The Value of Trading Relationships in Turbulent Times

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Motivation

- The financial crisis highlighted the key role played by the intertwined nature of the financial markets in shaping the transmission of risk and the buildup of fragility.

- At the same time, the growing importance of opaque OTC markets, has been blamed for some of the persistent illiquidity of these markets.

- <u>Policy debate</u>: proposal for a CCP, definition of systemically important financial institutions, etc…have incorporated these views.

- Yet, the exact role played by the interconnectedness of the financial system remain, at best, imperfectly understood.

This Paper

- This paper studies the role of networks in the OTC market.

- In particular we study the relation between network structure and the pricing behavior of dealers in the OTC market.

- We highlight the time-varying importance of the relationships between dealers.

- And we look at the role of networks in propagation of shocks.

Preview of the Results

- **Dealer Network**: The corporate bonds dealer network has a clear and persistent core-periphery structure. More central dealers are able to pay lower spreads but charge significantly higher spreads to their counterparties.

- **Trading Relationships and its Importance in Turbulent Times:** Spreads are significantly lower among dealers with stronger trading relationships. These relationships become more important during turbulent times.

- **Collapse of a Core Dealer:** we find that the dealers more connected with Dealer D earned significantly less profits after September 2008. Intermediation chains became longer and intermediation costs increased significantly.

- **No Evidence of Leaning Against the Wind**

Related Literature

- *Transactions costs in OTC markets:* Bessembinder, Maxwell and Venkataraman (2006), Edwards, Harris and Piwowar (2007), Green, Li and Schürhoff (2007, 2010) and Hendershott and Madhavan (2014).

- *Theoretical literature*
  - Financial Networks: Allen and Gale (2000), Freixas et al. (2000), Acemoglu et al. (2015), Elliott et al. (2015), Farboodi (2014), Allen and Babus (2009), Stanton, Walden and Wallace (2015).
  - OTC: Duffie, Gârleanu and Pedersen (2005, 2007), Weill (2007), Afonso and Lagos (2015), Babus and Kondor (2015).

- *Evidence on dealers' behavior:* Hendershott and Madhavan (2015), Li and Schürhoff (2012), Choi and Shachar (2013) and Afonso, Kovner and Schoar (2013).

- **Our contribution:** show how trading relationships might sometime serve as a buffer in periods of distress, but also on how they contribute to the fragility of the system, as being connected to more fragile dealers might adversely affect trading outcomes for healthy dealers as well.

Outline

1. Data

2. Dealer Network

3. Trading Relationships in Turbulent Times

4. Failure of a Core Dealer

5. Implications

Data

- Corporate bond prices and volumes are obtained from an enhanced version of the Trade Reporting and Compliance Engine (TRACE).

- TRACE specifies whether a trade is carried out between two dealers, or between a customer and a dealer.

- Crucially for our analysis: The enhanced TRACE also includes <u>dealers' identifiers</u>.

- We match the bond CUSIP with information about the bond and the issuer/underwriter.

- We match also the characteristics of the dealers, such as CDS.

Main Variables

- **Spread**: we look at roughly contemporaneous (less than 2 hours) buy and sell prices of the same bond to impute a spread.

- **Bilateral Trading Relationships:** fraction of bonds exchanged in the previous quarter. Very persistent ~90%

- **Centrality Measures**: eigenvector centrality in previous quarter. It takes all trading partners into account and connections to more-connected dealers increase more the score of the dealer than similar connections to less-connected dealers: not only how many connections but *who* they are connected to that matters.

Summary Statistics

	Bonds	Trades
Number of Bonds and Trades	56,707	52,151,496
Credit Quality Distribution (%)		
Superior (AA and UP)	9.7%	8.8%
Other Investment Grade (BBB-A)	74.5%	81.5%
High-Yield (below BBB)	5.4%	7.3%
Not Rated	10.4%	2.4%
Issue Size Distribution (%)		
Small (< $100 Million)	85.9%	61.4%
Medium ($100 - $500 Million)	3.8%	24.4%
Large (> $500 Million)	0.0%	0.14%
Missing Offering Data	10.3%	14.1%
Age Distribution (%)		
Under 2 years	51.30%	35.6%
2-5 years	31.61%	35.3%
5+ years	17.08%	29.1%
Maturity Distribution (%)		
Under 2 years	7.0%	0.3%
2-5 years	20.8%	6.8%
5-20 years	59.9%	76.4%
20+ years	12.0%	15.8%
Missing Maturity Data	0.3%	0.6%

Dealer Centrality

Fraction of Total Transactions by Seller Rank
Jan 2005 - May 2011

Core-Periphery Structure

Client
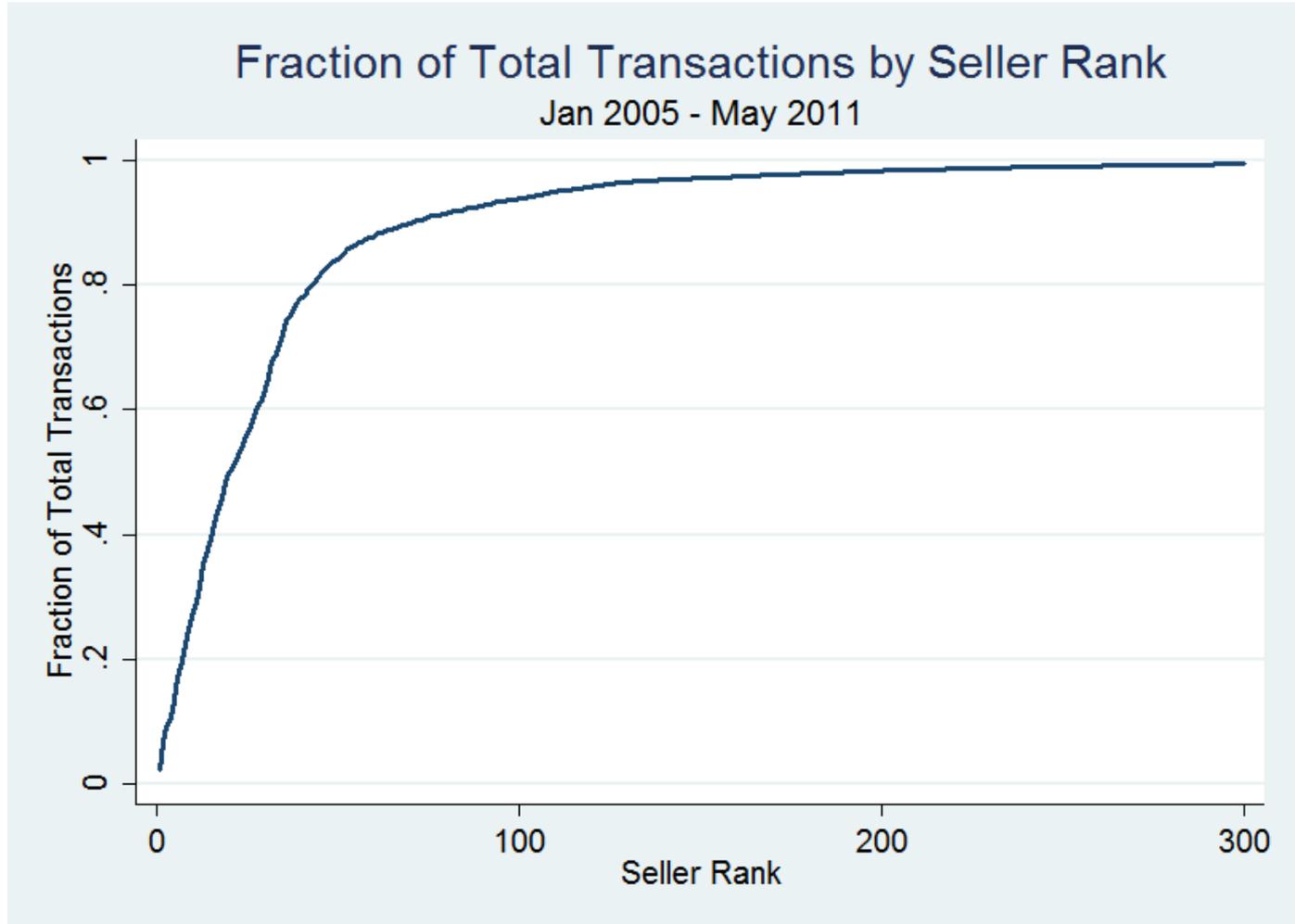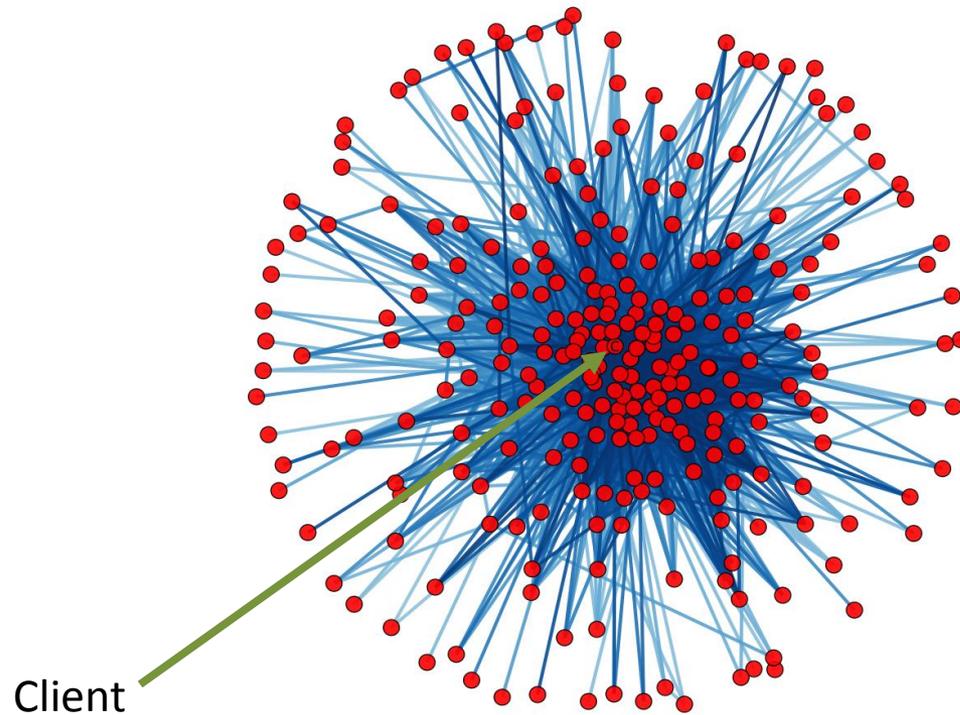
Network Stability

	Rank quarter t+1					
	Top 10	**11-20**	**21-50**	**51-100**	**101-200**	**> 200**
Top 10	90.00%	9.31%	0.69%	0.00%	0.00%	0.00%
11-20	9.31%	75.52%	14.14%	0.34%	0.34%	0.34%
21-50	0.12%	5.06%	84.12%	9.67%	0.46%	0.58%
51-100	0.07%	0.00%	6.29%	83.13%	9.68%	0.83%
101-200	0.00%	0.00%	0.00%	4.82%	81.83%	13.35%
> 200	0.00%	0.00%	0.00%	0.06%	1.57%	98.37%

Rank quarter t

Inter-Dealers Spreads

Spreads: Cumulative Distribution by Buyer's Type
2005 - 2011

Spreads by Pair Type
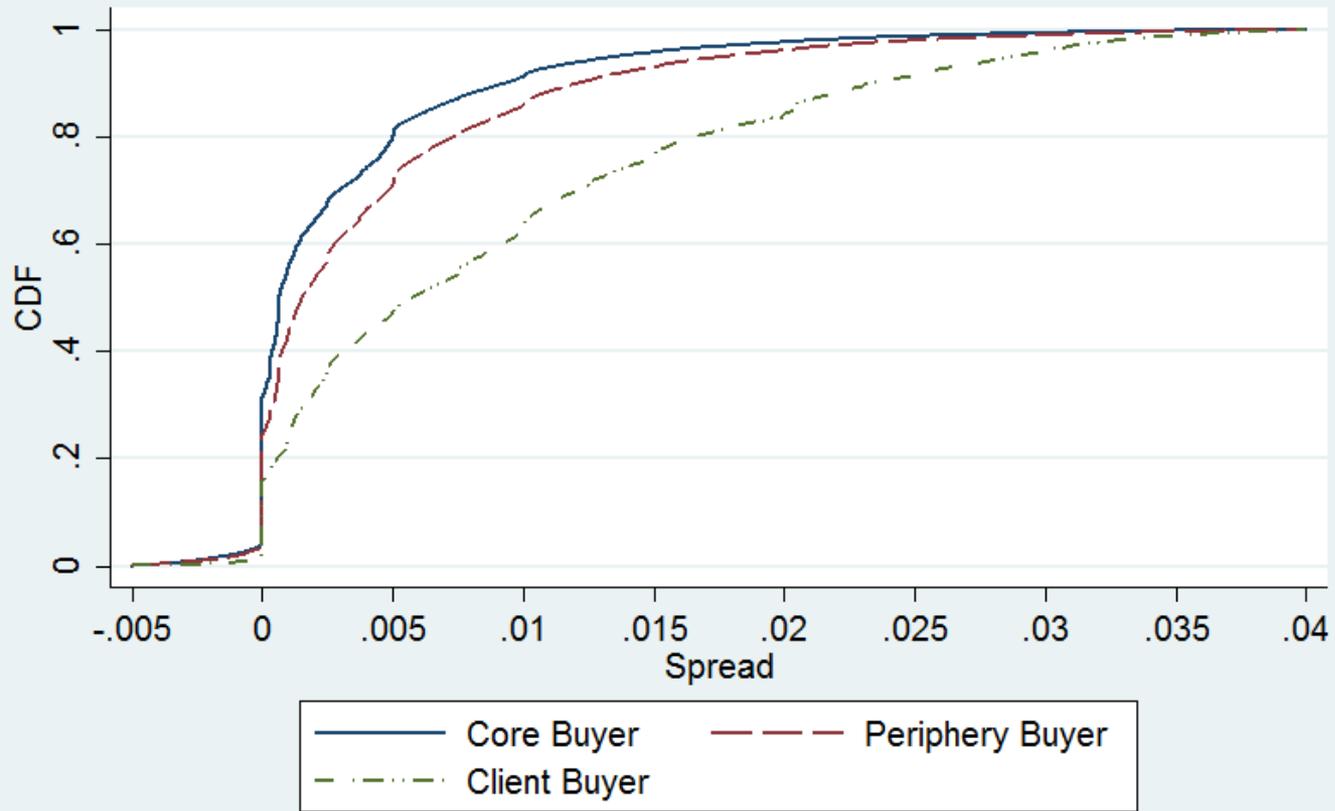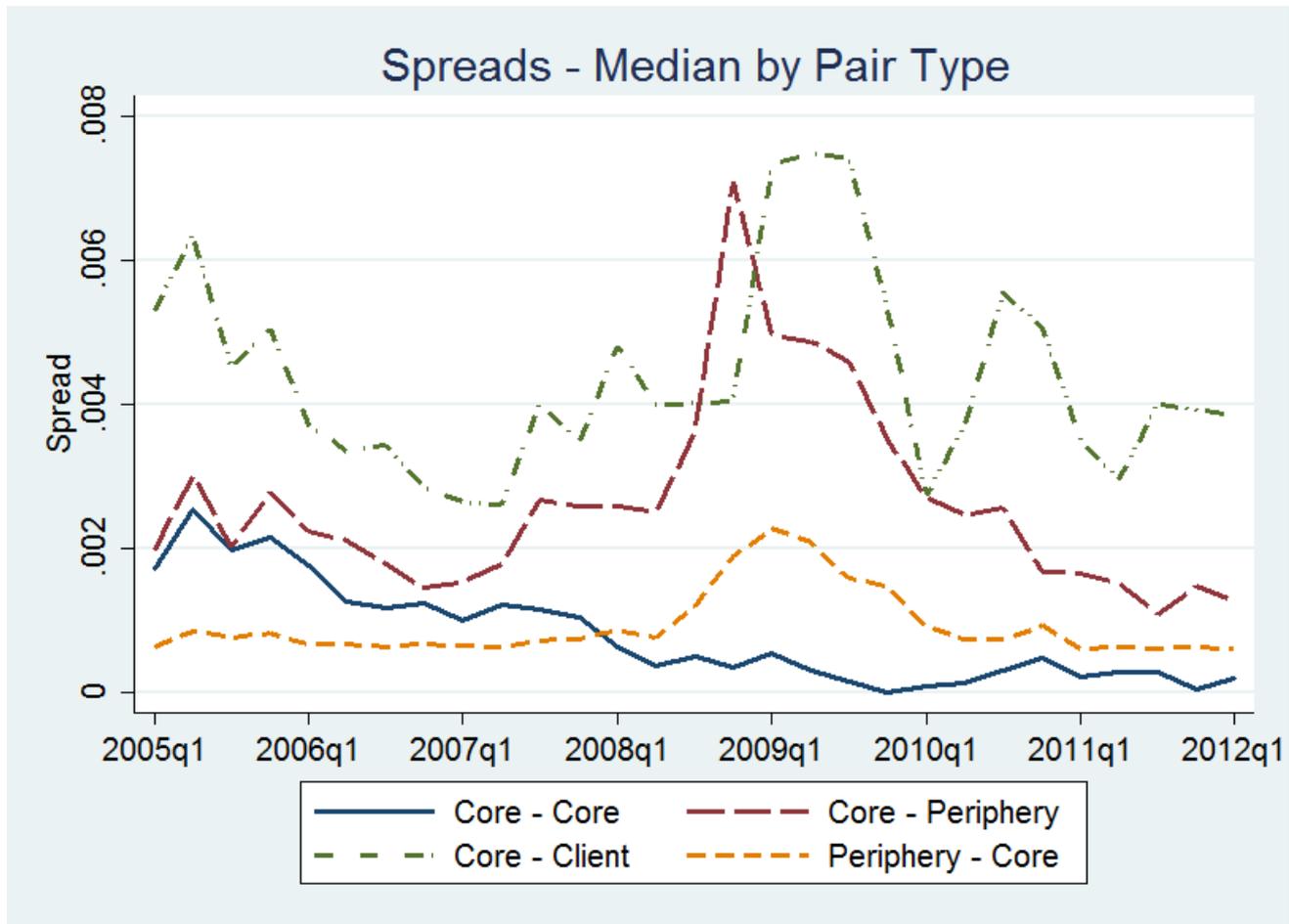
Spreads - Median by Pair Type

Research Design

Factors Affecting Spreads

1. Execution date
2. Differences in bonds' characteristics
3. Differences in counterparties' characteristics
4. …
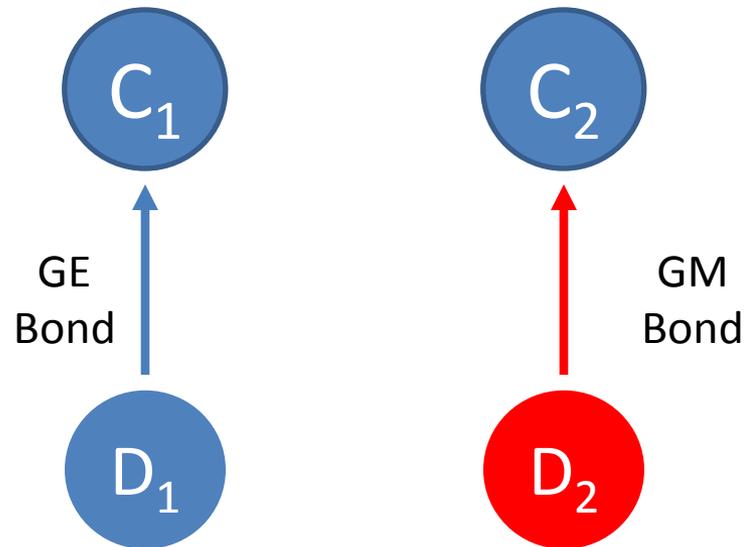
Research Design

Factors Affecting Spreads

1. Execution date
2. Differences in bonds' characteristics
3. Differences in dealers' characteristics
4. …

In our preferred specification, we compare the <u>same bond</u>, traded in the <u>same week</u>, by the <u>same seller</u> to two different counterparties.

C_1

C_2

GE Bond

D_1

Dealers-Clients Spreads

	(1)	(2)	(3)	(4)	(5) Investment Grade Bonds	(6) Non-Investment Grade Bonds
			All Bonds			
Client Counterparty	0.00526***	0.00587***	0.00531***	0.00564***	0.00550***	0.00468***
	(0.000296)	(0.000276)	(0.000233)	(0.000212)	(0.000297)	(0.000235)
Log(Transaction Volume)		-0.00112***	-0.00076***	-0.00083***	-0.00068***	-0.00097***
		(4.89e-05)	(3.26e-05)	(3.31e-05)	(3.25e-05)	(7.48e-05)
Rating			0.000101**	9.46e-05*	2.36e-05	8.29e-05
			(5.08e-05)	(4.87e-05)	(6.68e-05)	(7.06e-05)
Market Share			0.00698***	0.00705***	0.00564**	0.0307*
			(0.00248)	(0.00258)	(0.00235)	(0.0176)
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
CUSIP Fixed Effects			Yes	Yes	Yes	Yes
Seller Fixed Effects				Yes		
Observations	789,985	738,659	738,659	738,659	536,387	202,272
R-squared	0.044	0.078	0.157	0.201	0.243	0.078

Dealers-Clients Spreads

	(1)	(2)	(3)	(4)	(5) Investment Grade Bonds	(6) Non-Investment Grade Bonds
Client Counterparty			0.00531***	0.00564***	0.00550***	0.00468***
			(0.000233)	(0.000212)	(0.000297)	(0.000235)
Log(Transaction Volume)			-0.00076***	-0.00084***	-0.00068***	-0.00097***
			(3.26e-05)	(3.31e-05)	(3.25e-05)	(7.48e-05)
Rating			0.000101**	9.46e-05*	2.36e-05	8.29e-05
			(5.08e-05)	(4.87e-05)	(6.68e-05)	(7.06e-05)
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Dealers charge 50 basis points more to clients than to other dealers

Dealers-Clients Spreads by Size

	(1)	(2)	(3)	(4)
	Transaction Size Below Median	*Transaction Size between 50th and 75th*	*Transaction Size between 75th and 90th*	*Transaction Size Above 90th*
Client Counterparty	0.00656***	0.00542***	0.00185***	0.000887***
	(0.000301)	(0.000262)	(0.000121)	(0.000145)
Log(Transaction Volume)	-0.000493***	-0.000956***	-0.000779***	-0.000151
	(7.72e-05)	(7.51e-05)	(9.63e-05)	(0.000183)
Rating	5.99e-05	0.000216***	0.000309***	0.000262***
	(6.28e-05)	(7.88e-05)	(7.20e-05)	(5.13e-05)
Market Share	0.00832***	0.00620*	-0.00336	0.0111
	(0.00261)	(0.00348)	(0.00527)	(0.0161)
Week Fixed Effects	Yes	Yes	Yes	Yes
CUSIP Fixed Effects	Yes	Yes	Yes	Yes
Observations	381,317	185,563	103,149	68,630
R-squared	0.216	0.140	0.071	0.060

Dealers-Clients Spreads by Size

	(1)	(2)	(3)	(4)
	Transaction Size Below Median	*Transaction Size between 50th and 75th*	*Transaction Size between 75th and 90th*	*Transaction Size Above 90th*
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Rating	5.99e-05	0.000316***	0.000309***	0.000262***
	(6.28e-05)			(5.13e-05)
Market Share	0.00832***			0.0111
	(0.00261)			(0.0161)
Week Fixed Effects	Yes			Yes
CUSIP Fixed Effects	Yes	Yes	Yes	Yes
Observations	381,317	185,563	103,149	68,630
R-squared	0.216	0.140	0.071	0.060

Spreads are lower for larger transactions

Inter-Dealers Spreads

	(1)	(2)	(3)	(4)	(5)
		All Bonds		*Investment Grade Bonds*	*Non-Investment Grade Bonds*
Core-Periphery	0.00253***	0.00270***	0.00234***	0.00201***	0.00339***
	(0.000124)	(0.000128)	(0.000118)	(0.000110)	(0.000314)
Periphery-Periphery	0.00191***	0.00236***	0.00153***	0.00116***	0.00224***
	(0.000143)	(0.000144)	(0.000129)	(0.000134)	(0.000276)
Periphery-Core	0.000725***	0.00159***	0.00106***	0.00107***	0.00121***
	(0.000120)	(0.000154)	(0.000132)	(0.000163)	(0.000232)
Log(Transaction Volume)		-0.000761***	-0.000503***	-0.000438***	-0.000651***
		(3.96e-05)	(3.39e-05)	(2.89e-05)	(8.23e-05)
Rating		0.000150***	0.000209***	0.000129**	0.000171**
		(1.88e-05)	(5.69e-05)	(5.80e-05)	(7.61e-05)
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes
CUSIP Fixed Effects			Yes	Yes	Yes
Observations	456,868	434,390	434,390	303,659	130,731
R-squared	0.015	0.026	0.061	0.076	0.064

Inter-Dealers Spreads

	(1)	(2)	(3)	(4)	(5)
		All Bonds		*Investment Grade Bonds*	*Non-Investment Grade Bonds*
Core-Periphery	0.00253***	0.00270***	0.00234***	0.00201***	0.00339***
	(0.000124)	(0.000128)	(0.000118)	(0.000110)	(0.000314)
Periphery-Periphery	0.00191***	0.00236***	0.00153***	0.00116***	0.00224***
	(0.000143)	(0.000144)	(0.000129)	(0.000134)	(0.000276)
Periphery-Core	0.000725***	0.00159***	0.00106***	0.00107***	0.00121***
	(0.000120)	(0.000154)	(0.000132)	(0.000163)	(0.000232)
Log(Transaction Volume)		0.000761***	-0.000503***	-0.000438***	0.000651***
		(3.96e-05)	(3.39e-05)	(2.89e-05)	(8.23e-05)
Rating		0.000150***	0.000209***	0.000129**	0.000171**
		(1.83e-05)	(5.69e-05)	(5.80e-05)	(7.61e-05)
Week Fixed Effects	Yes	Yes			Yes
CUSIP Fixed Effects					Yes
Observations	456,868	434,3			130,731
R-squared	0.015	0.02			0.064

Core dealers charge 25 basis points more to periphery dealers. Even more for non-IG bonds.

Bilateral Relationships

	(1)	(2)	(3)	(4)
Fraction Selling to Counterparty	-0.00672***	-0.00700***	-0.00360***	-0.00426***
	(0.000270)	(0.000240)	(0.000294)	(0.000253)
Fraction Buying from Counterparty	-0.00464***	-0.00447***	-0.00774***	-0.00717***
	(0.000232)	(0.000187)	(0.000270)	(0.000254)
Log(Transaction Volume)	-0.000797***	-0.000573***	-0.000798***	-0.000577***
	(4.26e-05)	(3.52e-05)	(4.22e-05)	(3.58e-05)
Rating	0.000139***	0.000164***	0.000135***	0.000178***
	(1.92e-05)	(5.40e-05)	(1.85e-05)	(5.43e-05)
Seller Network Centrality			-0.00256	0.00267*
			(0.00159)	(0.00146)
Buyer Network Centrality			-0.0261***	-0.0213***
			(0.00152)	(0.00130)
Week Fixed Effects	Yes	Yes	Yes	Yes
CUSIP Fixed Effects		Yes		Yes
Observations	423,251	423,251	423,203	423,203
R-squared	0.032	0.069	0.036	0.071

Bilateral Relationships

	(1)	(2)	(3)	(4)
Fraction Selling to Counterparty	-0.00672***	-0.00700***	-0.00360	
	(0.000270)	(0.000240)	(0.0002	
Fraction Buying from Counterparty	-0.00464***	-0.00447***	-0.00774	
	(0.000232)	(0.000187)	(0.0002	
Log(Transaction Volume)	-0.000797***	-0.000573***	-0.000798***	-0.000577***
	(4.26e-05)	(3.52e-05)	(4.22e-05)	(3.58e-05)
Rating	0.000139***	0.000164***	0.000135***	0.000178***
	(1.92e-05)	(5.40e-05)	(1.85e-05)	(5.43e-05)
Seller Network Centrality			-0.00256	0.00267*
			(0.00159)	(0.00146)
Buyer Network Centrality			-0.0261***	-0.0213***
			(0.00152)	(0.00130)
Week Fixed Effects	Yes	Yes	Yes	Yes
CUSIP Fixed Effects		Yes		Yes
Observations	423,251	423,251	423,203	423,203
R-squared	0.032	0.069	0.036	0.071

Dealers charge 18% less to their closest counterparties.

Trading Relationships in Turbulent Times

Bilateral Relationships over Time

	(1)	(2)	(3)	(4)
Fraction Selling to Counterparty × VIX	-0.00364***	-0.00358***	-0.00160***	-0.00137***
	(0.000282)	(0.000286)	(0.000310)	(0.000327)
Fraction Buying from Counterparty × VIX	-0.000509***	-0.000347**	-0.00214***	-0.00217***
	(0.000181)	(0.000173)	(0.000294)	(0.000291)
Seller Network Centrality × VIX			0.00928***	0.0110***
			(0.00167)	(0.00169)
Buyer Network Centrality × VIX			-0.0102***	-0.0117***
			(0.00179)	(0.00175)
Fraction Selling to Counterparty	-0.00716***	-0.00735***	-0.00401***	-0.00461***
	(0.000286)	(0.000260)	(0.000301)	(0.000262)
Fraction Buying from Counterparty	-0.00456***	-0.00440***	-0.00751***	-0.00690***
	(0.000227)	(0.000181)	(0.000277)	(0.000258)
Seller Network Centrality			-0.00344**	0.00190
			(0.00158)	(0.00146)
Buyer Network Centrality			-0.0254***	-0.0204***
			(0.00153)	(0.00129)
Week Fixed Effects	Yes	Yes	Yes	Yes
CUSIP Fixed Effects		Yes		Yes
Observations	423,220	423,220	423,172	423,172
R-squared	0.034	0.071	0.039	0.074

Core Sellers charge 20 basis points more when VIX spikes. Core Buyers pay 22 bps less when VIX spikes

Bilateral Relationships over Time

	(1)	(2)
	Jan05-Aug08	*Sep08-May09*
Fraction Selling to Counterparty	-0.00368***	-0.00939***
	(0.000321)	(0.00130)
Fraction Buying from Counterparty	-0.00507***	-0.0116***
	(0.000238)	(0.000906)
Seller Network Centrality	0.00576***	0.0316***
	(0.00177)	(0.00587)
Buyer Network Centrality	-0.0139***	-0.0439***
	(0.00122)	(0.00489)
Week Fixed Effects	Yes	Yes
CUSIP Fixed Effects	Yes	Yes
Observations	140,498	57,101
R-squared	0.076	0.160

Centrality in Turbulent Times

	(1) All Bonds	(2) Investment Grade Bonds	(3) Non-Investment Grade Bonds
Core-Periphery × VIX	0.000921*** (0.000173)	0.000885*** (0.000174)	0.00169*** (0.000396)
Periphery-Periphery × VIX	0.000477*** (0.000182)	0.000409** (0.000188)	0.00104*** (0.000396)
Periphery-Core × VIX	-0.000171 (0.000170)	-0.000337* (0.000195)	0.000367 (0.000322)
Bond Characteristics	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes
CUSIP Fixed Effects	Yes	Yes	Yes
Observations	434,358	303,631	130,727
R-squared	0.062	0.078	0.066

Shock to the Network: Default of a Core Dealers

	(1)	(2)	(3)	(4)
Fraction of Purchase Transactions with Dealer D × Post	-0.0484***	-0.0567***	-0.0433***	-0.0441***
	(0.0123)	(0.0129)	(0.0109)	(0.0113)
Fraction of Purchase Transactions with Dealer D	0.00779	-0.00688		
	(0.0115)	(0.0120)		
Week Fixed Effects	Yes	Yes	Yes	Yes
CUSIP Fixed Effects	Yes	Yes	Yes	Yes
Seller Fixed Effect			Yes	Yes
Buyer Fixed Effect				Yes
Observations	29,398	28,855	28,855	28,855
R-squared	0.148	0.163	0.254	0.299

Longer Trading Chains
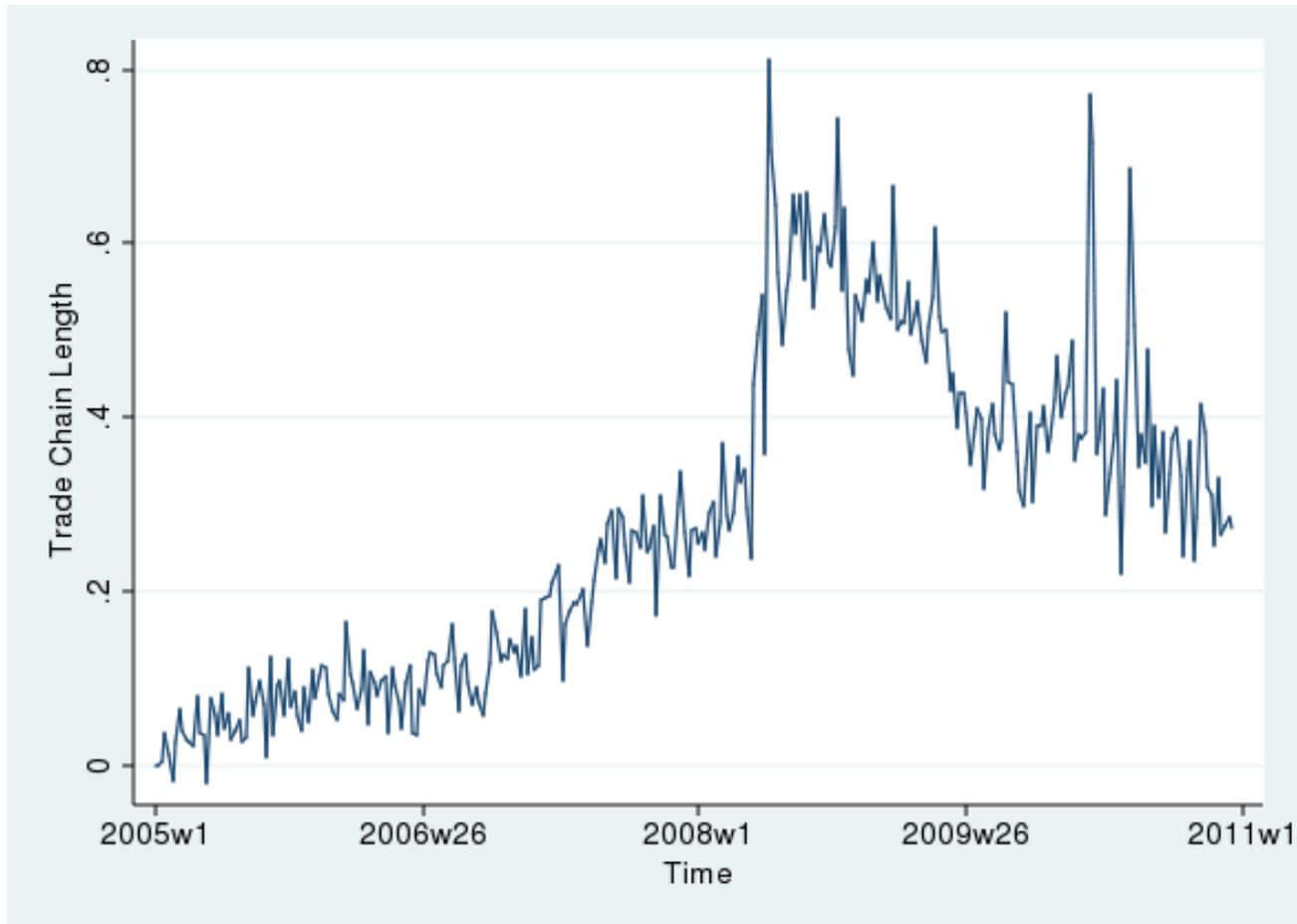
Longer Trading Chains

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All Bonds	*All Bonds*	*All Bonds*	*Investment Grade Bonds*	*Non-Investment Grade Bonds*	*Seller is in the Core*	*Seller is in the Periphery*
Post	0.285***	0.189***	0.189***	0.194***	0.187***	0.205***	0.165***
	(0.00548)	(0.00560)	(0.00604)	(0.00665)	(0.0148)	(0.00848)	(0.00846)
Log(Transaction Volume)			-0.0360***	-0.0338***	-0.0430***	-0.0451***	-0.00800***
			(0.00179)	(0.00201)	(0.00400)	(0.00246)	(0.00271)
Rating			-0.00846**	-0.0315***	0.0111	-0.00763*	-0.0176***
			(0.00337)	(0.00645)	(0.00686)	(0.00457)	(0.00507)
Market Share			-0.138	-0.843***	0.665***	-1.420***	0.311
			(0.161)	(0.217)	(0.246)	(0.266)	(0.239)
Seller Network Centrality			-3.410***	-3.559***	-2.789***	2.035***	-1.445***
			(0.0646)	(0.0707)	(0.161)	(0.220)	(0.157)
CUSIP Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	143,164	143,164	125,818	108,553	17,265	69,406	56,412
R-squared	0.019	0.176	0.193	0.195	0.176	0.169	0.275

Position in the Intermediation Chain

	(1)	(2)	(3)	(4)	(5)
Third Intermediary in the Chain	-0.263***	-0.255***	-0.302***	-0.255***	-0.145***
	(0.0123)	(0.0123)	(0.0122)	(0.0126)	(0.0131)
Fourth Intermediary in the Chain	-0.317***	-0.313***	-0.297***	-0.231***	-0.160***
	(0.0217)	(0.0217)	(0.0214)	(0.0221)	(0.0216)
Fifth Intermediary in the Chain	-0.368***	-0.362***	-0.293***	-0.215***	-0.167***
	(0.0365)	(0.0364)	(0.0359)	(0.0367)	(0.0359)
Pair Controls	No	Yes	Yes	Yes	Yes
CUSIP Fixed Effects	No	No	Yes	Yes	Yes
Seller Fixed Effects	No	No	No	No	Yes
Transaction Controls				Yes	Yes
Observations	115,079	115,079	115,079	109,098	109,098
R-squared	0.034	0.037	0.132	0.133	0.195

Position in the Intermediation Chain

	(1)	(2)	(3)	(4)	(5)
Third Intermediary in the Chain	-0.263***	-0.255***	-0.3		**
	(0.0123)	(0.0123)	(0.		1)
Fourth Intermediary in the Chain	-0.317***	-0.313***	-0.2		**
	(0.0217)	(0.0217)	(0.		6)
Fifth Intermediary in the Chain	-0.368***	-0.362***	-0.2		**
	(0.0365)	(0.0364)	(0.		9)
Transaction Controls				Yes	Yes
CUSIP Fixed Effects	No	No	Yes	Yes	Yes
Seller Fixed Effects	No	No	No	No	Yes
Observations	115,079	115,079	115,079	109,098	109,098
R-squared	0.034	0.037	0.132	0.133	0.195

The dealers that are closer to the clients are able to charge higher spreads than others along the chain.

Position in the Intermediation Chain

	(1)	(2)	(3)	(4)	(5)
Third Intermediary in the Chain	-0.263***	-0.255***	-0.3...		****
	(0.0123)	(0.0123)	(0...		1)
Fourth Intermediary in the Chain	-0.317***	-0.313***	-0.2...		***
	(0.0217)	(0.0217)	(0...		6)
Fifth Intermediary in the Chain	-0.368***	-0.362***	-0.2...		***
	(0.0365)	(0.0364)	(0...		9)
Transaction Controls				Yes	Yes
	No	No	Yes	Yes	Yes
	No	No	No	No	Yes
	115,079	115,079	115,079	109,098	109,098
R-squared	0.034	0.037	0.132	0.133	0.195

The dealers that are closer to the clients are able to charge higher spreads than others along the chain.

INTERMEDIATION COSTS INCREASE!

Changes in Dealers' Inventory

Core Dealers' Inventory by Change in Chain Length
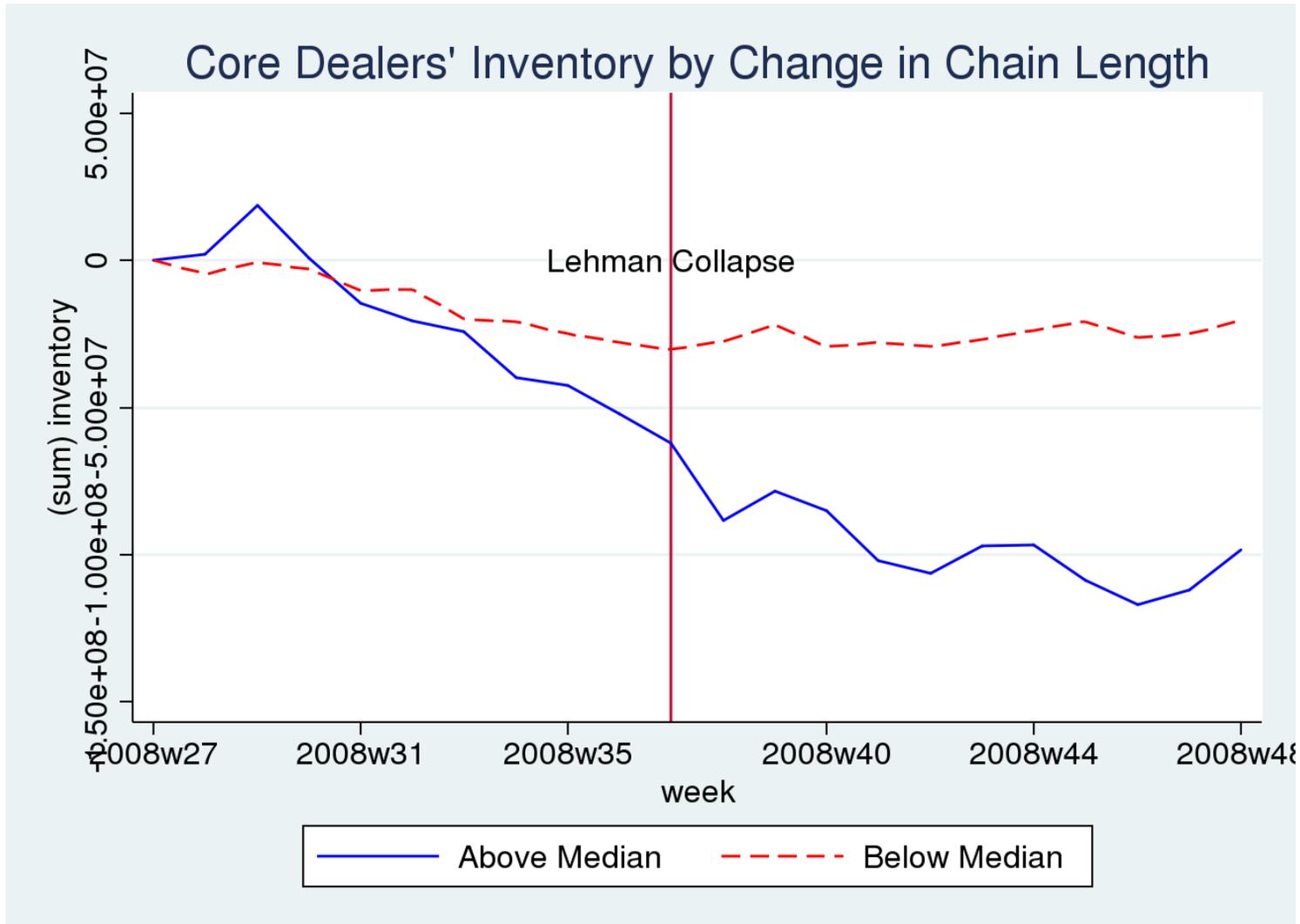
Changes in Dealers' Inventory

	(1)	(2)	(3)
	Inventory		
Above Median X Post	-0.262***	-0.268***	-0.200**
	(0.0790)	(0.0806)	(0.0947)
Above Median	0.0225	0.00451	0.110
	(0.0539)	(0.0553)	(0.0946)
Post	-0.184**	-0.729***	0.112
	(0.0735)	(0.144)	(0.109)
Time Period around Lehman	+/- 3 months	+/- 3 months	+/- 4 weeks
Dealer and Week Fixed Effects	N	Y	Y
Observations	6,731	6,731	1,940
R-squared	0.024	0.254	0.322

Leaning Against the Wind?

Changes in Dealers' Inventory by Clients' Selling Pressure

Core Dealers' Inventory by Clients' Selling Pressure
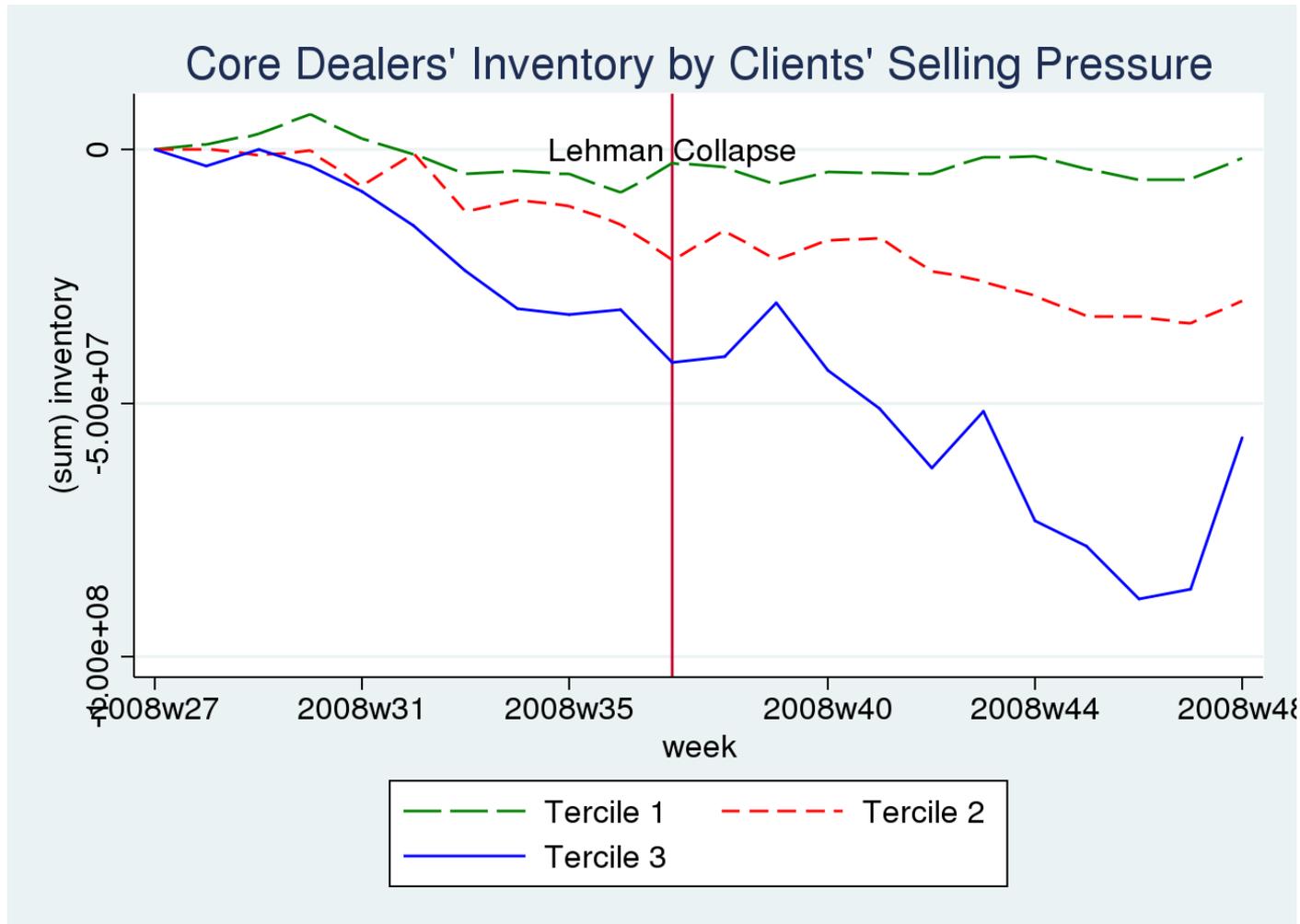
Changes in Dealers' Inventory by Clients' Selling Pressure

	(1)	(2)	(3)
	Inventory		
tercile3Xpost	-0.269**	-0.302***	-0.205*
	(0.104)	(0.105)	(0.116)
tercile2Xpost	-0.248**	-0.251**	-0.0331
	(0.0968)	(0.0983)	(0.101)
tercile3	-0.0952	-0.160**	-0.148
	(0.0692)	(0.0730)	(0.114)
tercile2	0.0326	0.000412	0.0673
	(0.0609)	(0.0624)	(0.106)
post	-0.174*	-0.714***	0.122
	(0.0907)	(0.182)	(0.123)
Time Period around Lehman	+/- 3 months	+/- 3 months	+/- 4 weeks
Dealer and Week Fixed Effects	N	Y	Y
Observations	6,711	6,711	1,937
R-squared	0.033	0.257	0.317

Conclusion and Implications

1. Consistent with the search literature, the spreads decline with the size of the transaction, suggesting that for larger transactions, there is more competition among dealers and higher search efforts, which result in lower spreads.

2. However, papers on OTC markets assume that markets participants engage in spot transactions (randomly matching counterparties). We show that relationships between counterparties affect liquidity provision and how shocks spread.

3. Dynamic aspect: reliance on these relationships is time-varying: more crucial in distress times.

4. Related to works on endogenous network formation: takes time for the network to adjust to shocks and chains become longer, intermediation costs increase.