Banning Dark Pools: Venue Selection and Investor Trading Costs

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Motivation

- Much research on impact of dark on lit market
  - Limited on how investors benefit from and use dark pools
- Tension between protecting lit market vs investor benefit from dark venues
  - Negative externalities of dark trading vs private benefits
- We examine the impact of dark trading on:
  - Investor execution costs – implementation shortfall
  - Venue selection and venue routing sequencing
- Using Ban on midpoint dark trading in MiFID2 called the “Double Volume Cap” (DVC)

Current State of Regulatory Divergence

- **UK**
  - DVC suspended in early 2021
  - Will legislate to remove entirely

- **EU**
  - DVC: replace with single cap of 7%
  - Periodic Auctions: More pre-trade transparency
    - Existing: Indicative uncrossing price and volume
  - Cannot use midpoint when trade size < 2x SMS (10-30k)

Hypotheses on Overall Dark Trading

- Dark trading ⟶ Mixed implications for transaction costs
  - Theory: Lower lit market liquidity: Zhu (2014), Buti et al. (2016)
  - Empirical:
    - Lower costs for individual trades: Conrad et al. (2003); Garvey et al. (2016); Gresse (2017)
    - No impact on lit: Farley et al. (2018); Foley and Putnins (2016)

      Negative impact: Degryse et al. (2015) Negative in large amounts: Comerton-Forde and Putnins (2016)
- **H1:** Dark trading ⟶ lower investor transaction costs
- **H2**: Substitute venues will benefit from liquidity "participation externalities"
- **H3:** Dark pool ban increases transaction costs unless participation externalities dominate

Hypotheses on Investor Venue Selection

- **H4a:** Venue choice follows a pecking order. The use of dark venues decreases over the order life-cycle: Menkveld et al. (2017)

- More pronounced decline:
  - **H4b:** On high volatility days, Menkveld et al. (2017), Buti et al. (2016), Anselmi et al. (2021) except Degryse et al. (2021)
  - **H4c:** For informed and/or impatient investors: Zhu (2014)

Results

On Overall Dark Trading:

- **H1:** Dark Trading ⟶ reduced transaction costs (implementation shortfall)
  - We are first to show this on institutional parent order basis
- **H2:** Yes, ↑ Liquidity (Participation Externality) for Periodic Auctions
- **H3:** No Impact of DVC on Transaction costs due to close substitutes

On Investor Venue Selection:

1. **H4a**: Venues follow pecking order Menkveld et al. (2017). Dark Venues executed first, use declines over the order life-cycle
2. More pronounced decline for:
   a) **H4b**: high volatility days = No evidence
   b) **H4c**: Informed = No evidence
   c) **H4c**: Impatient = Yes

Data

- We use FCA MiFID2 Transaction Data
- Contains Price, Quantity, Time, Venue & **Legal Entity Identifiers**
- We string together trades into parent orders by **institutional investors**
- $$IS = D \times \frac{\bar{p} - m_0}{m_0},$$
- Sample Period:
  - +/- 20 Days Around DVC Ban and Lift

	All	> 1 mln	≤ mln
Panel B. Full sample			
Average value (GBP, millions)	0.95	3.07	0.35
	(2.18)	(3.95)	(0.23)
Average # of children	167.21	427.31	93.32
	(272.40)	(467.88)	(91.74)
Average duration	4.37	5.13	4.16
	(3.06)	(2.94)	(3.06)
Average IS (bps)	12.42	14.41	7.43
# of parent orders	58,437	12,928	45,509
# of unique participants	989	632	931
Auction (%)	15.55	16.19	13.94
Midpoint Dark (%)	8.53	8.76	7.97
Block Dark (%)	11.72	15.67	1.81
Lit (%)	49.83	45.72	60.13
Periodic Auction (%)	5.69	5.13	7.10
SI (%)	2.42	2.18	3.05
Off-book (%)	6.25	6.35	6.00

Primer on European Execution Venue Types

Category	Explanation	Examples
Auction	Open, Midday or Closing Auction of Primary Market	LSE Closing Auction
Midpoint Dark **(Banned under DVC)**	Usually smaller trades that are pegged to the Lit market Midpoint.	Chi-X Dark, Turquoise Dark, UBS MTF
Periodic Auctions	Auctions that can occur several times a second. Participants can submit a lit-market midpoint order as their auction order, or any price	CBOE PA, Turquoise PA, UBS MTF PA
Block Dark	Larger trades arranged using block matching mechanisms. >0.5m for larger stocks	Liquidnet
Systematic Internalisers (SI)	Bilateral executions with an SI operator, e.g. Virtu. Quotes are streamed electronically, often match lit markets.	Virtu SI, Citadel SI, Goldman's SI, Barclays SI, Morgan Stanley SI
Off-book	Broker's arranging trades for their clients off-market	Eg. Goldman arranging trades between fund managers
Lit Market	Pre-trade transparent limit orderbook	LSE, BATS, Chi-X, Turquoise

Results – Dark trading reduces transaction costs

- Regress IS on Venue % Shares for individual parent orders
  - Controls:
    - Stock and date fixed effects
    - Participant fixed effects
    - Parent order size
    - Parent order execution time
    - Market-wide volatility

$$IS_\tau = \alpha + \sum_{n=1}^{N-1} \beta_n \, PctVenue_{n,\tau} + \gamma Size_\tau + \delta_2 Execution\ time_\tau$$

$$+ \theta Volatility_\tau^{Index} + FE + \epsilon_\tau,$$

- Higher parent order share of dark trading = lower execution costs
  - Effect is economically significant = 10% ↑ in venue = 1bps ↓ in IS
- After ban, similar effects for periodic auctions

	Total IS (bps)	
Midpoint Dark (%)	−0.097***	
	(0.020)	
Block Dark (%)	−0.203***	−0.164***
	(0.035)	(0.032)
Periodic Auction (%)	−0.037	−0.117***
	(0.034)	(0.014)
Auction (%)	−0.022	−0.069***
	(0.026)	(0.025)
SI (%)	0.007	−0.003
	(0.055)	(0.038)
Off-book (%)	0.026	−0.041
	(0.029)	(0.027)
Size	4.312***	4.677***
	(0.563)	(0.500)
'Execution time'	−0.571	−0.270
	(0.501)	(0.508)
'Index Volatility'	0.531	0.356
	(0.795)	(0.964)
Stock-Day FE	Yes	Yes
Participant FE	Yes	Yes
Broker FE	Yes	Yes
Observations	28,616	28,335
R^2	0.371	0.376
Adjusted R^2	0.107	0.110

Results – Institutional Investors substitute dark venues

- DID of routing decisions
  - Regress VenueShare on:
    - Treated = heavy dark pool users (>median)
    - Control = other investors
- Similar finding to Johann et al. (2019), except we use participant-level data
- Dark pool users mainly substitute towards Periodic Auctions & lit venues
- Reversal after LIFT

	Dependent variable:					
	Periodic Auction	Lit	Block Dark	Auction	SI	Off-book
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: BAN						
Dark Participant × *Post*	0.068***	0.123***	0.011	0.019**	0.009**	0.001
	(0.009)	(0.018)	(0.007)	(0.009)	(0.004)	(0.013)
Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Participant FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,199	6,199	6,199	6,199	6,199	6,199
R^2	0.250	0.438	0.217	0.250	0.562	0.455
Adjusted R^2	0.201	0.402	0.166	0.202	0.533	0.420
Panel B: LIFT						
Dark Participant × *Post*	−0.075***	−0.095***	0.005	−0.014	−0.015**	0.009
	(0.014)	(0.020)	(0.011)	(0.010)	(0.007)	(0.009)
Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Participant FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,546	5,546	5,546	5,546	5,546	5,546
R^2	0.337	0.403	0.208	0.256	0.442	0.470
Adjusted R^2	0.295	0.364	0.157	0.208	0.406	0.436

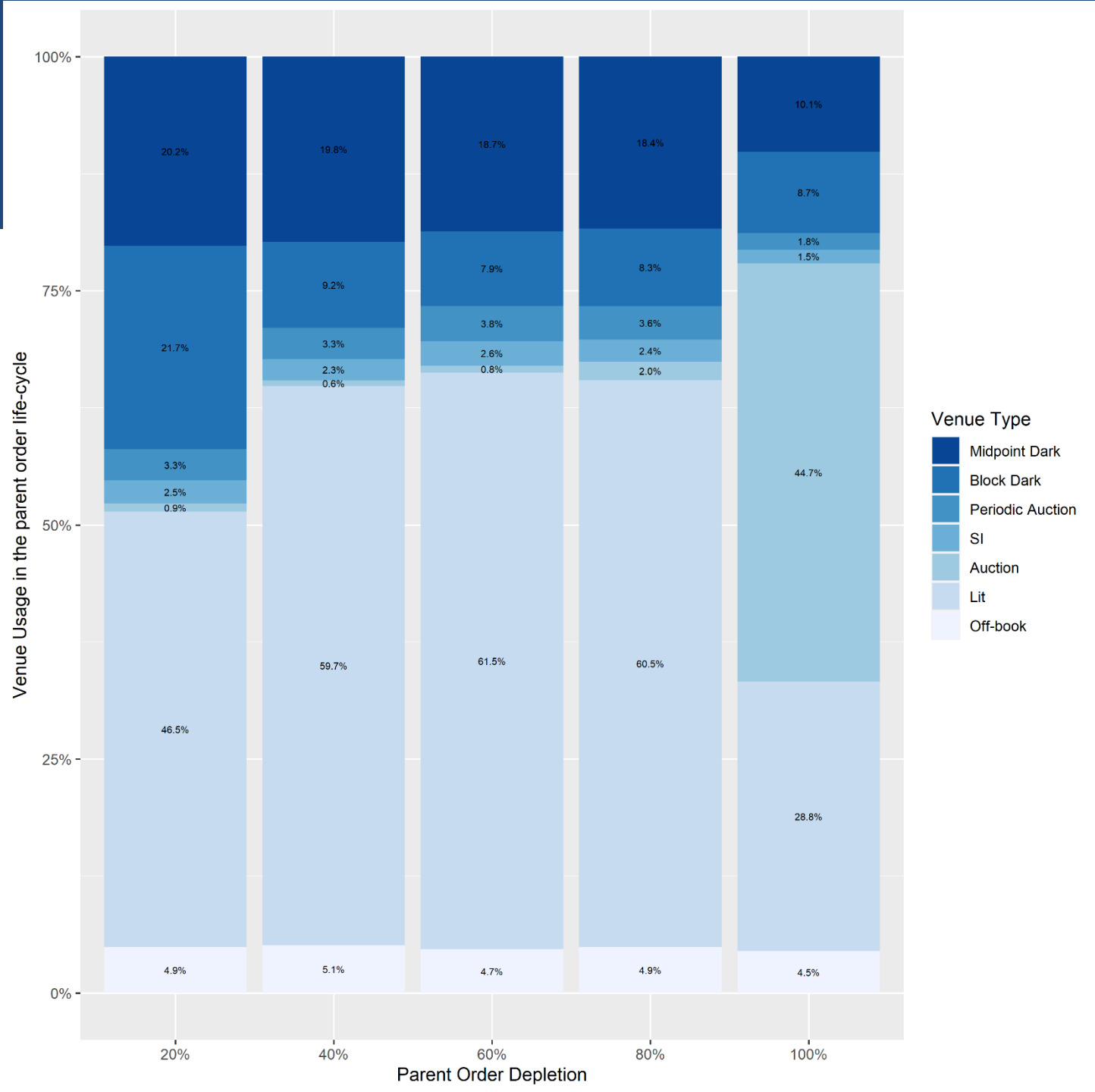
Results – DVC had no significant effect on institutional investor trading costs

- DVC has no significant effect on participants' transaction costs
- Largely unsurprising: Substitute venues benefit from participation externalities

	Dependent variable:	
	Total IS (bps)	
	BAN	LIFT
	(1)	(2)
Dark participant×Post	0.519	3.649
	(2.780)	(2.830)
Day FE	Yes	Yes
Participant FE	Yes	Yes
Observations	6,199	5,546
R^2	0.106	0.112
Adjusted R^2	0.048	0.055
Note:	*p<0.1; **p<0.05; ***p<0.01	

Pecking Order of Venue Selection

- Decompose % venue shares of parent order into quantiles by sequence
- Larger share of dark venues early in parent order life-cycle
  - Consistent with Menkveld et al. (2017)



Pecking Order Regression

- Regress dummy=1 for child execution in respective column dark venue
- Higher depletion buckets correspond to orders executed later in life cycle
- Decreasing use of dark pools over life-cycle consistent with pecking order theory

	Midpoint Dark	Midpoint and Block Dark	Periodic Auction	Periodic Auction and Block Dark
	(1)	(2)	(3)	(4)
Depletion Bucket 2	−0.005***	−0.005***	−0.003**	−0.003***
	(0.002)	(0.002)	(0.001)	(0.001)
Depletion Bucket 3	−0.007***	−0.007***	−0.002**	−0.003**
	(0.002)	(0.002)	(0.001)	(0.001)
Depletion Bucket 4	−0.010***	−0.011***	−0.002	−0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
Depletion Bucket 5	−0.016***	−0.016***	−0.004***	−0.004***
	(0.002)	(0.002)	(0.001)	(0.001)
Stock-Day FE	Yes	Yes	Yes	Yes
Participant FE	Yes	Yes	Yes	Yes
Broker FE	Yes	Yes	Yes	Yes
Period	pre-BAN and post-LIFT	pre-BAN and post-LIFT	post-BAN and pre-LIFT	post-BAN and pre-LIFT
Observations	4,851,067	4,851,067	4,885,124	4,885,124
R^2	0.315	0.318	0.170	0.174
Adjusted R^2	0.314	0.317	0.168	0.173

Pecking Order Regression

- Interact depletion buckets with dummies for:
  - High volatility days
  - Informed Investors (regression of order flow informativeness)
  - Impatient Investors (% aggressive fills)
- Only investor patience has an impact on sequence/pecking order

	Midpoint Dark			Periodic Auction		
	Vola	Informed	Impatient	Vola	Informed	Impatient
	(1)	(2)	(3)	(4)	(5)	(6)
Depletion Bucket 2	−0.004**	−0.006***	−0.003*	−0.004***	−0.002	−0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Depletion Bucket 3	−0.008***	−0.007***	−0.005*	−0.004**	−0.002	−0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)
Depletion Bucket 4	−0.012***	−0.012***	−0.006**	−0.004**	−0.002	0.0003
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Depletion Bucket 5	−0.017***	−0.018***	−0.011***	−0.008***	−0.004**	−0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Bucket2 x Dummy	−0.002	0.003	−0.003	0.002	−0.003	−0.004**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Bucket3 x Dummy	0.003	0.002	−0.003	0.003	−0.003	−0.004*
	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.002)
Bucket4 x Dummy	0.003	0.005	−0.008*	0.004*	−0.0003	−0.006**
	(0.004)	(0.004)	(0.004)	(0.002)	(0.004)	(0.003)
Bucket5 x Dummy	0.003	0.006	−0.009**	0.007***	−0.0005	−0.004
	(0.004)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
Stock-Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Participant FE	Yes	Yes	Yes	Yes	Yes	Yes
Broker FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,851,067	4,851,067	4,851,067	4,883,551	4,883,551	4,747,530
R^2	0.315	0.315	0.315	0.170	0.170	0.172
Adjusted R^2	0.314	0.314	0.314	0.169	0.169	0.170

Conclusions

- ↑ Dark trading is associated with ↓ investor trading costs (implementation shortfall)
- Participation externalities arise on substitute venues (periodic auctions)
- MiFID2's DVC Ban on dark trading did not impact trading costs
- Usage of dark pools decreases over the parent order life-cycle consistent with pecking order theory
  - More pronounced with investor impatience, but not volatility or informedness

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Investor Characteristic Measures

- **Informed**: How well daily net signed orderflow flow predicts daily returns
- Model with 5 lags:

$$ret_i^{t+1,t} = \beta_0 + \beta_1 D_{t,i,j} + \beta_2 D_{t,i,j} \times Size_{t,i,j}$$
$$+\beta_3 Vola_{t,i} + \sum_{d=1}^{5} \gamma_d D_{t,i,j} \times ret_i^{t+1-d,t-d} + \epsilon_\tau,$$

- where *D* is aggregate net order flow of investor *j,* on day t, for stock *i*
- **Impatience:** where % share of aggressive orders is > than median