

# Tick Size Wars. Competitive Tick Size Regimes and Trader Behavior

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Overview

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## 1 Intro

Introduction

**The tick size in equity market design**

- *Tick size*: the grid of possible price increments on a stock exchange.
- Choice variable in the design of a limit order market.
- World-wide trend towards smaller tick sizes

**Too little liquidity provision?**

- Claim: Current tick size too small — deters intermediaries from providing liquidity
- US response: Tick Size Pilot — pilot program experimentally increased tick size – not successful
- EU response: MiFID II – tick size contingent on stock liquidity (in addition to price)

## Introduction ctd.

### Market Fragmentation

- Tick sizes fix terms of trade in an exchange.
- Competing exchanges “improve” on fixed tick sizes by
  - Midpoint execution (Kwan, Masulis, and McNish, 2015; Buti, Rindi, and Werner, 2017)
  - Fee structure changing implied ticks (maker-taker vs taker-maker). (Chao, Yao, and Ye, 2019; Comerton-Forde, Grégoire, and Zhong, 2019).
- Each regulatory intervention seeking to eliminate implicit competition met by ever more imaginative structures.

### This paper

#### This study

- The impacts of *pure* exchange tick size competition
- The immediate responses of HFT liquidity suppliers

## 2 Events of War

### The Tick Size Wars of '09

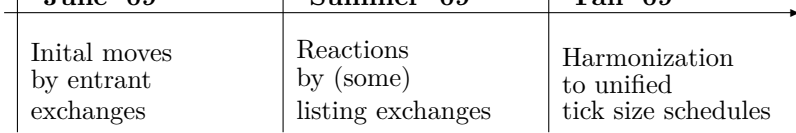
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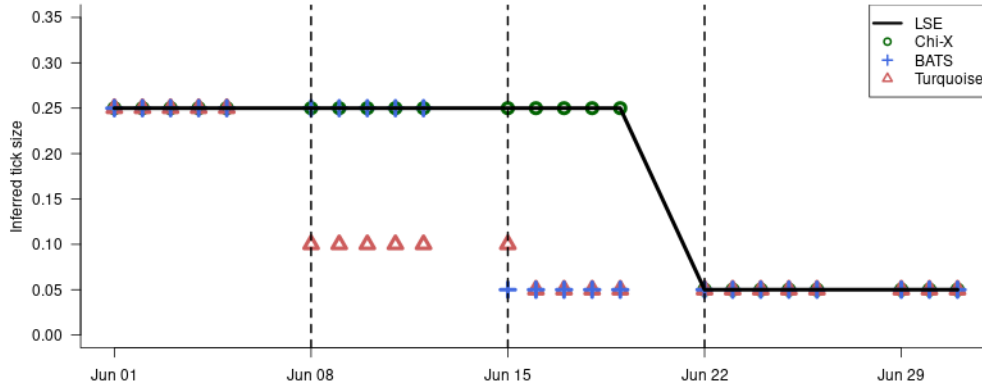
### Events of War

- 2007: MiFID
- 2008: Chi-X, BATS, Turquoise starts trading limited range UK, Scandinavian stocks.
- June 2009: Chi-X, BATS, Turquoise reduces tick sizes selected LSE, Scandinavian stocks.
- Later that month: LSE reacts, all exchanges trade London shares on new lower tick.
- Early July: OSE reacts, competitive lowering of tick sizes, but still higher than competitors.
- Fall: Pan-European agreement on common tick sizes across all exchanges.

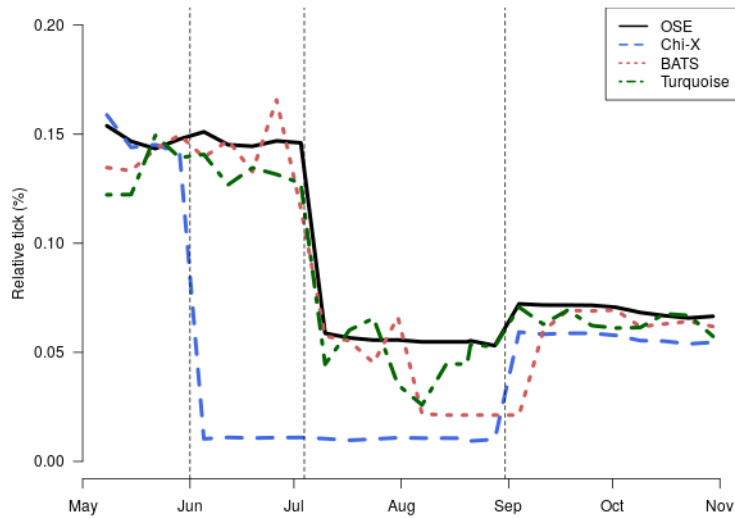
### Simplified timeline



### BP at LSE: Tick size evolution



### Market aggregate: Relative Tick (Oslo)

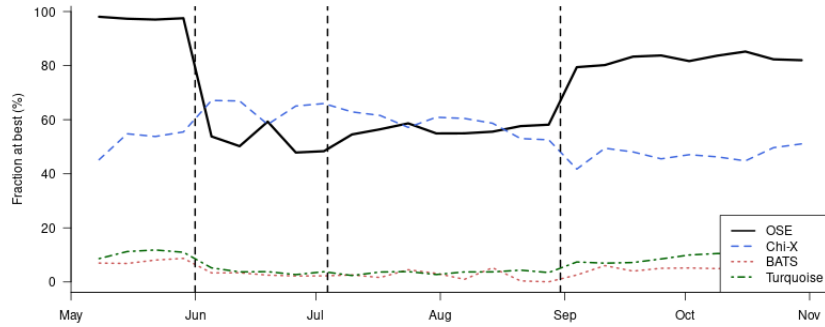


Relative tick size: Tick size/stock price

### Consequence 1: Pre-trade market share

Scandinavian exchanges *overnight*

- go from quoting the best price all the time to 50% of the time.

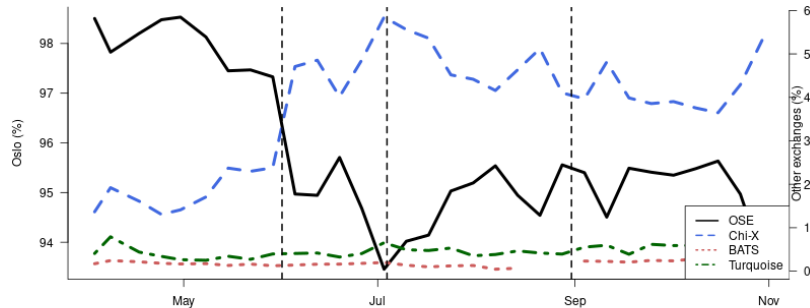


Fraction of day each exchange is quoting best price (Oslo)

### Consequence 2: post-trade market share

Scandinavian exchanges *overnight*

- lose 3-4% market share.

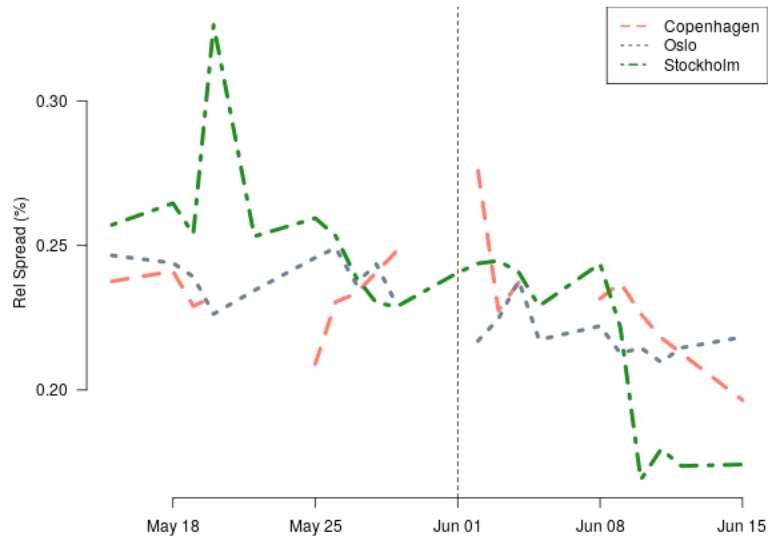


## 3 Effect on Market Quality of first lowering of tick sizes

Effect on market quality of first lowering of tick sizes

- Spreads (transaction costs) fall in both away and home markets
- Depth is unchanged
- Volume increases in both home and away markets.

## Spread (NBBO) around first move



### Diff-in-Diff – quality effects of first (june) move

To quantify effects – diff in diff.

- Stocks with significant cross-market trade (stocks in Scandinavian main indices).
- Control in diff-in-diff: Stocks *only* traded at the listing exchanges.
- Timing: Comparing:
  - Short period before initial tick size lowering
  - Short period after initial tick size lowering

### Diff-in-Diff – quality effects of first (june) move

	Home	Away	NBBO
$\tau$ (Quoted spread)	-0.08*** (-4.40)	-0.33*** (-12.30)	-0.20*** (-8.39)
$\tau$ (Effective spread)	-0.09*** (-4.24)	-0.27*** (-10.86)	
$\tau$ (Realized spread)	-0.15*** (-3.94)	-0.31*** (-7.31)	
$\tau$ (Price impact)	-0.05 (-1.51)	-0.24*** (-5.73)	
$\tau$ (Depth)	0.00 (0.10)	-0.00 (-0.16)	
$\tau$ (Volatility)	-0.06 (-0.65)	0.05* (1.80)	
$\tau$ (Volume)	0.12*** (2.65)	0.66*** (13.68)	
# treated RICs	89	222	
# control RICs	577	577	
$n$	23344	27311	

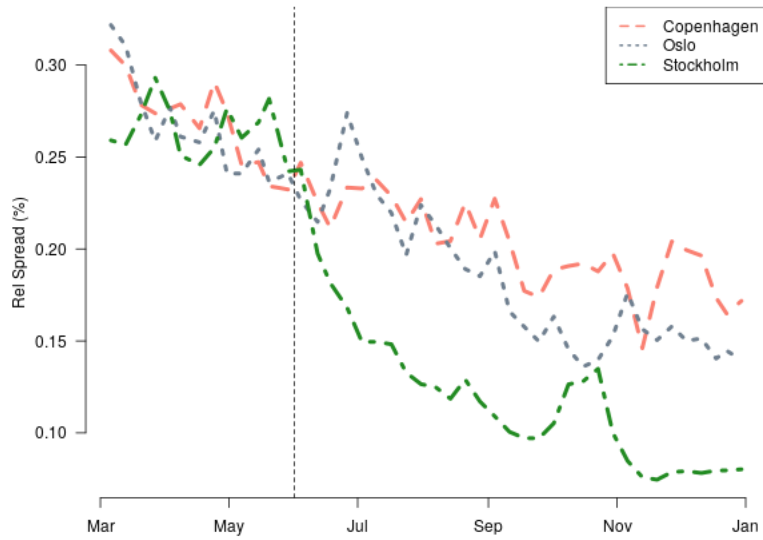
Estimated quality effects of initial lowering of tick size using difference-in-differences

## 4 Total effects – pre to post harmonization

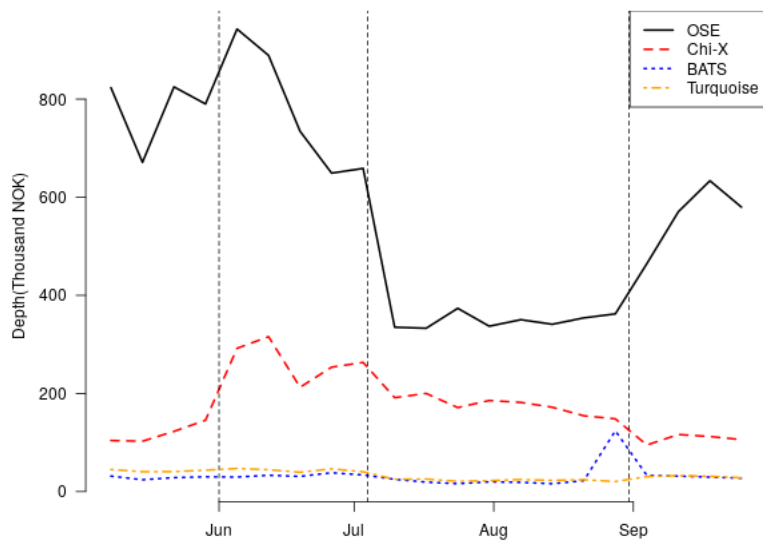
### Total effects – pre-war to post-harmonization

- Spreads (transaction costs) fall in both away and home markets
- Depth falls
- Volume
  - decreases in home markets.
  - increases in away markets.

### Spread (NBBO) throughout the war



**Depth throughout the war (Oslo)**



**Diff-in-Diff pre-war to post-harmonization**

To quantify effects – diff in diff

- Stocks with significant cross-market trade (stocks in Scandinavian main indices).
- Control: Stocks *only* traded at the listing exchanges.

- Timing: Comparing:
  - Short period before initial tick size lowering
  - Short period after harmonization *in that market*

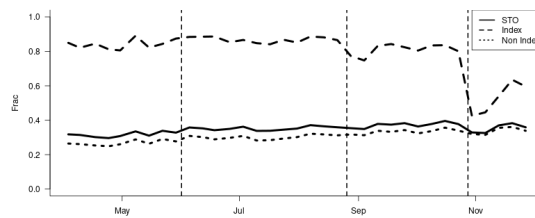
### Diff-in-Diff pre-war to post harmonization

	Home	Away	NBBO
$\tau$ (Quoted spread)	-0.49*** (-10.16)	-0.59*** (-13.02)	-0.63*** (-13.46)
$\tau$ (Effective spread)	-0.62*** (-12.62)	-0.76*** (-19.47)	
$\tau$ (Realized spread)	-0.89*** (-11.56)	-1.21*** (-17.44)	
$\tau$ (Price impact)	-0.42*** (-9.20)	-0.56*** (-11.15)	
$\tau$ (Depth)	-0.93*** (-13.20)	-0.16*** (-3.81)	
$\tau$ (Volatility)	-0.00 (-0.04)	0.08 (1.44)	
$\tau$ (Volume)	-0.15*** (-2.72)	0.92*** (11.28)	
# treated RICs	67	200	
# control RICs	577	577	
$n$	23040	27594	

## 5 Main market constrained?

### Does tick sizes constrain?

Tick sizes lower bound on bid/ask spread. If trading at one tick, trading costs can't go lower. Were these markets constrained? Stockholm: Fraction of the day quoting at one tick.



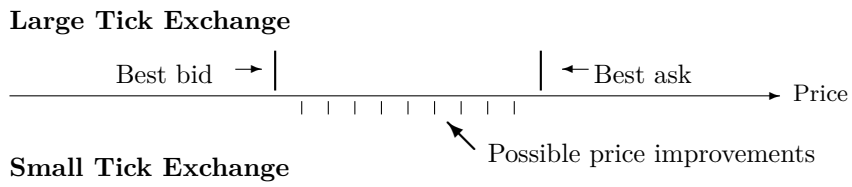
### Results

Effects on market quality concentrated in stocks which are constrained at one tick.

## 6 Quoting behavior in small-tick market

### Competition from small-tick markets

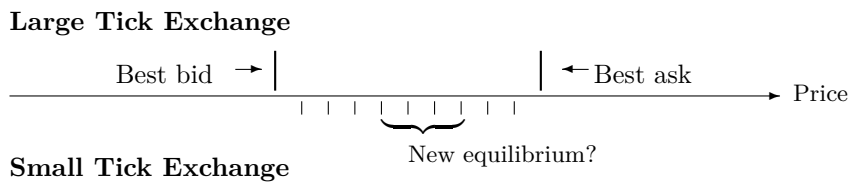




**Quoting strategies in small-tick markets**

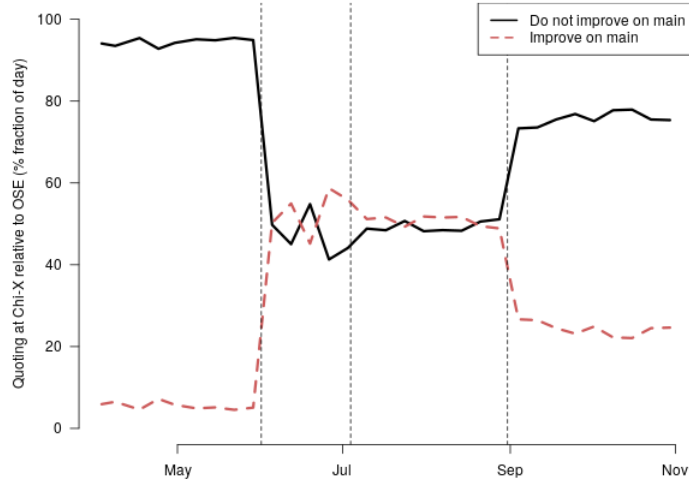
Possibilities

- Undercutting of prices at the large-tick exchange?
- Price competition at the small-tick exchange?

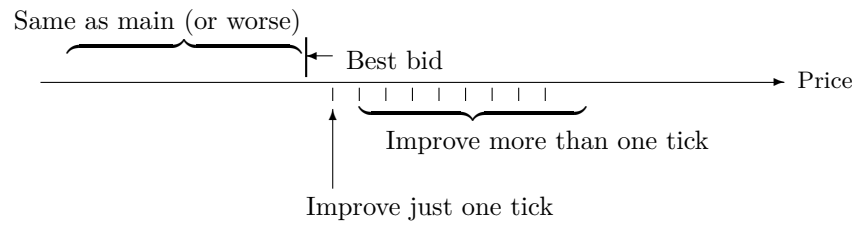


**Chi-X improvement on OSE price**

Fraction of day Chi-X improves on OSE price

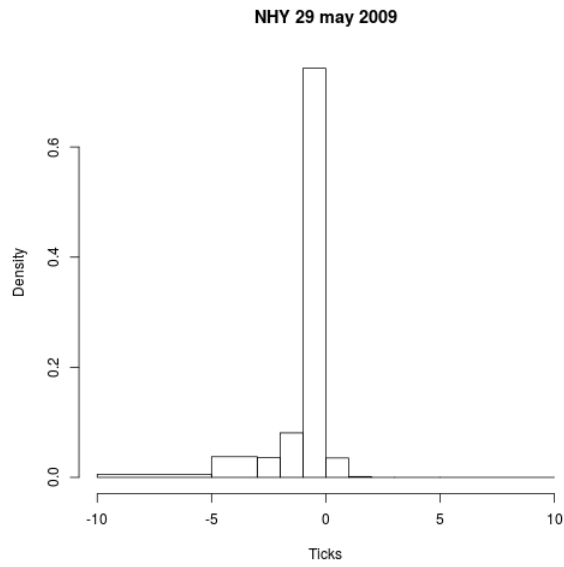


What are traders using small-tick market for?



**Placing of Chi-X quotes relative to main market**

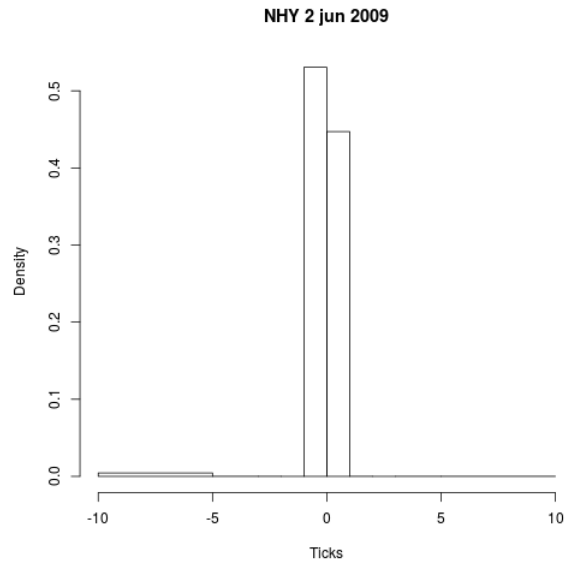
When tick sizes are the same:



Example: NHY at Oslo

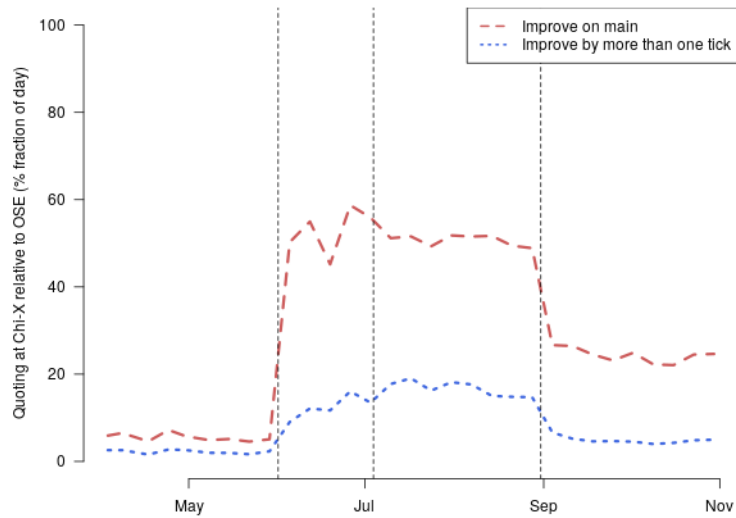
**Placing of Chi-X quotes relative to main market**

When Chi-X tick sizes are smaller:



Example: NHY at Oslo

**How often does Chi-X improve by more than one tick?**



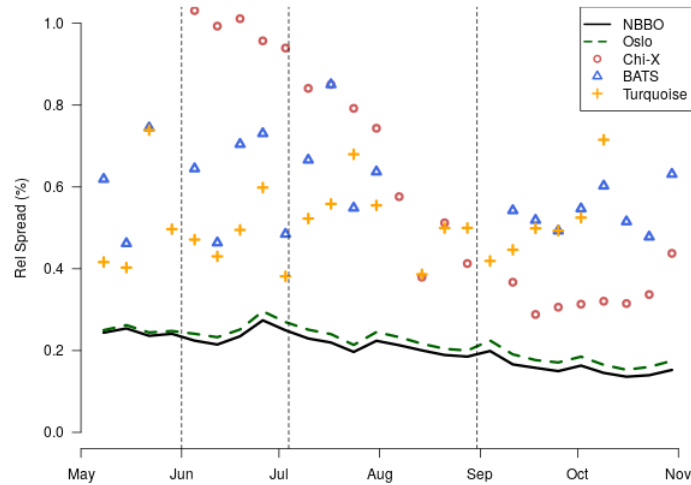
Case: Oslo

**Competitive small tick markets**

**HFT traders at the small-tick markets**

- Use the small-tick markets to undercut main market by minimal ticks.
- Do *not* use to the small-tick market to move prices towards a less constrained equilibrium.

## Minimal effect on NBBO



Relative Spreads for OSE stocks

## 7 Conclusion

### Summary

'09 Tick Size War: Exchanges' competitive lowering tick size

- Entrant exchanges undercut to gain market share.
- Immediate loss of market for old exchanges:
  - 100% → 50% time at best quote
  - 98% → 92% trading volume
- Market quality effects: pre-war → post-war (post-harmonization)
  - Spreads (transaction costs) fall in both away and home markets
  - Depth falls
  - Volume
    - \* decreases in home markets.
    - \* increases in away markets.
- Quoting behavior: Traders use small-tick market to undercut main market by one tick, not for price competition on the small-tick market.

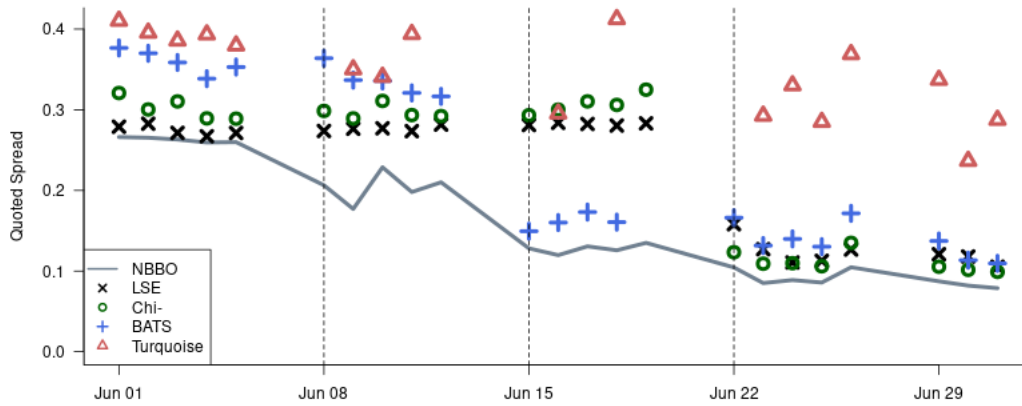
### Implications - A Race to the bottom?

- Explicit tick size competition leads to undercutting behavior.
- HFT market makers undercut by only one new tick – No new “equilibrium” spread.

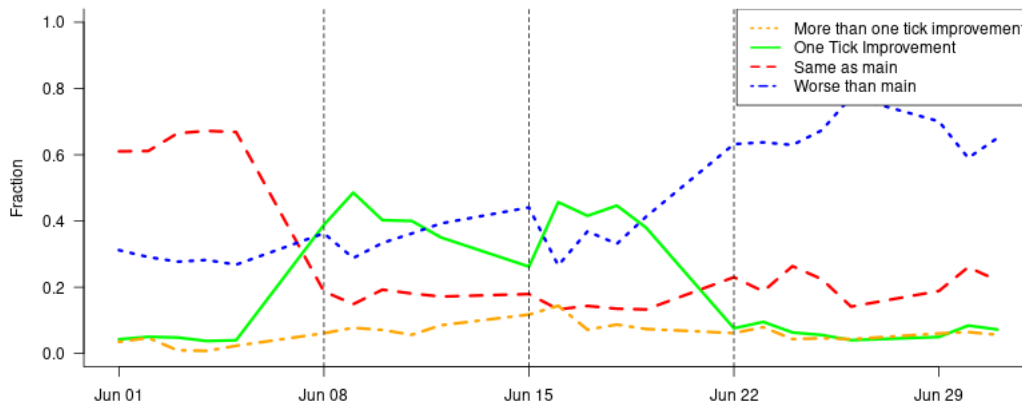
- Regulation required to avoid explicit tick size competition
- With regulation requiring harmonized ticks, implicit competition emerges
  - Midpoint Dark Trading (Europe)
  - Fractional Dark Trading (US)
  - Large in Scale Blocks
  - Inverted Fee Venues
- Narrower unconstrained tick sizes may eliminate this competitive conduct.

### Extra Figures and Tables

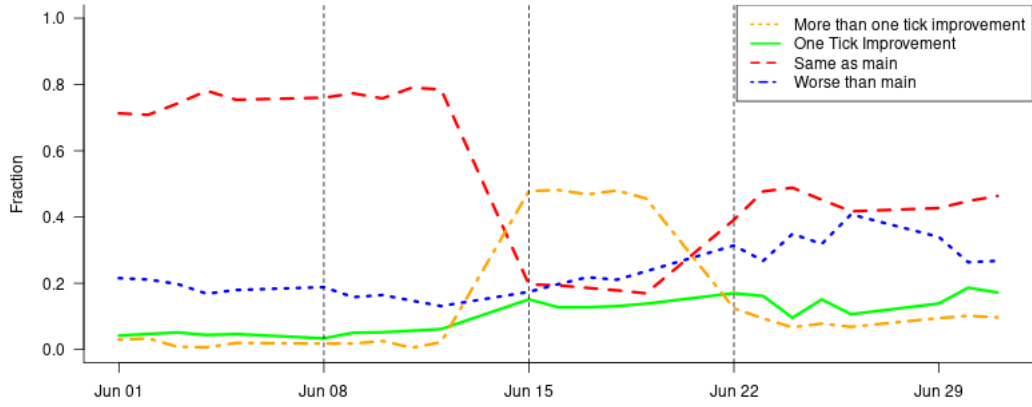
#### Example: Spread of BP at LSE



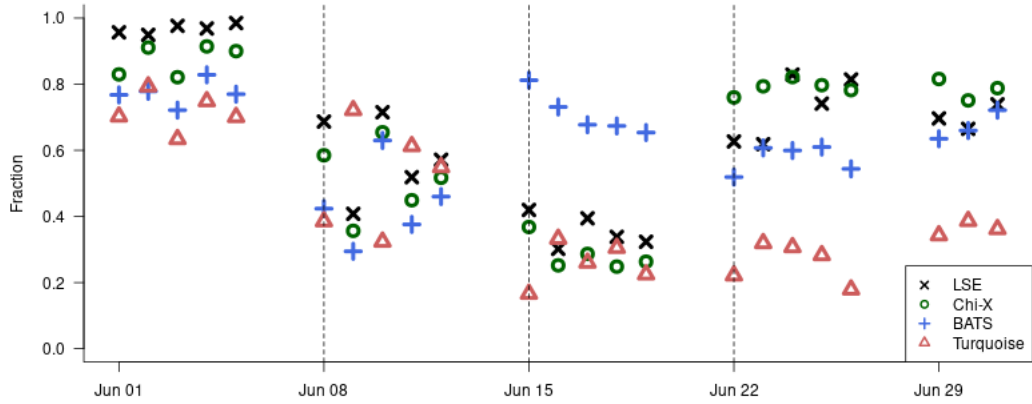
#### BP: Turquoise quote placement relative to LSE



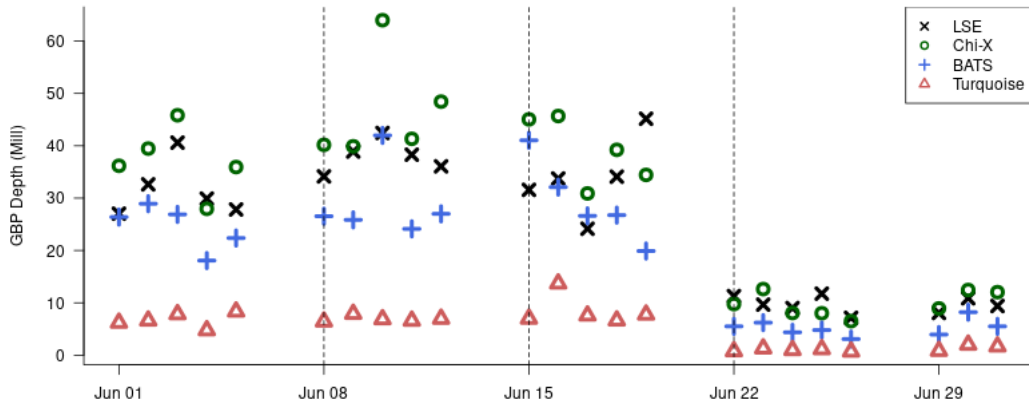
BP:BATS quote placement relative to LSE



BP: Fraction at best bid



BP: Aggregate depth at LSE quotes



## References

- Sabrina Buti, Barbara Rindi, and Ingrid M Werner. Dark pool trading strategies, market quality and welfare. *Journal of Financial Economics*, 124(2):244 – 265, 2017. doi: 10.1016/j.jfineco.2016.02.002.
- Yong Chao, Chen Yao, and Mao Ye. Why Discrete Price Fragments U.S. Stock Exchanges and Disperses Their Fee Structures. *The Review of Financial Studies*, 32(3):1068–1101, March 2019. doi: 10.1093/rfs/hhy073.
- Carole Comerton-Forde, Vincent Grégoire, and Zhuo Zhong. Inverted fee structures, tick size, and market quality. *Journal of Financial Economics*, 2019. doi: 10.1016/j.jfineco.2019.03.005. Forthcoming.
- Amy Kwan, Ronald Masulis, and Thomas H McNish. Trading rules, competition for order flow and market fragmentation. *Journal of Financial Economics*, 28(2):592–636, 2015.