

Liquidity Provision in a One-Sided Market: The Role of Dealer-Hedge Fund Relations

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Introduction

- ▶ Most of the U.S. corporate bond market trades OTC and dealer intermediation is essential to its functioning, especially in stress periods
 - Funding costs and regulatory constraints affect dealers' ability to provide liquidity
Adrian et al. (2017); Anderson and Stulz (2017); Bao, O'Hara and Zhou (2018); Bessembinder et al. (2018); Choi, Huh and Shin (2023); Dick-Nielsen and Rossi (2019); Duffie (2022); Macchiavelli and Zhou (2022); Saar et al. (2023); Schultz (2017); Trebbi and Xiao (2019)
- ▶ Dealers' willingness to absorb order flow or match buyers and sellers depends on their ability to find entities willing to take the other side
 - Especially valuable in **one-sided markets** when searching for counterparties becomes challenging
- ▶ Dealers have multifaceted relationships with hedge funds through their prime brokerage and repo businesses
 - Hedge funds are less regulated than dealers and more willing and able to absorb risk
 - Corporate bond-trading hedge funds are **natural buyers** (Shleifer and Vishny, 2011)
 - Hedge funds increased investment-grade corporate bond holdings in the COVID crisis, despite severe dislocations (Haddad, Moreira, and Muir, 2021)
- ▶ **Question:** Do dealer-hedge fund relationships matter for corporate bond liquidity when markets become one-sided?

Our paper

- ▶ **Setting:** March 2020 COVID liquidity crisis
 - Corporate bond market faced severe selling pressure amid a dash for liquidity (O'Hara and Zhou, 2021 & 2023)
 - Bond mutual funds saw heavy outflows and were forced to sell corporate bonds to meet redemptions (Falato, Goldstein, and Hortaçsu, 2021; Ma, Xiao, and Zeng, 2022)
 - The bonds heavily sold by MFs likely presented one-sided flows to dealers
- ▶ **Approach:** We link data on dealers' corporate bond trades with data on their relationships with hedge funds
 - We test whether dealers' connections to corporate bond-trading hedge funds mattered for the liquidity of bonds that were heavily sold by mutual funds

Preview of findings

- ▶ For bonds more heavily sold by mutual funds, dealers with stronger connections to corporate bond-trading hedge funds charged smaller bid-ask spreads
- ▶ Our results are not driven by other factors that could affect dealer liquidity provision, such as repo funding availability and costs, leverage constraints, or prime brokerage sophistication
- ▶ Hedge funds' size and risk tolerance predict their ability to absorb more corporate bonds during the COVID liquidity crisis

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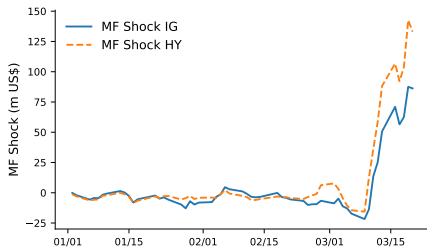
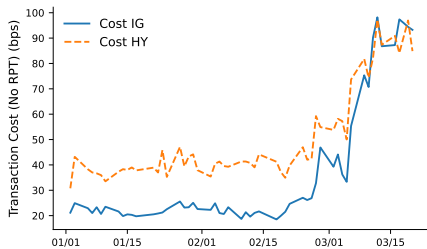
- ▶ U.S. corporate bond transactions from FINRA Regulatory TRACE
 - Dealers identified, customers anonymous
 - Merge with FISD and keep rated, straight coupon bonds
 - Transaction cost for each trade computed (Hendershott and Madhavan 2015):

$$Cost_{i,j,r} = \log \left(\frac{P_{i,j,r}}{P_{j,r}^B} \right) \cdot Sign_{i,j,r}.$$

- ▶ Quarterly bond holdings of mutual funds from eMAXX and daily mutual fund flows from Morningstar to determine which bonds were heavily sold
 - As in Ma, Xiao and Zeng (2022), we construct a bond-specific imputed outflow, $MFS_{shock}_{j,t}$ as

$$MFS_{shock}_{j,t} = \sum_k Fund\ outflow_{k,t} \times \frac{Holding_{j,k,2019Q4}}{\sum_l Holding_{j,l,2019Q4}}$$

Measures during the COVID liquidity crisis



Data

- ▶ Dealer-hedge fund connections from SEC Form PF and SEC Form ADV
 - Credit data at dealer-hedge fund level
 - Focus on hedge funds with corporate bond exposures
 - Our proxy $HFExp_{i,j,t-1}$ is the log of the average corporate bond exposure of connected hedge funds

- ▶ Daily transaction data on corporate bond triparty repo from FRBNY
 - $RepoRate_{pre}$: average pre-crisis repo rate, weighted by loan amount
 - $RepoShock$: monthly change in corporate bond repos between the dealer and prime money market funds (Li et al., 2020)

- ▶ Leverage ratios from Fed stress tests and SEC FOCUS reports
 - We construct a measure of the tightness of the leverage constraint
$$LeverageIntensity_{pre} = (\min LR - 2019Q4 LR) / \min LR$$

Summary statistics

Panel A: Bond-Dealer-Day Level

Variable	count	mean	st.dev.	p(10)	p(50)	p(90)
Cost (bps)	230,555	41.39	54.97	1.10	18.38	117.75
Cost (No RPT) (bps)	152,441	39.96	57.03	1.89	17.42	108.57
MF Shock (m US\$)	230,555	38.88	23.16	3.65	39.54	67.86
HF Expo	230,555	20.85	1.11	19.05	20.93	22.12
Log(TTM)	230,555	7.57	1.07	6.18	7.61	9.12
Repo Shock (%)	194,531	2.29	33.36	-26.88	0	15.80
Repo Rate _{pre} (%)	201,959	1.75	0.21	1.61	1.77	1.95
Leverage Intensity _{pre} (%)	230,555	-26.55	9.98	-41.40	-27.20	-12.50

Summary Statistics

Panel B: Hedge Fund-Month Level

Variable	count	mean	st.dev.	p(10)	p(50)	p(90)
<i>NAV</i> _{<i>h,t</i>} (m US\$)	1,419	1,863.68	2,902.84	220.21	952.91	3,964.29
<i>CorpBondGNE</i> _{<i>h,t</i>} (m US\$)	4,189	383.82	752.96	1.51	111.74	1,013.33
<i>CorpBondLNE</i> _{<i>h,t</i>} (m US\$)	4,189	330.47	655.35	0.42	95.51	853.76
<i>CorpBondSNE</i> _{<i>h,t</i>} (m US\$)	4,189	53.33	178.85	0.00	0.00	103.33
<i>RiskLimit</i> _{<i>h,t</i>} (%)	1,568	3.84	4.33	0.94	2.71	6.73
<i>PortIlliq</i> _{<i>h,t</i>} (days)	1,419	68.77	96.10	1.78	23.41	213.27
<i>ShareRes</i> _{<i>h,t</i>} (days)	1,419	186.31	136.55	0.50	185.50	366.00
<i>FinDur</i> _{<i>h,t</i>} (days)	1,147	66.99	106.48	0.50	19.00	273.00
<i>LiqMismatch</i> _{<i>h,t</i>} (days)	1,140	-92.21	94.58	-241.64	-72.02	1.99
<i>NetRetM</i> _{<i>h,t</i>} (%)	3,829	-1.33	5.66	-8.74	0.20	2.55
<i>NetFlows</i> _{<i>h,t</i>} (%)	1,353	-0.76	17.91	-14.67	-0.86	10.75
<i>MgrStake</i> _{<i>h,t</i>} (%)	1,352	12.88	23.79	0.00	3.00	37.00

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Dealer-Hedge Fund Relations and Corporate Bond Liquidity

- ▶ We hypothesize that dealers' relations with hedge funds played an important role in their liquidity provision during the COVID crisis
- ▶ To test this hypothesis, we run the following panel regression:

$$\begin{aligned} Cost_{i,j,t} = & \beta_1 HFExpo_{i,j,t-1} + \beta_2 MFShock_{j,t} + \beta_3 HFExpo_{i,j,t-1} \times MFShock_{j,t} \\ & + \beta_4 HFExpo_{i,j,t-1} \times Crisis \\ & + \beta_5 MFShock_{j,t} \times Crisis \\ & + \beta_6 HFExpo_{i,j,t-1} \times MFShock_{j,t} \times Crisis \\ & + \gamma Controls + \mu_{i,j,t} + \varepsilon_{i,j,t}, \end{aligned}$$

Dealer-Hedge Fund Relations and Corporate Bond Liquidity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Cost							
HF Expo×Crisis	-0.556 (2.276)	0.045 (2.357)						
MF Shock×Crisis	1.779** (0.662)							
HF Expo×MF Shock ×Crisis ₋₄								
HF Expo×MF Shock ×Crisis ₋₃								
HF Expo×MF Shock ×Crisis ₋₂								
HF Expo×MF Shock ×Crisis	-0.073** (0.032)	-0.065*** (0.022)						
Log(TTM)	33.369*** (7.526)							
<i>N</i>	229,856	161,633						
<i>R</i> ²	0.335	0.582						
Dealer FE	Yes	Yes						
Day FE	Yes	No						
Bond FE	Yes	No						
Bond-Day FE	No	Yes						

Dealer-Hedge Fund Relations and Corporate Bond Liquidity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Cost		Cost					
HF Expo×Crisis	-0.556 (2.276)	0.045 (2.357)	-1.486 (2.036)	-0.329 (2.345)				
MF Shock×Crisis	1.779** (0.662)		1.656** (0.611)					
HF Expo×MF Shock ×Crisis ₋₄			-0.019 (0.011)	-0.007 (0.017)				
HF Expo×MF Shock ×Crisis ₋₃			-0.002 (0.009)	-0.007 (0.018)				
HF Expo×MF Shock ×Crisis ₋₂			0.014 (0.012)	0.014 (0.018)				
HF Expo×MF Shock ×Crisis	-0.073** (0.032)	-0.065*** (0.022)	-0.069** (0.029)	-0.061** (0.026)				
Log(TTM)	33.369*** (7.526)		31.986*** (7.763)					
<i>N</i>	229,856	161,633	229,856	161,633				
<i>R</i> ²	0.335	0.582	0.335	0.582				
Dealer FE	Yes	Yes	Yes	Yes				
Day FE	Yes	No	Yes	No				
Bond FE	Yes	No	Yes	No				
Bond-Day FE	No	Yes	No	Yes				

Dealer-Hedge Fund Relations and Corporate Bond Liquidity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Cost		Cost		Cost (No RPT)		Cost (No RPT)	
HF Expo×Crisis	-0.556 (2.276)	0.045 (2.357)	-1.486 (2.036)	-0.329 (2.345)	0.893 (2.498)	4.874** (1.899)	-0.040 (2.304)	4.632** (1.898)
MF Shock×Crisis	1.779** (0.662)		1.656** (0.611)		1.221** (0.568)		1.344** (0.562)	
HF Expo×MF Shock ×Crisis ₋₄			-0.019 (0.011)	-0.007 (0.017)			-0.008 (0.014)	0.019 (0.022)
HF Expo×MF Shock ×Crisis ₋₃			-0.002 (0.009)	-0.007 (0.018)			-0.010 (0.013)	-0.023 (0.023)
HF Expo×MF Shock ×Crisis ₋₂			0.014 (0.012)	0.014 (0.018)			0.004 (0.012)	-0.002 (0.018)
HF Expo×MF Shock ×Crisis	-0.073** (0.032)	-0.065*** (0.022)	-0.069** (0.029)	-0.061** (0.026)	-0.059* (0.028)	-0.081** (0.033)	-0.064** (0.028)	-0.089** (0.037)
Log(TTM)	33.369*** (7.526)		31.986*** (7.763)		59.140*** (7.585)		60.724*** (7.878)	
<i>N</i>	229,856	161,633	229,856	161,633	151,629	93,197	151,629	93,197
<i>R</i> ²	0.335	0.582	0.335	0.582	0.426	0.671	0.427	0.671
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	No	Yes	No	Yes	No	Yes	No
Bond FE	Yes	No	Yes	No	Yes	No	Yes	No
Bond-Day FE	No	Yes	No	Yes	No	Yes	No	Yes

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1. Dealer access to, and cost of, repo funding for corporate bond collateral
 - *RepoShock*: monthly change in corporate bond repo funding from prime MMFs (Li et al. 2020)
 - *RepoCost_{pre}*: pre-crisis repo rate paid by dealers to finance corporate bond repo
2. Dealer balance sheet constraints may hinder their ability to make markets, resulting in higher transactions costs
 - *LeverageIntensity_{pre}*: measure of tightness of leverage constraint
3. Overall sophistication of prime brokerage activities, rather than connections to corporate bond hedge funds
 - Placebo tests: If so, we would observe similar results if we use equity or Treasury exposures of connected hedge funds
 - We construct *HFExpoEq* and *HFExpoTsy* similarly to *HFExpo*

Alternative Explanations: Repo funding and leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Cost		Cost		Cost		Cost	
HF Expo×Crisis	-1.170 (2.475)	-0.625 (2.324)	2.122 (3.478)	3.867 (3.659)	-2.216 (1.965)	-0.445 (2.118)	0.806 (3.602)	3.806 (3.674)
MF Shock×Crisis	2.031** (0.761)		2.291*** (0.589)		1.815** (0.651)		2.014*** (0.570)	
HF Expo×MF Shock ×Crisis	-0.084** (0.037)	-0.066** (0.027)	-0.097*** (0.029)	-0.062** (0.026)	-0.073** (0.031)	-0.065** (0.025)	-0.083*** (0.028)	-0.062** (0.023)
Log(TTM)	29.454*** (6.489)		29.194*** (7.064)		29.240*** (6.573)		29.187*** (6.920)	
Repo Shock	-0.005 (0.013)	0.002 (0.011)	-0.005 (0.014)	0.003 (0.011)				
Repo Rate _{pre}					1.435 (19.548)	-3.335 (10.783)	8.444 (14.640)	2.820 (7.608)
Leverage Intensity _{pre}			-0.447 (0.639)	-0.544 (0.445)			-0.443 (0.554)	-0.538 (0.405)
<i>N</i>	193,803	126,532	193,803	126,532	202,560	134,757	202,560	134,757
<i>R</i> ²	0.336	0.582	0.336	0.583	0.332	0.578	0.333	0.579
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	No	Yes	No	Yes	No	Yes	No
Bond FE	Yes	No	Yes	No	Yes	No	Yes	No
Bond-Day FE	No	Yes	No	Yes	No	Yes	No	Yes

Alternative Explanations: Placebo tests

	(1)	(2)	(3)	(4)	(5)	(6)
HFExpoEq×Crisis	2.261 (3.207)	3.868 (3.238)	2.368 (3.758)			
HFExpoTsy×Crisis				-1.577 (5.932)	6.256 (8.065)	5.457 (7.962)
MF Shock×Crisis	0.783 (0.624)	0.796 (1.159)	0.394 (0.715)	1.223 (0.925)	1.882* (1.039)	1.510 (0.975)
HFExpoEq×MF Shock ×Crisis	-0.022 (0.025)	-0.021 (0.047)	-0.005 (0.029)			
HFExpoTsy×MF Shock ×Crisis				-0.041 (0.038)	-0.066 (0.043)	-0.051 (0.040)
Log(TTM)	33.968*** (8.009)	30.619*** (7.505)	30.511*** (7.251)	33.646*** (7.297)	29.481*** (7.183)	29.800*** (7.139)
Repo Shock		-0.012 (0.018)			-0.031* (0.016)	
Repo Rate _{pre}			9.487 (15.821)			8.223 (16.804)
Leverage Intensity _{pre}		-0.697 (0.536)	-0.736 (0.459)		-0.747 (0.602)	-0.778 (0.532)
<i>N</i>	229,856	193,803	202,560	229,856	193,803	202,560
<i>R</i> ²	0.334	0.336	0.333	0.334	0.337	0.333
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Bond FE	Yes	Yes	Yes	Yes	Yes	Yes

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Hedge Fund Characteristics and Corporate Bond Liquidity

- ▶ Which hedge fund characteristics were associated with bond-buying funds during the crisis?
 - Literature on hedge fund liquidity provision focuses on equity markets and share restrictions (Ben-David, Franzoni and Moussawi, 2012; Hombert and Thesmar, 2014; Aragon, Martin and Shi, 2019)
 - Kruttli et al (2021) highlight the importance of hedge funds' internal risk limits in the Treasury market
- ▶ Corporate bonds trade OTC and are much less liquid than Treasuries
 - Lower liquidity of bonds might place importance on share restrictions and liquidity mismatch (Aragon, 2007; Agarwal, Daniel and Naik, 2009; Teo, 2011; Sadka, 2010)
 - Internal risk limits may also be important in corporate bond markets
- ▶ To test these hypotheses, we run the following panel regression model:

$$\Delta \log CorpBondLNE_{h,t} = \gamma_1 Z_{h,t-1} + \gamma_2 Z_{h,t-1} \times Crisis + \mu_h + \theta_t + \varepsilon_{h,t}$$

Hedge Fund Characteristics and Corporate Bond Liquidity

Dependent variable: $\Delta \log \text{CorpBondLNE}$

	(1)	(2)	(3)	(4)
RiskLimit \times Crisis	10.080*** (3.853)	10.082*** (3.848)	14.425*** (4.296)	14.431*** (4.299)
LiqMismatch \times Crisis	0.709 (4.981)	0.716 (4.984)	-0.693 (4.962)	-0.679 (4.963)
LogNAV \times Crisis			11.155** (4.713)	11.181** (4.721)
NetRetM \times Crisis			-1.538 (5.305)	-1.452 (5.360)
NetFlows \times Crisis			-9.413 (5.964)	-9.281 (6.010)
MgrStake \times Crisis			-6.490 (4.526)	-6.486 (4.519)
<i>N</i>	1,054	1,054	1,054	1,054
<i>R</i> ²	0.164	0.165	0.195	0.196
Fund FE	Yes	Yes	Yes	Yes
Month FE	No	Yes	No	Yes

Hedge Fund Characteristics and Corporate Bond Liquidity

Dependent variable: $\Delta \log \text{CorpBondLNE}$

	(1)	(2)	(3)	(4)
RiskLimit \times Crisis	12.913*** (4.157)	12.881*** (4.155)	13.748*** (4.318)	13.746*** (4.317)
LogNAV \times Crisis	6.466** (2.943)	6.477** (2.943)	12.251*** (4.668)	12.276*** (4.676)
LiqMismatch \times Crisis	0.308 (2.762)	0.312 (2.762)		
NoRiskLimit \times Crisis	-4.986 (5.080)	-5.025 (5.081)		
PortIlliq \times Crisis			10.423 (6.919)	10.415 (6.923)
ShareRes \times Crisis			-3.825 (5.226)	-3.818 (5.226)
FinDur \times Crisis			4.390 (6.093)	4.416 (6.092)
<i>N</i>	2,599	2,599	1,054	1,054
<i>R</i> ²	0.223	0.224	0.216	0.217
Controls \times Crisis	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Month FE	No	Yes	No	Yes

In process

- ▶ Dealers with stronger relationships with corporate bond hedge funds held less inventory during the COVID crisis
- ▶ Some hedge funds that increased corporate bond positions may have been trading the CDS-bond basis

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- ▶ The secondary market for corporate bonds relies on dealers for intermediation
- ▶ For bonds more heavily sold by mutual funds during the COVID crisis, dealers with stronger connections to corporate bond-trading hedge funds charged smaller bid-ask spreads
- ▶ Our results are not driven by other factors that could affect dealer liquidity provision, such as repo funding availability and costs, leverage constraints, or prime brokerage sophistication
- ▶ Hedge funds that are larger and better positioned to absorb risk are valuable to dealers in one-sided markets