Very Low Frequency Trading and Security Design

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The Question

How does the design of structured credit products (SCPs) influence their liquidity and trading costs?

In particular, does security *complexity* affect:

- Liquidity?
  - whether a security trades and how much it trades conditional on trading at all
- Trading costs (bid-ask spreads)?

How do various other features of the deal design affect liquidity and trading costs?

Why do We Care?

- Lack of liquidity became source of systemic risk during financial crisis of 2007-2009
    - Particular lack in SCPs
    - Made price discovery very difficult
    - Introduced significant uncertainty into marks used by financial institutions
    - Made it difficult for some institutions to meet investor redemption requests

- Studying how product complexity affects trading may aid in guiding security design to ensure liquidity in the future
    - Subsequent liquidity key concern of security design (e.g., Gorton and Pennacchi 1990, JF; Boot and Thakor 1993, JF; DeMarzo and Duffie 1999, EMA)

- Understanding drivers of liquidity may help explain the collapse in trading of non-agency securitization and the slow recovery

Existing Empirical Work on Structured Finance Trading

Primarily, hampered by lack of data

- Until May 2011, no requirement to report structured finance trades unlike FINRA requirement for corporate bonds
- Trade data on TBA agency MBS trades since May 2011 now publicly disseminated
- Trade data collected on non-agency trades since May 2011 not yet publicly disseminated

Three existing papers:

- Bessembinder, Maxwell, and Venkataraman (2013, FAJ): Descriptive statistics on trading of different security types
- Hollifield, Neklyudov, and Spatt (2013, WP): Securities issued under 144A trade less than registered securities
- Atanasov and Merrick (2013): In agency market, find that suitability restrictions confine retail MBS traders (!) to illiquid part of agency MBS market

Existing Work on Security Complexity

Complexity and trading:

- Experimental work: higher complexity in trading environment leads to increased price volatility and lower liquidity (Carlin, Kogan, and Lowery 2013, JF)
- To date: no evidence on relationship between complexity and trading in established market with professional traders

Complexity and security design:

- Ghent, Torous, and Valkanov (2014, WP): more complex PLMBS default more and get more generous credit ratings
- Furfine (2014, RCFS): more complex CMBS have worse quality *collateral*
- Cohen and Lou (2012, JFE): stock returns of more complicated firms have more predictability
- Celerier and Vallee (2014, WP): more complex retail products sold to less sophisticated consumers

What we Do

We study the relationship between deal complexity and the liquidity of non-prime PLMBS in the secondary market

Proxy for complexity of deal using

1. Number of loan groups in the deal
2. Number of securities in the deal
3. Length of description of the waterfall
4. Length of description of the collateral
5. First principal component of 1)-4)

Preliminary Results

1. Securities in more complex deals are less likely to trade at all
2. Securities in more complex deals trade less frequently
3. Conditional on trading, securities in more complex deals have higher trading costs
4. Securities from larger deals are more liquid
5. Securities with more subordination (even controlling for current and original ratings) are more liquid

Result between complexity and trading does not appear to be driven by extent to which tranche is "bespoke"

- Current proxy for bespokeness is the tranche size
- Ideal measure would be inverse of number of trades in the primary market
- Working on validating this proxy for bespokeness using CMBS trades in primary market for 2011-2014 period

Reasons Complexity may Matter for Trading

Tailoring

Complexity may be a byproduct of tailoring (completing the market)

- If more complex MBS are custom-designed (bespoke) tranches designed for a particular buyer
- Some evidence of tailoring to satsify GSE demand (Ghent, Hernandez-Murillo, and Owyang, forthcoming REE; Adelino, Frame, and Gerardi WP)
- **Prediction: Greater security complexity will lead to less liquidity if no control for degree of tailoring**

Reasons Complexity may Matter for Trading

Information Asymmetries

Complexity endogenously creates information asymmetry:

- Different traders have different understandings of the securities even with the same information disclosure (Glode, Green, and Lowery 2012, JF)
- Because more complex securities are harder to value, informed traders (who invest in understanding securities) have larger advantage over uninformed traders
- Information asymmetry leads to lower participation in financial markets and an increase in trading costs
  - Glosten and Milgrom (1985, JFE); Kyle (1985, EMA)
- **Prediction: Greater complexity will lead to less frequent trading and higher bid-ask spreads**

Reasons Complexity may Matter for Trading

Ambiguity

Investors have more ambiguity in their valuations of more complex assets

- Have difficulties assigning probabilities to different payoffs, not just lowers their valuation of the payoffs
- Ambiguity can lead to a collapse in trading
  - Easley and O'Hara (2009, RFS; 2010, JF; 2010 JFE)
- **Prediction: Greater security complexity will lead to less liquidity**

Summary Measures of Liquidity

1. *trades*: Whether a security trades at all during our 40-month sample (0/1 variable)
2. *numtrad*: How many times the security trades (left-censored variable)
3. *numtradday*: On how many days during the sample the security trades (left-censored variable)
4. *cumdolvol*: Cumulative $ trading volume (in millions) in security (left-censored variable)

Whether a Security Trades

Estimate probit model, i.e.,

$$\Phi(\beta_c cvar_i + \beta_x' \mathbf{X_i})$$

where $\Phi(\cdot)$ is the standard normal distribution, $cvar_i$ is a measure of the complexity of the security, and X_i is a vector of controls

Dpendent variable, *trades*, takes a value of 1 if the security trades, 0 otherwise.

Other Liquidity Measures

Use a Tobit model because of left-censoring

Estimate

$$y_i^* = \beta_c cvar_i + \beta_x' \mathbf{X_i} + u_i$$

$$y_i = \max\left(0, y_i^*\right)$$

where u_i is a normally distributed random variable

y_i is the number of times we observe the security trading (*numtrad*), the number of days on which we observe the security trading (*numtradday*), or the total dollar volume of trading in the security (*cumdolvol*)

Transaction Costs

Inferring Bid-Ask Spreads

Want to know bid-ask spreads

No quote data... Instead, use methodology of Bessembinder, Maxwell, and Venkataraman (2006, JFE) to infer trading costs.

Idea is that dealer quotes

$$P_t = E(V_t) + \alpha * Q_t$$

- V is "fundamental" value of bond
- $Q_t = 1$ for customer-initiated buy (compensation to dealer=α)
- $Q_t = -1$ for customer-initiated sell (compensation to dealer=α)

Transaction Costs

Inferring Bid-Ask Spreads

$$P_t = E(V_t) + \alpha * Q_t$$

Now, want to infer bid-ask spread from difference in trade prices between date t and last trade (at s)

$$\Delta P_{s,t} = P_t - P_s \quad = E(V_t) - E(V_s) + \alpha * \Delta Q_{s,t}$$

Drop interdealer trades in trading cost analysis since cannot sign the trade

Transaction Costs

Estimate

$$\begin{aligned}\Delta P_{s,t,i} &= \beta_0 + \beta_1 TRSYret_{s,t-1} + \beta_2 STOCKret_{s,t-1} + \beta_3 MBSret_{s,t-1} \\ &+\beta_4 TSret_{s,t-1} + \beta_5 CSret_{s,t-1} + \beta_Q \Delta Q_{s,t} \\ &+\beta'_{Q*x} \Delta Q_{s,t} * \mathbf{X_i} + \beta_{Q*c} \Delta Q_{s,t,i} * cvar_i + \varepsilon_{s,t,i}\end{aligned}$$

- $\Delta P_{s,t,i}$ is % change in security price between previous and current trade
- $\Delta Q_{s,t,i}$ captures bid-ask spreads
  - $\Delta Q_{s,t,i} = Q_{t,i} - Qs, i$
  - $Q_{t,i} = 1$ if customer-initiated buy, $Q_{t,i} = -1$ if customer-initiated sell
  - β_Q measures the average difference between the price paid by a buyer and that paid by a seller (bid-ask spread)

Transaction Costs

Inferring Bid-Ask Spreads

$$\Delta P_{s,t,i} = \beta_0 + \beta_1 TRSYret_{s,t-1} + \beta_2 STOCKret_{s,t-1} + \beta_3 MBSret_{s,t-1} + \beta_4 TSret_{s,t-1} + \beta_5 CSret_{s,t-1} + \beta_Q \Delta Q_{s,t} + \beta'_{Q*x} \Delta Q_{s,t} * \mathbf{X_i} + \beta_{Q*c} \Delta Q_{s,t,i} * cvar_i + \varepsilon_{s,t,i}$$

- $TRSYret_{s,t-1}$: % change in Yield on 7-10 Year Treasury index between date t-1 and date s
- $STOCKret_{s,t-1}$: % change in S&P 500 between date t-1 and date s
- $MBSret_{s,t-1}$: % change in Barclay's MBS index between date t-1 and date s
- $TSret_{s,t-1}$: % change in spread between 7-10 and 3-month Treasury indices
- $CSret_{s,t-1}$: % change in spread between investment grade and high yield bonds

Data

Securities: PLMBS deals issued 2001-2007

- Deals marketed to investors as subprime or Alt-A
- Limit sample to floating rate securities backed by ARM collateral (main risk is credit)
- Security characteristics obtained from Bloomberg terminals and hand-collected from prospectus supplements downloaded from Bloomberg terminals
- Trading data made available via agreement with FINRA
- Trading data covers trades from May 16, 2011 - September 30, 2014
- Drop securities that are no longer active as determined by FINRA
- Include only securities with prospectus supplements availlable and with rating information as of May 2011

Data: Security Characteristics

Use information on

- complexity of deal
- length of prospectus supplement
- rating at issuance
- rating as of May 2011
- tranche subordination (percentage points)
- size of tranche (millions of $)
- Weighted Average Life (WAL) of security in years
- size of deal (millions of $)
- year of issuance

Complexity Measures

1. *nloangroups*: Number of loan groups within the deal
2. *ntranches*: Number of securities within the deal
3. *pagesmpool*: Number of pages of prospectus supplement describing the collateral
4. *pageswaterfall*: Number of pages of prospectus supplement describing the waterfall
   - Description of rule for allocating the cashflows from the collateral to the securities
5. *complexityfactor*: First principal component of *nloangroups*, *ntranches*, *pagesmpool*, and *pageswaterfall*
   - normalized to have a standard deviation of 1 and mean 0 in 2001

Security-Level Summary Statistics 1

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	8942	2005.2	1.2	2001	2007
trades	8942	0.75	0.43	0	1
numtrad	8942	11.8	30.1	0	852
numtradday	8942	5.6	8.1	0	152
cumdolvol	8942	25.3	68.2	0	1174.0
nloangroups	8942	2.1	1.1	1	11
ntranches	8942	18.7	6.2	2	68
pagesmpool	8942	37.6	18.2	4	148
pageswaterfall	8942	27.2	9.9	1	62
complexityfactor	8942	0.9	1.0	-1.5	8.5

Security-Level Summary Statistics 2

Variable	Obs	Mean	Std. Dev.	Min	Max
pagesprosup	8942	146.1	39.6	27	391
aaa	8942	0.44	0.50	0	1
aa	8942	0.28	0.45	0	1
a	8942	0.17	0.38	0	1
subordination	8484	13.3	8.1	0	98.4
origtranchebal	8780	75.1	130.4	0	2232.4
origwal	8789	5.0	2.0	0.5	16.2
dealsize	8942	1005.8	628.0	90	4928
currate_aa	8942	0.04	0.20	0	1
currate_a	8942	0.04	0.21	0	1
currate_bbb	8942	0.07	0.26	0	1
currate_bb	8942	0.08	0.27	0	1
currate_b	8942	0.19	0.39	0	1
currate_def	8942	0.50	0.50	0	1

Frequency of Trading

Probit for Security Trading, Marginal Effects

	(1)	(2)	(3)	(4)
nloangroups	-0.030***			
ntranches		-0.0063***		
pagesmpool			-0.00061	
pageswaterfall				-0.0020***
pagesprosup	-0.00026	-0.00033	-0.00049*	-0.00057***
subordination	0.0027**	0.0029***	0.0029***	0.0029***
origtranchebal	-0.00063***	-0.00066***	-0.00060***	-0.00061***
origwal	-0.0045	-0.0033	-0.0037	-0.0036
dealsize	0.00012***	0.00013***	0.00011***	0.00012***
Obs.	8,221	8,221	8,221	8,221
Orig. Rtg FEs	Yes	Yes	Yes	Yes
Curr. Rtg FEs	Yes	Yes	Yes	Yes
Yr of Issue FEs	Yes	Yes	Yes	Yes
SEs Clustered	Yes	Yes	Yes	Yes
Pseudo-R^2	6.9%	7.1%	6.5%	6.7%

Frequency of Trading

Tobit for Number of Trades, Marginal Effects

	(1)	(2)	(3)	(4)
nloangroups	-2.02***			
ntranches		-0.31***		
pagesmpool			-0.0011	
pageswaterfall				-0.062
pagesprosup	-0.043**	-0.056***	-0.074***	-0.069***
subordination	0.084	0.10	0.096	0.096
origtranchebal	-0.024***	-0.024***	-0.021***	-0.021***
origwal	-1.07***	-1.01***	-1.02***	-1.01***
dealsize	0.0090***	0.0091***	0.0083***	0.0084***
Obs.	8,221	8,221	8,221	8,221
Orig. Rtg FEs	Yes	Yes	Yes	Yes
Curr. Rtg FEs	Yes	Yes	Yes	Yes
Yr of Issue FEs	Yes	Yes	Yes	Yes
SEs Clustered	Yes	Yes	Yes	Yes
Pseudo-R^2	0.6%	0.5%	0.5%	0.5%

Frequency of Trading

Tobit for Number of Trading Days, Marginal Effects

	(1)	(2)	(3)	(4)
nloangroups	-0.82***			
ntranches		-0.17***		
pagesmpool			-0.0012	
pageswaterfall				-0.031**
pagesprosup	-0.015***	-0.017***	-0.027***	-0.025***
subordination	0.055**	0.062**	0.060**	0.060**
origtranchebal	-0.0054***	-0.0061***	-0.0045**	-0.0046**
origwal	-0.44***	-0.41***	-0.42***	-0.42***
dealsize	0.0034***	0.0036***	0.0031***	0.0032***
Obs.	8,221	8,221	8,221	8,221
Orig. Rtg FEs	Yes	Yes	Yes	Yes
Curr. Rtg FEs	Yes	Yes	Yes	Yes
Yr of Issue FEs	Yes	Yes	Yes	Yes
SEs Clustered	Yes	Yes	Yes	Yes
Pseudo-R^2	1.7%	1.8%	1.6%	1.7%

Frequency of Trading

Tobit for Cumulative $ Trading Volume, Marginal Effects

	(1)	(2)	(3)	(4)
nloangroups	-7.51***			
textitntranches		-1.51***		
pagesmpool			-0.23***	
pageswaterfall				-0.41***
pagesprosup	-0.0078	-0.033	-0.032	-0.088**
subordination	0.23	0.29	0.28	0.27
origtranchebal	0.062***	0.057***	0.072***	0.069***
origwal	-4.31***	-4.09***	-4.09***	-4.10***
dealsize	0.020***	0.022***	0.018***	0.019***
Obs.	8,221	8,221	8,221	8,221
Orig. Rtg FEs	Yes	Yes	Yes	Yes
Curr. Rtg FEs	Yes	Yes	Yes	Yes
Yr of Issue FEs	Yes	Yes	Yes	Yes
SEs Clustered	Yes	Yes	Yes	Yes
Pseudo-R^2	1.5%	1.6%	1.5%	1.5%

Frequency of Trading

Summary Measure of Complexity, Marginal Effects

	trades	*numtrad*	*numtradday*	*cumdolvol*
complexityfactor	-0.054***	-2.64***	-1.24***	-13.0***
pagesprosup	0.00023	-0.028	-0.0055	0.10***
subordination	0.0029***	0.094	0.059**	0.26
origtranchebal	-0.00065***	-0.024***	-0.0058***	0.058**
origwal	-0.0036	-1.02***	-0.42***	-4.13***
dealsize	0.00014***	0.0093***	0.0036***	0.023***
Obs.	8,221	8,221	8,221	8,221
Orig. Rtg FEs	Yes	Yes	Yes	Yes
Curr. Rtg FEs	Yes	Yes	Yes	Yes
Yr of Issue FEs	Yes	Yes	Yes	Yes
SEs Clustered	Yes	Yes	Yes	Yes
Pseudo-R^2	7.2%	0.6%	1.8%	1.6%

Summary of Trading Frequency Results

A one standard deviation increase in complexity results in

- 5 percentage point (7%) lower chance the security trades at all
- 2.6 (22%) fewer trades
- 1.2 (21%) fewer trading days
- $13 million (48%) less in cumulative trading volume

Investors should be aware that more complex securities have much lower liquidity

Also, securities with more subordination and from larger deals more liquid

Benchmark Trading Costs, Trades May 2011 to Sept. 2014

	(1)	(2)	(3)	(4)
ΔQ	0.409***		1.129***	1.034***
ΔQ*Small Trade		0.547***		
ΔQ*Medium Trade		0.437***		
ΔQ*Large Trade		0.260***		
ΔQ*TradeSize (in $ ml)			-8.38***	-8.35***
ΔQ**dealsize*			-0.0001***	-0.0001***
ΔQ**origtranchebal*			-0.0001	-0.0001
ΔQ**origwal*			-0.0067	-0.0057
ΔQ**subordination*			-0.0061***	-0.0055***
ΔQ**pagesprosup*			-0.0003	-0.0003
Obs.	42,201	42,201	40,328	40,328
Fundamentals	Yes	Yes	Yes	Yes
ΔQ*Orig. Rtgs	No	No	Yes	Yes
ΔQ*Curr. Rtgs	No	No	No	Yes
ΔQ*Yrs of Issue	No	No	No	Yes
Adjusted-R^2	8.82%	9.48%	9.43%	9.62%

Trading Costs and Security Design

	(1)	(2)	(3)	(4)
ΔQ	1.021***	0.998***	1.052***	1.011****
ΔQ**nloangroups*	0.0194**			
ΔQ**ntranches*		0.0065***		
ΔQ**pagesmpool*			0.0013*	
ΔQ**pageswaterfall*				0.0019**
ΔQ*TradeSize	-8.38***	-8.30***	-8.32***	-8.34***
ΔQ**dealsize*	-0.0001***	-0.0001***	-0.0001***	-0.0001***
ΔQ**origtranchebal*	-0.0001	0.0001	-0.0001	-0.0001
ΔQ**origwal*	-0.0057	-0.0051	-0.0057	-0.0051
ΔQ**subordination*	-0.0051***	-0.0055***	-0.0055***	-0.0053***
ΔQ**pagesprosup*	-0.0005**	-0.0007**	-0.0008**	-0.0005*
Obs.	40,328	40,328	40,328	40,328
Fundamentals	Yes	Yes	Yes	Yes
ΔQ*Orig. Rtgs	Yes	Yes	Yes	Yes
ΔQ*Curr. Rtgs	Yes	Yes	Yes	Yes
ΔQ*Yrs of Issue	Yes	Yes	Yes	Yes
Adjusted-R^2	9.63%	9.66%	9.63%	9.63%

Trading Costs and Security Design, Complexity Index

ΔQ	1.12***
ΔQ**complexityfactor*	0.052***
ΔQ*TradeSize	-8.27***
ΔQ**dealsize*	-0.0001***
ΔQ**origtranchebal*	0.0001
ΔQ**origwal*	-0.0049
ΔQ**subordination*	-0.0050***
ΔQ**pagesprosup*	-0.0011***
Obs.	40,328
Fundamentals	Yes
ΔQ*Orig. Rtgs	Yes
ΔQ*Curr. Rtgs	Yes
ΔQ*Yrs of Issue	Yes
Adjusted-R^2	9.67%

Trading Cost Summary

Benchmark trading costs:

- Average bid-ask spread is 41 basis points
- Bid-ask spread for trades of under $100,000 is 55 basis points (58% of trades)
- Bid-ask spread for trades between $100,000 and $1 m is 44 basis points (18% of trades)
- Bid-ask spread for trades over $1 m is 26 basis points (24% of trades)

Trading costs and security design:

- 1 std. dev. increase in complexity raises trading costs by 5 bps (12%)
- 1 percentage pt more subordination lowers costs by 1/2 a bp
- Larger deals have lower trading costs (similar to findings in stocks)
- Longer prospectus supplements associated with *lower* trading costs

Conclusions

Security complexity meaningfully affects liquidity and costs:

- Robust liquidity result
- Economic magnitudes of effect on liquidity are large
- High trading costs for PLMBS (41 bp on average) higher still (5 bp per standard deviation) for more complex securities

Other security features and liquidity:

- Securities with more subordination are more liquid and have lower trading costs
- Securities from larger deals are more liquid and have lower trading costs
- Securities with longer prospectus supplements (disclosure?) are less liquid but have lower trading costs

Liquidity (and thus price discovery) can be enhanced by paying attention to security design

To Do List

Security design and price discovery spillovers:

- Look at incorporation of information from price changes and ratings of securities in same deal

Security design and primary market trading:

- Look at CMBS market for relationship between security features and frequency of primary market (at issuance) trading