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Regulatory Spillover: Evidence from Classifying Municipal Bonds as High-Quality Liquid Assets

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Research Question

- Does changing the regulatory accounting for the liquidity coverage ratio (LCR) by including certain municipal bonds in its computation have a spillover effect on the municipal bond market?
  - Bond yield spreads
  - Issuance Behavior

- Underlying Mechanism: a change in demand for the affected bonds.

Motivation

- There were many changes to bank regulatory standards after the financial crisis.
  - Basel III introduced or updated Capital, Leverage, and Liquidity ratios.

- The liquidity coverage ratio (LCR) introduced in Basel III is "*the most important bank regulation to emerge from the financial crisis*" (Gorton and Muir, 2016).
  - $LCR = \frac{Stock\ of\ High\ Quality\ Liquid\ Assets\ (HQLA)}{Total\ stressed\ net\ cash\ outflows\ over\ the\ next\ 30\ days} >= 100\%$

- The measurement of this is subject to intense debate.

Preview of Results

- I find that reclassifying a municipal bond as a high-quality liquid asset for the purpose of bank liquidity management can affect municipal markets and behavior.
  - Assigning the HQLA label to a municipal bond has an effect of between 4.5 and 15 basis points on the yield spread.
  - Municipalities increase issuances of affected bonds, relative to unaffected bonds.

Contribution

- I contribute to the literature on the economic consequences of bank liquidity regulation.
  - Most existing research in this area studies the direct effects on banks.
  - Regulatory research should incorporate an analysis of spillovers (Leuz and Wysocki, 2016).
  - I find that switching a regulatory accounting classification can have spillover effects to *another sector of the economy*.

- Municipal bond pricing
  - I provide evidence that a non-risk, demand based change affects the yield spread of municipal bonds.

Liquidity Coverage Ratio – Basel III

- In December 2010 the Basel Committee on Banking Supervision introduced a new liquidity standard: the Liquidity Coverage Ratio.

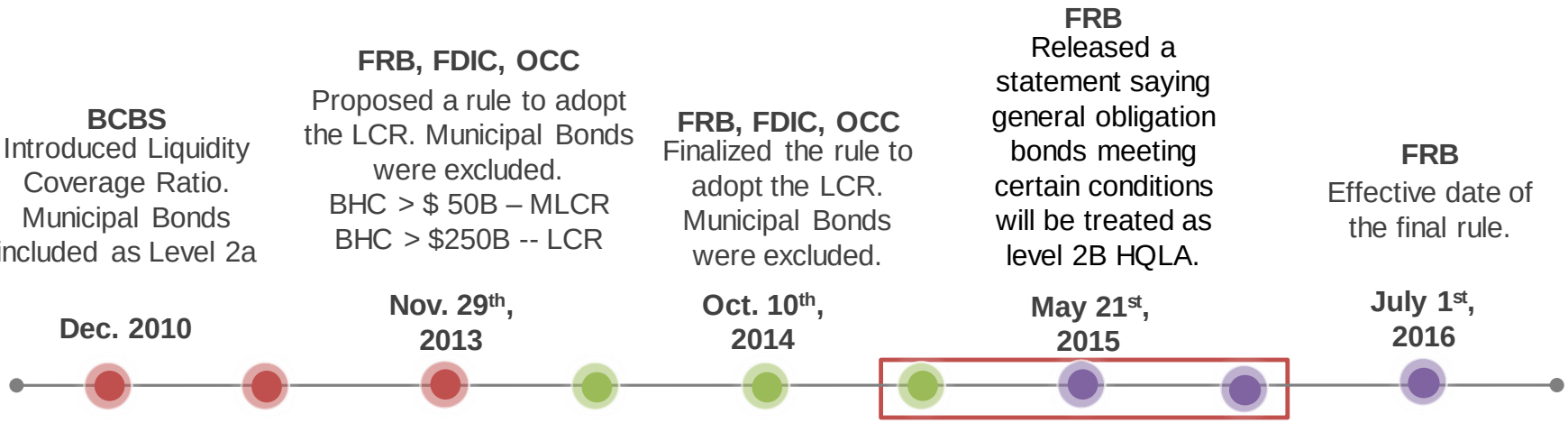
- The goal is for banks to be able to survive a 30 day period of significant stress.

- Three levels of HQLA:
  - Level 1: 0% haircut (e.g. central bank reserves, treasuries)
  - Level 2a: 15% haircut (e.g. certain corporate debt securities, *municipal bonds*)
  - Level 2b: 25% - 50% haircut (e.g. corporate debt securities, equity)

Liquidity Coverage Ratio – U.S. Adoption

- U.S. Regulators excluded municipal bonds in the proposal.
- Banks, issuers, trade associations, and politicians requested that municipal bonds be treated as HQLA.
  - Certain Municipal bonds are as safe and liquid as other assets included in HQLA.
  - Exclusion would “hurt the real engines of the U.S. economy” (Arrieta-Candelaria, 2014)
  - The international standards included municipal bonds in HQLA.
- U.S. Regulators excluded municipal bonds in the final rule.
  - They did not think there would be a significant impact on the municipal market.
- The FRB subsequently reversed its position and included *general obligation* municipal bonds in the computation of the LCR.

Liquidity Coverage Ratio - Timeline



General Obligation Vs. Revenue

- General Obligation Bond (treatment)
  - Backed by the full faith and credit of the issuer
  - 1970-2015 Annual Default Rate - .003%
  - More likely to be subject to constitutional or statutory limits.

- Revenue Bond (control)
  - Backed by the revenue stream from a specific project(s)
    - Toll Roads, Sewer Service, Sports Stadium, etc.
  - 1970-2015 Annual Default Rate - .034%
  - Usually trade at higher yields

Source for defaults: Seeking Alpha – "Municipal Defaults, While Rare, Do Occur" taken from "https://seekingalpha.com/article/4066127-municipal-defaults-while-rare-occur"

Hypothesis Development – Municipal Pricing

- In a competitive market, under standard asset pricing theories, only changes in the fundamentals of a bond should affect its yield.
  - Most prior municipal bond pricing literature examines factors directly related to risk.
  - Municipal bonds are only reclassified from banks' perspective for the LCR, unlikely it would affect the municipalities underlying risk

- However, there is theoretical and empirical evidence that factors unrelated to traditional risk can affect municipal bond yields.
  - Holmström and Tirole (2001) introduce an asset pricing model that incorporates *financial liquidity.*
  - "Safe asset" yields are related to consumer demand (Krishnamurthy and Vissing-Jorgensen 2012).
  - These assets are scarce and thus command a premium (convenience yield).

- *H1: Relative to revenue bonds, the yield spread of general obligation bonds does not change as a result of the FRB's rule change.*

Data Sources

- Municipal Securities Rulemaking Board (WRDS): yield, volume, coupon rates, and maturity date
- SDC Platinum: general obligation identifier, callability, estimated par value, and the issuer's state
- Center for Municipal Finance: credit ratings
- USDT: treasury yields
- BEA: county level population and income
- USDA: county level unemployment

- Samples includes bonds that are uninsured, rated, tax-exempt, and have a time to maturity of between 1 and 30 years.

Research Design

- Municipal bonds trade OTC and are thinly traded relative to exchange traded stocks.
- I follow Cornaggia et al. (2018) and use a 60 day window difference in differences research design centered on the relevant events.
  - Variables are averaged over the 30 day pre-period and 30 day post-period.*
  - I require at least two trades separately in the pre- and post-periods.*

- $Spread = \alpha_1 + \alpha_2 GO + \alpha_3 Post + \boldsymbol{\alpha_4 Post * GO} + \alpha_5 \ln(Time\ to\ Maturity) + \alpha_6 Coupon + \alpha_7 Call + \alpha_8 \ln(Par) + \alpha_8 Negotiated + \alpha_9 FixedRate + FIXED\ EFFECTS + \varepsilon$
  - Spread: Yield of the bond minus a maturity matched Treasury bond's yield.
  - Entropy Balanced

Research Design - Events

- The WSJ report (4/17/15)
- FRB proposal press release (5/21/15)
  - Contain overlapping periods. I combine them into one event (WSJ-PPR): pre-period (3/17/15 – 4/17/15) post-period (5/21/15 – 6/21/15).*
  - This combined event represents the time period in which the market first becomes aware of the proposed change. If there is an effect it would likely be around this event.

- The FRB final press release (4/1/16) (FRPR)
  - Event window: (3/1/16 – 5/1/16).
  - The direction of the effect is not clear in this case. The FRB stayed with the proposal on classifying general obligations as level 2b.

Multivariate Spread Analysis

Panel A: WSJ-PPR

VARIABLES	Spread	Spread	Spread
Post	-0.0008	-0.0026	-0.0321
	(0.958)	(0.863)	(0.249)
GO	0.0096	0.0444	
	(0.661)	(0.181)	
Post*GO	**-0.0500*** **	**-0.0456*** **	**-0.0454*** **
	(0.00292)	**(0.00580)**	**(0.00592)**
Maturity	0.0025*	-0.0038**	-0.174
	(0.0846)	(0.0353)	(0.254)
Volume	-0.0251***	-0.0231***	-0.0227***
	(<.0001)	(<.0001)	(<.0001)
Negotiated	0.0412**	0.0202	
	(0.0496)	(0.539)	
Coupon	-0.225***	-0.233***	
	(<.0001)	(<.0001)	
Ln(Par)	-0.0196*	-0.0312**	
	(0.0994)	(0.0417)	
Call	-0.142***	-0.172***	
	(<.0001)	(<.0001)	
Observations	29,092	29,092	29,092
R-squared	0.627	0.757	0.950
Bond FE	NO	NO	YES
Issuer FE	NO	YES	NO
Ratings FE	YES	YES	YES
State FE	YES	NO	NO
Issuer Type FE	YES	NO	NO

- This is the analysis around the WSJ report (4/17/15) and the proposal press release (5/21/15)
- Across specifications *Post*GO* is significant and represents an effect of about 4.5 to 5 basis points on the Spread.
- Similar to the magnitude found in other studies: Corruption increases yields by about 6 basis points (Butler et al., 2009); Newspaper closings increase yields by about 5 to 11 basis points (Gao et al., 2019).

Multivariate Spread Analysis

Panel B: FRPR

VARIABLES	Spread	Spread	Spread
Post	0.0077	0.0063	0.0114
	(0.186)	(0.282)	(0.297)
GO	0.00878	0.0324	
	(0.570)	(0.145)	
Post*GO	**-0.0071**	**-0.0071**	**-0.0068**
	(0.328)	**(0.328)**	**(0.344)**
Maturity	0.0013	-0.0047***	0.0287
	(0.264)	(0.00110)	(0.802)
Volume	-0.0172***	-0.0163***	-0.0195***
	(<.0001)	(<.0001)	(<.0001)
Negotiated	0.00148	-0.0115	
	(0.924)	(0.579)	
Coupon	-0.191***	-0.203***	
	(<.0001)	(<.0001)	
Ln(Par)	-0.0073	0.0030	
	(0.453)	(0.800)	
Call	-0.116***	-0.137***	
	(<.0001)	(<.0001)	
Observations	32,938	32,938	32,938
R-squared	0.515	0.700	0.944
Bond FE	NO	NO	YES
Issuer FE	NO	YES	NO
Ratings FE	YES	YES	YES
State FE	YES	NO	NO
Issuer Type FE	YES	NO	NO

- This is the analysis around the final rule press release (4/1/16)
- Across specifications *Post*GO* is insignificant.
- Consistent with no additional news.

Triple Difference

Panel A: WSJ-PPR

VARIABLES	Spread	Spread	Spread
AA-*Post*GO	**-0.153****	**-0.152****	**-0.155****
	(0.0330)	**(0.0345)**	**(0.0327)**
Observations	29,092	29,092	29,092
R-squared	0.587	0.751	0.948
Controls	YES	YES	YES
Bond FE	NO	NO	YES
Issuer FE	NO	YES	NO
Ratings FE	NO	NO	NO
State FE	YES	NO	NO
Issuer Type FE	YES	NO	NO

Panel B: FRPR

VARIABLES	Spread	Spread	Spread
AA-*Post*GO	**0.0151**	**0.0124**	**0.0140**
	(0.375)	**(0.472)**	**(0.410)**
Observations	32,938	32,938	32,938
R-squared	0.434	0.693	0.944
Controls	YES	YES	YES
Bond FE	NO	NO	YES
Issuer FE	NO	YES	NO
Ratings FE	NO	NO	NO
State FE	YES	NO	NO
Issuer Type FE	YES	NO	NO

- In order to count as a HQLA a bond must be "investment grade and readily marketable".
- In an MSRB report, the 90th percentile of trades per calendar year was 16.6, while the 95th percentile was 30.6 (MSRB, 2014).
  - My sampling procedure requires *at least* 2 trades in both the month before and after the event.
- I use AA- as a cutoff for investment grade (mentioned in Basel III).
- Incremental effect on "high quality" GO bonds is around 15 basis points in the initial announcement period.
  - No significant effect around the final rule proposal. Again, consistent with no additional news.

Additional Analysis - Pricing

- To further rule out a risk based explanation for a price change, I examine if measured risk is differentially changing for GO bonds after the event windows.
  - Evidence of a deterioration in GO quality relative to REV quality.

- In order to alleviate concerns about the parallel trend assumption I rerun analysis using two separate pseudo event dates.
  - 3/17/15; 2/17/15
  - Each pseudo analysis uses the three separate fixed effect structures and does not produce a *Post*GO* coefficient significant at the 10% level or better. I then rerun each specification using the DDD design. The coefficient on *AA-*Post*GO* is not significant at the 10% level or better.

- As a robustness check, I employ an alternative matching strategy.
  - I match each general obligation bond (if possible) with revenue a bond from the *same issuer*, same years to maturity (rounded), same credit rating, with the smallest difference in pre-period yield spread.
  - Similar results to the entropy balanced results.

Hypothesis Development – Municipal Issuance

- There are municipalities that can issue both general obligation and revenue bonds.
- The decision on what type to issue involves a lot of factors.
  - E.g. Specific project, debt limitations, credit rating concerns, and differences in yields

- If the yield difference widens, I expect municipalities (if able) will issue relatively more general obligation bonds.

- If the yield change is short-term, or if switching between the two bonds is sufficiently costly, then I would not expect an effect.

- *H2: Relative to revenue bond issuances, general obligation bond issuances do not change as a result of the FRB's rule change.*

Research Design

- I limit my analysis to municipalities who issued at least one revenue bond *and* one general obligation bond in the pre period.
- In order to examine municipality behavior, I aggregate variables up to the issuer-bond type-year level.
  - (i.e. for each issuer-year in the data, there is an observation for revenue issuances and general obligation issuances).
- Pre-period 2013-2014; Post-period 2016-2017

- $$Ln(Amount)_t = \beta_0 + \beta_1 Post_t + \beta_2 GO_t + \boldsymbol{\beta_3 Post * GO_t} + \beta_4\, Ln(Population)_t + \beta_5 Population\ Growth_t + \beta_6 Ln(PC\ Income)_t + \beta_7 Unemployment_t + \varepsilon_t$$
  - If GO = 1 (0), then *Amount* is the dollar amount of general obligation (revenue) bonds issued.

Issuance

VARIABLES	(1) Ln(Amount)	(2) Ln(Amount)	(3) Ln(Amount)
GO	0.220*	0.163	0.127
	(0.0670)	(0.207)	(0.314)
Post*GO	**0.321***	**0.334****	**0.332****
	(0.0582)	**(0.0488)**	**(0.0407)**
Ln(Pop)	0.413***	4.658	
	(0)	(0.107)	
Pop Growth	-0.0322	-0.0568	
	(0.688)	(0.612)	
Ln(PC Income)	-0.209	-1.385	
	(0.671)	(0.400)	
Unemployment	-0.0647	0.148	
	(0.488)	(0.312)	
Observations	1,922	1,922	1,922
R-squared	0.256	0.422	0.537
Ratings FE	YES	YES	YES
Issuer FE	NO	YES	NO
State-Year FE	YES	YES	NO
Issuer-Year FE	NO	NO	YES

- *Post*GO* is significant in all Columns and reflects about a 33% increase in GO bond issuance relative to REV bond issuance.
- This provides evidence that the rule change does affect municipality behavior.

Triple Difference

VARIABLES	(1) Ln(Amount)	(2) Ln(Amount)	(3) Ln(Amount)
*Post*GO*	-0.516	-0.733	-0.732
	(0.267)	(0.124)	(0.140)
Post*GO*AA-	**0.981***	**1.203****	**1.171****
	(0.0512)	**(0.0198)**	**(0.0293)**
Observations	1,922	1,922	1,922
R-squared	0.265	0.435	0.550
Controls	YES	YES	YES
Issuer-Type FE	NO	NO	NO
Issuer FE	NO	YES	NO
State-Year FE	YES	YES	NO
Issuer-Year FE	NO	NO	YES

- Similar to pricing analysis, I use AA- as a cutoff for investment grade (mentioned in Basel III).
- There is an Incremental effect for municipalities who issue “high quality” GO bonds.

Municipal Issuances

- I provide evidence that the FRB's rule change did have an impact on the issuance behavior of municipalities.

- The economic magnitude is significant as well.

- Financing costs may be reduced, but there are clear cut costs.
  - The municipality's tax base is at an increased risk.
  - Potential for less "slack" in credit rating.

Mechanism Underlying the Spillover

- Proposed Mechanism: increase in demand by banks

- If reclassifying general obligations as HQLA incentivizes banks to hold more, then the rule change would provide a plausibly exogenous increase to demand.
  - Banks, municipal officials, politicians, and trade groups commented that HQLA status would be an important determinant in demand.
  - However, "the agencies [did] not believe the final rule [would] have a significant impact on the overall demand for municipal securities."

- Roberts et al. (2018) find that banks increase their holdings of HQLA.
- Key issue: General obligation and revenue bond holdings are not disclosed separately by banks.
  - Using a short window around the effective date, I provide evidence that banks increase their municipal bond holdings. I conjecture this is due to an increase in general obligations.

Summary and Conclusion

- This study finds that changing the accounting classification of municipal bonds for the purpose of liquidity regulation can affect pricing and behavior outside of the banking sector.
  - I find that assigning the HQLA label to a municipal bond has an effect of between 4.5 and 15 basis points on the yield spread.
  - This reduction in financing costs appears to influence municipalities' real issuance decisions.

- Potential policy implication: A switch to level 2a status may have an additional effect on the municipal market.
- Important Caveat: My research does not speak to the optimality of switching municipal bonds to HQLA for the purposes of liquidity management.