Liquidity, Liquidity Risk and Spreads: Some Results and Open Questions

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Outline

• Spread puzzle for corporate bonds
• Liquidity and liquidity risk
  ✓ Framework
  ✓ Measurement
  ✓ Examples
  ✓ Evidence
• Open questions
• Time-varying risk-premium
Spread Puzzle

- **Spread** - Difference between yields on corporate bonds and equivalent maturity treasuries is *too high*
  - Inconsistent with
    - Observed default rates and recoveries
    - Structural models of credit risk a la Merton (1973)
  - Huang and Huang (2005): AAA spread close to zero!
- **Changes in the spread** are not explained well
  - By changes in factors affecting credit risk
    - Collin-Dufresne, Goldstein and Martin (2001)
  - R² of 30% to 40% only, higher for lower-rated bonds
  - Unexplained portion appears to have a common factor
Preferred Explanations

- **Hedge ratios** from credit risk models are close to the empirically computed hedge ratios
  - Schaefer and Strebulaev (2004)
  - Unexplained portion thus most likely unrelated to credit risk

- **Liquidity and liquidity risk**
  - A burgeoning area of research but many open questions

- **Time-varying risk-premium**
  - A less commonly adopted approach but potentially important

- **Are these two explanations related?**
Liquidity and Liquidity Risk

• *A useful framework: Acharya-Pedersen (2005)*

\[
E_t(r^i_{t+1} - c^i_{t+1}) = r^f + \lambda_t \frac{\text{cov}_t(r^i_{t+1} - c^i_{t+1}, r^M_{t+1} - c^M_{t+1})}{\text{var}_t(r^M_{t+1} - c^M_{t+1})}
\]

- **Expected illiquidity:** \( E_t(c^i_{t+1}) \)
- **Liquidity risk(s):**
  \( \text{cov}_t(c^i_{t+1}, c^M_{t+1}) \)
  \( \text{cov}_t(c^i_{t+1}, r^M_{t+1}) \)
  \( \text{cov}_t(r^i_{t+1}, c^M_{t+1}) \)
- **Risk premium:**

\[
\lambda_t = E_t(r^M_{t+1} - c^M_{t+1} - r^f)
\]
Liquidity and Liquidity Risk

• A useful framework: Acharya-Pedersen (2005)

\[ E_t(r^i_{t+1} - c^i_{t+1}) = r^f + \lambda_t \frac{\text{cov}_t(r^i_{t+1} - c^i_{t+1}, r^M_{t+1} - c^M_{t+1})}{\text{var}_t(r^M_{t+1} - c^M_{t+1})} \]

✓ Expected illiquidity: \( E_t(c^i_{t+1}) \)
✓ Liquidity risk(s): \( \text{cov}_t(c^i_{t+1}, c^M_{t+1}) \), \( \text{cov}_t(c^i_{t+1}, r^M_{t+1}) \)
✓ Risk premium: \( \lambda_t = E_t(r^M_{t+1} - c^M_{t+1} - r^f) \)
Liquidity and Liquidity Risk

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Liquidity and Liquidity Risk


\[
E_t(r_{t+1}^i - c_{t+1}^i) = r^f + \lambda_t \frac{\text{cov}_t(r_{t+1}^i - c_{t+1}^i, r_{t+1}^M - c_{t+1}^M)}{\text{var}_t(r_{t+1}^M - c_{t+1}^M)}
\]

✓ Expected illiquidity:

✓ Liquidity risk(s):

✓ Risk premium:

\[
\lambda_t = E_t(r_{t+1}^M - c_{t+1}^M - r^f)
\]
## Bond Liquidity Measures

<table>
<thead>
<tr>
<th><strong>One-way or round-trip cost (bid-ask spread)</strong></th>
<th>Chen, Lesmond and Wei (2005), Goldstein, Hotchkiss and Sirri (2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency of zero returns</strong> and its variants</td>
<td>Lesmond, Ogden and Trzcinka (1999), Chen, Lesmond and Wei (2005)</td>
</tr>
<tr>
<td><strong>Accessibility</strong>: Turnover of portfolios holding the bond</td>
<td>Chacko (2005), Chacko, Mahanti, Mallik and Subrahmanyam (2005)</td>
</tr>
</tbody>
</table>
Example: Trade Size

• From Goldstein, Hotchkiss and Sirri (2005): BBB bonds
  
  ✓ 2.35% for trades of 10 bonds, with a standard deviation of 4.33%
    • Comparable stocks: market capitalization of USD 50 million
      (Portfolio 22 out of 25 illiquidity-sorted portfolios)

  ✓ 0.45% for trades of >=1000 bonds, standard deviation of 1.04%
    • Comparable stocks: market capitalization of USD 250 million
      (Portfolio 13 out of 25 illiquidity-sorted portfolios)

• Suggests substantial illiquidity on average
Example: Cross-section

From Chen, Lesmond and Wei (2005):

<table>
<thead>
<tr>
<th>Liquidity &amp; Yield Spreads</th>
<th>AAA</th>
<th>AA</th>
<th>A</th>
<th>BBB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeros (%)</td>
<td>9.79</td>
<td>12.59</td>
<td>10.61</td>
<td>11.94</td>
</tr>
<tr>
<td>LOT (bp)</td>
<td>24.28</td>
<td>47.26</td>
<td>57.74</td>
<td>70.29</td>
</tr>
<tr>
<td>Yield Spread (bp)</td>
<td>82.44</td>
<td>146.24</td>
<td>177.68</td>
<td>277.45</td>
</tr>
<tr>
<td>N</td>
<td>49</td>
<td>120</td>
<td>539</td>
<td>730</td>
</tr>
<tr>
<td>Zeros (%)</td>
<td>10.36</td>
<td>8.34</td>
<td>6.62</td>
<td>8.91</td>
</tr>
<tr>
<td>LOT (bp)</td>
<td>25.00</td>
<td>36.17</td>
<td>36.82</td>
<td>51.45</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>S&amp;P Credit Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB</td>
</tr>
<tr>
<td>259.34</td>
</tr>
<tr>
<td>566.53</td>
</tr>
<tr>
<td>152</td>
</tr>
<tr>
<td>42.40</td>
</tr>
<tr>
<td>266.11</td>
</tr>
<tr>
<td>54.65</td>
</tr>
<tr>
<td>497.45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yield Spread (bp)</th>
<th>70.65</th>
<th>129.02</th>
<th>154.19</th>
<th>251.68</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>37</td>
<td>67</td>
<td>386</td>
<td>394</td>
</tr>
<tr>
<td>Bid-Ask (bp)</td>
<td>49.52</td>
<td>36.57</td>
<td>38.20</td>
<td>44.22</td>
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Liquidity and Spreads

• Chen, Lesmond and Wei (2005): \( E_t(c_{t+1}^i) \)

• *Cross-sectional* regressions:
  ✓ Investment grade bonds:
    • 1 bp bid-ask implies 0.42 bp increase in spread, \( R^2 = 7\% \)
  ✓ Speculative grade bonds:
    • 1 bp bid-ask implies 2.3 bp increase in spread, \( R^2 = 22\% \)

• *Time-series* regressions: Similar effects

• Do we expect the effect of bid-ask to be *so large*?
Liquidity and Liquidity Risk

• **Recall**

\[
E_t(r_{t+1}^i - c_{t+1}^i) = r_f^i + \lambda_t \frac{\text{cov}_t(r_{t+1}^i - c_{t+1}^i, r_{t+1}^M - c_{t+1}^M)}{\text{var}_t(r_{t+1}^M - c_{t+1}^M)}
\]

✓ **Expected illiquidity:**

✓ **Liquidity risk(s):**

✓ **Risk premium:**

\[
\lambda_t = E_t(r_{t+1}^M - c_{t+1}^M - r_f^i)
\]
Measurement of Liquidity Risk

- Exposure of bond returns to liquidity risk: \( \text{cov}_t(r^i_{t+1}, c^M_{t+1}) \)
  - **Corporate bond-market factor**
    - Of high minus low liquidity portfolio returns
      - Downing, Underwood and Xing (2005)
      - Chacko (2005)
  - **Equity-market liquidity fluctuations**
    - de Jong and Driessen (2005)
  - **Treasury-market liquidity fluctuations**
    - Longstaff, Mithal and Neis (2004), de Jong and Driessen (2005)
Liquidity Risk and Spreads

• Credit, interest rate, and liquidity risks *correlated*

• Downing, Underwood and Xing (2005):
  ✓ *Liquidity risk* adds 15% in explaining bond returns

• Chacko (2005): *Alphas* on liquidity risk portfolios

• de Jong and Driessen (2005):
  ✓ One standard deviation *shock in stock market and treasury liquidity* each changes bond returns by 0.3%
  ✓ Contribute 45 bps to spread for investment grade bonds
    100 bps for (some) speculative grade bonds
Figure 3: Illiquidity measure for US government bond market and credit spread

10-Year Bond: Bid-Ask Spread and Avg. Credit Spread

Credit spread: average across rating categories

Bid-ask spread: 10-yr gov't bond

The graph shows the bid-ask spread on 10-year US government bonds, and, for comparison, the average credit spread across all US indices.
Open Questions

• Evidence of **liquidity** and **liquidity risk** effects on bond spreads consistent and compelling

• **But are the effects distinct from each other?**
  - Liquidity studies do not control for liquidity risk, and vice-versa
  - **Illiquidity and liquidity risk are highly correlated**
    - Acharya and Pedersen (2005)

• Illiquidity effect should be $1 / \text{Holding Period (yrs)}$
• Other forms of liquidity risk may be important

\[
\text{cov}_t(c_{t+1}^i, c_{t+1}^M) \quad \text{cov}_t(c_{t+1}^i, r_{t+1}^M)
\]
Open Questions (continued)

- How does the evidence on liquidity and liquidity risk relate to the time-series spread puzzle?
- Is the *common factor in residuals* from Collin-Dufresne, Goldstein and Martin (2001) closely related to a *liquidity risk factor*?
  - Chen, Lesmond and Wei (2005) relate bond spread changes to liquidity changes for that bond
  - Commonality in liquidity changes? $\text{cov}_t(c^d_{t+1}, c^M_{t+1})$
  - Is liquidity risk time-varying?
Time-varying Risk-premium

- Two views: \( \lambda_t = E_t(r_{t+1}^M - c_{t+1}^M - r_f^M) \)

- **Risk-premium common across equities and bonds**
  - Chen, Collin-Dufresne and Goldstein (2005)
  - Pricing kernel from habit-formation models helps explain/fit the BBB-AAA spread
  - BBB-AAA: *credit* spread, AAA-Tsy: *liquidity* spread

- **Risk-premium in bonds due to market segmentation**
  - Lack of capital mobility into bond markets upon common shocks to banks and financial institutions
    - Example: GM and Ford downgrade in May 2005
  - Bond-market *liquidity risk* should capture this: Does it?
Figure 1: Estimated actual and risk-neutral 1-year default probabilities for Disney.
Conclusion

- Much has been accomplished over the past year
  - Measuring corporate bond market liquidity
  - Quantifying the liquidity risk of corporate bonds
  - Relating liquidity and liquidity risk to spreads
- Much remains to be done
  - Isolating effects of liquidity and liquidity risk
  - Relating these effects to time-series of spread changes
  - Understanding their relationship with time-varying risk-premium