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

Jacob Ott

Ninth Annual Brookings Municipal Finance Conference
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).
  \[
  LCR = \frac{\text{Stock of High Quality Liquid Assets (HQLA)}}{\text{Total stressed net cash outflows over the next 30 days}} \geq 100\%
  \]

• The measurement of this is subject to intense debate.
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.
• 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**

**Dec. 2010**
- BCBS: Introduced Liquidity Coverage Ratio. Municipal Bonds included as Level 2a

**Nov. 29th, 2013**
- FRB, FDIC, OCC: Proposed a rule to adopt the LCR. Municipal Bonds were excluded.
  - BHC > $50B – MLCR
  - BHC > $250B – LCR

**Oct. 10th, 2014**
- FRB, FDIC, OCC: Finalized the rule to adopt the LCR. Municipal Bonds were excluded.

**May 21st, 2015**
- FRB: Released a statement saying general obligation bonds meeting certain conditions will be treated as level 2B HQLA.

**July 1st, 2016**
- FRB: Effective date of the final rule.

**Jan. 2013**
- BCBS: Issued the revised LCR standard. No relevant changes.

**Jan. 31, 2014**
- FRB, FDIC, OCC: Comment period ended. Hundreds of comments were received. Excluding municipal bonds would “hurt the real engines of the U.S. economy”.

**April 17th, 2015**
- WSJ: The WSJ reported that the FRB was going to propose including municipal bonds.

**April 1st, 2016**
- FRB: Released a statement with a summary of the final rule. Insured bonds can count; 25% CUSIP cap is removed.

**François 30th, 2013**

**Nov. 27th, 2013**
- FRB, FDIC, OCC: Proposed a rule to adopt the LCR. Municipal Bonds were excluded.
  - BHC > $50B – MLCR
  - BHC > $250B – LCR

**Oct. 10th, 2014**
- FRB, FDIC, OCC: Finalized the rule to adopt the LCR. Municipal Bonds were excluded.

**May 21st, 2015**
- FRB: Released a statement saying general obligation bonds meeting certain conditions will be treated as level 2B HQLA.

**July 1st, 2016**
- FRB: Effective date of the final rule.

**Jan. 2013**
- BCBS: Issued the revised LCR standard. No relevant changes.

**Jan. 31, 2014**
- FRB, FDIC, OCC: Comment period ended. Hundreds of comments were received. Excluding municipal bonds would “hurt the real engines of the U.S. economy”.

**April 17th, 2015**
- WSJ: The WSJ reported that the FRB was going to propose including municipal bonds.

**April 1st, 2016**
- FRB: Released a statement with a summary of the final rule. Insured bonds can count; 25% CUSIP cap is removed.
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.
  – “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.*

• $\text{Spread} = \alpha_1 + \alpha_2 GO + \alpha_3 Post + \alpha_4 Post \ast GO + \alpha_5 \ln(\text{Time to Maturity}) + \alpha_6 \text{Coupon} + \alpha_7 Call + \alpha_8 \ln(\text{Par}) + \alpha_8 \text{Negotiated} + \alpha_9 \text{FixedRate} + \text{FIXED EFFECTS} + \epsilon$
  – 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)
  – 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

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Spread</th>
<th>Spread</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>-0.0008</td>
<td>-0.0026</td>
<td>-0.0321</td>
</tr>
<tr>
<td>(0.958)</td>
<td>(0.863)</td>
<td>(0.249)</td>
<td></td>
</tr>
<tr>
<td>GO</td>
<td>0.0096</td>
<td>0.0444</td>
<td></td>
</tr>
<tr>
<td>(0.661)</td>
<td>(0.181)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post*GO</td>
<td>-0.0500***</td>
<td>-0.0456***</td>
<td>-0.0454***</td>
</tr>
<tr>
<td>(0.00292)</td>
<td>(0.00580)</td>
<td>(0.00592)</td>
<td></td>
</tr>
<tr>
<td>Maturity</td>
<td>0.0025*</td>
<td>-0.0038**</td>
<td>-0.174</td>
</tr>
<tr>
<td>(0.0846)</td>
<td>(0.0353)</td>
<td>(0.254)</td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>-0.0251***</td>
<td>-0.0231***</td>
<td>-0.0227***</td>
</tr>
<tr>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td></td>
</tr>
<tr>
<td>Negotiated</td>
<td>0.0412**</td>
<td>0.0202</td>
<td></td>
</tr>
<tr>
<td>(0.0496)</td>
<td>(0.539)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupon</td>
<td>-0.225***</td>
<td>-0.233***</td>
<td></td>
</tr>
<tr>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(Par)</td>
<td>-0.0195*</td>
<td>-0.0312**</td>
<td></td>
</tr>
<tr>
<td>(0.0994)</td>
<td>(0.0417)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call</td>
<td>-0.142***</td>
<td>-0.172***</td>
<td></td>
</tr>
<tr>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Spread</th>
<th>Spread</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>0.0077</td>
<td>0.0063</td>
<td>0.0114</td>
</tr>
<tr>
<td></td>
<td>(0.186)</td>
<td>(0.282)</td>
<td>(0.297)</td>
</tr>
<tr>
<td>GO</td>
<td>0.00878</td>
<td>0.0324</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.570)</td>
<td>(0.145)</td>
<td></td>
</tr>
<tr>
<td>Post*GO</td>
<td>-0.0071</td>
<td>-0.0071</td>
<td>-0.0068</td>
</tr>
<tr>
<td></td>
<td>(0.328)</td>
<td>(0.328)</td>
<td>(0.344)</td>
</tr>
<tr>
<td>Maturity</td>
<td>0.0013</td>
<td>-0.0047***</td>
<td>0.0287</td>
</tr>
<tr>
<td></td>
<td>(0.264)</td>
<td>(0.00110)</td>
<td>(0.802)</td>
</tr>
<tr>
<td>Volume</td>
<td>-0.0172***</td>
<td>-0.0163***</td>
<td>-0.0195***</td>
</tr>
<tr>
<td></td>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
</tr>
<tr>
<td>Negotiated</td>
<td>0.00148</td>
<td>-0.0115</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.924)</td>
<td>(0.579)</td>
<td></td>
</tr>
<tr>
<td>Coupon</td>
<td>-0.191***</td>
<td>-0.203***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td></td>
</tr>
<tr>
<td>Ln(Par)</td>
<td>-0.0073</td>
<td>0.0030</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.453)</td>
<td>(0.800)</td>
<td></td>
</tr>
<tr>
<td>Call</td>
<td>-0.116***</td>
<td>-0.137***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(&lt;.0001)</td>
<td>(&lt;.0001)</td>
<td></td>
</tr>
</tbody>
</table>

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

### Panel A: WSJ-PPR

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Spread</th>
<th>Spread</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AA-Post*GO</strong></td>
<td>-0.153** (0.0330)</td>
<td>-0.152** (0.0345)</td>
<td>-0.155** (0.0327)</td>
</tr>
<tr>
<td>Observations</td>
<td>29,092</td>
<td>29,092</td>
<td>29,092</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.587</td>
<td>0.751</td>
<td>0.948</td>
</tr>
<tr>
<td>Controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Bond FE</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Issuer FE</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Ratings FE</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>State FE</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Issuer Type FE</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

### Panel B: FRPR

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Spread</th>
<th>Spread</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AA-Post*GO</strong></td>
<td>0.0151 (0.375)</td>
<td>0.0124 (0.472)</td>
<td>0.0140 (0.410)</td>
</tr>
<tr>
<td>Observations</td>
<td>32,938</td>
<td>32,938</td>
<td>32,938</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.434</td>
<td>0.693</td>
<td>0.944</td>
</tr>
<tr>
<td>Controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Bond FE</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Issuer FE</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Ratings FE</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>State FE</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Issuer Type FE</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>
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

\[
\ln(Amount)_t = \beta_0 + \beta_1 Post_t + \beta_2 GO_t + \\
\beta_3 Post \times GO_t + \beta_4 \ln(Population)_t + \beta_5 Population\ Growth_t + \\
\beta_6 \ln(PC\ Income)_t + \beta_7 Unemployment_t + \epsilon_t
\]

  – If GO = 1 (0), then Amount is the dollar amount of general obligation (revenue) bonds issued.
### Issuance

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.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ln(Amount)</td>
<td>Ln(Amount)</td>
<td>Ln(Amount)</td>
</tr>
<tr>
<td>GO</td>
<td>0.220*</td>
<td>0.163</td>
<td>0.127</td>
</tr>
<tr>
<td></td>
<td>(0.0670)</td>
<td>(0.207)</td>
<td>(0.314)</td>
</tr>
<tr>
<td>Post*GO</td>
<td>0.321*</td>
<td>0.334**</td>
<td>0.332**</td>
</tr>
<tr>
<td></td>
<td>(0.0582)</td>
<td>(0.0488)</td>
<td>(0.0407)</td>
</tr>
<tr>
<td>Ln(Pop)</td>
<td>0.413***</td>
<td>4.658</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(0.107)</td>
<td></td>
</tr>
<tr>
<td>Pop Growth</td>
<td>-0.0322</td>
<td>-0.0568</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.688)</td>
<td>(0.612)</td>
<td></td>
</tr>
<tr>
<td>Ln(PC Income)</td>
<td>-0.209</td>
<td>-1.385</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.671)</td>
<td>(0.400)</td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td>-0.0647</td>
<td>0.148</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.488)</td>
<td>(0.312)</td>
<td></td>
</tr>
</tbody>
</table>

- **Observations**: 1,922
- **R-squared**: 0.256
- **Ratings FE**: YES
- **Issuer FE**: NO
- **State-Year FE**: YES
- **Issuer-Year FE**: NO
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.

\[
\begin{array}{cccc}
\text{VARIABLES} & \text{(1) Ln(Amount)} & \text{(2) Ln(Amount)} & \text{(3) Ln(Amount)} \\
\text{Post*GO} & -0.516 & -0.733 & -0.732 \\
 & (0.267) & (0.124) & (0.140) \\
\text{Post*GO*AA-} & 0.981^* & 1.203^{**} & 1.171^{**} \\
 & (0.0512) & (0.0198) & (0.0293) \\
\text{Observations} & 1,922 & 1,922 & 1,922 \\
\text{R-squared} & 0.265 & 0.435 & 0.550 \\
\text{Controls} & \text{YES} & \text{YES} & \text{YES} \\
\text{Issuer-Type FE} & \text{NO} & \text{NO} & \text{NO} \\
\text{Issuer FE} & \text{NO} & \text{YES} & \text{NO} \\
\text{State-Year FE} & \text{YES} & \text{YES} & \text{NO} \\
\text{Issuer-Year FE} & \text{NO} & \text{NO} & \text{YES}
\end{array}
\]
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.