

THE CAUSAL IMPACT OF MARKET  
FRAGMENTATION ON LIQUIDITY  
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# THE ISSUE

- Causal relation between fragmentation,  $X$ , and liquidity (market quality),  $Y$
- Ingredients
  - Metrics for  $X$  and  $Y$
  - A statistical method,  $M$ , to identify the causal impact of  $X$  on  $Y$
- Not the first analysis. Recently studied by O'Hara and Ye (2011); Chung and Chuwonganat, 2012; Degryse, De Jong, and van Kervel (2014), among others
  - Similar intentions, different samples
  - Closely related measures of  $Y$
  - They differ in metric for  $X$  and choice of  $M$

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# THE PAPER IN PERSPECTIVE

Study	X	Sample	Take away on $\frac{dY}{dX}$
Bennett and Wei (2006)	Listing Exchange	US Stocks	(-)
O'Hara and Ye (2011)	Fraction TRF volume	US stocks	(+)
Degryse et al. (2014)	HHI lit trades	Dutch stocks	(+) if X is lit
	Fraction dark trades		(-) if X is dark
This paper	HHI lit trades (OLS)	US stocks	(+) for large caps
	Reg NMS (DD)		(-) for small caps
	#venues (IV)		

# ON THE CHOICE OF $Y$ (AS LIQUIDITY)

- Natural choices: quoted bid-ask spread and depth
- Bid-ask spread may give incomplete picture of liquidity cost
  - Time dimension. Effect on realized spread? Price impact?
  - Quantity dimension. Effect on  $\Lambda$ , ILLIQ?
- Depth may give incomplete picture of liquidity supply
  - TAQ only displays top-of-the book depth
  - We may seriously overestimate depth in fragmented markets (van Kervel, 2015)
- Ideally one would get as close as possible to welfare
  - Metrics correlated with total gains from trade: volume and investor participation (e.g., Pagnotta 2014; Pagnotta and Philippon, 2015)

# CHOICE OF M: DIFF-IN-DIFF SETTING

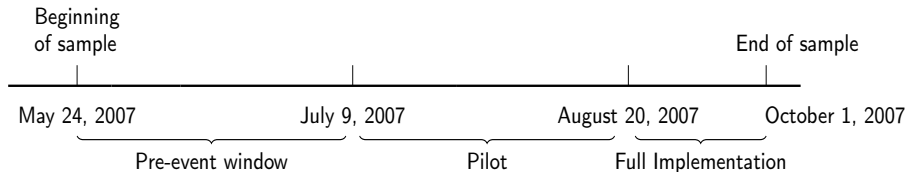


FIGURE: Diff-in-diff Timeline

- Staggered implementation of Reg NMS
- Random-like selection. Nice!

# REG NMS IN PERSPECTIVE

## ■ Roots

- Order handling rules (1997) → Fragmentation of NASDAQ space, rise of ECNs (e.g., Island, ARCA)
- Regulation ATS (1998) → Further fragmentation, ECNs, Dark Pools

## ■ Reg NMS: Proposed in 2004, implemented in 2007

## ■ Foster competition: Created competition for NYSE securities

## ■ But it did more...

- Order protection rule
- Forced adoption of automation (increased speed at NYSE and marginalized specialists)
- Fair access rules - Access fee cap (\$0.30/100 shares for all stocks > \$1) → maker-taker, rebates, web of complex order types,...
- New formula for allocation of market data revenue

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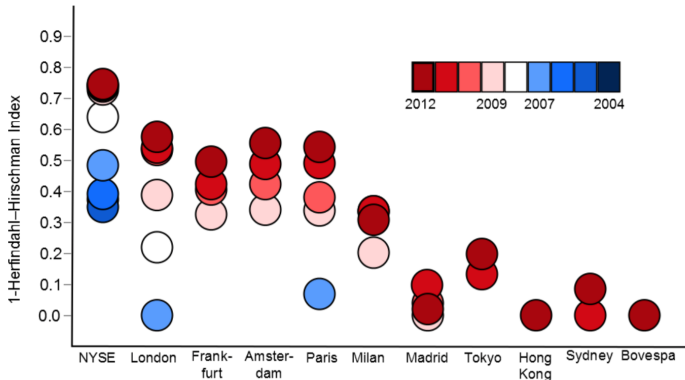
# FRAGMENTATION IS NOT ONE DIMENSIONAL

- **Volume fragmentation (spatial and lit / dark)**
  - ↑ Reg ATS
  - ↑ Reg NMS access rule
  - ↑ Algorithmic trading (e.g., AT arbitrage, smart routing)
- **Price fragmentation**
  - ↑ Decimalization
  - ↑ Exchange fee schemes (e.g., make-take, take-make)
  - ↓ Reg NMS order protection rule
- **Time Fragmentation**
  - ↑ Algorithmic trading, reduced exchange latencies
  - ↑ Reg NMS quote automation requirement (mainly for NYSE)

# CHOICE OF M: DIFF-IN-DIFF SETTING (II)

- Challenging to see Reg NMS as an exogenous shock to volume fragmentation
  - Perhaps results better seen as evidence on the effect of order protection + access rule
  - Interesting in itself! (e.g., SEC's 2015 request for comments on trade-through)
- What is the effect on volume fragmentation (acting as  $Y$ ) for Pilot stocks?
- Reg ATS / MiFID I better settings for pure volume fragmentation?

# INTERNATIONAL DIMENSION AND REGULATIONS



- **Regulation flavors:** Reg NMS in the US, MiFID in Europe, FIEA in Japan, OPR in Canada, FSCMA in S. Korea, MIR in Australia,...

# CHOICE OF M: IV APPROACH

- Instrument is number of trading venues
  - Correlated with volume fragmentation, but “not with asset characteristics”
- Advantage:
  - Can be applied to longer samples than quasi-experimental diff-in-diff
  - Easier to reproduce

# CHOICE OF M: IV APPROACH (II)

- Is sample length a concern for identification of causal effect?
  - Y variables can be measured at daily or higher frequencies
- **Cost 1:** Longer period -> more confounding factors: changes in exchange pricing schemes, HFT, additional regulations, macro shocks
  - These factors maybe correlated with the number of venues.  
Example: HFT may bring more business to fast venues and thus increase entry
- **Cost 2:** “Broad brush”: only time series variation
  - Alternative approach (But, Randi, and Werner, 2011):  
instrument for stock  $i$  is the average level of fragmentation of all stocks in same size group (excluding stock  $i$ )
- Mismatch? X includes all venues, lit and dark, but Y based on lit trade records (i.e. TAQ)
  - Why not considering both #lit and #dark venues?

# CONCLUDING REMARKS

- Paper addresses important and timely issue from new empirical perspective
  - Main results largely in line with previous findings
  - Important addition: the effect on US large and small caps is quite different
  - Identification concerns suggest toning down causal claims
- Potential (lots) for further exploration.
  - Positive. Why do small stocks suffer? Liquidity externalities? Information production-liquidity feedback? Same effect lit/dark fragmentation?
  - Normative 1: What is the optimal price regulation for fragmented markets? Nothing? SEC's trade-through? Top-of-the book protection? Consolidated limit order book?
  - Normative 2: Is the status quo optimal for small stocks? Does fragmentation hurt valuations / capital formation? Do we need continuous fragmented markets?