Calling All Issuers: The Market for Debt Monitoring

Brookings Municipal Finance Conference 2021

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Market for Municipal Securities

There are $3.8 trillion dollars outstanding in municipal debt.

These debt fund many important public projects, including:

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The interest payment on these debt adds up to hundreds of billions of dollars per year.
How do public institutions managed this debt in low interest rate environments?

Optimal Management of Debt

Refinancing features of municipal debt occurs through "Calls."

- Callable feature- almost 95% of long-term bonds (10 year or greater tenor) are callable at an unlock date.
- Standard 4% to 6% coupon rates vs lower prevailing market interest rates makes calling and refinancing particularly attractive.

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First order feature in public financing:

Execution of these call features for refinancing.

Results

Delays in optional calling are observed both within and across:

- Bond issue sizes (large and small issuances)
- Municipal issuer sizes (big cities and small towns)
- Geographic locations (throughout entire United States)
- Sample periods (from early 2000's to present day)
- Bond structures (GO and Revenue bonds)
- Bond purposes (from hospitals to schools to roads)
- Initial credit ratings and up/downgrades (from AAA to BBB)

These delays add up quantitatively: using simple calibration, the estimated value lost is $1.74 billion per year between 2001 and 2018.

This is about 0.046% of existing principal value of municipal debt. I.e. $1 of every $100 of interest payment (5% coupon) can be saved.

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Results

Issuer Effects: Delays originate in the issuers.

1. Sophistication: Larger issuers tend to delay less.
2. Workload: GO Bonds with calls unlocked at FY End on average delay by an **additional 2 months**.

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Underwriter Effects: Underwriters have varying efficacy in alleviating this gap.

1. Sticky Relationships: Issuers use the same lead underwriter the vast majority **(57% to 87%)** of the time.
2. Sticky Relationships: Issuers who rely on the same underwriter over time **are 8.1% more likely to delay**.
3. Underwriter's regional expertise: Bonds that use the largest underwriter (by state and year) **are 8.4% less likely to delay**.
4. Causal Interpretation: Issuers utilizing Bear Stearns and Lehman pre-crisis had significantly larger delays post crisis.

Data Sources

1. Our primary data on issuance, calling, and agent information comes from Mergent's Municipal Bond database
   - We consider all callable bonds whose call option unlocked 2001-2018.
   - Aggregate value outstanding is similar to the time series calculated by SIFMA and MSRB.
   - For uniformity, we remove bonds with variable rate, puttable, or make whole features. We also removed those that defaulted; had a super sinker provision; or was issued by Puerto Rico, Virgin Islands, Guam, or Detroit.
2. History of S&P credit ratings comes from the Capital IQ database.
3. For comparison, our corporate bond data comes from the Mergent FISD database.

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Optimal Exercise: American Call Option

After the bond is unlocked, there is an *Exercise Value* (the premium captured) for exercising the call, and a *Continuation Value* (the market value of the call option after a delay, given that it isn't presently exercised).

- If *Exercise value* > *Continuation value*, then the issuer should exercise.
- *Annual Value Lost*: *Exercise Value* – *Continuation Value* given it is not exercised.

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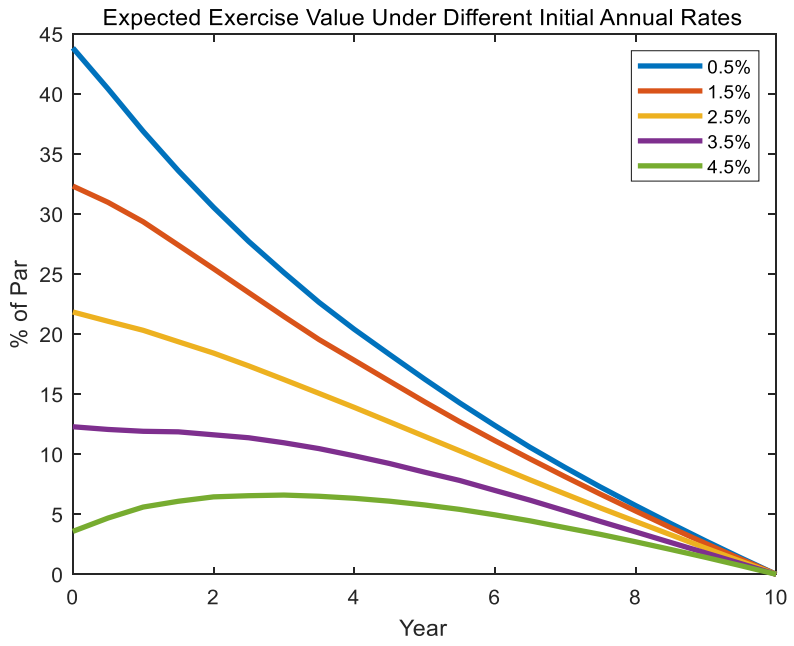

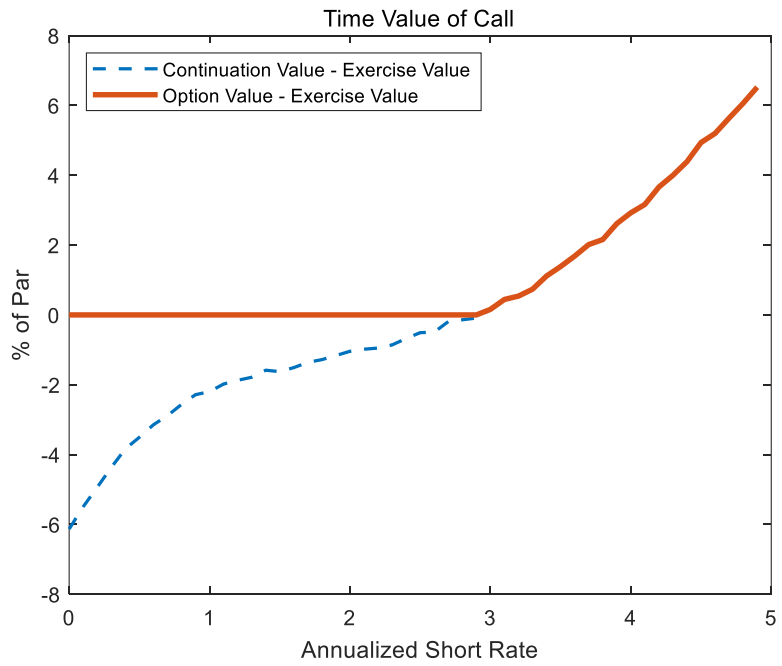

Estimating Value Lost

1. We establish a panel of currently callable bonds outstanding each year.

2. Group them into bins separated by coupon rates (interval of 10 basis points), matched contemporaneous offering yields (using non-callable bonds with the same credit rating and similar maturities), and leftover number of coupon paying periods (every six months).

3. For each bin, calculate exercise value. Additionally, calculate continuation value using a flat Merton model with zero-rate bound and 40 basis point of semi-annual volatility at six months.

4. We sum the cost of delayed exercise (the positive difference) for all callable bonds per year with investment grade credit ratings from S&P.

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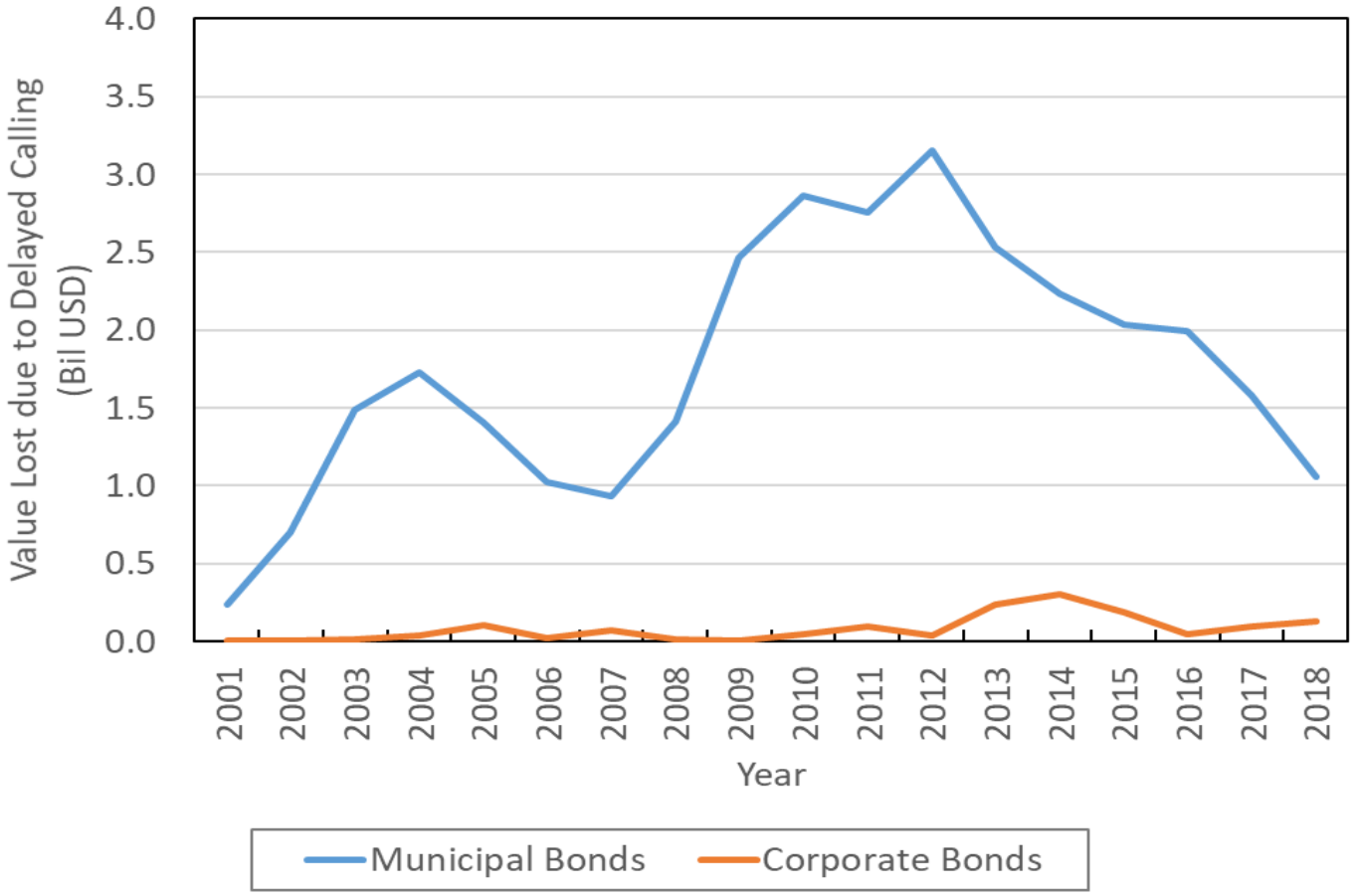
Annual Value Lost From Delaying to Exercise



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- Value lost generally ranges between 1 to 3 billion dollars annually in the municipal market (assuming 2% of par issuance cost)
- In comparison, the estimated value lost is much lower for the corporate bond market, even though it has a larger amount outstanding.

Variation across Bond Type

Type	N	Total Size (bil USD)	% Delay Year+	% Never Call
Revenue	**146,768**	**890.01**	**23.71**	**11.88**
Unlimited Tax G.O.	**298,547**	**704.98**	**17.79**	**10.56**
Loan Agreement	43,667	291.70	32.73	14.21
Mortgage Loans	26,420	147.03	25.92	12.54
Lease/Rent	39,237	125.95	24.73	14.53
Limited G.O.	39,819	64.15	22.78	14.33
Sales/Excise Tax	10,226	55.24	19.25	10.58
US Government	19,374	37.36	7.23	3.71
Tobacco Agreement	387	33.61	30.39	15.84
Special Tax	9,410	33.36	52.75	15.95
Tax Allocation	7,487	20.51	51.53	22.32
Double barreled	11,024	20.13	24.42	14.24
Special Assessment	6,416	13.44	37.31	17.90
Fuel / Vehicle Tax	1,322	11.89	15.91	8.41
Loan Agreement	1,110	9.43	38.68	14.67
Tuition Agreement	2,087	5.93	20.61	9.80
Education Loans	707	4.42	32.96	19.38
Other	318	1.52	32.70	17.30
Public Improvement	125	0.44	31.20	14.40

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Variation across States

We see a large amount of variation across states, with some (eg Montana) that delay a lot, while others (eg Texas) that tend to call on time

Even within a state, we find a lot of variation. For example, within Montana, 28% of bonds delay by more than one year while 72% of bonds call within a year of the unlock date.

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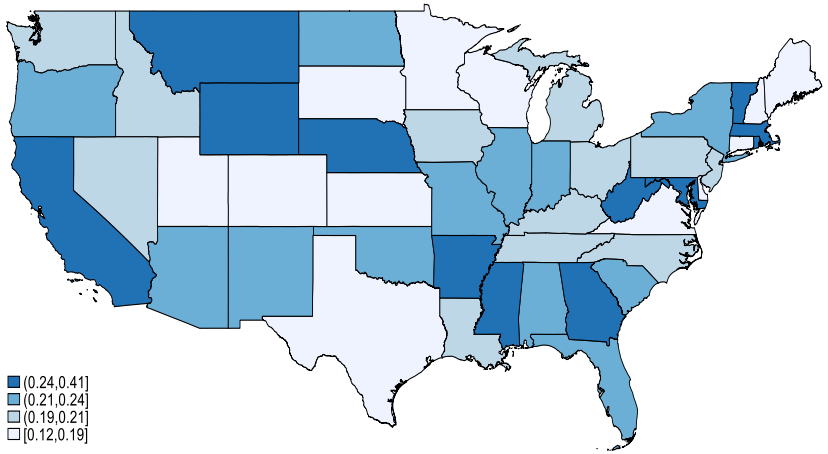
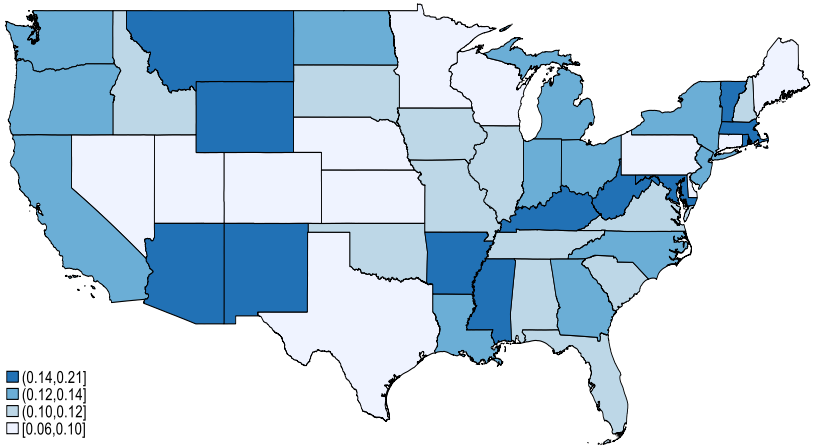
Pct of Bonds that Call with >1Y Delay



Pct of Bonds that Never Call



Variation across Credit Ratings

Rating	N	Total Size (bil USD)	% Delay Year+	% Never Call
AAA	89,024	454.69	25.24	9.92
AA	168,535	797.52	13.38	6.34
A	43,391	221.00	24.34	9.06
BBB	11,668	61.60	31.55	10.31
BB	619	8.01	63.19	21.99
B	247	10.34	75.00	22.95
CCC	55	2.09	81.82	36.36

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- Most municipal bonds are highly rated. Even within a rating bucket (eg AA), we find significant variation in delays.

- Some bonds may delay if their ratings become downgraded. If we additionally bucket by whether a bond is downgraded, we still find significant variation in calling. To control for this, we add rating fixed effects and a dummy for downgrades to our regressions.

Baseline Regression

- In our calculations, we find that most bonds should exercise immediately after the unlock date over our time sample.

- In practice, many bonds delay calling by at least one year, losing billions in value each year.

- We try to explain these delays using the regression on observables:

$$Delay_{i,s,t} = \alpha + \mu_s + \gamma_t + \beta\overrightarrow{\boldsymbol{X}_{i,s,t}} + \varepsilon_{i,s,t}$$

- $Delay_{i,s,t}$ is a measure of delay. Either a dummy for delay of 1yr+, or the amount of time from the bond's call unlock date to the day it was called.
- μ_s , γ_t refer to state and year fixed effects respectively
- $\overrightarrow{\boldsymbol{X}_{i,s,t}}$ is a vector of bond, issuer, or underwriter characteristics

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Baseline Regression

Here, we will look at several key traits of the bond that should affect their call decision:

1. **Coupon rate-** larger coupon rates benefit more from refunding

2. **Offer yield-** do bonds which do not call receive better prices?

3. **Dummy for credit downgrades-** downgraded bonds will not benefit as much from refunding

4. **Remaining time to maturity-** bonds with more maturity remaining may benefit from waiting

5. **Size of Issuance-** larger bond issues face more costly consequences from not refunding

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Baseline Regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Call Delay at Year+					
Coupon (%)	-0.128***					-0.069***
	(0.010)					(0.0157)
Offering Yield (%)		-0.112***				-0.063***
		(0.007)				(0.016)
Dummy for Downgraded			0.052***			0.047***
			(0.010)			(0.011)
Days until Maturity				0.013		0.230***
				(0.012)		(0.023)
Ln Size (USD)					-0.042***	-0.032***
					(0.006)	(0.007)
Observations	192,574	186,726	192,586	192,586	192,586	186,721
R-squared	0.122	0.110	0.083	0.081	0.104	0.140
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Capital Purpose FE	YES	YES	YES	YES	YES	YES
Initial Rating FE	YES	YES	YES	YES	YES	YES

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Workload: Fiscal Year End

- Next, we look at the issuer, who directly benefits from refinancing when calling at favorable rates.

- For local governments, the end of their state's fiscal calendar is an especially busy time as they work to produce annual budgets. We test to see whether this larger-than-average workload slows the calling process by regressing the call delay time on a dummy for whether the bond was unlocked around the end of the FY.

- We also test whether this delay is especially pronounced for smaller governments, which may be especially short-staffed around FY end.

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Workload: Fiscal Year End

DEPENDENT VARIABLES:	(1)	(2)	(3)
	Avg Wait Time (Yrs)		
Month before FY End	0.158		0.094
	(0.149)		(0.143)
FY End	**0.181****		**0.159***
	(0.082)		**(0.084)**
Month after FY End	-0.022		-0.050
	(0.049)		(0.052)
Dummy for Small Issuer		0.110**	0.102**
		(0.045)	(0.044)
Interaction Terms			
Small * Month before FY End			**0.449****
			(0.174)
Small * FY End			0.086
			(0.064)
Small * Month after FY End			0.073
			(0.060)
Sample	**Non-prerefunded GO Bonds**	**Non-prerefunded GO Bonds**	**Non-prerefunded GO Bonds**
Observations	95,676	95,676	95,676
R-squared	0.342	0.343	0.344
Control for Bond Charas	YES	YES	YES
State FE, Year FE	YES	YES	YES
Capital Purpose FE	YES	YES	YES
Initial Rating FE	YES	YES	YES

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GO bonds that become callable during the month of the fiscal year end are delayed by an **additional two months (t=2.21).**

The effect is similar for small issuers, with additional delays if a bond becomes callable in the month before FY end (t=2.58).

Workload: Number of Bonds to Consider

- Due to factors like local bond ballot outcomes, municipal borrowing may be lumpy over time. Sometimes, there are no bonds to refinance and other times, many bond issues may become unlocked all at once.

- We test to see whether an abnormally large number of unlocked bonds (ie a larger workload) leads to longer delays, since this implies there are more items to consider for the issuer.

- We regress delay time on the difference between the number of contemporaneous bonds being unlocked in the same year and the average number of unlocked bonds the issuer considers refinancing per year. A larger difference implies a heavier workload.

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Workload: Number of Bonds to Consider

	(1)	(2)
DEPENDENT VARIABLE:	Avg Wait Time (Years)	
Num Issues Unlocked - Prev 10y Avg	0.0159**	
	(0.00780)	
Num Issues Unlocked		0.0172**
		(0.00749)
Prev 10y Avg of Num Issues Unlocked		-0.0235***
		(0.00806)
Observations	158,050	158,050
R-squared	0.382	0.382
Control for Bond Charas	YES	YES
State FE, Year FE	YES	YES
Capital Purpose FE	YES	YES
Initial Rating FE	YES	YES

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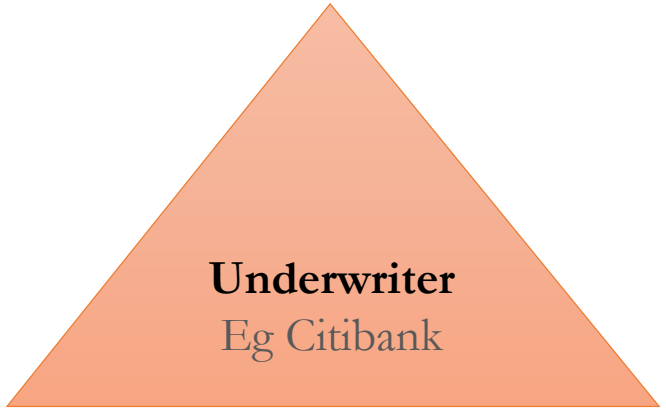
Each additional standard deviation (3.1 bonds) increase in the number of bonds unlocked is associated with **an additional delay of 0.6 months (t=2.04).**

Municipal market structure



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Legal Counsel

Voting Public

Underwriter Relationship

	% of Bonds Issued with the Top Lead Underwriter (2002 to 2007)							
	Mean	Std.	Min	25%	Median	75%	Max	N
All Issuers	86.97%	21.87%	10.20%	75.00%	100.00%	100.00%	100.00%	28,402
Issuers with at least 20 bonds issued	75.36%	25.48%	10.20%	52.94%	81.36%	100.00%	100.00%	12,313
Issuers with at least 40 bonds issued	62.85%	25.90%	10.20%	40.54%	57.38%	93.33%	100.00%	5,438
Issuers with at least 60 bonds issued	57.01%	25.59%	10.20%	35.29%	51.52%	75.89%	100.00%	2,898
Issuers with Bear Stearns as top lead underwriter	76.42%	24.33%	17.57%	56.71%	83.33%	100.00%	100.00%	141
Issuers with Lehman as top lead underwriter	81.98%	24.64%	14.96%	60.61%	100.00%	100.00%	100.00%	234

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The Market for Underwriters

- Next, we turn to external monitoring and examine the financial agents, which include the advisers and underwriters. First, we examine the underwriters.
- Empirically, many underwriters choose to concentrate in a specific geographic region, creating a fractured market for monitoring.
- We benchmark underwriters' regional presence by calculating the ratio of each underwriter's dollar amount written in a state to the amount written by the state's largest underwriter.
- Citibank (concentrated nationally) versus Dougherty (concentrated in the Dakotas) shown below.

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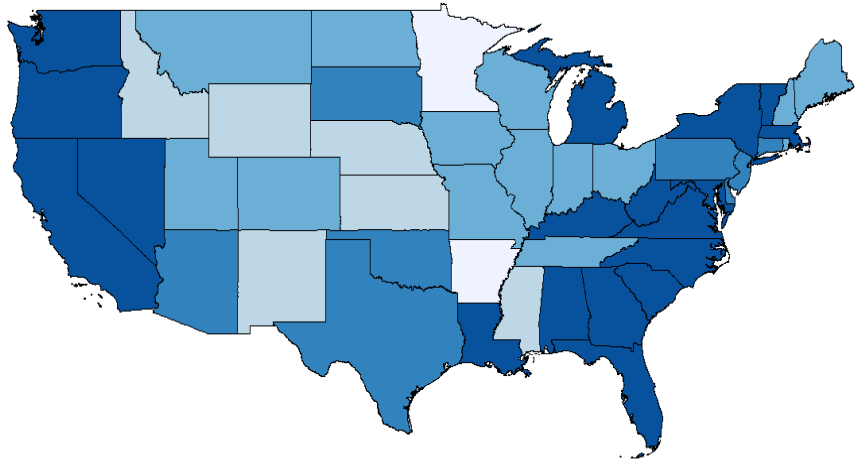
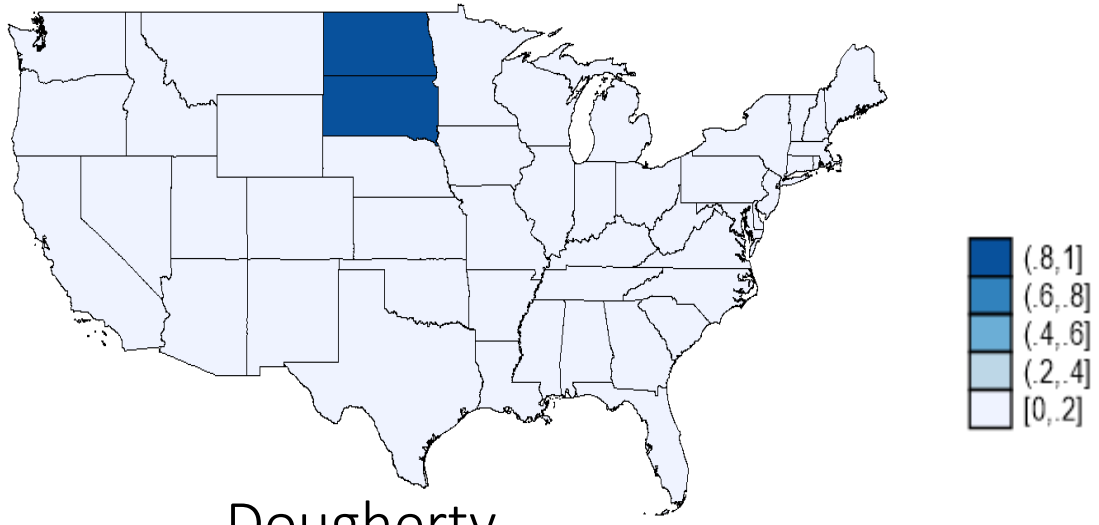


Citibank



Dougherty

Underwriters' Regional Concentration

- Underwriters have an incentive to help the issuers call their bonds, because they make a profit from writing the refunded bond.

- However, as we saw, underwriters have varying regional focus and may not have as much staff or pay attention to all states equally. Thus, we rank underwriters within each state and year based on size. We test to see whether using the largest underwriter in the state improves bonds' calling delays.

- In addition, since any underwriter can approach the issuer for a refinancing, we test to see whether having additional external monitors (ie having more active underwriters in the market) improves calling delays.

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Underwriters' Regional Concentration

	(1) Call Delay at Year+	(2) Call Delay at Year+	(3) Call Delay at Year+	(4) Call Delay at Year+
Pctl Rank of Underwriter	-0.084***	-0.052***		-0.084***
	(0.009)	(0.015)		(0.009)
# Underwriters in State			-0.011**	-0.012**
			(0.005)	(0.005)
Observations	185,079	185,079	185,079	185,079
R-squared	0.141	0.173	0.141	0.141
Control for Bond Charas	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Capital Purpose FE	YES	YES	YES	YES
Rating FE	YES	YES	YES	YES
Underwriter FE	NO	YES	NO	NO

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Even controlling for the underwriter FE, a bond that uses a state's largest underwriter **is would be 5% (*t*=3.47) less likely to delay** than a bond that uses a state's smallest underwriter.

Each additional underwriter is associated with a **1.2% (t=2.23) smaller probability of calling delay.**

Stickiness of Underwriter-Issuer Relationship

- Next, we look at the relationship between the issuer and its underwriter.
- Empirically, we find that many issuers have very sticky relationships with their underwriters. While issuers can switch underwriters with each new issuance, on average, we find that municipals issue 87% of bonds using the same lead underwriter.
- We create a measure of underwriter persistence by calculating the dollar-weighted percentage of all bonds that are underwritten by the same lead underwriter over the last 10 years prior to the bond unlock date. If the issuer has only used the same underwriter, then this measure would be equal to 1.
- Not all sticky relationships are bad. Use of the same underwriter over time may be beneficial if the underwriter has unique qualifications (eg local expertise). To proxy for this, we use the local size of the underwriter, and we interact it with persistence to test whether repeated use of a qualified underwriter may be beneficial.

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Stickiness of Underwriter-Issuer Relationship

	(1) Call Delay at Year+	(2) Call Delay at Year+	(3) Call Delay at Year+
Underwriter Persistence	0.081***	0.048***	0.101***
	(0.003)	(0.004)	(0.006)
Pctl Rank of Underwriter			-0.061***
			(0.010)
Persistence* Pctl Rank			-0.052***
			(0.004)
Control for Bond Charas	NO	YES	YES
State FE	YES	YES	YES
Year FE	YES	YES	YES
Rating FE	YES	YES	YES
Capital Purpose FE	YES	YES	YES
Observations	172,944	167,995	167,995
R-squared	0.080	0.135	0.136

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When a bond comes from an issuer that relies heavily on its lead underwriter (persistence=1), it is **8% more likely to delay calling** than if it used an underwriter that it no longer uses (persistence=0).

Difference in Difference Interpretation

	Call Delayed by At Least 1 Year			
	(1)	(2)	(3)	(4)
Bear Stearns or Lehman Dummy	-0.145***	-0.140***	-0.132***	
	(0.040)	(0.037)	(0.035)	
Year >= 2009 Dummy	-0.184**			
	(0.071)			
Diff-in-Diff Interaction	0.167**	0.163**	0.160**	
	(0.054)	(0.052)	(0.053)	
Goldman Sachs Dummy				-0.075
				(0.098)
Goldman Sachs Interaction				0.058
				(0.101)
State FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	No
Year X Rating FE	No	No	Yes	Yes
Observations	38,480	38,480	38,479	38,479
Adjusted R-squared	0.072	0.103	0.127	0.124

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Conclusion

- We find that roughly **$1.74 billion is lost annually by public issuers through calling delays**.

- These delays exist across many different dimensions: bond sizes, issuer sizes, geographic locations, time periods, bond structures, bond purposes, and credit ratings.

- We find that these delays are consistent with gaps in monitoring:
  1. ***Attentiveness of Issuer*** –GO Bonds with calls unlocked at FY End on average delay by an additional 2 months.
  2. ***Attentiveness of Underwriter***- Bonds that use the largest underwriter (by state and year) are 8.4% less likely to delay.

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