Whose Asset Sales Matter?

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Motivation

Price impact of sales of financial assets.

- Efficiency of markets.
- Risks to financial stability.

Literature & recent episodes indicate asset sales can depress prices, and this can spill over to other parts of financial system.

Relatively little known about how price impacts vary across assets, time & investors, and what determines their size.

This Paper

Question

1. How do asset sales impact prices?
2. How does this depend on who is selling?

Approach

1. Unique data on all types of firms' trading in corporate & government bonds.
2. New measure of selling pressure based on traders' sales of bonds other than bond in question.
   $\rightarrow$ Instrumental variable for sales.
3. Study price impact of sales across time, bonds & traders.

Findings

Findings

- Price impacts of sales material, greater in corporate bonds, & in 'dash for cash' in March 2020.
- Impacts vary depending on who is selling.
- Sales by dealers & hedge funds generate much larger impacts than sales of same size by other investors.
  $\rightarrow$ Consistent with informational advantages & specialist roles in OTC markets.

Implications

- Risks from asset sales function of likelihood of selling and impact of selling.
- Devote more attention to risks from these impactful sellers.
- Price impact measure useful to monitor risks from asset sales by all investors.

Literature & Contribution

Impact of fire sales on asset prices & other outcomes
Coval & Stafford (2007); Choi, Hoseinzade, Shin & Tehranian (2020); Wardlaw (2020); Falato, Hortacsu, Li & Shin (2021); Edmans, Goldstein & Jiang (2012); Ellul, Jotikasthira & Lundblad (2011).

Innovation: Data across all traders (& asset types) & consistent measure of selling pressure.

Contribution: Whose sales matter? Which assets?

Literature & Contribution

Developments in OTC market liquidity
Duffie (2018, 2020); He, Nagel & Song (2021); Choi, Huh & Shin (2023).

Our paper: propensity of traditional liquidity suppliers to become liquidity demanders as key determinant of liquidity.

Trading in recent stress episodes
Barth & Kahn (2021); Haddad, Moreira & Muir (2020); Kargar, Lester, Lindsay, Liu, Weill, Zúñiga (2020); Schrimpf, Shin & Sushko (2020); Czech, Gual-Ricart, Lillis & Worlidge (2021); Czech, Huang, Lou & Wang (2021).

Our paper: different focus – importance of **who** is selling – and both corporate & government bonds.

Data

Data

Transactions: Transactions of government and corporate bonds from MiFID II.

Funds: Mutual funds' TNAs, estimated net flows and quarterly portfolio holdings from Morningstar.

Time period: 1 January 2019 to 1 July 2020 (smaller subsample for fund analysis), weekly aggregation.

Bond markets

Secondary markets for bonds tend to be over-the-counter and dealer-intermediated.

Segmentation across:

- Bonds: different investors trade different bonds.
- Investors: relationships between investors.

Little pre- and post-trade transparency, especially for corporate bonds.

One issuer can issue multiple bonds.

Summary stats: Instruments

	Share	Trade Share
Corporate	85	44
Government	15	56
GBP	7	11
EUR	26	44
USD	47	39
Other	20	6
0-5 years	45	21
6-10 years	37	44
11-20 years	7	12
21+ years	11	24

Summary stats: Traders

	Share	Trade Share
Fund	44	15
Bank	11	14
Dealer	3	51
Hedge Fund	6	2
Other	37	18

Summary stats: Weekly Trading

	Number
Instruments	23,588
Traders	2,922
Instruments per Trader	78
Traders per Instrument	10

On average:

- each trader trades a large number of bonds; and
- each bond is traded by a large number of traders.

Research Design

Why do sales have price impacts?

2 paradigms for understanding price impacts:

1. **Asymmetric information** (Kyle, 1985).
   - Informed traders' sales signal asset value, so cause price impact (even if this trade is not informative).

2. **Specialists vs non-specialists** (Shleifer & Vishny, 1992)
   - Assets usually held by specialists, who value them.
   - Assets sold en masse by specialists can only be bought by non-specialists, who demand a discount.

Both paradigms: **non-fundamental sales $\rightarrow$ prices fall**.

Identification of price impacts

Why not just look at price falls when assets sold?

News: signals observable to investors but not econometrician.

Suppose we observe investors selling bond i issued by Dell. We cannot know if sale was due to:

- **Bond**: investors received signal about Dell.
- **Investor**: needed to sell for their own reasons.

Joint determination: cannot regress price on quantity!

Implication: can't study price impacts by looking at price changes when assets are sold.

Outside Selling Pressure: Intuition

Suppose:

- We can identify **unrelated bonds**.
- There are no 'systemic' events in a period.

If investor selling bond i is selling many unrelated bonds,
$\rightarrow$ trades in i likely driven by investor's condition, rather than idiosyncratic properties of bond i.

If investor is selling bond i for idiosyncratic (to the bond) reasons,
$\rightarrow$ sales of unrelated bonds should average ≈ 0.

Outside Selling Pressure: Details

For investors $j \in \mathcal{J}$ selling bond i at time t:

- Compute their % net selling of all bonds except those issued by the same entity as bond i.
- Call this variable **outside selling pressure (OSP)** $z_{i,t}$.

Pressure high when investors selling asset i at time t are big net sellers of other bonds. Formalism

Empirical Approach

Two steps:

1. Use outside selling pressure $z_{i,t}$ as an instrumental variable.
2. Include issuer-week fixed effects (& control for bond characteristics).

Compare bonds **within issuers**: price falls in one Dell bond facing large outside selling pressure to another Dell bond that isn't.

Assumptions:

1. Exogeneity: selling pressure uncorrelated with news.
2. Relevance: selling pressure correlated with sales.

...conditional on fixed effects.

Empirical Specification

$$p_{i,t} = \sum_{\mathcal{J}} \beta_{\mathcal{J}} s^{V}_{i,t,\mathcal{J}} + X_{i,t}\gamma + \epsilon_{i,t}$$

$$s^{V}_{i,t,\mathcal{J}} = \sum_{\mathcal{J}} \eta_{\mathcal{J}} z_{i,t,\mathcal{J}} + X_{i,t}\omega + \nu_{i,t}$$

where:

- $p_{i,t}$ is price of bond i at time t.
- $s^{V}_{i,t,\mathcal{J}}$ are sales of bond i by firms of type $\mathcal{J}$.
- $z_{i,t,\mathcal{J}}$ is outside selling pressure for bond i and firms of type $\mathcal{J}$.
- $X_{i,t}$ is a vector of controls including issuer-week and bond fixed effects.

Role of Instrumental Variable

$$p_{i,t} = \sum_{\mathcal{J}} \beta_{\mathcal{J}} s^{V}_{i,t,\mathcal{J}} + X_{i,t}\gamma + \epsilon_{i,t}$$

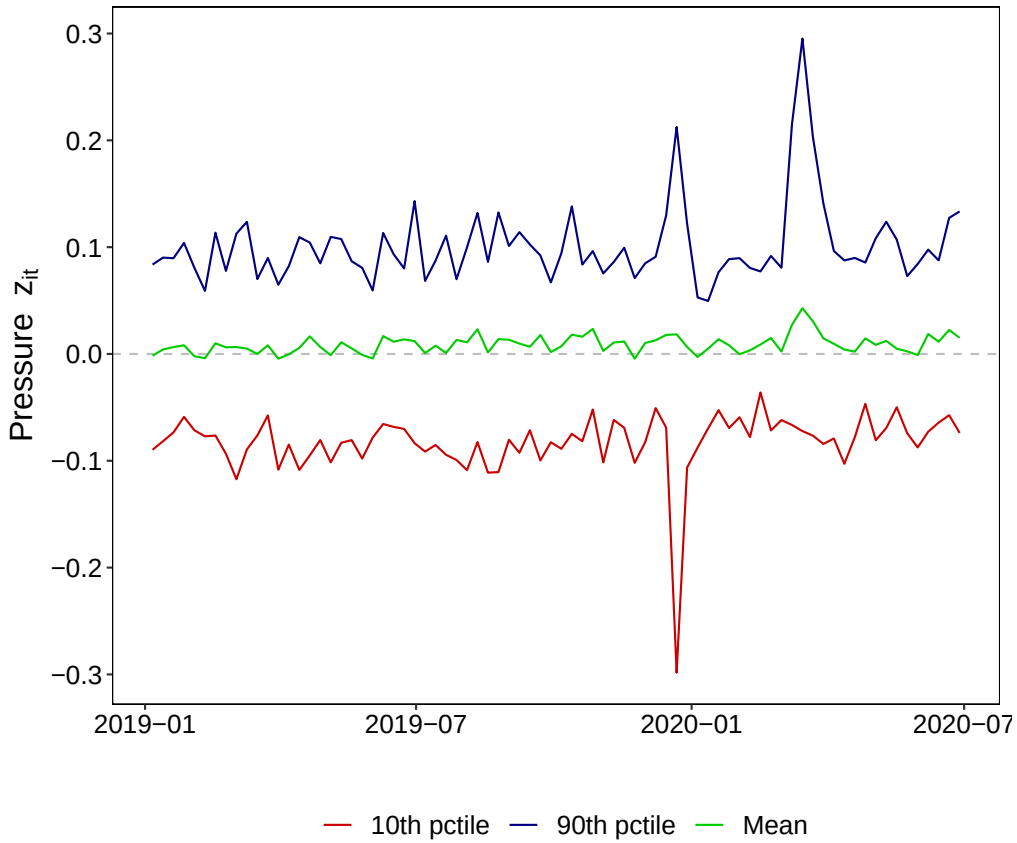
2 issues with OLS:

1. Prices & sales simultaneously determined: supply or demand?
2. Sales endogenous: responding to information?

2 roles for instrument:

1. Exogenous shift in traders' demand: trace out liquidity supply.
2. Sales unrelated to fundamentals.

Selling Pressure through Time



Selling pressure varies across bonds and spiked for some bonds during dash-for-cash. Summary Stats

Outside Selling Pressure (OSP) vs. Existing Measures

	Fund outside selling pressure $z^F_{i,t}$		
	(1)	(2)	(3)
Coval-Stafford	0.007^{***}		
	(0.002)		
Wardlaw F2V		0.0002	
		(0.0007)	
Wardlaw F2S			0.003^{***}
			(0.0008)
R^2	0.38	0.30	0.30
Observations	335,335	830,292	830,292
Issuer-Week FEs	Yes	Yes	Yes
Instrument FEs	Yes	Yes	Yes

OSP shares some common variation with existing measures of selling pressure based on fund flows.

Results

Results Overview

Aggregate results.

- Impact of pressure on all traders on prices.
- Variation across bonds & time.
- Aggregate sales net to zero $\rightarrow$ cannot use 2SLS approach, so use reduced form:

$$p_{i,t} = \sum_{\mathcal{J}} \delta_{\mathcal{J}} z_{i,t,\mathcal{J}} + X_{i,t}\eta + \nu_{i,t}$$

Sector-level results.

- Variation across trader types, for the same bond.
- Use 2SLS approach: coefficient is price impact of selling.

Price Impacts of Pressure

	Price (%)
	(1)
Pressure $z_{i,t}$	-0.3727***
	(0.0506)
R^2	0.89582
Observations	1,514,387
Issuer-Week FEs	Yes
Instrument FEs	Yes

5^{th} to 95^{th} percentile of OSP $\rightarrow$ 25 basis point fall in price.

Summary Stats

Price Impacts: Bond type & Stress

	Price (%)			
	Corporate	Government	March 2020	Rest of sample
	(1)	(2)	(3)	(4)
Pressure $z_{i,t}$	-0.468***	-0.102	-0.593***	-0.402***
	(0.055)	(0.114)	(0.176)	(0.052)
R^2	0.89	0.90	0.97	0.90
Observations	1,193,684	320,703	80,541	1,433,846
Issuer-Week FEs	Yes	Yes	Yes	Yes
Instrument FEs	Yes	Yes	Yes	Yes

Impact of selling pressure greater in:

- Less liquid (corporate) bonds.
- Times of stress (March 2020).

Duration of Price Impacts

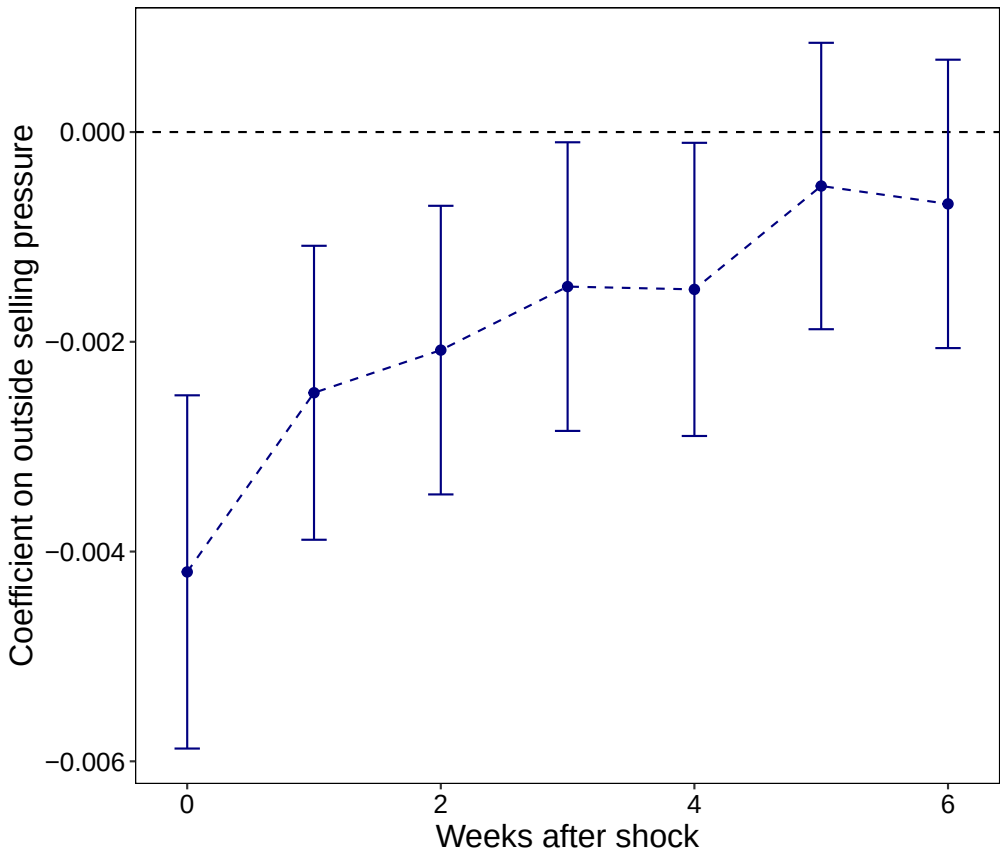
Truly non-fundamental sales should have only temporary impacts on price $\rightarrow$ no news about asset fundamentals.

$$p_{i,t+\tau} = \sum_{\mathcal{J}} \delta_{\mathcal{J}} z_{i,t,\mathcal{J}} + X_{i,t}\eta + \nu_{i,t}$$

for $\tau = 0, 1, 2, 3, ...$

Price impacts should **die away**.

Price Impacts through Time



Price impacts persistent, but indistinguishable from 0 after a month.

Sector-level Results

Key features of paper:

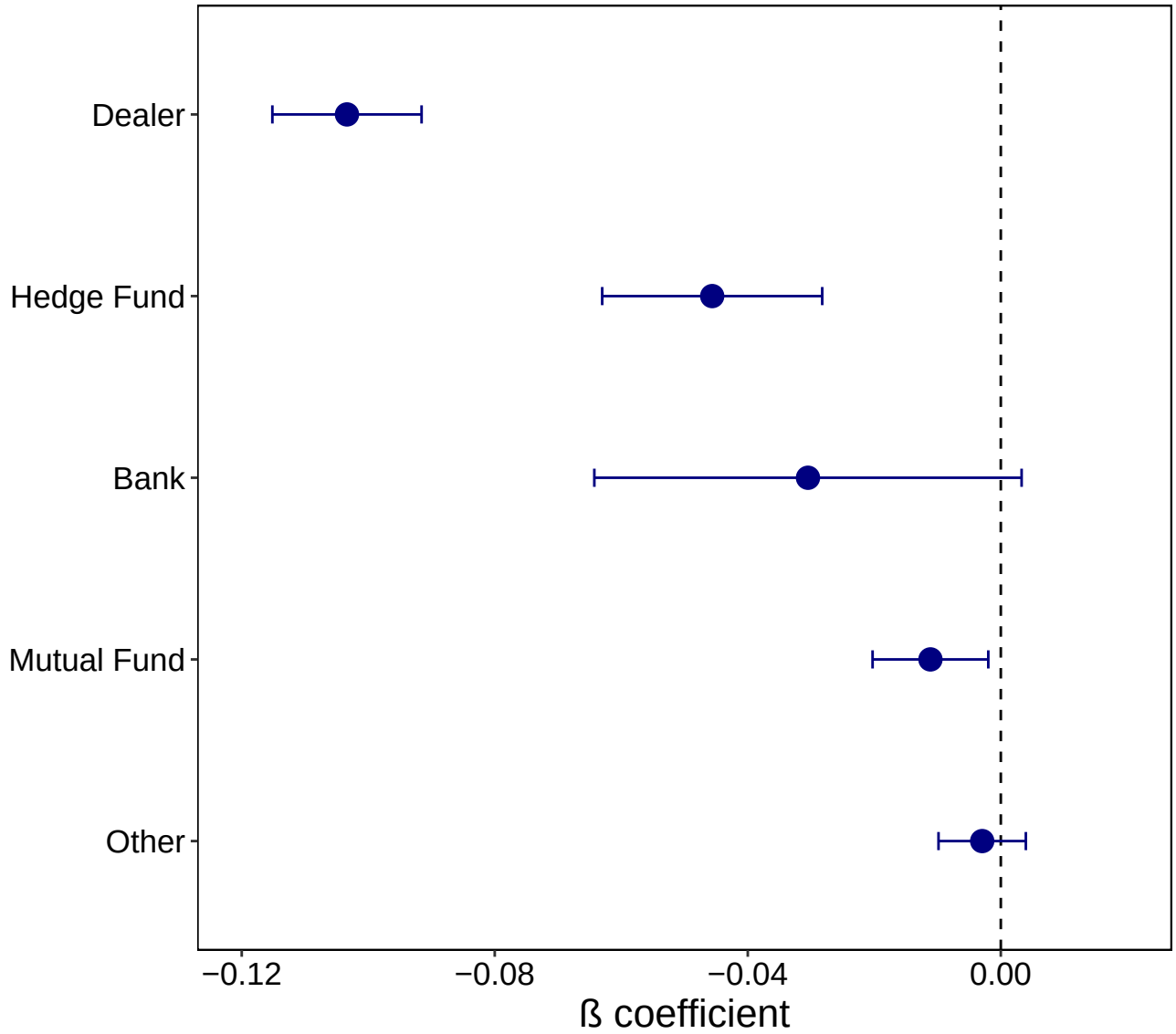
1. **Common measure** of selling pressure across all types of trader.
2. Data on identities of **all types of trader**.

Whose asset sales matter?

$$p_{i,t} = \sum_{\mathcal{J}} \beta_{\mathcal{J}} s^{V}_{i,t,\mathcal{J}} + X_{i,t}\gamma + \epsilon_{i,t}$$

Summary Stats

Price Impacts by Sector



Price Impacts by Sector

Clear **ordering across sectors**:

- Dealers' sales most impactful.
- Hedge funds second.
- Mutual funds are relatively low impact.

Large magnitudes:

- 1 standard deviation change in dealers' sales associated with 6.9pp drop in bond price.
- Impact of funds' sales 9 times smaller than dealers' sales.

Trader-specific price impacts

Interpretation

Two questions:

1. What drives variation in our pressure measure?
2. Why does it matter who sells an asset?

What drives outside selling pressure?

Three types of sales:

1. **Fundamentals** trading: based on news about cashflows.
2. **Noise** trading: uncorrelated with anything.
3. **Correlated** trading: non-fundamental & correlated across assets.

Outside selling pressure removes fundamentals & noise trading.

What's left?

- Fire sales.
- Other correlated non-fundamental sales.

Non-fundamental sales

Balance in OSP between fire sales and other non-fundamental sales likely varies across sectors.

Ample evidence of fire sale dynamics in **mutual funds** (Ma, Xiao & Zeng, 2022).
$\rightarrow$ OSP correlated with fund-based measures of selling pressure.

Evidence of fire sales by **hedge funds** (Ben-David, Franzoni & Moussawi, 2012; Barth & Kahn, 2021).
$\rightarrow$ OSP captures this plus other non-fundamental trading.

Dealers not thought of as major fire sellers in recent years.
$\rightarrow$ OSP likely to capture other non-fundamental trading, e.g. selling for inventory/liquidity management during dash-for-cash (O'Hara & Zhou, 2021).

Determinants of price impacts

2 paradigms for understanding price impact:

1. Asymmetric information (Kyle, 1985).
2. Specialists vs non-specialists (Shleifer & Vishny, 1992).

Asymmetric information

Kyle model of trading:

- Informed & uninformed trader, plus market maker.
- Market maker cannot tell informed & uninformed trading apart, so sets price to break even on average.

Per-unit impact of sales on price given by **Kyle's lambda**:

$$\lambda = \frac{1}{2}\frac{\sqrt{\Sigma_0}}{\sigma_u}$$

where:

- Σ_0 is variance of asset's fundamental value.
- σ_u is standard deviation of noise trading.

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Better private info $\rightarrow$ greater price impact.

Asymmetric information in our context

Our IV approach means we know sales are non-fundamental.
$\rightarrow$ But counterparties to these sales do not.

Counterparty faces inference problem to establish extent to which sales are driven by private information.
$\rightarrow$ More private information leads to greater price discount.

Two types of information.

- Information about **bond fundamentals**.
- Information about **future order flow**.

Informational advantages

Dealers

- Informational advantage from bookbuilding process extends to secondary markets (Goldstein et al., 2021).
- Dealers benefit from observing order flow (Bessembinder et al., 2006; Kondor & Pinter, 2022; Pagano & Röell, 1996).

Hedge funds

- Strategies based on acquiring superior information.
- Benefit from informational advantage over future trading flows & bond fundamentals (Czech et al., 2021).

Specialists & Non-specialists

Specialist & non-specialist asset holders (Shleifer & Vishny, 1992).

Fire sales occur when:

- There are natural holders of an asset.
- Natural holders forced to sell to non-specialists, who value asset less & thus demand price discount.

Our context: **specialists in liquidity provision**.

Specialists & non-specialists in our context

Dealers and hedge funds are specialists in OTC markets.

Dealers as market makers.

- Market making business model, linking buyers with sellers & 'leaning against the wind' (Weill, 2007).

Hedge funds as arbitrageurs.

- Exploit mispricing of securities & seek to profit when other firms sell (Jylhä et al., 2014), providing liquidity as a result.

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Large price falls when these specialists in liquidity provision switch to demanding liquidity.

Determinants of price impacts

2 paradigms for understanding price impact:

1. Asymmetric information. ✓
2. Specialists vs non-specialists. ✓

Next steps: can we discriminate between the two?

Implications: Literature

Price impact of trading depends on who is selling.

- Literature on fire sales understudies role of dealers.
- Recent findings of modest effects of mutual fund forced sales (Wardlaw, 2020; Choi et al, 2020) do not imply risks from asset sales are always modest.

Importance of understanding determinants of price impact (information & specialist roles) & how they vary across traders, times & instruments.

Variation in price impact reveals underlying market frictions.

Implications: Policy

Risk from fire sales by a sector a function of:

- Likelihood of fire sales.
- **Impact of fire sales.**

The role of price impact perhaps under-discussed.

All else equal, more focus should be placed on impactful sellers.

Methods & results useful inputs into regulatory models.

Conclusion

New method to identify price impacts of asset sales, applicable in principle to any trader in any asset.

Key result: price impacts of selling depend on who is selling.

Implications for:

- Nature of price impact in OTC markets.
- Who poses risks to financial stability.

Thank you!

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Outside Selling Pressure: Formalism

Let $s_{i,j,t}$ be net sales of bond i by trader j at time t, and iss_i be the issuer of bond i.

Define:

$$\begin{aligned} z^{NS}_{i,j,t} &= \sum_k \mathbf{1}(iss_i \neq iss_k) s_{k,j,t} \\ z^{T}_{i,j,t} &= \sum_k \mathbf{1}(iss_i \neq iss_k) |s_{k,j,t}| \end{aligned}$$

Outside selling pressure:

$$z_{i,t,\mathcal{J}} = \frac{\sum_{j \in \mathcal{J}} \mathbf{1}(s_{i,j,t} > 0) z^{NS}_{i,j,t}}{\sum_{j \in \mathcal{J}} \mathbf{1}(s_{i,j,t} > 0) z^{T}_{i,j,t}}$$

where $\mathcal{J}$ is a set of investors of a particular type. Back

Summary stats: Pressure, Prices & Sales

	Mean	Std. dev.	95^{th} - 5^{th} pctile
Prices $p_{i,t}$	99.82	4.86	5.65
Sales $s^V_{i,t}$	0.36	67.73	144.06
Pressure $z_{i,t}$	0.02	0.22	0.68

Back Regressions

Sector Summary Stats

Sector	Mean	Std dev	95^{th} - 5^{th} pctile
Sales $s^V_{i,t}$			
Bank	-0.6	46.0	66.5
Dealer	-0.5	68.7	149.8
Fund	0.5	48.3	78.4
Hedge fund	0.1	14.4	3.5
Other	0.3	42.6	52.4
Pressure $z_{i,t}$			
Bank	-0.01	0.14	0.40
Dealer	0.00	0.07	0.12
Fund	0.01	0.16	0.40
Hedge fund	0.00	0.07	0.00
Other	0.01	0.16	0.32

Back

Sector Impacts: Reduced Form

	Price (%) (1)
Dealer pressure	-2.147***
	(0.1050)
Bank pressure	-0.0579*
	(0.0349)
Fund pressure	-0.0861***
	(0.0326)
Hedge fund pressure	-0.3496***
	(0.0674)
Other pressure	-0.0625**
	(0.0314)
R^2	0.88798
Observations	1,864,873
Issuer-Week FEs	Yes
Instrument FEs	Yes

Back

Sector Impacts: Two-Stage Least Squares

	Price (%)				
	(1)	(2)	(3)	(4)	(5)
Dealer sales	-0.1034***				
	(0.0071)				
Bank sales		-0.0305			
		(0.0194)			
Fund sales			-0.0111**		
			(0.0053)		
Hedge fund sales				-0.0456***	
				(0.0105)	
Other sales					-0.0029
					(0.0039)
R^2	0.68722	0.88544	0.89221	0.89152	0.89323
Observations	1,591,470	1,591,470	1,591,470	1,591,470	1,591,470
Issuer-Week FEs	Yes	Yes	Yes	Yes	Yes
Instrument FEs	Yes	Yes	Yes	Yes	Yes

Back

Sector Impacts: First stage

Sector	Coeff ($z_{i,t}$)	t-stat	R-squared	F-stat
Dealer	22.7	21.1	0.25	1,125.7
Hedge fund	6.6	40.8	0.27	35.0
Bank	1.9	6.8	0.28	4.4
Fund	6.2	23.3	0.29	7.5
Other	8.0	34.8	0.28	0.9

Back