Credit Default Swaps and Corporate Bond Trading*

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* The views expressed in this paper are those of the author, and not necessarily those of the Bank of England or its committees.

Can CDS trading increase liquidity of underlying bonds?

Corporate bond market: importance and challenges

- Corporate bond markets provide funding to real economy firms
- Almost all net financing raised via bond finance
  (Bank of England, 2016)
- Lower dealer inventories and day-to-day liquidity
- Higher market concentration and lower capacities to absorb substantial asset sales
- This paper: isolate effect of CDS positions on bond trading using comprehensive micro-level data and recent regulatory reforms

How can CDS positions affect corporate bond trading?

- Trading motives: hedging / regulatory relief, basis trades, "doubling-up" on credit risk
- Potentially positive spillover effects re: informational efficiency, pricing and volumes
- Negative spillovers if investors prefer more liquid CDS market (crowding-out effect)
- Margin calls on CDS can dry up funding and cause fire sales in bond market → liquidity spiral (Brunnermeier and Pedersen, 2009)

Main questions

1. Are there indeed positive spillover effects, particularly around credit events?

   → Liquidity spillover effect (Sambalaibat, 2018)

   Or do CDS markets attract liquidity away from underlying bond market?

   → Crowding-out effect (e.g. Che and Sethi, 2014)

2. Do margin calls on CDS positions lead to fire sales and price drops in the corporate bond market?

   → Liquidity spiral (Brunnermeier and Pedersen, 2009)

Main findings: spillover effect

1. Liquidity spillover effect dominates crowding-out effect
   - Identification: quasi-natural experiment
   - CDS investors associated with 60% higher *buy* volumes in bonds of reference entity
   - Termination of CDS position associated with 54% drop in bond buy volumes and 113% increase in bond sell volumes
   - Around rating downgrades, CDS buyers have five times higher buy volumes and 64% lower sell volumes
   - Increase in CDS trading intensity substantially improves liquidity of underlying bonds

Main findings: liquidity spiral

2. Margin calls on CDS positions cause fire sales in the corporate bond market
   - Identification: instrumental variable
   - Mark-to-market losses cause significant increase in corporate bond sell volumes
   - Exposure to *large* mark-to-market losses leads to three times higher bond sell volumes
   - Distressed investors more likely to sell liquid and better rated bonds
   - Returns decrease by more than 100bp with subsequent mean reversion

CDS data

1. Depository Trust & Clearing Corporation (DTCC) trade repository data
   - Regulatory CDS data, capturing all single name CDS positions at investor-reference entity level when:
     I. underlying reference entity is a UK firm
     II. counterparty registered in the UK
   - Data on underlying ISIN, notional, *counterparties*, mark-to-market values, initiation and maturity dates
   - Sample covers around 7% of global single name CDS market

Corporate bond data

2. Zen corporate bond data set
   - Regulatory FCA transaction level data set, capturing all corporate bond trades when:
     I. counterparty registered in the UK
     II. counterparty is branch of UK firm regulated in the EEA
   - ISIN, price, quantity, *counterparties*, trading venue, trading capacity and the exact time of the trade have to be reported

Features of final dataset

- Unique dataset, linking single name CDS positions with corporate bond transactions at investor-reference entity level
- Aggregated at monthly level, November 2014 - December 2016
- $>$ 400,000 observations, 1,825 counterparties, 722 issuers

CDS net positions

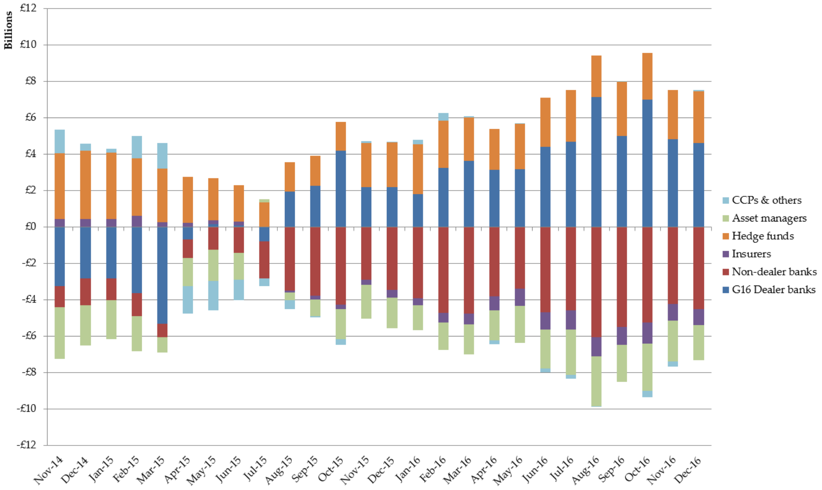

Figure 1: CDS net positions of different investor types

CDS positions and bond trading volumes: setup

$$\ln(Volume^{Buy/Sell})_{i,z,t} = \beta_1\ CDS\ buyer_{i,z,t} + \beta_2\ CDS\ seller_{i,z,t} + \alpha_{i,t} + \alpha_{z,t} + \xi_{i,z,t}$$

- i = issuer, z = investor, month t
- $\ln(Volume^{Buy/Sell})_{i,z,t}$ = natural logarithm of buy *or* sell volume across bonds of issuer i by investor z in month t
- $CDS\ buyer_{i,z,t}$ ($CDS\ seller_{i,z,t}$) equal to one if investor z is net short (long) in CDS contract written on issuer i in month t
- *investor∗month* fixed effects ($\alpha_{z,t}$) and *issuer∗month* fixed effects ($\alpha_{i,t}$)

CDS positions and bond trading volumes: results

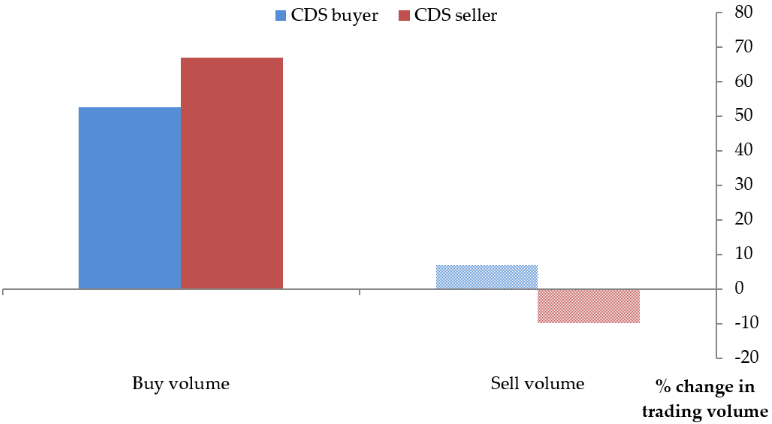

Figure 2: CDS positions and bond trading volumes

Quasi-natural experiment: setup

- Endogeneity concerns for previous specification
- Experiment: publication of higher margin requirements for OTC derivatives in March 2015
- New margin requirements linked to aggregate notional amount at group level $\rightarrow$ increase in CDS trading costs for large dealer banks

Quasi-natural experiment: results

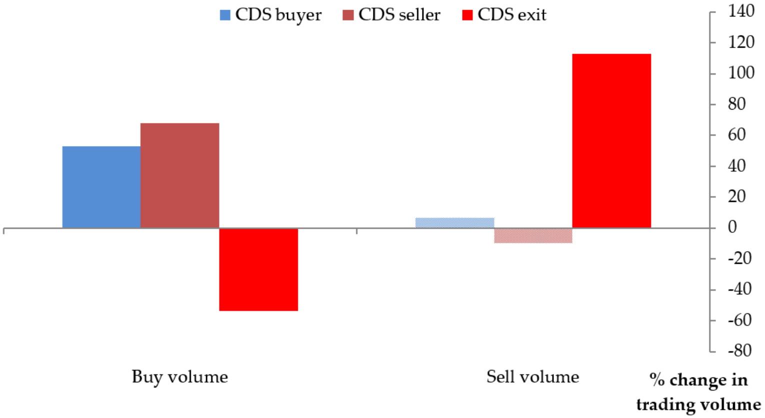

Figure 3: Response to higher margin requirements

Impact on bond-level liquidity measures

- Increase in CDS trading intensity $\rightarrow$ improvement in liquidity of underlying bonds?
- 10% increase in number of active CDS contracts on debt issuer $\rightarrow$ 5.9% increase in bond trading volume and 3.5% increase in number of trades
- Also fewer zero-trading days, lower effective half-spreads and higher bond turnover

Liquidity spiral in the credit market

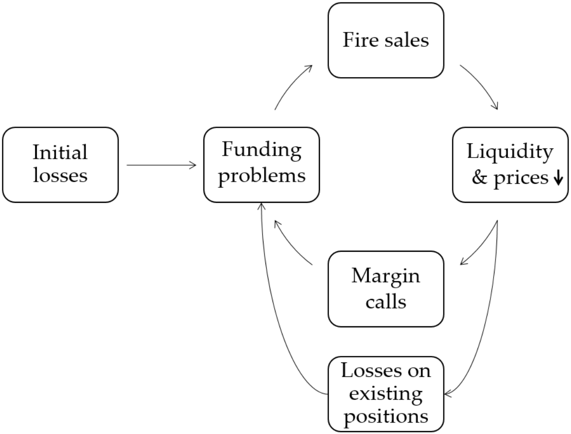

Figure 4: Liquidity spirals: margin spiral and loss spiral

Instrumental variable: intuition

- Mark-to-market losses as a proxy for margin calls:

$$MtM\ losses_{z,t} = \max(-\Delta MtM_{z,t}, 0)$$

  - *MtM losses* = losses (if any) in mark-to-market values across all single name CDS positions of investor z from month t-*1* to month t

- Instrument for mark-to-market losses:
  fraction of non-centrally cleared CDS contracts

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Instrumental variable: requirements

Relevance condition:

- Central clearing offers multilateral netting of risk exposures $\rightarrow$ higher netting efficiency
- CCPs require more rigorous risk management practices than dealer banks

Exclusion restriction:

- No direct impact of CDS clearing decisions on corporate bond trading volumes? $\surd$

Instrumental variable: results

- 2SLS second stage:

$$\ln(\mathit{Sell\ volume})_{z,t} = \beta \ln(\widehat{\mathit{MtM\ losses}})_{z,t} + \alpha_{j,t} + \xi_{z,t}$$

- 10% increase in CDS mark-to-market losses causes 2.2% increase in bond sell volumes
- Investors exposed to mark-to-market ‘shocks’ have three times (£16m) higher bond sell volumes

Choice of fire sale bonds

- Distressed investors follow ‘horizontal cut’ liquidation strategy by selling most liquid (IG) bonds first (see Jiang et al., 2017)
- Fire sale probability decreases with bond age and increases with remaining time-to-maturity
- More vulnerable to future funding shocks due to increased illiquidity of bond portfolio

Impact on bond returns

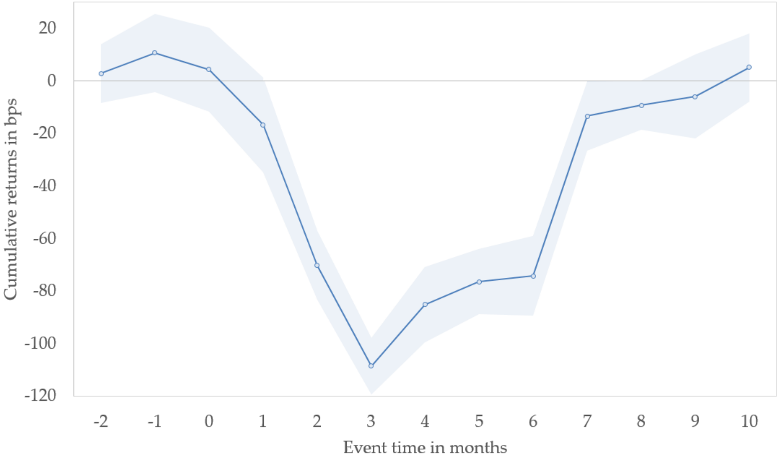

Figure 5: Cumulative returns of bonds sold by distressed investors

Conclusion & financial stability implications

- Micro-level evidence for impact of single name CDS positions on corporate bond trading volumes
- Accessible CDS market enhances liquidity and market-making in secondary corporate bond market
- Regulations that increase CDS trading costs likely to have negative impact on bond market liquidity
- In stress periods, CDS margin calls can cause fire sales and price drops in bond market
- Central clearing of CDS contracts can reduce liquidity spiral risk

APPENDIX

Related literature

1. Theoretical literature on link between CDS and bond markets
   - Che and Sethi (2014), Oehmke and Zawadowski (2015), Fostel and Geanakoplos (2016), Sambalaibat (2018)
2. Empirical literature on CDS and corporate bond trading
   - Ashcraft and Santos (2009), Massa and Zhang (2013), Das et al. (2014), Jiang and Zhu (2016), Oehmke and Zawadowski (2017), Boyarchenko et al. (2018)
3. Liquidity spiral theory
   - Brunnermeier and Pedersen (2009), Garleanu and Pedersen (2011), Brunnermeier et al. (2013)

CDS gross and net notionals

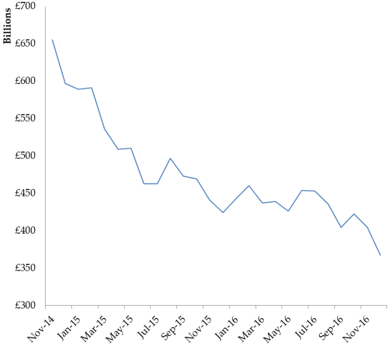

Figure 6: CDS gross notional amount

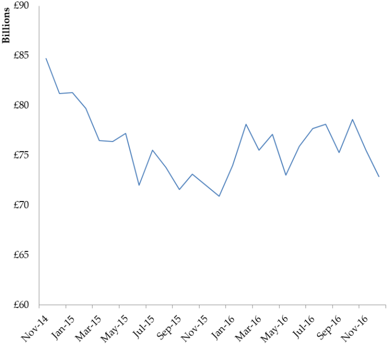

Figure 7: CDS net notional amount

CDS summary statistics

Currency	
EUR	60.3%
USD	38.2%
GBP	0.7%
Other	0.8%
Clearing status	
Cleared	14.6%
Not cleared	85.4%
Industry	
Bank	35.0%
Financial	21.6%
Industrial	22.1%
Other	21.3%
Credit quality	
Prime & high grade	11.4%
Medium grade	66.1%
High yield	7.4%
Not rated	15.1%

Overlap with corporate bond market

Active in bond & CDS market	
Dealer banks	100.0%
Non-dealer banks	5.9%
Insurers	13.9%
Hedge funds	7.9%
Asset managers	5.6%
CDS on % of reference entities	
Dealer banks	49.6%
Non-dealer banks	42.2%
Insurers	15.1%
Hedge funds	35.4%
Asset managers	22.3%

CDS positions and bond buy volumes: results

Dependent variable:	*ln(Buy volume)*			
	(1)	(2)	(3)	(4)
$CDS\ buyer_{i,z,t}$	0.952***	0.913***	0.473***	0.423***
	(0.149)	(0.169)	(0.119)	(0.126)
$CDS\ seller_{i,z,t}$	1.061***	1.039***	0.554***	0.512***
	(0.146)	(0.171)	(0.098)	(0.109)
Issuer*time fixed effects	N	Y	N	Y
Investor*time fixed effects	N	N	Y	Y
Observations	404,087	404,083	403,825	403,821
R-squared	0.003	0.015	0.083	0.090

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CDS positions and bond sell volumes: results

Dependent variable:	$ln(Sell\ volume)$			
	(1)	(2)	(3)	(4)
$CDS\ buyer_{i,z,t}$	0.771***	0.749***	0.138*	0.066
	(0.144)	(0.164)	(0.072)	(0.092)
$CDS\ seller_{i,z,t}$	0.524***	0.490***	-0.032	-0.104
	(0.133)	(0.150)	(0.078)	(0.094)
Issuer*time fixed effects	N	Y	N	Y
Investor*time fixed effects	N	N	Y	Y
Observations	404,087	404,083	403,825	403,821
R-squared	0.001	0.010	0.063	0.069

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Quasi-natural experiment: results

Dependent variable:	ln(Buy volume)		ln(Sell volume)	
	(1)	(2)	(3)	(4)
$CDS\ buyer_{i,z,t}$	0.953***	0.424***	0.770***	0.065
	(0.150)	(0.129)	(0.144)	(0.092)
$CDS\ seller_{i,z,t}$	1.062***	0.518***	0.522***	-0.105
	(0.146)	(0.109)	(0.133)	(0.094)
$CDS\ exit_{i,z,t}$	-0.754***	-0.768***	0.793***	0.755***
	(0.008)	(0.008)	(0.281)	(0.224)
Issuer*time fixed effects	N	Y	N	Y
Investor*time fixed effects	N	Y	N	Y
Observations	404,087	403,821	404,087	403,821
R-squared	0.003	0.090	0.001	0.069

Quasi-natural experiment: diff-in-diff

- Difference-in-difference specification to identify causal impact of CDS margin regulations on bond trading volumes:

$$\ln(Volume^{Buy/Sell})_{i,z,t} = \beta\ Dealer_z * after_t + \delta\ CDS\ counterparty_{i,z,t} + \alpha_z + \alpha_{i,t} + \xi_{i,z,t}$$

  - $after_t = 1$ for all months after February 2015
  - Treatment group: dealer banks
  - Control group: non-dealer banks
- Recent CDS margin regulations have lasting impact on bond trading volumes of dealer banks

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Quasi-natural experiment: diff-in-diff

Dependent variable:	*ln(Buy volume)*		*ln(Sell volume)*	
	(1)	(2)	(3)	(4)
$Dealer_z * after_t$	-0.252***	-0.458***	0.238**	0.377***
	(0.097)	(0.098)	(0.094)	(0.096)
Time fixed effects	Y	-	Y	-
Investor fixed effects	Y	Y	Y	Y
Issuer*time fixed effects	N	Y	N	Y
Observations	208,635	207,608	208,635	207,608
R-squared	0.051	0.118	0.029	0.094

- Change in buy (sell) volumes 36% lower (46% higher) for dealers

Impact on bond-level liquidity measures: setup

$$\textit{Bond liquidity}_{b,t} = \beta \ \ln(\textit{CDS trading})_{i,t} + \alpha_t + \alpha_b + \lambda' \, Z_{b,t} + \xi_{b,t}$$

- Six measures of bond liquidity: trading volume, number of trades, turnover, zero-trading days, effective half spread, Amihud ratio
- $\ln(\textit{CDS trading})_{i,t}$ = number of active CDS contracts or CDS gross notional amount written on issuer i in month t
- $Z_{b,t}$ = vector of bond-specific controls (rating, time-to-maturity, age)

Impact on bond-level liquidity measures: results

Dep. variable:	$ln(Volume)$	$ln(\#\ trades)$	$Turnover$	$Zero\ trading$	$Half\ spread$	$Amihud$
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\#\ CDS)_{i,t}$	0.601***	0.357***	0.024***	-0.062***	-0.000***	0.007
	(0.078)	(0.048)	(0.004)	(0.009)	(0.000)	(0.009)
Bond FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	33,364	33,364	32,048	32,986	15,584	25,774
R-squared	0.858	0.800	0.857	0.846	0.286	0.408

- 10% increase in number of CDS contracts → 5.9% increase in bond trading volume and 3.5% increase in number of trades

CDS buyers and downgrades

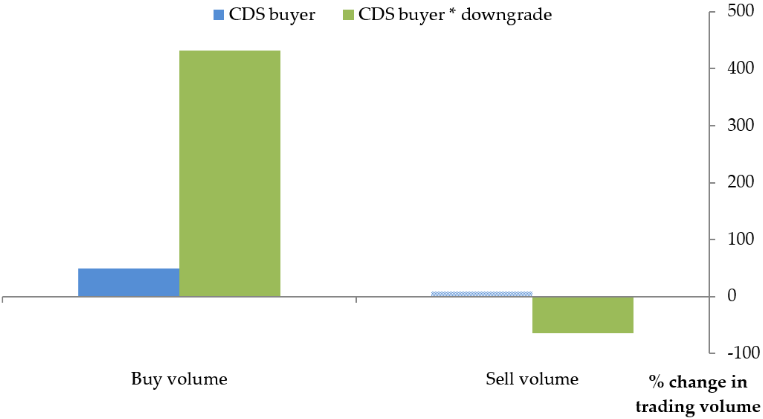

Figure 8: Response of CDS buyers to downgrades

CDS sellers and downgrades

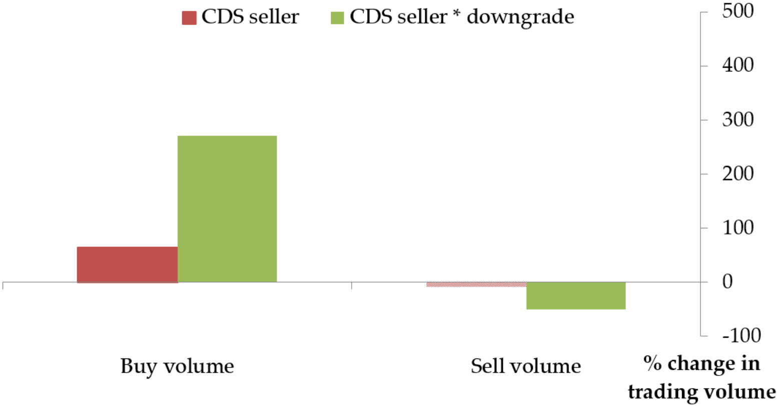

Figure 9: Response of CDS sellers to downgrades

CDS positions and issuer downgrades: results

Dependent variable:	$ln(Buy\ volume)$		$ln(Sell\ volume)$	
	(1)	(2)	(3)	(4)
$CDS\ buyer_{i,z,t}$	0.929***	0.399***	0.791***	0.086
	(0.150)	(0.127)	(0.145)	(0.103)
$CDS\ seller_{i,z,t}$	1.044***	0.500***	0.535***	-0.093
	(0.151)	(0.112)	(0.136)	(0.100)
$CDS\ buyer_{i,z,t} * upgrade_{i,t}$	0.856	0.816	-0.789	-0.635
	(0.924)	(0.938)	(0.843)	(0.875)
$CDS\ seller_{i,z,t} * upgrade_{i,t}$	0.876**	0.851**	-0.464	-0.430
	(0.398)	(0.383)	(0.273)	(0.262)
$CDS\ buyer_{i,z,t} * downgrade_{i,t}$	1.321***	1.272***	-1.060***	-1.110***
	(0.225)	(0.212)	(0.146)	(0.183)
$CDS\ seller_{i,z,t} * downgrade_{i,t}$	0.815**	0.812**	-0.619*	-0.616*
	(0.334)	(0.109)	(0.357)	(0.328)
Issuer*time fixed effects	N	Y	N	Y
Investor*time fixed effects	N	Y	N	Y
Observations	404,087	403,821	404,087	403,821
R-squared	0.003	0.090	0.001	0.069

Liquidity spiral in credit market

- Margin calls on CDS positions can force distressed investors into corporate bond fire sales
- Fire sales can further depress prices and spread to bonds of correlated issuers $\rightarrow$ new margin calls
  (Brunnermeier and Pedersen, 2009)
- Adverse effects on market liquidity and provision of immediacy

2SLS regression: setup

- First stage:

$$\ln(\mathit{MtM\ losses})_{z,t} = \pi\ \mathit{fraction\ noncleared}_{z,t} + \alpha_{j,t} + \epsilon_{z,t}$$

  - $\mathit{fraction\ noncleared}_{z,t}$ = fraction of non-centrally cleared CDS contracts of investor z in month t

- Second stage:

$$\ln(\mathit{Sell\ volume})_{z,t} = \beta \ln(\widehat{\mathit{MtM\ losses}})_{z,t} + \alpha_{j,t} + \xi_{z,t}$$

  - $\ln(\mathit{Sell\ volume})_{z,t}$ = natural logarithm of aggregated corporate bond sell volumes of investor z in month t

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First stage regression: results

Dependent variable:	$ln(MtM\ losses)$		
	(1)	(2)	(3)
$fraction\ noncleared_{z,t}$	6.257*** (0.313)	5.980*** (0.354)	5.978*** (0.354)
Time fixed effects	N	Y	N
Investor type fixed effects	N	Y	N
Investor type*time fixed effects	N	N	Y
Observations	24,696	24,696	24,696
F-statistic	400.21	286.05	284.63

- Fraction of non-centrally cleared CDS contracts has significant and positive impact on mark-to-market losses variable

  $\rightarrow$ relevance condition $\surd$

2SLS regression: results

Dependent variable:	$ln(Sell\ volume)$					
	2SLS			OLS		
	(1)	(2)	(3)	(4)	(5)	(6)
$ln(MtM\ losses)_{z,t}$	0.274*** (0.053)	0.223*** (0.058)	0.224*** (0.058)	0.116*** (0.031)	0.075** (0.029)	0.074** (0.029)
Time FE	N	Y	-	N	Y	-
Investor type FE	N	Y	-	N	Y	-
Investor type*time FE	N	N	Y	N	N	Y
Observations	24,696	24,696	24,696	24,696	24,696	24,696
R-squared				0.002	0.013	0.011

- 10% increase in mark-to-market losses causes 2.2% increase in bond sell volumes

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Mark-to-market shocks

Dependent variable:	*ln(Sell volume)*			*Sell volume*		
	(1)	(2)	(3)	(4)	(5)	(6)
$MtM\ shock_{z,t}$	1.698***	1.145***	1.165***	23.869***	15.997**	15.878**
	(0.441)	(0.400)	(0.396)	(6.255)	(5.943)	(5.868)
Time FE	N	Y	-	N	Y	-
Investor type FE	N	Y	-	N	Y	-
Investor type*time FE	N	N	Y	N	N	Y
Observations	24,696	24,696	24,696	24,696	24,696	24,696
R-squared	0.002	0.013	0.011	0.021	0.054	0.054

- Investors exposed to mark-to-market shocks have three times (£16m) higher bond sell volumes

Choice of fire sale bonds: setup

- Which bonds are more likely to be sold following large mark-to-market losses?

$$\Pr(distressed_{b,z,t} = 1) = \Phi(\beta_0 + \delta' \, X_{b,t} + \gamma' \, Y_{b,t-1} + \alpha_t + \alpha_i + \xi_{b,z,t})$$

  - $distressed_{b,z,t} = 1$ if bond b is sold by investor z facing large CDS mark-to-market loss in month t
  - $X_{b,t}$ = vector of bond-specific characteristics that includes time-to-maturity, age, and an investment grade dummy
  - $Y_{b,t-1}$ = vector of lagged liquidity measures ($Amihud_{b,t-1}$ and $turnover_{b,t-1}$) and lagged yield change ($\Delta yield_{b,t-1}$) of bond b

Choice of fire sale bonds: results

Dependent variable:	*Fire sale probability*			
$Time\ to\ maturity_{b,t}$	0.007***	0.007***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
$Age_{b,t}$	-0.002	-0.002	-0.003*	-0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
$Investment\ grade_{b,t}$	0.209***	0.212***	0.261***	0.264***
	(0.031)	(0.031)	(0.045)	(0.046)
$Turnover_{b,t-1}$	0.192*	0.207**	0.024	0.042
	(0.101)	(0.104)	(0.056)	(0.058)
$Amihud_{b,t-1}$	-0.371***	-0.375***	-0.127***	-0.127***
	(0.104)	(0.106)	(0.045)	(0.046)
$\Delta yield_{b,t-1}$	0.008	0.022**	0.002	0.012
	(0.010)	(0.009)	(0.010)	(0.009)
Time fixed effects	N	Y	N	Y
Issuer fixed effects	N	N	Y	Y
Observations	287,842	287,842	287,728	287,728
Pseudo R-squared	0.014	0.029	0.031	0.046

Impact on bond returns: setup

- Significant impact of fire sales on bond returns?

$$return_{b,t} = \sum_{\tau=-2}^{10} \beta_\tau \; distressed_{b,t-\tau} + \alpha_{i,t} + \lambda' \, Z_{b,t} + \xi_{b,t}$$

  - $return_{b,t}$ = trade-weighted return on bond b in month t
  - $distressed_{b,t-\tau}$ equal to one if bond b is sold by investors with large CDS mark-to-market losses in month $t-\tau$
  - $Z_{b,t}$ = vector of bond-specific controls (rating, time-to-maturity, age, and UK gilt yield of comparable maturity)