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 McInish, 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

Investigate 2009 “Tick Size War” between

- Established Exchanges: LSE, Copenhagen, Oslo, Stockholm

Unique case of using tick size lowering as a competitive move.

2 Events of War

The Tick Size Wars of ’09

In the left corner....
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.

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.

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 regression – quality effects of first move

Diff in diff formulation:

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

Diff-in-Diff regression – quality effects of first move

<table>
<thead>
<tr>
<th></th>
<th>Home</th>
<th>Away</th>
<th>NBBO</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau$ (Quoted spread)</td>
<td>$-0.08^{***}$</td>
<td>$-0.33^{***}$</td>
<td>$-0.20^{***}$</td>
</tr>
<tr>
<td></td>
<td>$(-4.40)$</td>
<td>$(-12.30)$</td>
<td>$(-8.39)$</td>
</tr>
<tr>
<td>$\tau$ (Effective spread)</td>
<td>$-0.09^{***}$</td>
<td>$-0.27^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(-4.24)$</td>
<td>$(-10.86)$</td>
<td></td>
</tr>
<tr>
<td>$\tau$ (Realized spread)</td>
<td>$-0.15^{***}$</td>
<td>$-0.31^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(-3.94)$</td>
<td>$(-7.31)$</td>
<td></td>
</tr>
<tr>
<td>$\tau$ (Price impact)</td>
<td>$-0.05$</td>
<td>$-0.24^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(-1.51)$</td>
<td>$(-5.73)$</td>
<td></td>
</tr>
<tr>
<td>$\tau$ (Depth)</td>
<td>$0.00$</td>
<td>$0.00$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(0.10)$</td>
<td>$(-0.16)$</td>
<td></td>
</tr>
<tr>
<td>$\tau$ (Volatility)</td>
<td>$-0.06$</td>
<td>$0.05^{*}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(-0.65)$</td>
<td>$(1.80)$</td>
<td></td>
</tr>
<tr>
<td>$\tau$ (Volume)</td>
<td>$0.12^{***}$</td>
<td>$0.66^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(2.65)$</td>
<td>$(13.68)$</td>
<td></td>
</tr>
</tbody>
</table>

# 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)

Analysis: Measuring quality effects

Technicalities:

Want: change in quality measures linked to tick size.

Diff in diff

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

• Timing: Each market:
  – Short period before initial tick size lowering
  – Short period after harmonization in that market

Diff-in-Diff Regression - overall effects

<table>
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<th>Away</th>
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</tr>
</thead>
<tbody>
<tr>
<td>$\tau$ (Quoted spread)</td>
<td>$-0.49^{***}$</td>
<td>$-0.59^{***}$</td>
<td>$-0.63^{***}$</td>
</tr>
<tr>
<td></td>
<td>(-10.16)</td>
<td>(-13.02)</td>
<td>(-13.46)</td>
</tr>
</tbody>
</table>
| $\tau$ (Effective spread) | $-0.62^{***}$ | $-0.76^{***}$ | ($\tau$ (Realized spread) | $-0.89^{***}$ | $-1.21^{***}$ | ($\tau$ (Price impact) | $-0.42^{***}$ | $-0.56^{***}$ | ($\tau$ (Depth) | $-0.93^{***}$ | $-0.16^{***}$ | ($\tau$ (Volatility) | -0.00 | 0.08 | ($\tau$ (Volume) | $-0.15^{***}$ | 0.92*** | ($
|               | (-12.02)   | (-19.47)   | ($\tau$ (Effective spread) | $-0.62^{***}$ | $-0.76^{***}$ | ($\tau$ (Realized spread) | $-0.89^{***}$ | $-1.21^{***}$ | ($\tau$ (Price impact) | $-0.42^{***}$ | $-0.56^{***}$ | ($\tau$ (Depth) | $-0.93^{***}$ | $-0.16^{***}$ | ($\tau$ (Volatility) | -0.00 | 0.08 | ($\tau$ (Volume) | $-0.15^{***}$ | 0.92*** | ($

The table reports estimates from the following difference-in-differences regression specification:

$$y_{it} = \alpha_i + \beta Post_{it} + \gamma Post_{it} \times \alpha_m + \tau D_{it} + \mathbf{X}_{it} + \omega_{it},$$

where $\alpha_i$ and $\alpha_m$ represent RIC and market-level fixed effects, respectively. $D_{it} = 1$ for all treatment group observations on dates $t \geq t^*$, where $t^*$ is tick size harmonization date for a given stock exchange. $Post_{it} = 1$ for all observations after tick size harmonization in a given market. $\mathbf{X}_{it}$ is a vector of control variables, comprising the natural logarithm of the stock price. Our treatment sample consists of blue-chip index stocks that experienced tick size harmonization. Our control sample consists of all home exchange stocks that did not experience tick size harmonization. The sample period comprises one month of data from the pre-war period (May, 2009) and one month of data from after each of Norwegian, Danish, and Swedish harmonization events (August 31, 2009, October 26, 2009, and January 4, 2010, respectively). The difference-in-differences specification is estimated pooled for all stocks, regardless of whether they experienced increased or reduced tick size. $Qspread$ is the quoted relative spread, transformed with the natural logarithm. $Espread$ is the effective spread, transformed with the natural logarithm. $Depth$ is order book depth, transformed with the natural logarithm. $Volatility$ is measured in percentage points. $Volume$ is currency trading volume, transformed with the natural logarithm. For ease of exposition, we have included $N$, the number of observations, only for regressions using $Volume$ as the dependent variable. The number of observations varies slightly across dependent variables. $t$-statistics are presented in parentheses. Standard errors are clustered at the RIC-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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

Large Tick Exchange

\[ \text{Best bid} \quad | \quad | \quad \text{Best ask} \]

Price

Small Tick Exchange

Possible price improvements

Quoting strategies in small-tick markets

Possibilities

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

Large Tick Exchange

\[ \text{Best bid} \quad | \quad | \quad \text{Best ask} \]

Price

Small Tick Exchange

New equilibrium?

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


