Debt, Information, and Illiquidity
by
Efraim Benmelech and Nittai Bergman

Discussion

Pierre Collin-Dufresne
SFI@EPFL and CEPR

NBER July 2017

- Summary
- The literature
- The Evidence
- Comments
- Conclusion

Summary

- Compute Roll (1984) illiquidity measure for bonds as in Bao, Pan, Wang (2011) using Trace data from 2002-2012.
- Run cross-sectional panel regressions of firms' illiquidity measures on various characteristics (with bond and time fixed effects). They find:

(1) Illiquidity is higher for bonds that are riskier:

- lower bond prices
- higher credit spreads
- lower past industry returns
- lower stock returns.
- worse credit ratings.
- higher equity volatility.
- higher bond maturity.
- without collateral.

(2) Illiquidity is non-linear in price deciles: highest in lowest price decile.

(3) Sensitivity of bond illiquidity to bond price increases with equity volatility and decreases with bond maturity.

$\Rightarrow$ *'results confirm the notion that liquidity is determined by informational sensitivity of debt contracts'* and support *asym-info sec-design model* of Dang, Gorton, Holmstrom.

(4) Illiquidity is increasing in downgrade since issuance holding fixed current rating.

$\Rightarrow$ *'Strong support for Hanson and Sunderam (2013) hypothesis'* that *'bonds issued at higher ratings do not develop a robust information-gathering infrastructure.'*

Large literature on bond liquidity

- Many papers have shown that illiquid bonds have higher credit spreads (Chen, Lesmond and Wei (2007), Houweling, Mentink, and Vorst (2005), Downing, Underwood, and Xing (2005), de Jong and Driessen (2006), Sarig andWarga (1989), Covitz and Downing (2007), Bao, Pan, Wang (2011))
- Also many papers that investigate determinants of bond specific liquidity-measures: (Edwards, Harris and Piwowar (2007), Dick-Nielsen, Feldhťter, and Lando (2012), Chacko, Mahanti, Mallik, Subrahmanyam (2008), Chacko (2005), Bao, Pan, Wang (2011))
- Recently renewed interest in bond market liquidity post-Dodd-Frank by regulators and academics (FINRA, IOSCO, NYFed, Blackrock, Bessembinder, Jacobsen, Maxwell, Venkataram (2017), Anderson and Stulz (2017))
- This literature documents that bond illiquidity increases with (risk):
  - worse bond rating
  - higher credit spreads
  - longer bond maturity
  - greater bond age
  - smaller bond issue size
  - smaller lagged equity returns
  - higher equity volatility

$\Rightarrow$ need to appropriately reference the literature.

Edwards, Harris and Piwowar (2007)

Table V

Cross-Sectional Transaction Cost Determinants

This table reports estimated regression coefficients in which estimated percentage transaction costs for various representative trade sizes are related to various bond characteristics. The transaction cost estimates are obtained for each bond by estimating (6) as described in the text. Variables with unit descriptions are continuous and those without are indicators. The regression is estimated using weighted least squares, where the weights are the inverses of the predicted values from the regression of the squared OLS residuals on a constant and the estimated error variances of the transaction cost estimates, as described in the text. Coefficient estimate *t*-statistics appear in parentheses.

	Coefficient Estimate					*t*-Statistic				
Representative Trade Size	10	20	100	200	1,000	10	20	100	200	1,000
Intercept (basis points)	−85.0	−79.0	−58.8	−47.6	−23.2	−37.6	−38.6	−39.9	−39.7	−29.7
Credit rating is BBB	4.4	3.4	4.2	4.6	3.1	7.0	5.7	8.2	10.2	10.3
Credit rating is B or BB	24.0	17.9	11.6	10.4	5.7	23.3	18.8	15.9	17.1	14.8
Credit rating is C and below	57.4	43.8	25.8	20.2	8.3	35.9	30.3	25.8	25.3	17.4
Coupon rate	1.5	1.1	0.3	0.1	0.1	8.1	6.4	2.2	1.5	3.7
Bond is in default	13.7	19.0	24.2	21.1	12.0	3.0	4.7	8.9	10.1	9.7
Years since issuance (sq. root)	5.8	5.7	4.4	4.3	3.5	16.1	16.9	15.9	18.3	22.7
Years to maturity (sq. root)	28.0	25.7	15.7	10.8	3.1	112.3	110.1	87.7	72.4	30.5
Bond is soon to be called	−73.5	−71.5	−44.8	−30.3	−18.7	−16.7	−15.8	−9.1	−7.0	−6.1
Bond has a sinking fund	−22.6	−19.3	−5.0	0.5	10.1	−4.1	−3.9	−1.6	0.2	7.6
Inverse average price (inverse percent of par)	7,508.9	7,107.8	5,317.4	4,251.0	2,098.4	44.0	47.1	53.8	55.3	41.1
Issue size (sq. root of millions)	−0.19	−0.27	−0.26	−0.22	−0.16	−5.5	−8.6	−11.7	−11.9	−13.7
Total other issues by same issuer (sq. root of millions)	0.06	0.06	0.07	0.06	0.01	19.3	22.0	30.6	28.1	7.2
Attached call	−8.8	−3.9	−0.9	−1.4	3.5	−11.4	−5.4	−1.5	−2.9	11.4
Attached put	−35.1	−36.7	−27.7	−19.0	−2.6	−12.0	−14.1	−15.3	−13.3	−2.7
Floating rate bond	−16.2	−15.2	−13.9	−13.7	−8.7	−8.5	−8.8	−10.6	−11.8	−9.0
Variable rate bond	11.6	11.2	8.7	5.3	0.6	6.3	6.6	6.5	4.8	0.9
Noncash call	1.5	1.2	−0.9	−1.4	0.0	0.7	0.6	−0.6	−1.2	0.0
Nonstandard accrual	3.5	3.9	2.4	1.5	1.7	2.7	3.2	2.8	2.0	3.7
Nonstandard payment	−0.1	0.4	2.6	6.2	7.2	−0.2	0.5	3.1	7.2	8.1
Maturity date extended or extendable	3.2	3.8	3.1	2.7	2.0	1.8	2.3	2.8	3.0	3.8
Issuer's equity is private	−4.8	−5.4	−3.9	−1.6	1.8	−4.3	−5.4	−5.8	−3.1	6.3
Rule 144a bond	−66.2	−58.3	−31.1	−18.8	−2.2	−35.6	−39.9	−37.7	−30.8	−6.1
Foreign bond	−9.5	−6.8	−1.3	−1.7	−2.0	−5.9	−4.7	−1.4	−2.3	−4.6
Global bond	−7.0	−7.3	−5.0	−3.0	0.1	−8.9	−10.2	−10.2	−7.6	0.3
Issuer is in finance industry	1.8	2.0	0.9	0.7	0.8	2.6	3.1	1.8	1.7	3.2
Issuer is a utility	−4.8	−4.9	−5.4	−4.8	−2.5	−5.2	−5.6	−8.7	−9.7	−8.1
TRACE-transparent (fraction of trades reported to public)	−5.4	−6.5	−5.1	−3.6	−2.5	−6.2	−8.0	−7.9	−6.5	−6.7
Issue listed on NYSE ABS	−11.4	−7.8	−1.5	−0.3	−0.3	−8.2	−6.1	−1.6	−0.4	−0.6
Adjusted R^2	52.8	52.6	45.3	40.0	27.5					
Sample size	21,965	21,965	21,965	21,965	21,965					

- EHR conclude (p.1442): The large differences between transaction costs of low and high rated bonds *are all highly statistically significant and are consistent with the well-known and well-tested adverse selection theory of spreads.*

Bao, Pan, Wang (2008)

Table 5: Cross-Sectional Variation in γ and Bond Characteristics

Cons	0.8795	0.8775	0.8671	0.8763	0.8830	0.8786	0.8908
	[21.93]	[23.28]	[14.97]	[23.03]	[22.83]	[22.66]	[13.65]
Age	0.0726	0.0523	0.0517	0.0464	0.0326	0.0571	0.0811
	[4.37]	[6.18]	[4.24]	[4.97]	[3.95]	[5.98]	[3.74]
Maturity	0.0708	0.0424	0.0401	0.0461	0.0481	0.0450	0.0672
	[11.05]	[19.59]	[3.12]	[11.04]	[10.96]	[9.80]	[17.76]
ln(Issuance)	-0.1951	-0.1373	-0.1294	-0.1368	-0.0257	-0.1551	-0.2914
	[-5.87]	[-3.23]	[-5.31]	[-3.57]	[-1.05]	[-3.81]	[-8.09]
Rating	0.0415	0.0164	0.0105	0.0232	0.0314	0.0190	0.0419
	[8.05]	[3.95]	[1.58]	[3.03]	[3.35]	[2.40]	[4.32]
beta (stock)	0.4389	0.1536	0.24				
	[4.34]	[0.70]	[1.13]				
beta (bond)	-0.0237	0.0351	0.0307				
	[-0.90]	[0.69]	[0.59]				
sig(e)		0.4730		0.4581	0.4120	0.4397	
		[4.37]		[4.04]	[3.82]	[3.79]	
sig(e^{firm})			-0.0357				
			[-0.42]				
sig($e^{\text{firm res}}$)			0.6570				
			[11.31]				
Turnover				-0.0165			
				[-2.60]			
ln(Trd Size)					-0.2350		
					[-10.15]		
ln(#Trades)						0.0571	
						[1.66]	
Quoted BA γ							2.0645
							[1.57]
R-sqd (%)	49.11	62.68	74.46	61.79	63.86	61.46	48.16

Yearly Fama-MacBeth regression with γ as the dependent variable. T-stats are reported in square brackets using Fama-MacBeth standard errors with serial correlations corrected using Newey-West. *Issuance* is the bond's amount outstanding in millions of dollars. *Rating* is a numerical translation of Moody's rating. 1=Aaa and 21=C. *Maturity* is the bond's time to maturity in years. *Turnover* is the bond's monthly trading volume as a

Bao, Pan, Wang (2008)

Table 6: Time Variation in γ and Market Variables

Cons	0.0035	0.0029	0.0066	0.0027	0.0159	0.0060	0.0126
	[0.30]	[0.33]	[0.53]	[0.33]	[1.11]	[0.48]	[1.51]
Bond Volatility	0.0079						0.0063
	[0.71]						[0.72]
ΔVIX		0.0312					0.0270
		[3.46]					[3.02]
ΔTerm Spread			0.1010				0.0210
			[1.57]				[0.37]
ΔDefault Spread				0.4757			0.2100
				[2.31]			[1.57]
Lagged Stock Return					-0.0125		-0.0087
					[-2.31]		[-3.07]
Lagged Bond Return						-0.0215	-0.0102
						[-3.52]	[-1.26]
Adj R-sqd (%)	-1.43	37.96	0.44	13.92	7.15	2.74	43.51

Monthly changes in γ regressed on monthly changes in bond index volatility, VIX, term spread, default spread, and lagged stock and bond returns. The Newey-West t-stats are reported in square brackets.

The evidence on liquidity and bond risk

- Fairly high consensus that higher bond risk leads to lower bond liquidity (an exception is Chacko, Mahanti, Mallik, Subrahmanyam (2008)).
- Is it clear evidence in favor of asymmetric-information-security-design theory of bond liquidity?
- Most micro-structure theories would predict such a relation:
  - Inventory risk (Stoll (1978)),
  - Limited risk-bearing capacity (or market power of intermediaries (Grossman-Miller (88))
  - Adverse selection (Kyle (1985)).
  - Search models (Duffie-Garleanu-Pedersen (2007)).

$\Rightarrow$ Need to test predictions that are specific to the Dang, Gorton, Holmstrom (2012) model.

The evidence on sensitivity of liquidity to price

Q? Is the evidence that sensitivity of illiquidity to price increases with equity volatility and decreases with bond maturity specific to that theory?

- He, Milbradt (2012) propose model that combines a structural model of the Leland-Toft (1996) where firms continuously have to roll over debt by issuing in a secondary OTC market with search frictions of the Duffie, Garleanu, Pedersen (2005) type. Their model generates:
  - an endogenous bid-ask spread for bonds that is increasing in credit risk
  - a credit-liquidity spiral: a bad shock to firm value increases the default probability, which increases the valuation differential between H and L types in secondary market, which increases the transaction costs, which lowers the bond value, which increases the roll-over cost, which increases the default probability...

$\Rightarrow$ Could their model generate similar results?

$\Rightarrow$ Their model suggests that liquidity and bond price are jointly determined.

The evidence on ratings

Q? Is the evidence that illiquidity is increasing in downgrade since issuance holding fixed current rating 'strong evidence for the information production hypothesis' of Hanson and Sunderam (2013)?

- Need to control for well-known "ratings momentum"

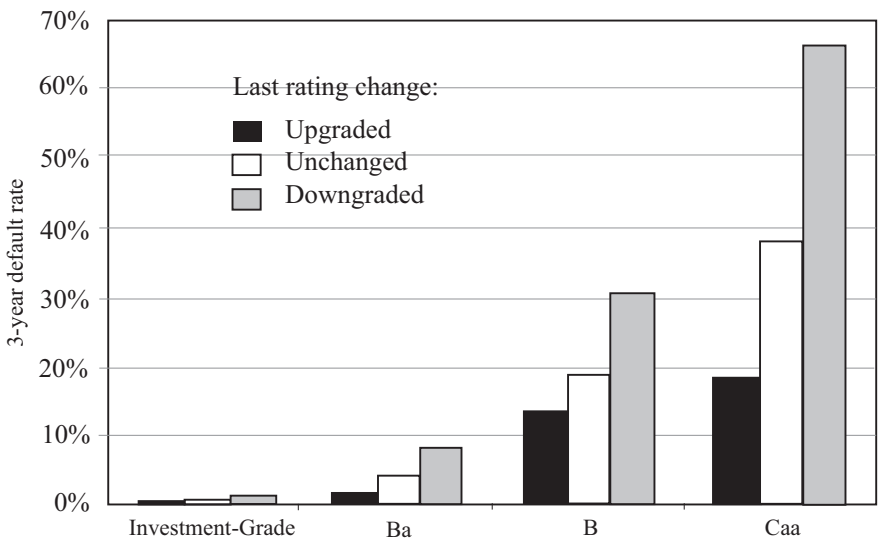

Figure 2: Upgrade-downgrade momentum (1996-2003 data). Source: Moody's, 2004.

⇒ Bonds with same current ratings that had larger downgrade since issuance are riskier!

The evidence on ratings

- 'Positive relation between bond illiquidity and change in credit rating is concentrated in bonds around the cutoff between investment grade and speculative grade.

$\Rightarrow$ authors argue " this is very consistent with asymmetric information theory of bond liquidity"

- However, there are many institutional constraints that are likely to play a role as well.

$\Rightarrow$ Chen, Lookman, Schuerhoff, Seppi (2014) show that institutional trading behavior (indexing...) has large impact on price behavior around that cutoff.

Is adverse selection a primary driver of bond liquidity?

- In adverse selection models, large (e.g., block) trades typically are done at a discount relative to small trades (e.g., Kraus and Stoll (1972)).
- In search based models, large trades typically execute at favorable spreads (DGP (2005)).
- Edwards, Harris, Piwowar (2007) and Bao, Pan, Wang (2008) find that illiquidity is decreasing with trade size.
- Feldhütter (2012) finds evidence for price pressure in the difference between t-costs of small and large trade that is consistent with search based frictions

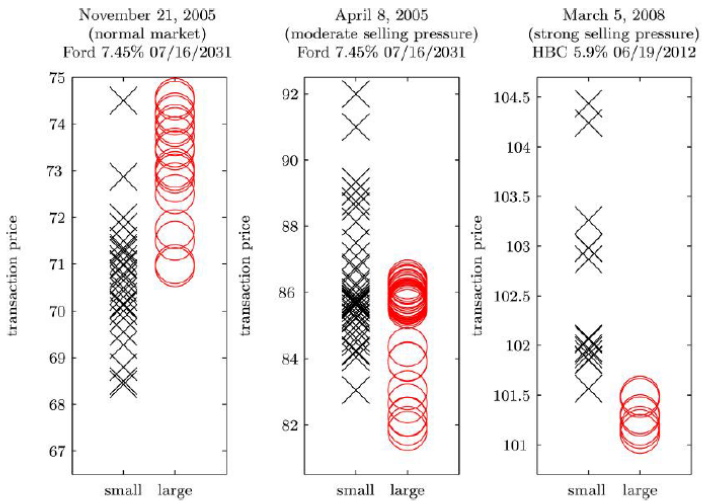

Figure 1
Small and large trades in a normal market, under moderate selling pressure, and under strong selling pressure
This graph shows three examples of all trades smaller than $100,000 (marked with crosses) and trades of at least $1,000,000 (marked with circles) for a bond during a day.

Is adverse selection primary driver of bond liquidity?

- Dick-Nielsen, Feldhütter, Lando (2012) find evidence that financial institution ability to make markets in bonds is significant driver of bond liquidity

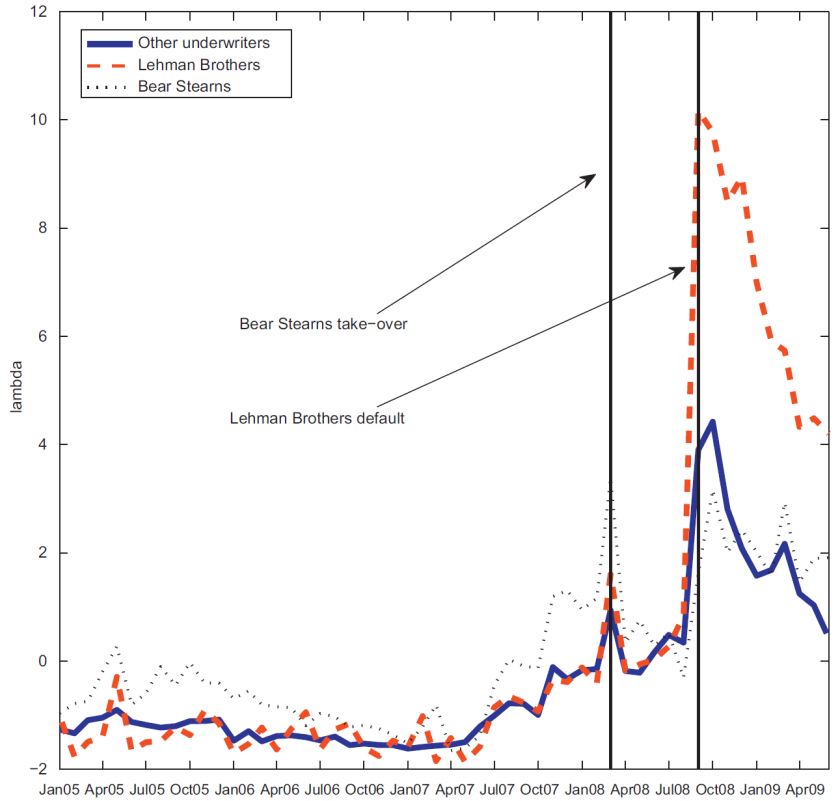

Fig. 4. Illiquidity of bonds underwritten by Lehman Brothers and Bear Stearns. This graph shows the time-series variation in illiquidity of bonds with Lehman Brothers as lead underwriter, bonds with Bear Stearns as lead underwriter, and the rest of the sample. The data are U.S. corporate bond transactions from TRACE and the sample period is from 2005:Q1 to 2009:Q2. For every bond underwritten by Lehman Brothers, their (il)liquidity measure λ is calculated each month and a monthly weighted average is calculated using amount outstanding for each bond as weight. The graph shows the time series of monthly averages. Likewise, a time series of monthly averages is calculated for bonds with Bear Stearns as a lead underwriter and for all bonds that are not included in the Lehman and Bear Stearns samples. Higher values on the y-axis imply more illiquid bonds.

'Everybody worries about bond market liquidity'

- New regulatory environment
  - Basel III capital and liquidity requirements for bank
  - Dodd-Frank in the USA
  - MIFIDII and MIFIR in Europe
- Dealer holdings of corporate bond has collapsed

$\Rightarrow$ move from 'principal' to agent model.

$\Rightarrow$ Widespread concern among practitioners and regulators that bond market liquidity has decreased. (IOSCO report, Blackrock viewpoint, NYFed report, FINRA report).

- Academic research (Anderson and Stulz (2017, Bessembinder, Jacobsen, Maaxwell, Venkataram (2017)) and NY FED Liberty Street Economics Research find that price-based measures of liquidity have returned to pre-crisis levels, but that non-price based measures of liquidity such as dealer capital commitment over various time horizons, turnover, block trade frequency, and average trade size not only decreased during the financial crisis, but continued to decline afterwards.

$\Rightarrow$ Institutional frictions affect bond liquidity

Evidence on bond liquidity factors unrelated to 'information sensitivity'

- On-off the run Treasury spreads
- Spreads between KFW bonds and German Bunds
- Spreads between RefCorp bonds and US Treasuries

Conclusion

- Interesting idea to test asymmetric information theory of bond liquidity
- Many findings are consistent with (or already) in the literature

$\Rightarrow$ needs to be better cited.

- Many findings do not seem specific to the asymmetric information security-design models.

$\Rightarrow$ Should try to construct theory-specific tests (based on a specific model).

- Is it possible to identify firms are more/less likely to be information sensitive and exploit variation in that dimension (tangible assets, small vs. big market cap, large vs. small book to market, analyst coverage, predictable sales and dividends, etc...)
- There seems to be growing evidence that institutional frictions and market structure are drivers of Bond market liquidity.
- Also substantial evidence that bond liquidity is driven by factors unrelated to information sensitivity (On-off the run, KFW, RefCorp. . .).