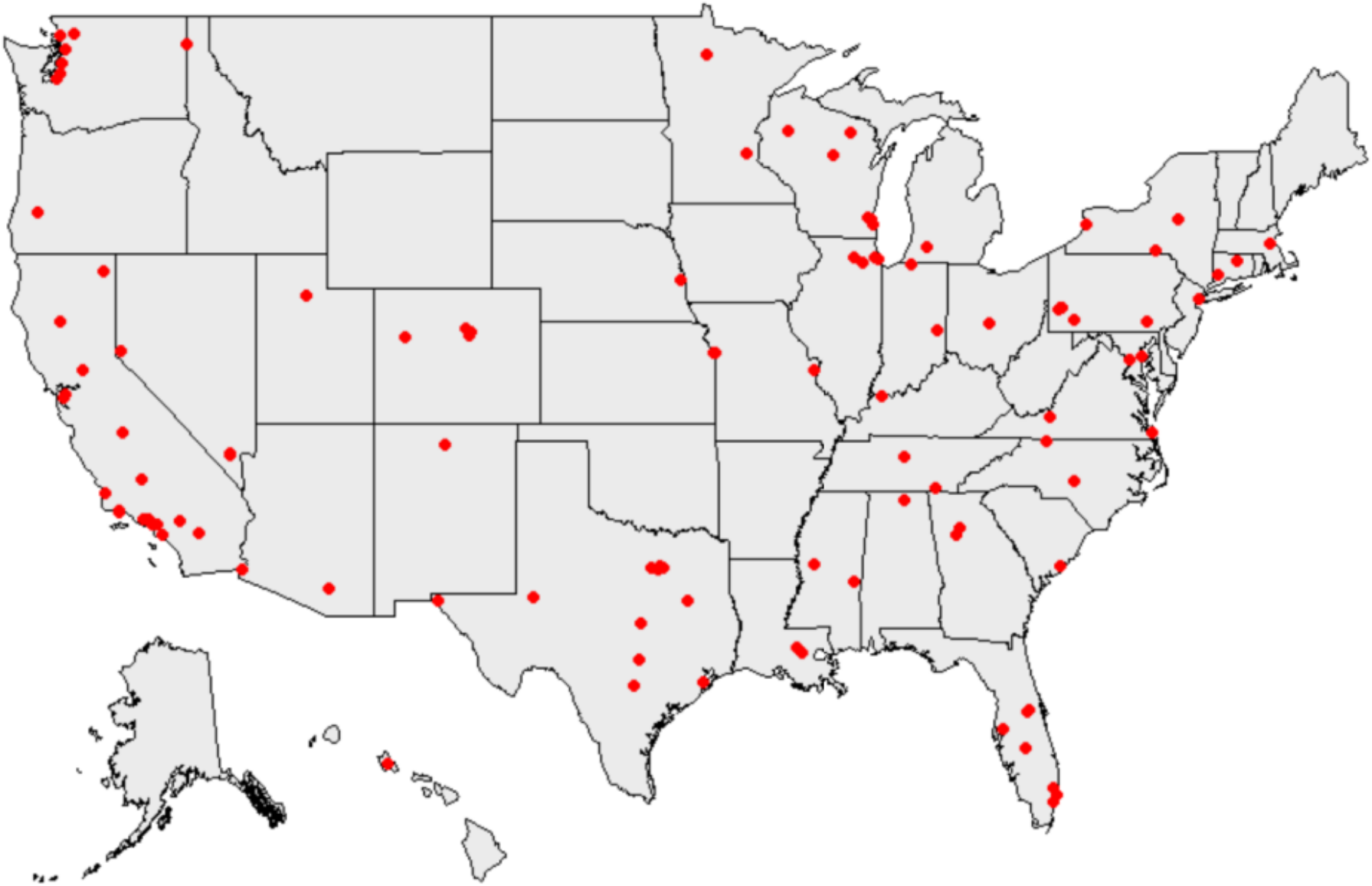
Contribution

- Investor expectations of fundamentals have explanatory power for
  - Return predictability due to return extrapolation – Greenwood & Shleifer (2014)
  - Portfolio allocations – Andonov and Rauh (2021), Giglio et al (2021)
  - Credit spread forecast errors – Bordalo et al (2018)
  - Firm-level investment decisions – Gennaioli, Ma, Shleifer (2016)
- Psychological genesis – representativeness, heuristic, experience
  - Malmendier and Nagel (2011)
- Anchoring in syndicated loan market – Dougal et al (2015)
- Media driven effects
  - Saliency and causal impact of media on returns
    - Huberman and Regev (2001), Engelberg and Parsons (2011)
  - TV broadcast of unrelated criminal events effect juror sentencing
    - Philippe and Ouss (2018)

Mass Shootings
Washington Post, 108 shootings



Map of Mass Shootings Counties



Summary Statistics

	Summary statistics		Test of equality	
Variables	Shooting	Non-Shooting	Diff	p-value
Number of counties	110	65,623	–	–
Log (Income per capita)	10.60	10.34	0.25***	<.0001
Log (Population)	13.03	10.26	2.78***	<.0001
Unemployment (%)	6.12	6.00	0.12	0.65
Without high school diploma (%)	17.17	21.17	-3.99***	<.0001
Racial index	0.34	0.19	0.14***	<.0001
Poverty (%)	13.68	15.01	-1.34**	0.04
GINI index	0.45	0.43	0.02***	<.0001

- Shooting counties are different – more populous, higher per capita income, lower without high school diploma, higher racial index, lower poverty ratio, and higher GINI index

Predictors of Mass Shootings
Logistic Regression

Dependent Variable	Probability of Mass Shooting				
	(1)	(2)	(3)	(4)	(5)
Unemployment	0.150***			0.121**	0.121**
	(0.0496)			(0.0564)	(0.0560)
Log (Population)		1.088***		1.095***	1.072***
		(0.0834)		(0.0848)	(0.0874)
Log (Income per capita)			0.6911	-0.9664	-0.9494
			(0.4845)	(0.7796)	(0.7843)
Without high school diploma	-0.064***	-0.0246	-0.044**	-0.043*	-0.044*
	(0.0189)	(0.0209)	(0.0194)	(0.0227)	(0.0227)
Racial index	5.187***	0.2426	5.036***	0.4917	0.4808
	(0.5751)	(0.7778)	(0.5999)	(0.8027)	(0.8056)
Poverty	-0.117***	0.0292	-0.075**	-0.0231	-0.0203
	(0.0246)	(0.0300)	(0.0295)	(0.0442)	(0.0443)
GINI index	15.369***	1.2056	11.961***	6.9393	6.6655
	(2.4275)	(3.5481)	(3.1587)	(5.2070)	(5.2131)
Post Shooting					(0.3474)
					(0.3050)
Constant	-12.598***	-19.656***	-18.333***	-11.904*	-11.904*
	(1.0418)	(1.3898)	(4.5976)	(6.9694)	(6.9694)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	65,733	65,733	65,733	65,733	65,733

Identification

- Shootings more likely in urban centers and metropolitan areas
- Maybe due to more potential perpetrators
- If unobservable time-varying shocks (e.g., housing market) differentially affect bond yields in treated versus non-treated sample, this will confound the effect of the treatment
- Need to construct a valid control sample for each treatment event
- Propensity Score Matching
  - Matched county from outside state of treated county
  - PSM within one standard deviation
  - Matched on unemployment, population, income per capita, education, racial diversity, poverty, and inequality
- Stacked Difference-in-Differences
  - Identify average effect of mass shootings on treated bonds by stacking separate observations on treated and control bonds for each mass shooting event
    - Gormley and Matsa (2011)

Matched Sample
Nearest Neighbor - PSM

Variables	Summary statistics		Test of equality	
	Treated	Control	Diff	p-value
Panel A: Mass Shootings				
Number of county-year	75	354		
Number of counties	65	245		
Number of shootings	75			
Number of fatalities	8.37			
Number of injuries	17.41			
Number of news stories	6.95			
Duration of news stories (minutes)	37.54			
Panel B: Matched County Characteristics				
Log (Income per capita)	10.59	10.57	0.03	0.47
Log (Population)	12.90	12.87	0.03	0.86
Unemployment (%)	6.35	6.53	-0.18	0.61
Without high school diploma (%)	16.21	16.88	-0.67	0.45
Racial index	0.33	0.33	-0.01	0.75
Poverty (%)	12.98	12.79	0.19	0.76
GINI index	0.45	0.44	0.00	0.45
Panel C: Other County Characteristics				
Log (House Index)	4.90	4.89	0.02	0.49
Log (Establishment per capita)	-3.58	-3.63	0.04	0.22
Log (Violence per capita)	-5.58	-5.64	0.06	0.53
Log (Property per capita)	-3.45	-3.58	0.13	0.23

Municipal Bond Data

- Mergent Municipal Bond Securities data
  - State of issuance, issue series, issuance date, type (negotiated vs competitive), maturity date, coupon, bond size, and bond ratings
- Issuer's county location from Bloomberg and SDC Platinum
- MSRB – transaction prices, yields, par value traded, transaction type (inter-dealer or customer-dealer) from March 1998 to June 2020
- Filtering
  - Exclude transactions that
    - occur < 1 year before maturity,
    - occur in first 3 months after issuance,
    - have non-positive yields or yields > 50%,
    - have dollar prices <50% or >150% of par
  - Average customer buys by bond-month, weighted by par value traded, exclude bonds <10 transactions, maturity>100 years, coupon>20%, variable coupon
  - In secondary market analysis – consider only bonds issued before shooting

County-Level Data

- Obtained from annual and quinquennial (once every 5 years) Census of Government surveys
- Linearly interpolate data for all cities, counties, townships, school districts, and special districts between 5-year survey dates
  - Cornaggia et al (2021)

- County demographics, local wages, employment from BEA and BLS
- Housing price data from FHFA – single family housing price indices

- Other violent and property crimes from FBI UCR – Uniform Crime Reporting program data on Offenses Known and Clearances by Arrest. Compiled from law enforcement agency reports across the US. Annual 1960-2020

Sample

- 75 shootings from March 2000 to June 2018 (*Washington Post*)
  - Exclude shootings tied to robberies or domestic shootings that take place exclusively in homes
- Bond issuance (primary market) and transactions (secondary market) from *Mergent* and *MSRB*
- Bond-Month panel with event window of two years around shooting

- Tax-Adjusted yield spread
  - Get yield of coupon equivalent synthetic treasury by calculating PV of future coupons and principal using treasury yield curve from Gurkaynak et al. (2007)
  - Following Schwert (2017) get tax-adjusted raw yield by dividing raw yield by tax rate computed using maximum federal and state income tax rates, i.e.,

$$tax\ rate = (1-T_{Fed})*(1-T_{State}) - 1$$

  - Tax-adjusted yield spread
    = Tax-adjusted raw yield – Coupon equivalent treasury bond yield

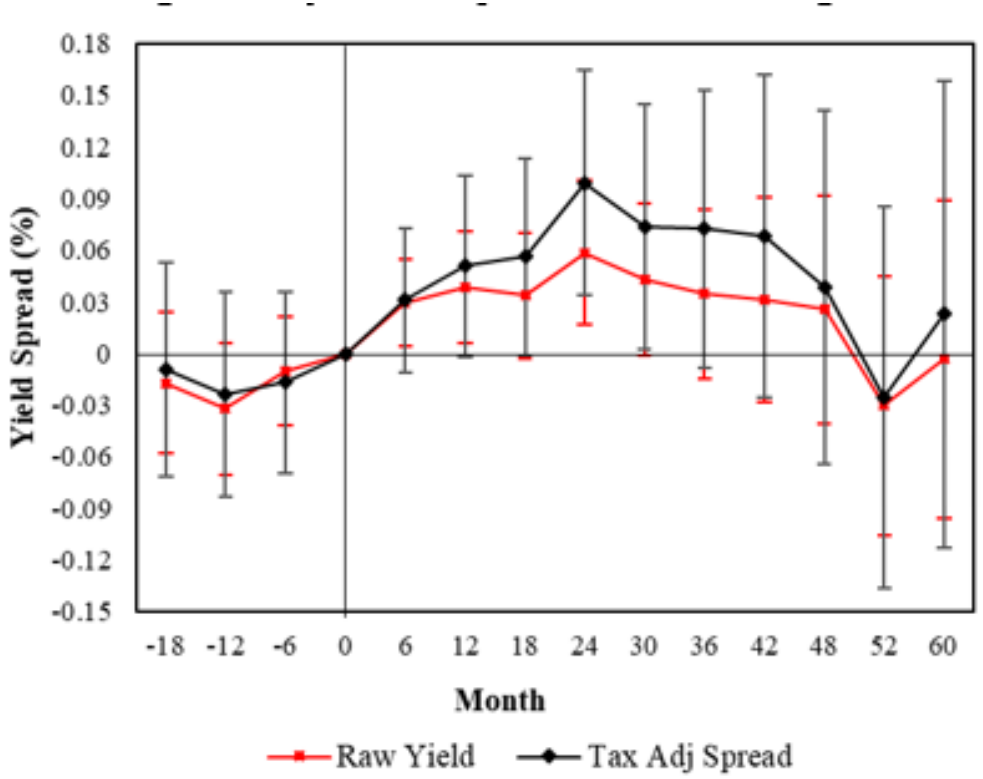
Variables	All		Treated		Control	
	Mean	SD	Mean	SD	Mean	SD
Panel A: Secondary Market Muni Bond Sample (MSRB)						
Raw Yield (%)	2.88	1.56	2.68	1.54	2.94	1.56
Tax-adjusted Yield Spread (%)	1.84	1.92	1.58	1.76	1.92	1.96
Benchmark Yield (%)	3.00	1.49	2.85	1.50	3.05	1.49
Price Dispersion (Equal)	0.98	0.87	0.91	0.84	1.00	0.88
Price Dispersion (Value)	0.77	0.69	0.72	0.66	0.79	0.70
Number of Trading	5.45	12.41	5.49	10.04	5.44	13.07
Trading Volume ($ Million)	0.64	3.57	0.62	2.81	0.64	3.79
Time to Maturity (Years)	10.68	6.95	10.61	6.87	10.71	6.98
Log (Bond Size)	15.39	1.31	15.50	1.24	15.36	1.33
General Obligation	0.41	0.49	0.40	0.49	0.41	0.49
Callable	0.71	0.46	0.71	0.45	0.71	0.46
Insured	0.53	0.50	0.46	0.50	0.55	0.50
Competitive	0.29	0.45	0.31	0.46	0.29	0.45
Obs (bond × year-month)	1,522,799		367,726		1,155,073	
Panel B: Primary Market Municipal Bond Sample (Mergent)						
Raw Yield (%)	3.18	1.33	3.06	1.37	3.22	1.32
Tax-adjusted Yield Spread (%)	2.05	1.28	1.92	1.17	2.10	1.31
Benchmark Yield (%)	3.32	1.56	3.17	1.63	3.37	1.54
Price Dispersion (Equal)	0.43	1.15	0.42	1.20	0.43	1.13
Price Dispersion (Value)	0.34	0.92	0.32	0.99	0.34	0.89
Maturity (years)	10.14	6.37	10.09	6.32	10.16	6.38
Bond Size ($ Million)	2.65	11.01	2.77	10.76	2.61	11.09
Log (Bond Size)	13.45	1.55	13.57	1.55	13.41	1.54
General Obligation	0.56	0.50	0.58	0.49	0.55	0.50
Callable	0.48	0.50	0.47	0.50	0.48	0.50
Insured	0.37	0.48	0.34	0.47	0.38	0.49
Competitive	0.43	0.49	0.46	0.50	0.42	0.49
Obs (bond × date)	235,744		56,561		179,183	
Issue Size ($ Million)	39.06	133.76	40.33	118.72	38.61	138.78
Number of Issuance	15,975		4,224		11,751	

Variables	All		Treated		Control	
	Mean	SD	Mean	SD	Mean	SD
Panel C: Local Finance and Economy Samples						
Municipal Revenue Growth	0.04	0.10	0.04	0.10	0.03	0.10
Municipal Expenditure Growth	0.04	0.13	0.04	0.13	0.04	0.13
Municipal Outstanding Debt Growth	0.04	0.35	0.04	0.35	0.04	0.35
Obs (entity × year)	38,334		8,122		30,212	
School Revenue Growth	0.04	0.10	0.04	0.10	0.04	0.11
School Expenditure Growth	0.05	0.15	0.05	0.15	0.05	0.14
School Outstanding Debt Growth	0.14	0.93	0.12	0.78	0.15	0.96
Obs (entity × year)	21,732		3,996		17,736	
Special Revenue Growth	0.05	0.23	0.05	0.25	0.05	0.23
Special Expenditure Growth	0.05	0.26	0.05	0.28	0.05	0.26
Special Outstanding Debt Growth	0.02	0.41	0.02	0.42	0.02	0.41
Obs (entity × year)	51,255		12,843		38,412	
Log (Employments per capita)	-0.91	0.32	-0.83	0.33	-0.93	0.32
Log (Establishments per capita)	-3.64	0.27	-3.58	0.29	-3.65	0.27
Log (Salaries per capita)	-1.97	1.25	-2.09	1.30	-1.94	1.24
Log (Violence per capita)	-5.73	1.04	-5.58	0.60	-5.77	1.12
Log (Property per capita)	-3.63	1.06	-3.46	0.42	-3.68	1.16
Log (House Index)	4.87	0.23	4.90	0.22	4.87	0.24
Obs (county × year)	4,360		838		3,522	

$$Y_{c,i,j,t} = \beta \cdot Treatment_{c,i} \cdot Post_{c,t} + \text{Bond Controls} + \text{County Controls} + \gamma_{c,i} + \delta_{c,t} + \epsilon_{c,i,j,t},$$

Dependent Variable	Raw Yield		Tax-adjusted Yield Spread	
	(1)	(2)	(3)	(4)
	Panel A: Secondary Market			
Treatment × Post	0.037***	0.039***	0.055**	0.060***
	(2.86)	(3.04)	(2.48)	(2.70)
Benchmark Yield	Yes	Yes	–	–
Bond controls	Yes	Yes	Yes	Yes
County controls	–	Yes	–	Yes
Cohort × County FE	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes
Observations	1,522,785	1,522,330	1,522,785	1,522,330
R-squared	0.682	0.682	0.396	0.396
	Panel B: Primary Market			
Treatment × Post	0.037**	0.036**	0.052*	0.052*
	(2.28)	(2.22)	(1.88)	(1.89)
Post	0.032	0.032	0.068*	0.067*
	(1.62)	(1.62)	(1.94)	(1.92)
Benchmark Yield	Yes	Yes	–	–
Bond controls	Yes	Yes	Yes	Yes
County controls	–	Yes	–	Yes
Cohort × County FE	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes
Observations	235,743	235,661	235,743	235,661
R-squared	0.879	0.879	0.618	0.618

Dynamic Effect of Mass Shootings



Note: The y-axis represents the difference in yield spread between treated and control counties.

Possible Explanations

- Three key determinants of muni yield spread changes
  - Impact of taxes
    - Unlikely that mass shootings can have an effect on the tax treatment of municipal bonds
  - Liquidity
    - Treated stocks could become more illiquid in the primary and secondary markets
    - Price pressure due to additional issuance amounts
  - Default Risk
    - Risk Aversion – Marginal investors may become more risk-averse following shootings
    - Credit Risk
      - Investors update on future risks – increased probability of further shootings?
      - Credit quality of treated issuers may deteriorate

Liquidity: Secondary and Primary Market

Dependent Variable	Price dispersion				Trading volume			
	All Transactions		All except Interdealer		All Transactions		All except Interdealer	
	Equal	Value	Equal	Value	# of trading	$ of trading	# of trading	$ of trading
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment × Post	0.002	0.003	-0.000	0.001	0.003	0.007	0.004	0.008
	(0.37)	(0.63)	(-0.01)	(0.18)	(0.63)	(0.68)	(0.99)	(0.85)
Benchmark Yield	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,522,330	1,522,330	1,522,330	1,522,330	1,522,330	1,522,330	1,522,330	1,522,330
R-squared	0.227	0.245	0.207	0.236	0.259	0.167	0.238	0.160

Dependent Variable	Price dispersion			
	Equal weighted		Value weighted	
	(1)	(2)	(3)	(4)
Treatment × Post	0.040	0.038	0.026	0.027
	(1.63)	(1.65)	(1.46)	(1.51)
Post	0.081***	0.081***	0.059***	0.059***
	(3.52)	(3.54)	(3.40)	(3.39)
Benchmark Yield	Yes	Yes	Yes	Yes
Bond controls	Yes	Yes	Yes	Yes
County controls	–	Yes	–	Yes
Cohort × County FE	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes
Observations	220,256	220,256	220,256	220,256
R-squared	0.058	0.058	0.062	0.062

Risk Aversion – Neighboring Counties in Same State

Dependent Variable	Raw Yield		Tax-adjusted Yield Spread	
	(1)	(2)	(3)	(4)
Treatment × Post	0.007	0.009	-0.005	0.000
	(0.68)	(0.97)	(-0.27)	(0.01)
Benchmark Yield	Yes	Yes	–	–
Bond controls	Yes	Yes	Yes	Yes
County controls	–	Yes	–	Yes
Cohort × County FE	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes
Observations	4,406,712	4,406,712	4,406,712	4,406,712
R-squared	0.637	0.637	0.314	0.314

Muni Bond Issuance

Dependent Variable:	Log (1+Issuance amount)		
	Total	GO	Rev
	(1)	(2)	(3)
Treatment × Post	-0.024	1.290	0.787
	(-0.15)	(1.19)	(0.82)
Post	0.115	-0.327	-0.275
	(0.97)	(-0.54)	(-0.33)
County controls	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes
Observations	1,358	1,358	1,358
R-squared	0.891	0.763	0.749

Default Risk and Individual Investors

Dependent Variable	Tax-adjusted Yield Spread									
	Default Risk						Capital Supplier			
	Credit Rating		Insurance		Maturities		Bank Qualified		Institutional Trading Vol	
	High	Non-High	Insured	Uninsured	Less 5-Year	More 5-Year	Qualified	Non-Qualified	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment × Post	0.043	0.113***	0.003	0.099***	0.052***	0.067**	0.031	0.062***	0.033	0.091***
	(1.61)	(3.15)	(0.09)	(2.91)	(2.69)	(2.55)	(0.39)	(2.75)	(1.41)	(2.70)
Bond controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	806,881	715,361	808,916	713,324	369,185	1,153,033	39,956	1,482,085	997,644	524,617
R-squared	0.370	0.411	0.368	0.343	0.427	0.394	0.505	0.398	0.453	0.346

Local Government Finances

Dependent Variable	Revenue Growth			Expenditure Growth			Outstanding Debt Growth		
	[-2,+1]	[-2,+2]	[-2,+3]	[-2,+1]	[-2,+2]	[-2,+3]	[-2,+1]	[-2,+2]	[-2,+3]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Municipal Governments									
Treatment × Post	-0.001	-0.000	-0.001	0.000	0.001	-0.001	0.004	0.001	0.001
	(-0.22)	(-0.07)	(-0.45)	(0.05)	(0.32)	(-0.16)	(0.31)	(0.11)	(0.08)
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,652	38,326	44,534	31,652	38,326	44,534	25,087	30,405	35,379
R-squared	0.098	0.094	0.091	0.084	0.084	0.079	0.076	0.073	0.069
Panel B: School Districts									
Treatment × Post	-0.011**	-0.005	-0.002	-0.001	0.002	0.005	-0.033	-0.011	-0.017
	(-2.48)	(-1.30)	(-0.40)	(-0.16)	(0.38)	(0.85)	(-0.76)	(-0.27)	(-0.47)
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,691	21,724	25,534	17,691	21,724	25,534	14,886	18,297	21,528
R-squared	0.153	0.143	0.140	0.090	0.081	0.079	0.057	0.052	0.052
Panel C: Special Districts									
Treatment × Post	0.007	0.010	0.008	0.004	0.007	0.008	0.010	0.017	0.021
	(1.32)	(1.64)	(1.44)	(0.70)	(1.02)	(1.27)	(0.74)	(1.29)	(1.62)
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42,172	51,208	59,615	42,172	51,208	59,615	22,647	27,560	32,158

Impact on Local Economy

Panel A: Employment and Establishment								
Dependent variable	100 × Log (Y)							
Y	Employments per capita				Establishments per capita			
	Total	Local	Service	Goods	Total	Local	Service	Goods
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment × Post	-2.159**	-4.815*	-2.090**	-0.262	-2.181**	-8.983*	-2.496**	-0.772
	(-2.55)	(-1.87)	(-2.38)	(-0.16)	(-2.00)	(-1.77)	(-2.20)	(-0.61)
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,259	3,988	4,259	4,259	4,259	4,203	4,259	4,259
R-squared	0.971	0.894	0.978	0.962	0.960	0.960	0.966	0.949

Panel B: Salary, Crime, and House							
Dependent variable	100 × Log (Y)						
Y	Salaries per capita				Crimes per capita		House Price Index
	Total	Local	Service	Goods	Violence	Property	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Treatment × Post	0.343	0.667	-0.348	0.231	-5.852	-1.676	1.395
	(0.80)	(1.01)	(-0.46)	(0.53)	(-1.06)	(-0.46)	(0.93)
County controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,259	3,988	4,259	4,259	4,151	4,189	4,215
R-squared	0.999	0.999	0.998	0.999	0.843	0.833	0.889

Dependent Variable	Raw Yield		Tax-adjusted Yield Spread	
	(1)	(2)	(3)	(4)
Treatment × Post	0.050***	0.054***	0.080**	0.087***
	(2.65)	(2.83)	(2.52)	(2.73)
Treatment × Post × Municipality	-0.045*	-0.050*	-0.078**	-0.085**
	(-1.74)	(-1.89)	(-2.00)	(-2.12)
Treatment × Post × School	-0.008	-0.011	-0.012	-0.016
	(-0.21)	(-0.28)	(-0.18)	(-0.25)
Treatment × Municipality	-0.037	-0.036	-0.043	-0.040
	(-1.20)	(-1.14)	(-0.83)	(-0.78)
Treatment × School	-0.039	-0.037	-0.035	-0.033
	(-1.12)	(-1.08)	(-0.61)	(-0.57)
Post × Municipality	0.026*	0.028*	0.035	0.037
	(1.71)	(1.83)	(1.37)	(1.45)
Post × School	0.018	0.020	0.025	0.027
	(1.07)	(1.15)	(0.84)	(0.91)
Municipality	0.043	0.042	0.072	0.071
	(1.53)	(1.51)	(1.46)	(1.45)
School	-0.048	-0.049	-0.094*	-0.094*
	(-1.59)	(-1.60)	(-1.78)	(-1.79)
GO	-0.231***	-0.231***	-0.382***	-0.382***
	(-8.36)	(-8.37)	(-7.96)	(-7.97)
Benchmark Yield	Yes	Yes	–	–
Bond controls	Yes	Yes	Yes	Yes
County controls	–	Yes	–	Yes
Cohort × County FE	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes
Observations	1,522,785	1,522,330	1,522,785	1,522,330
R-squared	0.682	0.683	0.397	0.397

Dependent Variable:	Downgrade (= 1 if credit rating is downgraded)					Tax-adjusted Yield Spread
	[-2, +1]	[-2, +2]	[-2, +3]	[-2, +4]	[-2, +5]	Non-Downgrade
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment × Post	0.010*	0.007	0.004	0.002	0.003	0.072***
	(1.92)	(1.39)	(0.74)	(0.46)	(0.47)	(3.09)
Benchmark Yield	Yes	Yes	Yes	Yes	Yes	–
Bond controls	Yes	Yes	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910,585	1,176,273	1,392,222	1,573,446	1,716,238	1,226,023
R-squared	0.209	0.201	0.195	0.189	0.185	0.371

County finances do not deteriorate and not much by way of downgrades, but impact on yield spreads is large

Investor misperception?

Media Coverage

Dependent Variable	Log (1 + Number of news stories)			Log (1 + Duration of news stories)		
	(1)	(2)	(3)	(4)	(5)	(6)
Log (Number of victims)	0.752***	0.769***	0.776***	1.367***	1.390***	1.340***
	(6.33)	(7.54)	(7.87)	(6.90)	(7.19)	(7.96)
Shooter age	-0.015*	-0.008	-0.021**	-0.027**	-0.016	-0.039***
	(-1.95)	(-1.06)	(-2.47)	(2.32)	(1.45)	(-2.94)
Location FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	–	Yes	Yes	–	Yes
Year FE	–	Yes	Yes	–	Yes	Yes
Observations	93	107	92	93	107	92
R-squared	0.669	0.635	0.751	0.747	0.684	0.801

Saliency

Dependent Variable	Tax-adjusted Yield Spread				
	(1)	(2)	(3)	(4)	(5)
Treatment × Post	0.018	0.017	0.045*	0.024	0.017
	(0.71)	(0.57)	(1.68)	(0.88)	(0.56)
Treatment × Post × News Duration	0.001***			0.001***	
	(3.46)			(3.37)	
Treatment × Post × News Number		0.006**			0.006**
		(2.21)			(2.04)
Treatment × Post × Fatalities			0.002	-0.001	-0.000
			(0.98)	(-0.53)	(-0.01)
Bond controls	Yes	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes	Yes
Cohort × County FE	Yes	Yes	Yes	Yes	Yes
Cohort × Month FE	Yes	Yes	Yes	Yes	Yes
Cohort × Year-Month FE	Yes	Yes	Yes	Yes	Yes
Observations	1,522,330	1,522,330	1,522,330	1,522,330	1,522,330
R-squared	0.397	0.397	0.397	0.397	0.397

Other Violent Crime

Dependent Variable	Raw Yield		Tax-adjusted Yield Spread	
	Primary	Secondary	Primary	Secondary
	(1)	(2)	(3)	(4)
Violence per capita	0.481	0.675	1.084	0.961
	(0.47)	(0.70)	(0.59)	(0.56)
Benchmark yield control	Yes	Yes	–	–
Bond controls	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	–	Yes	–
Year-Month FE	–	Yes	Yes	Yes
Observations	2,293,739	9,301,180	2,293,739	9,301,180
R-squared	0.804	0.676	0.394	0.361

Conclusion

- Public Mass Shootings lead to an increase in local government borrowing costs in the municipal debt market
- Evidence points to biased expectations of fundamentals
- Saliency due to media coverage
- Why do investors misperceive the real costs of mass shootings?
  - Investors in muni bonds are mainly high net worth individuals who require compensation for any perceived increase in default risk
  - Surveys and individual investor portfolios suggest that investing is driven by advice from CFAs, personal experiences and beliefs about rare disasters
  - Salience can distort decision making – when unemployment reaches 12-month high and local news coverage increases, local consumers reduce spending by 2% relative to others with same macro fundamentals (Garmaise et al., 2020)
  - Possible hypothesis – investors do not differentiate between non-pecuniary (emotional & mental health) and pecuniary costs (not that high). Psychological underpinning could be coarse thinking proposed by Mullainathan et al (2008)