Smoke without fire?
Reassessing empirical evidence of fire sales

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Outline

Introduction

Motivation

Fire sales are forced sales of assets by distressed investors

- Unrelated to asset fundamentals
- Drives price below counterfactual in absence of distress
- Key mechanism by which shocks are amplified and transmitted
- Phenomenon of both theoretical and policy interest

Settled consensus (until recently):

- Fire sales exist and can be substantial
- Coval & Stafford (2007) $\rightarrow$ mutual fund (MF) outflows used to identify and assess effects
- Derivative literatures and policies built upon these findings
- But literature now in a **state of flux**

This paper

What we **do**:

- Create a measure of selling pressure, unrelated to asset fundamentals
  - Use granular FCA MiFID II bond transaction data
  - Trades by *various* investor types (not just MF)
  - 'Unrelated' is conditional on issuer-time FE
- Assess price impact of sales instrumented with this measure
- See which factors are associated with greater/lesser impact

What we **find**:

- Significant (econ and stat) impact of sales on bond prices
- Greater in times of *stress* and in *corporate* bonds
- MF selling does not depress prices on average (preliminary)

Identifying fire sales

Identifying fire sales

Let us assume...

$$r_{i,t}^{\tau} = \beta s_{i,t} + \gamma' X_{i,t} + \epsilon_{i,t}$$

$r_{i,t}^{\tau}$ return on bond i from t to $t+\tau$

$s_{i,t}$ net sales by non-dealers

$X_{i,t}$ vector of controls

$\epsilon_{i,t}$ disturbance

OLS 'OK' if all sales motivated by reasons unrelated to price-relevant 'fundamentals' of bond

- Implausible
- Likely $cov(\epsilon_{i,t}, s_{i,t}) \neq 0$ even with sensible controls
- Example: news about credit risk of issuer

Identifying fire sales

Relevant literature:

- Coval & Stafford (2007) use net selling by funds with extreme in/outflows
  - Might include discretionary sales capturing knowledge of fundamentals (problem)
- Edmans *et al* (2012) refine C&S approach to strip out discretionary sales
  - Still find significant price effect
- Choi *et al* (2020) contrast bonds from same issuer (within issuer-time variation)
  - Find little evidence of a substantial price effect (see also Czech *et al* (2021))
- Wardlaw (2020) shows Edmans *et al* (2012)'s measure is *mechanically* correlated with realised returns
  - Adjusting for this issue leaves little evidence of a price effect

Data

Data

- **Bond transactions:** Transactions of government and corporate bonds by FCA-regulated entities reported under MiFID II
- **Bond metadata:** Additional information on bond characteristics from Eikon
- **Fund performance:** Mutual funds' total net assets and estimated net flows
- **Fund holdings:** Quarterly data on portfolio holdings from Morningstar
- **Time period:** 1 January 2019 to 1 July 2020 (smaller subsample for fund analysis), weekly aggregation

Most of our main work relates to the data on transactions and bond characteristics

▸ Detail

Econometric approach

Econometric approach

Intuition:

- Suppose we can identify 'unrelated' bonds and there are no 'systemic' events in a period
- If an investor trading bond i is selling many other unrelated bonds, then trades in i are likely driven, to a large degree, by the investor's condition, rather than any idiosyncratic properties of bond i
- Conversely, if an investor is trading bond i for purely idiosyncratic (to the bond) reasons then, on average, her sales of other unrelated bonds should be zero

Econometric approach

Calculate net sales of bonds other than i by all traders j among non-dealers transacting in bond i (normalizing by transactions)

$$z_{it} \equiv \frac{\sum_j \mathbb{1}_{s_{ijt} \neq 0} z_{ijt}^{NS}}{\sum_j \mathbb{1}_{s_{ijt} \neq 0} z_{ijt}^{T}}$$

where

$$\begin{aligned} z_{ijt}^{NS} &\equiv \sum_{k \neq i} s_{kjt} \\ z_{ijt}^{T} &\equiv \sum_{k \neq i} |s_{kjt}| \end{aligned}$$

Note that net sales *including* dealers would identically be 0 for all securities at all times

- Also, focusing on participants without a market-making role

Econometric approach

We call this measure 'outside selling pressure'

$$z_{it} \equiv \frac{\sum_j \mathbb{1}_{s_{ijt} \neq 0} z_{ijt}^{NS}}{\sum_j \mathbb{1}_{s_{ijt} \neq 0} z_{ijt}^{T}}$$

- $z_{i,t} \in [-1, 1]$
- Close to zero if no tendency for traders transacting in bond i to be sellers or buyers of other bonds
- Close to 1 (-1) if generally sellers (buyers)

Econometric approach

We will instrument $s_{i,t}$ with $z_{i,t}$ (2SLS)

$$\begin{aligned} r_{i,t+\tau} &= \beta s_{i,t} + \gamma' X_{i,t} + \epsilon_{i,t} \\ s_{i,t} &= \alpha z_{i,t} + \delta' X_{i,t} + \nu_{i,t}. \end{aligned}$$

But...

- While z_{it} should be highly correlated with s_{it}, it is implausible that the 'other bonds' are 'unrelated'
- They may reflect shared time varying factors that both induce sales of i *and* are tied to price-relevant fundamentals for i

We therefore include in $X_{i,t}$

- Bond FE
- Time to maturity
- Issuer-time FE (as in Choi *et al* (2020))

And thus can assert $cov(z_{i,t}, \epsilon_{i,t} | X_{i,t}) = 0$

Econometric approach

Intuition for importance of an issuer-time FE:

- No longer use variation from sales of Acer bonds by those selling Dell bonds
  - Pervasive problem of shared fundamentals

- Now exploit sales of Dell bond i_1 vs. Dell bond i_2 (in t)
  - Any time varying Dell fundamentals (shared or otherwise) are diffed out
  - Also, bond FE deals with collateral etc. and a time to maturity control deals with bond specific, within Dell-time variation
  - Definition of $z_{i,t}$ and inclusion of FEs $\Rightarrow$ we're *effectively* considering sales of 'unrelated' bonds

- Importance of trading patterns
  - Lots of bonds traded each week, often traded by multiple traders and at the same time as other bonds are being traded
  - Even with the issuer-time FE we have ample variation ▸ Detail

Econometric approach

Is remaining non-fundamental variation 'fire selling' or just noise?

- Does it matter?

Suggestive evidence that it is connected to distressed selling...

- Violent tail moves during March 2020 'dash for cash' (though perhaps mechanical)
- Comoves with Coval & Stafford's 'mutual fund flow'
- Comoves with Wardlaw's 'flow-to-stock' component of 'mutual fund flow'

▸ Distress

Results

Results: Average effect

	OLS	2SLS 2nd stage	2SLS 1st stage
	Return r_{it} (%)	Return r_{it} (%)	Sales (% turnover)
	(1)	(2)	(3)
Sales (% turnover)	-0.0004***	-0.004***	
	(4.1×10^{-5})	(0.0006)	
Pressure z_{it} (%)			0.26***
			(0.006)
R^2	0.33	0.33	0.25
F-test (IV only)		61.3	7,476.5
Observations	1,629,220	1,622,762	1,622,762
Issuer-Week fixed effects	Yes	Yes	Yes
Instrument fixed effects	Yes	Yes	Yes

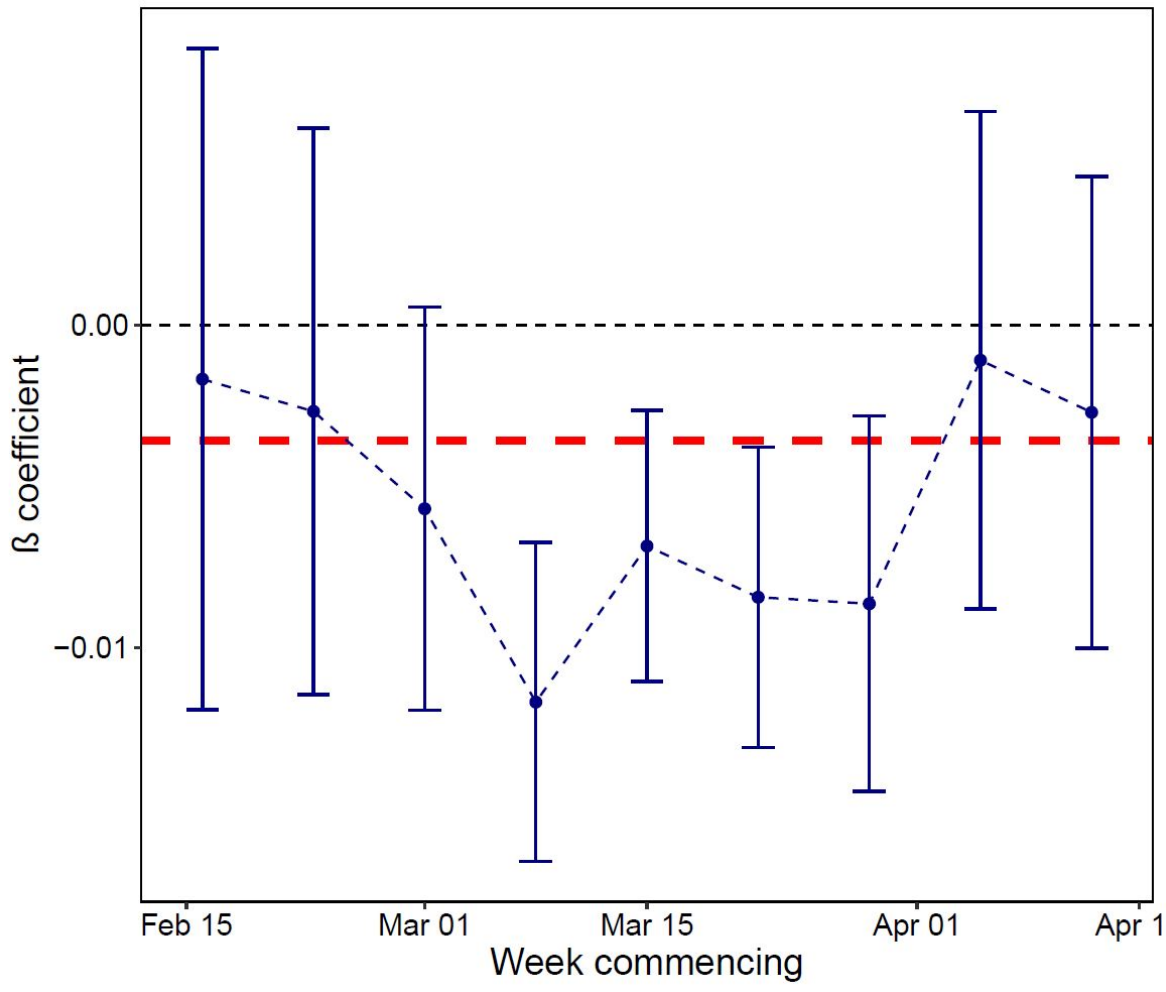
- Instrumenting makes a clear difference (and strength of instrument is reassuring)
- 2SLS estimates $\Rightarrow$ moving from 5^{th} to 95^{th} percentile of selling causes a $64 bps$ decline in returns
- Only refer to 2SLS henceforth

Results: Dependence on 'stress'

	Return r_{it} (%)	
	Full sample	March 2020
	(1)	(2)
Sales (% turnover)	-0.004***	-0.01***
	(0.0006)	(0.003)
R^2	0.33	0.66
Observations	1,622,762	87,647
Issuer-Week fixed effects	Yes	Yes
Instrument fixed effects	Yes	Yes

- Impact more than doubles in 'dash for cash' period of stress

Results: Dependence on ‘stress’



- Price impact of selling rises during stressed period before returning to ‘normal’

Results: Dependence on bond type

	Return r_{it} (%)	
	Corporate	Government
	(1)	(2)
Sales (% turnover)	-0.004***	-0.002
	(0.0007)	(0.002)
R^2	0.36	0.18
Observations	1,290,583	332,179
Issuer-Week fixed effects	Yes	Yes
Instrument fixed effects	Yes	Yes

- Greater impact in case of corporate bonds
- Aligns with various liquidity- or complexity-based fire sale theories

Results: Interaction of bond type with stress

	Return r_{it} (%)	
	Corporate	Government
	(1)	(2)
Sales (% turnover)	-0.02***	-0.004
	(0.004)	(0.004)
Standard-Errors	Issuer-Week	Instrument
R^2	0.67	0.57
Observations	69,133	18,561
Issuer-Week fixed effects	Yes	Yes
Instrument fixed effects	Yes	Yes

- Distinction between corporate and sovereign bonds exaggerated in stressed periods

Results: Distinct asset manager behavior

	Return r_{it} (%)	
	All traders	Asset Managers
	(1)	(2)
Sales (% turnover)	-0.004***	0.003***
	(0.0006)	(0.001)
R^2	0.33	0.42
F-test (1st stage), Sales (% turnover)	7,476.5	3,039.2
Observations	1,622,762	994,560
Issuer-Week fixed effects	Yes	Yes
Instrument fixed effects	Yes	Yes

- Preliminary results but suggestion of 'smaller' effects for asset managers
- Don't have data precision to distinguish MF, but possible reconciliation of (recent) literature's results on limited impact of MF selling, with a role for fire sales more broadly

Next steps

Ongoing work considering whether noise vs. fire sale interpretation 'matters'...

- Nonlinearities, asymmetries and spillovers
- Bounding the noise component
- Tighter connection to distress
- Can models help refine the measure

Tightening up regressions

- Especially roles of MF and dealers

Appendix

Data

Key aspects of the data ▸ Detail

- Both corporate and sovereign
  - Corporate $\approx 85\%$ (but 56% trades are of sovereign)
- Broad variety of participants
  - Dealers: 3% of participants but involved in $> 50\%$ of trades
  - Non-dealers: Asset managers, banks, hedge funds,...
- Average trading patterns
  - $> 24k$ bonds traded per week and $> 27k$ traders
  - Non-dealers trade 8 bonds per week and dealers trade > 700
  - Each instrument traded in a week is traded by 4 dealers and 10 non-dealers
  - Trading patterns key to identification approach

Data

	Share	Trade Share
PANEL A: BONDS		
Type		
Corporate	85	44
Government	15	56
Currency		
GBP	7	11
EUR	26	44
USD	47	39
Other	20	6
Maturity		
0-5 years	45	21
6-10 years	37	44
11-20 years	7	12
21+ years	11	24
PANEL B: TRADERS		
Sector		
Asset Manager	44	15
Bank	11	14
Dealer	3	51
Hedge Fund	6	2
Non-Financial	2	0
Other Financial	4	8
PFLDI	28	2
State	2	1
Trading Services	1	8

Note: Table summarizes the instruments traded and the types of traders in the dataset. The first column counts each bond (or trader) once. The second counts each trade once.

Data

	Number
Instruments traded	24,378
Traders	27,859
Instruments per trader	
Dealers	733
Customers	8
Traders per instrument	
Dealers	4
Customers	10

Note: Table summarizes the number of traders and instruments traded per week. 'Customers' are defined as all traders except dealers.

▸ Back

Econometric approach

We have purged sales of the variation that would be problematic for fire sale studies but. . . **did we throw the baby out with the bathwater**?

- Do we retain enough non-absorbed variation to allow us to assess the effect of non-fundamental sales?
- Remaining variation is derived from reasons unrelated to the issuer or to bond-specific (fixed or time-varying) fundamentals
- What if investors were fire selling all bonds from a given issuer to the same degree (which is eliminated in our method)?

It turns out that *ample* non-fundamental variation remains.

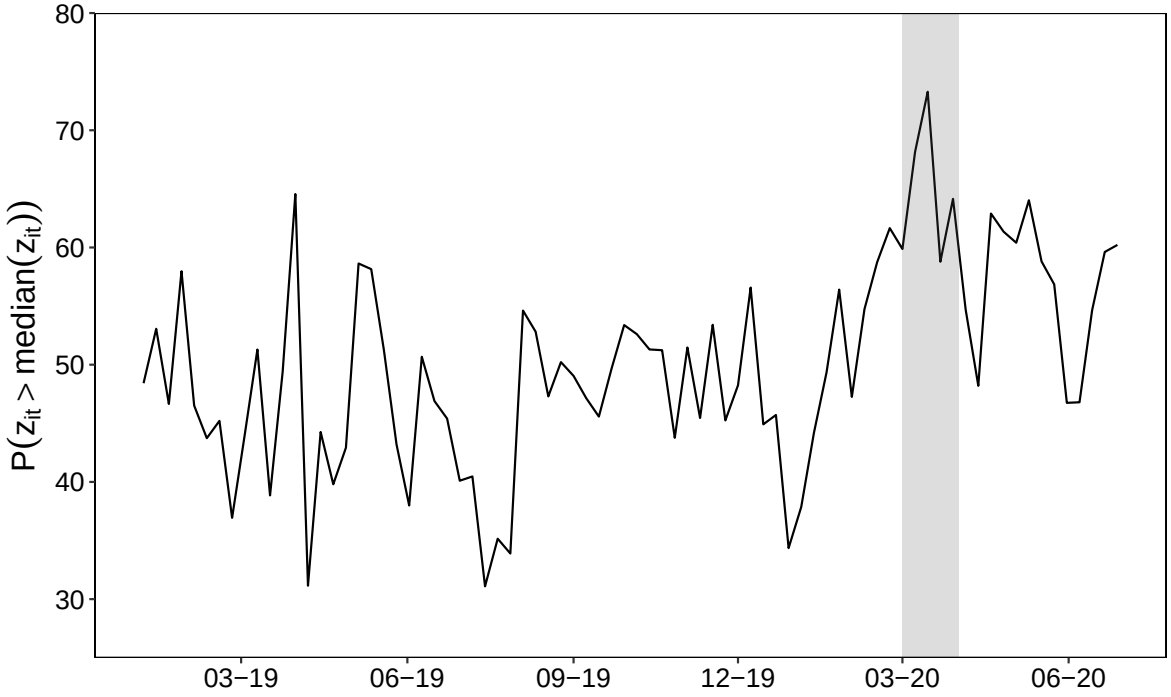
Econometric approach

	R-squared	
Fixed Effects	Returns r_{it}	Sales s_{it}
Instrument	0.02	0.07
Issuer	0.01	0.01
Week	0.04	0.00
Issuer & Week	0.05	0.02
Issuer-Week	0.31	0.20
Issuer-Week & Instrument	0.32	0.25

Note: Table shows the variation in returns ri;t and sales si;t that can be explained by various combinations of fixed effects. The first column shows the R-squared from a regression of returns on the relevant fixed effects, while the second shows the R-squared from a regression of sales on the relevant fixed effects.

▸ Back

Econometric approach



Note: Figure shows the fraction of bonds in a given month that have outside selling pressure greater than the median in the sample. Grey shaded area denotes March 2020.

Econometric approach

	Asset Manager Pressure z_{it}^{AM}		
	(1)	(2)	(3)
Coval-Stafford (pctile)	0.39**		
	(0.19)		
Wardlaw F2S (pctile)		0.33***	
		(0.12)	
Wardlaw F2V (pctile)			0.07
			(0.48)
R^2	0.49	0.45	0.45
Observations	257,743	491,863	46,636
Issuer-Week fixed effects	Yes	Yes	Yes
Instrument fixed effects	Yes	Yes	Yes

Note: Table shows the positive correlation between our measure of outside selling pressure (but computed solely for asset managers) and various measures of selling pressure induced by mutual fund flows defined in the literature, after including issuer-week and instrument fixed effects.

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