

Why We Should Start Thinking of Illiquidity Spells in Over-the-Counter Markets in Terms of Monopolistic Inefficiency

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Introduction - Fragility of OTC Markets

- ▶ OTC markets are fragile:
 - ▶ Crisis $\implies$ increase in spreads, decline in volume.
 - ▶ This fragility can impair the overall performance of the financial system.
 - ▶ No similar deterioration in trading conditions in centralized markets.
- ▶ Is the decentralized market structure the root cause of this fragility?
 - ▶ A common explanation is the rise in dealers' holding costs ([[Bao et al., 2018](#)], [[Dick-Nielsen and Rossi, 2019](#)], [[Guerrieri and Shimer, 2014](#)]).

Dealers Get Better Prices, Especially During Crisis

$$Price = bond \times date \times volume + dealer + D2D + D2D \times Crisis$$

Dependent Variable:	price
Trade Type:	Dealer buy
D2D	0.2346***
D2D $\times$ Crisis	0.1810***
<i>Bond $\times$ Date $\times$ trade_size</i>	Yes
<i>Dealer $\times$ Date</i>	Yes
Observations	6,981,016
R ²	0.99154

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table: Regression results - the gap between inter-dealer versus customer-dealer prices

Note: The data relied upon to generate this table was TRACE Data provided by FINRA's TRACE System.

THIS IS EMILY. SHE IS A
BROKER-DEALER



AND THIS IS KYLE. HE WORKS
FOR AN INSURANCE COMPANY.

HI EMILY. I WANT TO
SELL 1,000,000\$
OF BOND XYZ. HOW
MUCH TO YOU
OFFER FOR IT?



EMILY IS ONE OF THE ONLY DEALERS
WHO TRADES BOND XYZ. YET, SHE
DOES NOT WANT TO QUOTE A PRICE
THAT IS TOO LOW AND LOSE THE DEAL



HMMM.. HOW
ABOUT 99.6
CENTS ON THE
DOLLAR?



IT'S A
DEAL!



NOW, A CRISIS ERUPTS...



HI EMILY. ITS KYLE
AGAIN. I WANT TO SELL
AN ADDITIONAL
1,000,000\$ OF BOND
XYZ. SHALL WE DO IT
99.6 CENTS ON THE
DOLLAR JUST LIKE
BEFORE?



EMILY KNOWS THAT SOME PEOPLE ARE
SCARPING FOR LIQUIDITY. KYLE MIGHT BE
ONE OF THEM. SHE CAN MAKE A KILLING ON
THIS DEAL...



GEE KYLE, I DON'T KNOW
YOU SEE, WE ARE REALLY
SHORT ON LIQUIDITY
HERE AND I CAN BARELY
TAKE IN ANYTHING. THE
BEST I CAN OFFER IS
97.2 CENTS ON THE
DOLLAR...



TWO
POSSIBLE
OUTCOMES....

(HIGHER
SPREADS)



OK, I GUESS
WE WILL DO
IT.



(LOWER
VOLUME)



TOO LOW.
FORGET
IT.



AN INSTANCE OF A MORE GENERAL PRINCIPLE:
AS DEMAND BECOMES LESS ELASTIC, A MONOPOLY (A PLAYER WITH MARKET POWER)
TRANSITIONS TOWARD CHARGING HIGHER MARK-UPS AND REDUCING PRODUCTION
(INTERMEDIATION).

Talk Outline

- ▶ This study uses Regulatory TRACE data from the U.S. Corporate Bonds Market, 2006-2020 to show:
 - ▶ Evidence suggesting that these are the dealers who are better informed about the bond's value.
 - ▶ Bond-level concentration presages a greater increase in spreads in a crisis.
 - ▶ Calibrate a structural model to the COVID-19 crisis.
 - ▶ Reveals that the increase in risk premiums is key for the pass-through of customers' liquidity needs to dealer mark-ups.

Related Literature

- ▶ limits on dealers' capacity as the cause for illiquidity spells ([[Bao et al., 2018](#)], [[Dick-Nielsen and Rossi, 2019](#)], [[Duffie, 2020](#)]). [[Zou, 2019](#)]).
- ▶ Search models of OTC: [[Duffie et al., 2007](#)], [[Lagos and Rocheteau, 2007](#)].
- ▶ Specialization in financial markets: [[Veldkamp, 2014](#)], [[Globe and Opp, 2020](#)], [[Brancaccio and Kang, 2021](#)].

Concentration in OTC Markets

Data

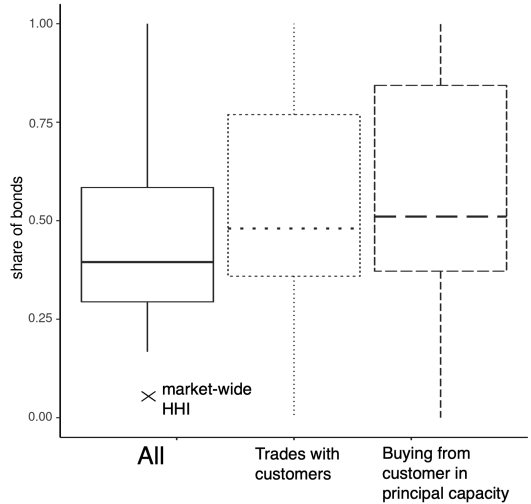
- ▶ US Corporate bonds market:
 - ▶ (as of 2019) Total amount outstanding: \$ 10 T.
 - ▶ Customers - institutional investors: insurance companies, pension funds, etc.
 - ▶ Dealers - Mostly subsidiaries of large banks.
 - ▶ Most trades are conducted over the phone.
 - ▶ Two types of trades: agency vs. principal.
- ▶ Regulatory TRACE data, 2006-2020:
 - ▶ Transaction level data from dealers' reports to FINRA.
 - ▶ For each trade: CUSIP identifier, price, volume, time, dealer role, bond attributes.
 - ▶ Special trait of the regulatory data: dealer identities.

Segmented Market; Concentration at the Bond-Level

- ▶ Bond-level HHI:

$$HHI_{b,t} = \sum_j s_{d,b,t}^2$$

- ▶ $s_{d,b,t}$: share of dealer d in the trade of bond b in year t .
- ▶ Alongside, dealers tend to specialize in trading specific bonds.



Distribution of dealer shares - Entry Cost Pattern

Distribution - $\text{Dev}_{b,d,t}$, top 50 dealers, 2019

$s_{d,b,t} - s_{d,t}$ - share of d in
all trade volume.

$$\text{Dev}_{d,b,t} = \frac{s_{d,b,t} - s_{d,t}}{s_{d,t}}$$

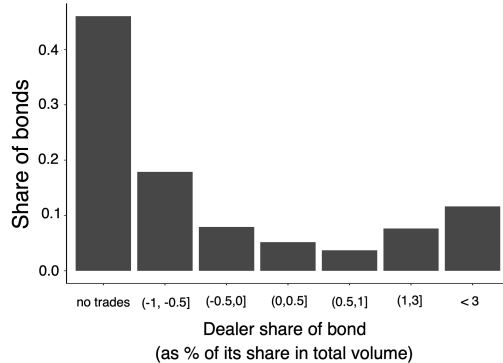


Figure: The data used to generate this was TRACE Data provided by FINRA's TRACE System.

What Underlies Concentration in OTC Markets?

- ▶ Claim: the dealers that dominate a market are those that acquire information about the quality of the underlying asset.
- ▶ Literature: Dealers are subject to adverse selection and compensate for their losses by charging higher spreads ([[Glosten and Milgrom, 1985](#)], [[Easley and O'hara, 1987](#)], [[Chalamandaris and Vlachogiannakis, 2020](#)]).
- ▶ Informed dealers are protected from adverse selection, enabling them to bid more aggressively and dominate the market.
- ▶ [[Brancaccio and Kang, 2021](#)] (municipal bonds market): underwriters charge higher spreads and win a greater market share when the bond is more complex.
- ▶ Suggestive evidence from the data:
 - ▶ Dealers specialize by [issuer and industry](#).
 - ▶ Dealers that dominate the trade in a bond [charge lower spreads for trading it](#).

Concentration and Response to Crisis

Defining Spreads

Following [O'Hara and Zhou, 2021], I define spreads as the percentage difference between inter-dealer and customer-to-dealer prices

$$spread = \ln\left(\frac{\text{trade price}}{\text{previous D2D price}}\right) * \text{trade sign}$$

The trade sign is positive when the customer buys from a dealer and negative when the customer sells to a dealer.

Does not (directly) embed holding cost.

Regression Model - HHI and Response of Spreads to Distress

Regression model:

$$\begin{aligned} Spread_{i,d,b,t} = & \alpha_0 + \beta_1 * HHI_{b,t-1} + \beta_2 * HHI_{b,t-1} * \mathbb{I}\{Crisis\} \\ & + \gamma * X_{b,t} + \eta_d + \xi_b + \nu_i + trade_date + \\ & \eta_d * trade_date + \xi_b * trade_date + \nu_i * trade_date + \\ & \lambda_b + \lambda_b * trade_date \quad (1) \end{aligned}$$

η_d , ξ_b , ν_i are dealer, bond rating, and trade volume (bins) FE, λ_b is the average holding period of the bond in the previous year, and $X_{b,t}$ is a set of bond attributes.

The Regressions Results Converge as Controls are Added

Dependent Variable: spread										
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Variables</i>										
HHI	10.1*** (1.1)	16.4*** (1.7)	18.1*** (1.7)	18.4*** (1.5)	17.6*** (1.6)	18.4*** (1.5)	18.5*** (1.5)	18.3*** (1.5)	16.8*** (1.5)	16.3*** (1.5)
HHI × crisis indicator	159.5*** (0.83)	108.6*** (11.6)	108.0*** (11.6)	87.9*** (11.1)	85.9*** (11.5)	89.0*** (10.9)	89.0*** (10.9)	90.9*** (10.6)	91.7*** (10.5)	88.4*** (10.1)
	-3.3*** (0.62)	-2.9*** (0.62)								
<i>Fixed-effects</i>										
date		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# days traded (prv. year)			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# days traded (prv. year)-date				Yes	Yes	Yes	Yes	Yes	Yes	Yes
rating					Yes	Yes	Yes	Yes	Yes	Yes
rating-date						Yes	Yes	Yes	Yes	Yes
trade size							Yes	Yes	Yes	Yes
trade size-date								Yes	Yes	Yes
dealer									Yes	Yes
dealer-date										Yes
<i>Fit statistics</i>										
Observations	883,600	883,600	883,600	883,600	874,895	874,895	874,895	874,895	874,895	874,895
R ²	0.04993	0.10811	0.10832	0.12570	0.12957	0.17713	0.17758	0.18346	0.19354	0.23565

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table: Results from applying the standard model (eq 1) to the Covid-19 crisis and the period

Same Day Reference Price

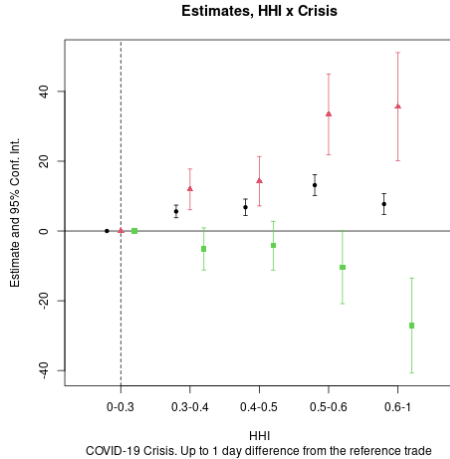


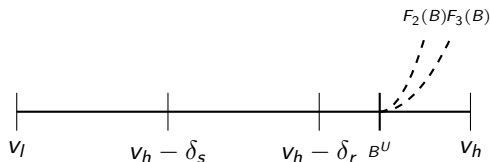
Figure: 2 same day D2D reference trade

Model

Model

- ▶ **The Economy:**
 - ▶ One period model; trade in a single security.
 - ▶ A continuum of sellers (customers) and a continuum of buyers (dealers).
 - ▶ All players maximize expected return.
- ▶ **Systemic distress level:** Value the bond by $v_i - \delta_x$, where δ_x is a liquidity shock that can be mild, $\delta_{regular}$, or dire $\delta_{stressed}$. The prob. of a dire shock is ξ
- ▶ **Uncertainty:** The value of the security, v_j , can be v_h or v_l . $\text{Prob}(v_j = v_h) = q_h$.
- ▶ **Information:** v_j is known to customers and to N dealers.
- ▶ **Imperfect competition:**
 - ▶ Customers get bids from dealers and choose which (if ever) to take.
 - ▶ (following [[Camargo et al., 2016](#)]) A dealer fails bid with probability π .

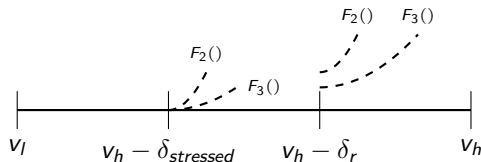
Equilibrium With Relevant Bids of the Uninformed



- ▶ For informed participants, this equilibrium resembles [Varian, 1980]'s model of sales, with the customers' reservation price being B^U .
- ▶ No pass-through of the liquidity shock, ξ , to prices.
- ▶ The uninformed is subject to adverse selection. Bids $B^U > v_h - \delta_r$ iff he can break even in spite of it.

Equilibrium with the Uninformed Withdrawing from Trade

- ▶ If uninformed participants cannot break even with a bid within the range $v_h - \delta_r$ to $v_h - \delta_s$, the equilibrium takes the following form:



- ▶ Much higher average markups.
- ▶ Larger difference in spreads between a market with 2 vs. 3 players.
- ▶ Pass-through of customer liquidity shocks.
- ▶ Decline in volume due to the monopolistic pricing scheme.

Calibration Overview

- ▶ Calibrate to the COVID-19 crisis and the period proceeding it.
- ▶ Sample: trades of size \$1M-\$5M in bonds rated “BBB-”; Between the 25th and 75th percentiles of liquidity.
- ▶ A crisis changes: asset composition (q_h, v_l), dealers’ capital constraints (π), and the customers’ liquidity shock (ξ).
- ▶ Key moments are derived directly from the data:
 - ▶ $(1 - q_h)$: Pr.(downgraded | rating updated)
 - ▶ v_l : expected change in the D2D price following a downgrade.
- ▶ Target: spreads by HHI before and during the Covid-19 crisis.
- ▶ Map HHI to the number of informed dealers:

HHI	0.3 - 0.4	0.4 - 0.7	0.7 - 1
# informed	3	2	1

Parameters

Variable	Value	Interpretation	Corresponding Moment/Source
q_h^g	0.87	Pr. that a bond is of high quality, normal times	Pr.(downgraded rating updated) pre-crisis.
q_h^c	0.82	As above, crisis	As above, crisis
v_l^g	0.99	Value of a low quality bond, normal times	Expected change in the D2D price following a downgrade (pre-crisis)
v_l^c	0.89	As above, crisis	As above, (crisis)
δ_r	0.0083	Liquidity shock incurred by non-distressed customers	[?]
δ_s	0.0165	Liquidity shock incurred by distressed customers	crisis spreads.
ξ^g	0	Share of distressed customers in normal times	(Unidentified).
ξ^c	0.55	As above, crisis	Change in volume
π^g	0.35	Prob. that the dealer does not submit a bid in normal times	Pre-crisis spreads.
π^c	0.49	As above, crisis	crisis spreads.

Model vs. Data

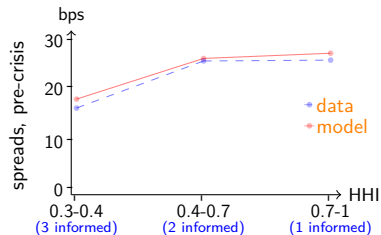


Figure: Spreads in the pre-crisis period

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

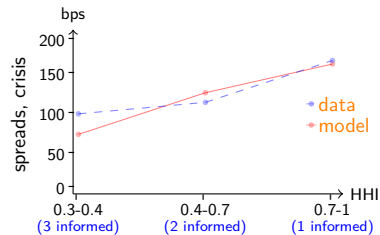


Figure: Spreads in a crisis period

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

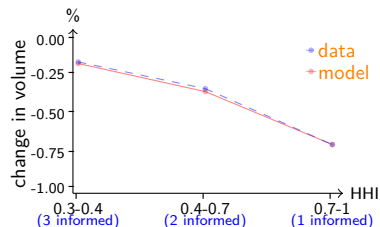


Figure: Volume response to the crisis

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

A Crisis Without a Change in Dealers' Capital Constraint

Counterfactual 2 - not changing dealers' capital constraint.

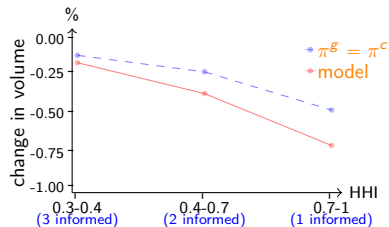


Figure: Volume response to the crisis:
model with and without tightening
capital constraints.

Note: The data relied upon to generate this figure was TRACE
Data provided by FINRA's TRACE System.

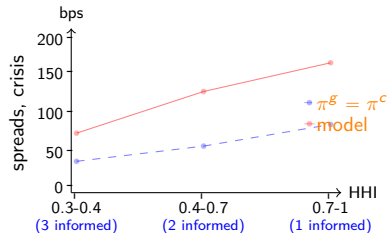


Figure: Spreads in the crisis period:
model with and without tightening
capital constraints

Note: The data relied upon to generate this figure was TRACE
Data provided by FINRA's TRACE System.

Take-away

1. Higher markups contribute to the rise in spreads in OTC markets during crisis.
2. OTC markets are less competitive than they appear: highly segmented, and a few dealers dominate the trade in each security.
3. Concentration is associated with a larger increase in spreads during crisis.
4. An increase in risk of adverse selection weakens competition and drives up markups.
5. Intermediation can “clog” trade even if dealers do not face tighter capital constraints.

Thank you!

Information Acquisition

1. Dealers can learn the quality of each bond the market with probability $\lambda \in (0, 1)$ by paying a cost $c(\lambda)$ in period 0.
2. $c(\cdot)$ is increasing ($c' > 0$), convex ($c'' > 0$) and satisfies the Inada conditions ($c'(0) = 0, c'(1) = \infty$).
3. The probability that j dealers will learn about a bond:

$$\lim_{m \rightarrow \infty} \binom{m}{j} \lambda^j (1 - \lambda)^{m-j} = e^{-\lambda} \frac{\lambda^j}{j!}$$

4. Optimality condition for information acquisition (MIT shock):

$$\mu_s q_h \sum_{n=1}^{\infty} e^{-\lambda n} \frac{(1 - \pi^n)}{n} (v_h - R^d(n)) = c'(\lambda), \quad R^d(n) = \min\{B^U(n), \delta_s\} \quad (2)$$

Dealer specialize - Trade Heavily on Specific Bonds

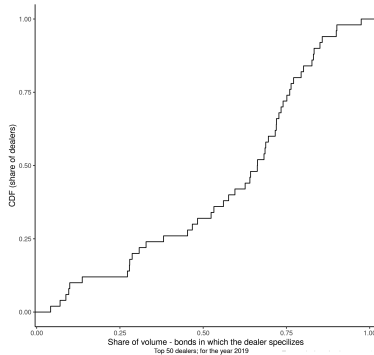


Figure: Share of dealer trades in bonds he specializes in trading.

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

Best Predictor of Bonds Concentration - Issue Size

Dependent Variable:	HHI	
	(1)	(2)
Rating (Code)	-0.0008	-0.0045***
Coupon Rate	0.0051	0.0080**
Non-standard coupon frequency	0.0650***	-0.0074
Rule 144a	0.0459***	0.0464***
Callable	0.0565***	-0.0356
Time to maturity	0.0007	0.0005*
Age	0.0044***	0.0016
Amount outstanding \$100M <		0.1501**
Amount outstanding \$100M – \$500M		0.1007***
Amount outstanding \$500M – \$1T		0.0379***
Issuer's industry FE	Yes	Yes
Observations	460,279	460,279
R ²	0.08	0.21

Clustered errors by the issuer's industry standard-errors in parentheses

Spreads by Dealer Prominence

$$\text{spread} = \beta \text{activity_level}_{t-1} + \text{bond} * \text{trade_size} * \text{date} + \text{dealer}$$

Prominent: at least 10% of trade and 5 transactions in principal capacity.

Active: at least 5 transactions in principal capacity.

Non-active: less than 5 principal trades.

trade type	C2D		D2C	
Model:	(1)	(2)	(3)	(4)
Active	-0.2227 (0.5272)	-1.178** (0.5568)	2.218*** (0.3878)	-0.4710 (0.3933)
Prominent	-11.58*** (0.5805)	-3.841*** (0.6147)	-8.617*** (0.4351)	-2.611*** (0.4511)
bond - trade size - date	Yes	Yes	Yes	Yes
dealer		Yes		Yes
Observations	10,702,378	10,702,378	12,097,754	12,097,754

Table: All principal trades in the years 2006 - 2020

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

Dealers Specialize by Issuer and by Industry

	Dealer share bond	Dealer share issuer
Dealer share issuer (but bond)	0.9780*** (0.0019)	
Dealer share industry (but issuer)		0.0134*** (5.4×10^{-5})
Observations	584,798	670,459
R ²	0.30679	0.21346

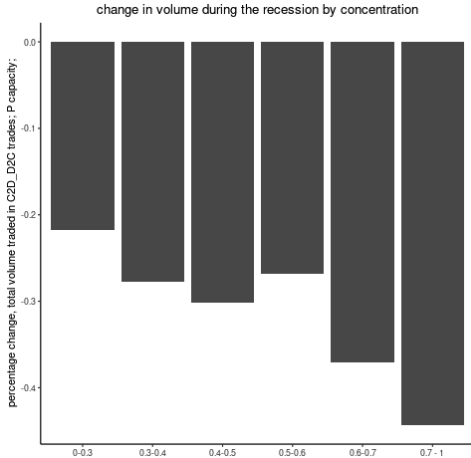
Table: Based on trades in the year 2019

Note: The data relied upon to generate this figure was TRACE Data provided by FINRA's TRACE System.

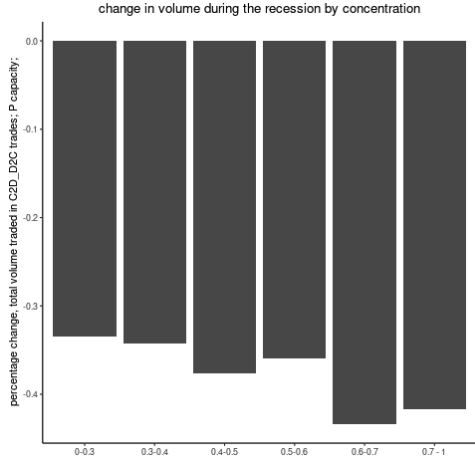
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Higher HHI - Greater Decline in Volume in Crisis



(a) Covid-19 Crisis



(b) 2007-2009 crisis

Figure: Behavior of spreads before and during a crisis.

Specialization by issuer, industry, and bond

- ▶ Regression model:

$$S_{d,b,t} = \beta_0 + \beta_1 S_{d,i,t,-b} + \epsilon$$

$S_{d,b,t}$ - share of d in the trade (volume) of bond b in year t .

$S_{d,i,t,-b}$ - share of d in trade of bonds by issuer i besides b .

- ▶ We get: $\beta_1 = 0.98^{***}$, $R^2 = 0.3$.

- ▶ Model 2:

$$S_{d,i,t} = \beta_0 + \beta_1 S_{d,j,t,-i} + \epsilon$$

Where j is a 5-digit NAICS industry classification code.

- ▶ Get: $\beta_1 = 26.27^{***}$, $R^2 = 0.21$.