Illiquidity or Credit Deterioration: A Study of Liquidity in the US Corporate Bond Market during Financial Crisis

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INQUIRE Europe and INQUIRE UK SPRING SEMINAR
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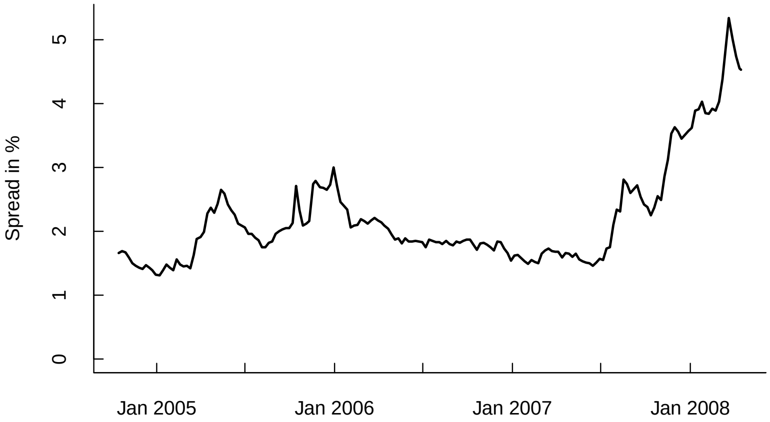
Introduction

- The ongoing financial crisis has shown that credit and liquidity risk are key determinants of asset prices.
- It is important to understand their (relative) effects and how the change during crises.
- The most affected financial markets have an over-the-counter (OTC) structure that makes research difficult.
- Our analysis explores time-series and cross-sectional aspects of US corporate yield spreads.
- The US corporate bond market is an ideal laboratory as detailed transaction data (since 2004) is available.

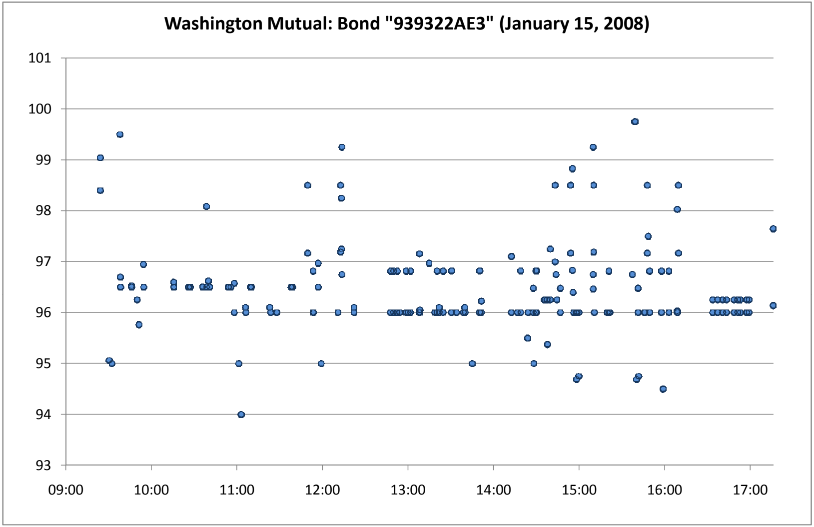
Dramatic increase of avg. US corporate bond yield spread



Research questions

- How can we measure liquidity both at the level of individual bonds and the aggregate market?
- To what degree is liquidity priced in the US corporate bond market?
- How do the liquidity and credit factors interact?
- Is the effect of liquidity stronger in times of financial crises vs. a normal period?
- How do different segments of the bond market react on liquidity effects?

Liquidity measures based on transaction data



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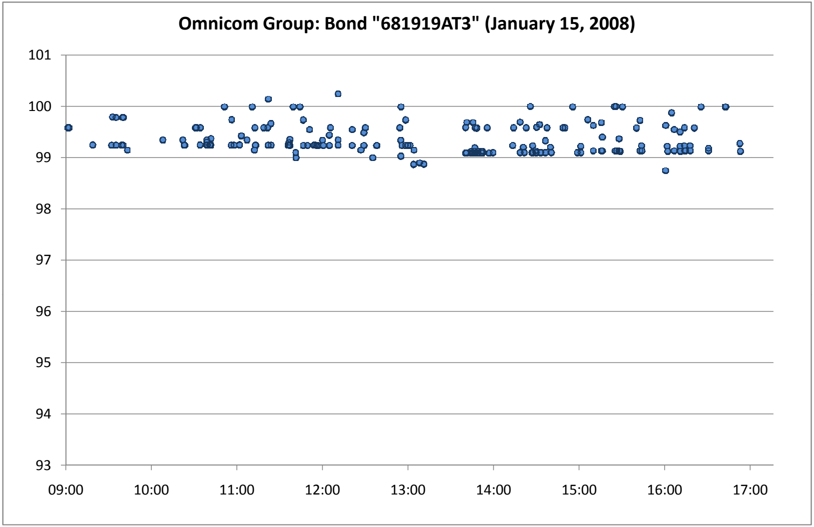

Relevant papers on liquidity

Impact of liquidity on asset prices

- Amihud and Mendelson (JFE, 1986) → liquidity priced
- Amihud, Mendelson and Pedersen (FTF, 2006) → overview

Evidence for corporate bond markets

- Longstaff, Mithal and Neis (JOF, 2005) → reduced-form models
- Huang and Huang (WP, 2003) → structural models

Bond characteristics and trading activity

- Fisher (JPE, 1959)
- Elton, Gruber, Agrawal and Mann (JOF, 2001) ...
- Edwards, Harris and Piwowar (JOF, 2007)

Relevant papers on liquidity

Liquidity measures

- Roll (JOF, 1984) → Roll measure
- Amihud (JFM, 2002) → Amihud measure
- Chen, Lesmond and Wei (JOF, 2007) → LOT measure
- Mahanti, Nashikkar, Subrahmanyam, Chacko and Mallik (JFE, 2008) → latent liquidity
- Jankowitsch, Nashikkar and Subrahmanyam (WP, 2009) → price dispersion measure

Liquidity studies for the financial crisis

- Bao, Pan and Wang (WP, 2008) → focus on Roll measure
- Dick-Nielsen, Feldhütter and Lando (WP, 2009) → various proxies

Data sources

Four different data sources

- Transaction data from TRACE
- Consensus market valuations from Markit
- Bid-ask quotations from Bloomberg
- Credit ratings from Standard and Poor's
- Bond characteristics from Bloomberg
- Treasury and swap data from Bloomberg

Data between Oct 2004–Apr 2008

- 31,911 bonds
- 4,482 issuers
- 20.7 million trades

Various liquidity proxies under consideration

Bond characteristics

- Amount issued $\uparrow$
- Coupon $\downarrow$
- Age $\downarrow$
- Maturity $\downarrow$
- Industry

Trading activity variables

- Number of trades $\uparrow$
- Trade volume $\uparrow$
- Number of traded bonds $\uparrow$

$\uparrow$ $\downarrow$ ... *assumed impact on liquidity*

Various liquidity proxies under consideration

Liquidity measures

- No-trade measure ↓
- Zero-return measure ↓
- Bid-ask spread ↓
- Price dispersion measure ↓
- Roll measure ↓
- Amihud measure ↓

↑ ↓ . . . *assumed impact on liquidity*

Liquidity measures based on transaction data

Price dispersion measure

$$\text{Price dispersion}_t = \sqrt{\frac{1}{\sum_{j=1}^{N_t} v_j} \sum_{j=1}^{N_t} (p_j - m_t)^2 v_j},$$

Roll measure

$$\text{Roll}_t = 2\sqrt{-\operatorname{Cov}(\Delta p_j, \Delta p_{j-1})}.$$

- p_j ... traded price
- v_j ... traded volume
- m_t ... market-wide evaluation
- N_t ... number of observations

Liquidity measures based on transaction data

Amihud measure

$$\text{Amihud}_t = \frac{1}{N_t} \sum_{j=1}^{N_t} \frac{|r_j|}{v_j},$$

- r_j ... return based on traded prices
- v_j ... traded volume
- N_t ... number of observations

Measuring liquidity

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  1. GM/Ford crisis (Mar 05–Jan 06)
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  3. Sub-prime crisis (since Jul 07)

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- Sub-segments of the market reveal whether liquidity is priced differently
  1. Financial vs. industrial bonds
  2. Investment vs. speculative grade bonds
  3. Retail (<$25,000) vs. institutional (>$500,000) traded bonds

Time-series and cross-sectional analysis

Time-series regression model

$$\begin{aligned}
\Delta(\text{Yield Spread})_t \;=\;& \alpha_0 + \alpha_1 \cdot \Delta(\text{Yield Spread})_{t-1} \\
& + \alpha_2 \cdot \Delta(\text{Rating Variable})_t \\
& + \boldsymbol{\beta} \cdot \Delta(\text{Bond Characteristics})_t \\
& + \boldsymbol{\gamma} \cdot \Delta(\text{Trading Activity Variables})_t \\
& + \boldsymbol{\lambda} \cdot \Delta(\text{Liquidity Measures})_t + \epsilon_t
\end{aligned}$$

Cross-sectional regression model

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\text{Yield Spread}_i \;=\;& \alpha_0 + \alpha_1 \cdot \text{Rating Variable}_i \\
& + \boldsymbol{\beta} \cdot \text{Bond Characteristics}_i \\
& + \boldsymbol{\gamma} \cdot \text{Trading Activity Variables}_i \\
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	GM/Ford	Normal	Sub-prime
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Roll (%)	1.44	1.25	1.60
Bid-Ask (%)	0.41	0.47	0.47

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Bid-Ask (%)	0.41	0.47	0.47
Amihud (10^{-8})	0.59	0.48	0.63
Zero Return (Markit) (%)	3.04	3.64	7.23
Zero Return (Bloomberg) (%)	4.30	6.81	5.47
No-Trade (%)	78.47	80.53	83.48

Time-series results

	Total	GM/Ford	Normal	Sub-prime
Intercept	0.0118	−0.0088	−0.0011	0.0469*
	(1.1965)	(−0.3874)	(−0.1272)	(1.8150)
Lagged ΔYld.Spr.	0.1665**	−0.0102	0.0676	0.3257**
	(2.1698)	(−0.0668)	(0.5737)	(2.1397)
ΔRating	0.2668***	0.1925	0.3179***	−0.1730
	(3.2171)	(0.9233)	(3.7484)	(−0.5309)
ΔPrice Dispersion	2.1478***	3.0403***	0.6475*	2.3735***
	(8.8143)	(3.0616)	(1.8011)	(4.2724)
ΔBid-Ask Spread	0.4279	0.0988	0.4038	−1.2564
	(0.7366)	(0.1363)	(0.7380)	(−0.5531)
ΔAmihud Measure	0.0936	0.0208	0.0337	0.6310
	(0.7171)	(0.1082)	(0.2049)	(1.4880)
ΔRoll Measure	0.5899***	0.8619**	0.2172	0.5507
	(2.6506)	(2.0814)	(0.7613)	(0.8675)
R^2	0.463	0.685	0.258	0.551
Observations	184	48	74	42

Economic significance

Std. dev. of yield spread changes

in bp	Total	GM/Ford	Normal	Sub-prime
Δ(Yld. spr.)	14.6	18.1	5.8	21.0

Effect on yield spread by one std. dev. change in...

in bp	Total	GM/Ford	Normal	Sub-prime
Δ(Rating)	3.6		4.5	
Δ(Price disp.)	7.6	11.3		12.4
Δ(Roll)	2.3	4.5		

Time-series results

- In the time-series direct measures of transaction costs are the most promising liquidity variables.
- Bond characteristics and trading activity variables do not show explanatory power.
- Considering the economical significance, the price dispersion has the highest impact.
- We find that approximately one-third of the time-series variation can be explained by the liquidity measures.
- In the crisis periods liquidity effects are even more pronounced.
- However, the GM/Ford crisis and the sub-prime crisis show differences in trading activity and flight-to-quality effects.
- Overall, liquidity is an important driver of US corporate yield spreads.

Financial vs. industrial bonds

- In normal periods, financial bonds have lower spreads compared to industrial bonds, whereas in times of crisis this difference is closer to zero.
- Yield spread of financial bonds react stronger in crisis periods.
- Rating and volume of traded financial bonds increased in sub-prime crisis $\rightarrow$ flight-to-quality.
- In general, liquidity is higher for financial bonds.
- In the sub-prime crisis the difference in liquidity is even more pronounced (measured by the price dispersion).
- However, price dispersion parameter of financial bonds is higher (about 50%) $\rightarrow$ financial bonds react stronger to changes in liquidity.
- Overall, increase in yield spreads for financial bonds relatively more due to credit risk (see cross-sectional results).

Investment vs. speculative grade bonds

- In general, the results show that the liquidity component is far more important for speculative grade bonds.
- Liquidity is lower for speculative grade bonds and we observe stronger reaction on liquidity changes $\rightarrow$ price dispersion significant in all sub-periods.
- Only in the GM/Ford crisis we find higher trading activity for speculative grade bonds $\rightarrow$ shuffling of clienteles due to downgrades.
- Only for investment grade traded bonds ratings improved in sub-prime crisis $\rightarrow$ flight-to-quality.

Institutional vs. retail traded bonds

- Large portion (60%) of bonds fall into retail category.
- Retail traders invest in better rated bonds (1 1/2 notches).
- Rating of retail traded bonds improved in sub-prime crisis $\rightarrow$ flight-to-quality.
- Higher price dispersion for retail traded bonds $\rightarrow$ lower liquidity.
- Liquidity of institutional traded bonds is reduced to a much larger extent in sub-prime crisis.
- Institutional traders react stronger to changes in liquidity.
- Change in credit rating always significant for institutional traded bonds $\rightarrow$ clientele preferences.

Cross-sectional results

	GM/Ford	Normal	Sub-prime
Intercept	2.608***	1.813***	0.892***
	(27.226)	(25.903)	(23.618)
Rating	1.534***	0.959***	1.424***
	(141.150)	(121.519)	(96.412)
Price disp.	1.606***	0.977***	1.043***
	(31.910)	(23.519)	(19.896)
Volume	−0.342***	−0.194***	
	(−43.115)	(−33.753)	
Amihud			0.210***
			(16.735)
Maturity			−0.066***
			(−24.668)
Financial			1.182***
			(28.525)
R^2	0.622	0.502	0.455
Observations	14,066	16,047	14,000

Cross-sectional results

- Cross-sectional results confirm the time-series results.
- Beside the transaction cost measure, trading activity itself is of importance.
- The liquidity measures have economically significant effects.
- This effect almost doubles during the financial crises.
- Additionally, we find that financial bonds were particulary affected by the sub-prime crisis.
- The results indicate that this increase in spreads is more related to credit risk.

Conclusion

- We provide both time-series and cross-sectional evidence of the effect of liquidity in the US corporate bond market.
- We employ a wide range of liquidity measures.
- Overall, liquidity is an important risk factor for corporate bond prices.
- In the time-series liquidity effects explain about one-third of the aggregate yield spread variation.
- In the sub-prime crisis the price dispersion measure explains about half of the market-wide variation.
- The most promising liquidity measures are based on transaction costs, e.g. price dispersion measure, as motivated by the market-microstructure literature.
- Results are relevant for pricing, risk management, and regulatory policy making.