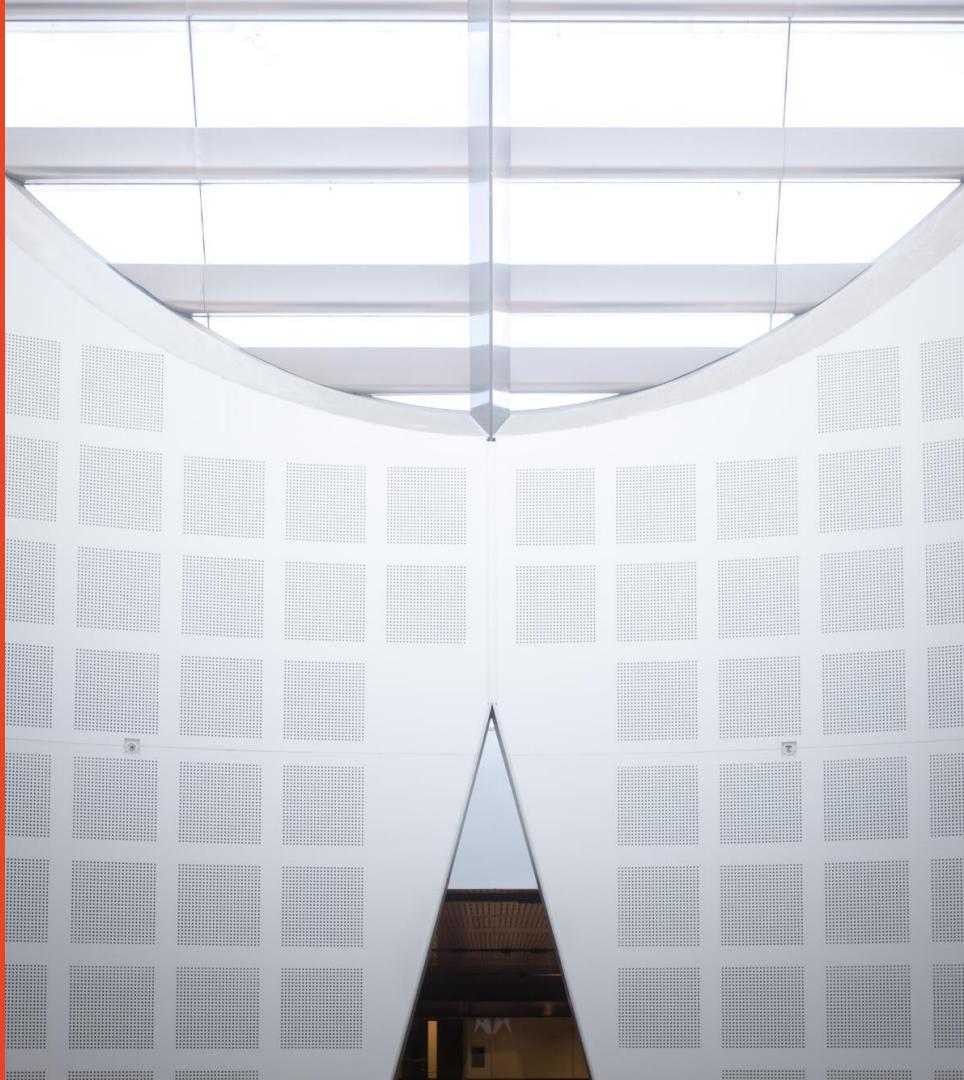


# **Trading behavior and market quality when the relative tick size is almost zero**

**Dr Sean Foley**

Jiri Svec

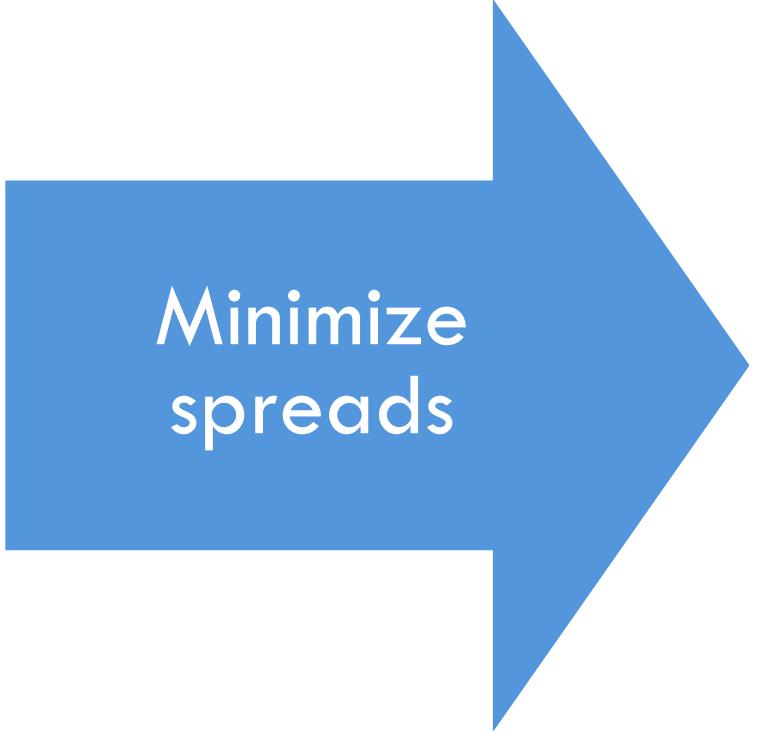
Anne Haubo Dyhrberg



# Tick size: Depth vs. Costs



Maximize liquidity provision



Minimize spreads

Quoted spread

| Tick size | Spread | Spread (ticks) |
|-----------|--------|----------------|
| 0.1c      | 2c     | 20             |

Increased spreads

Increased depth

Increased volatility

Improved liquidity provision

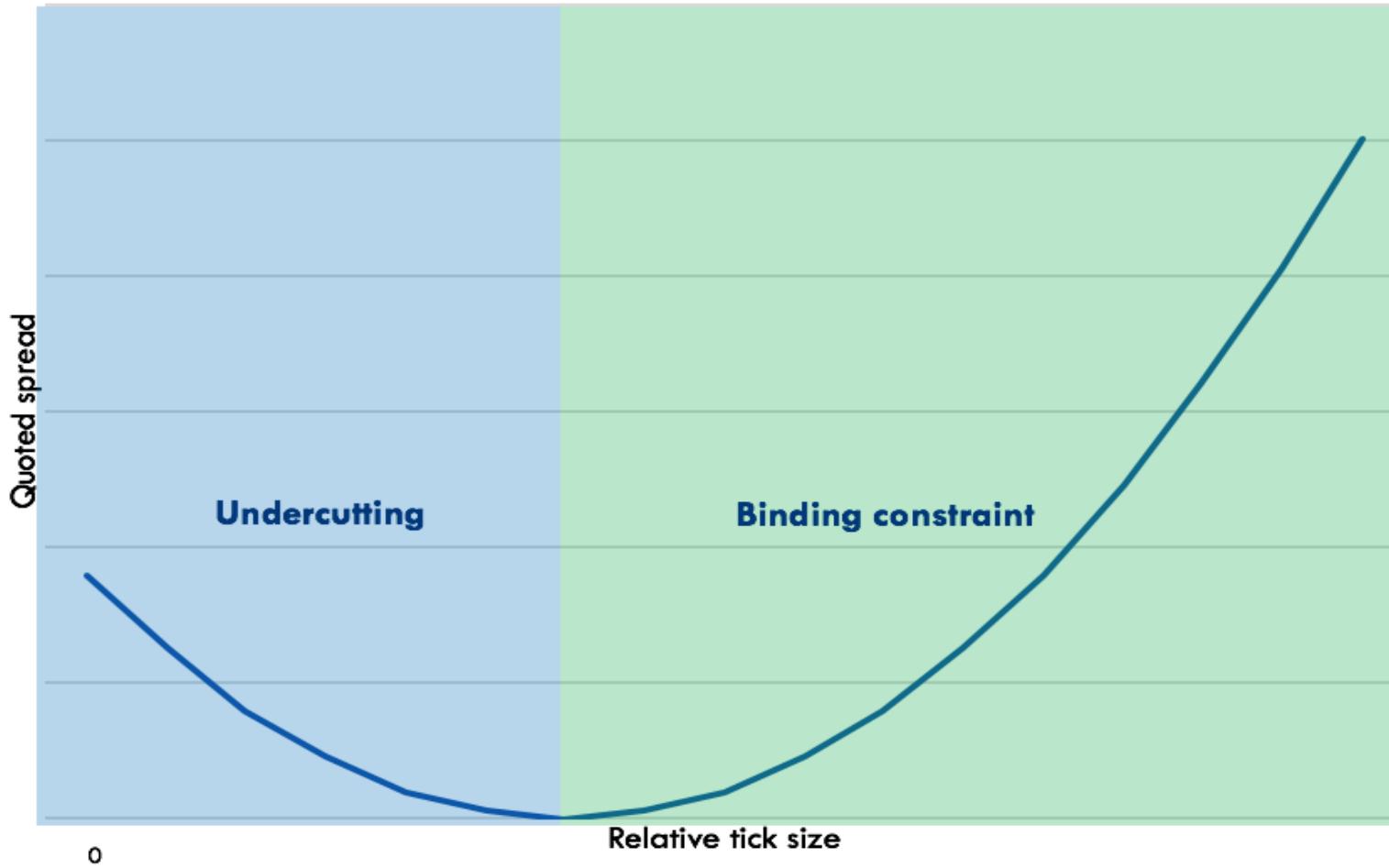
Binding constraint

Reduced spreads

Lower depth at best

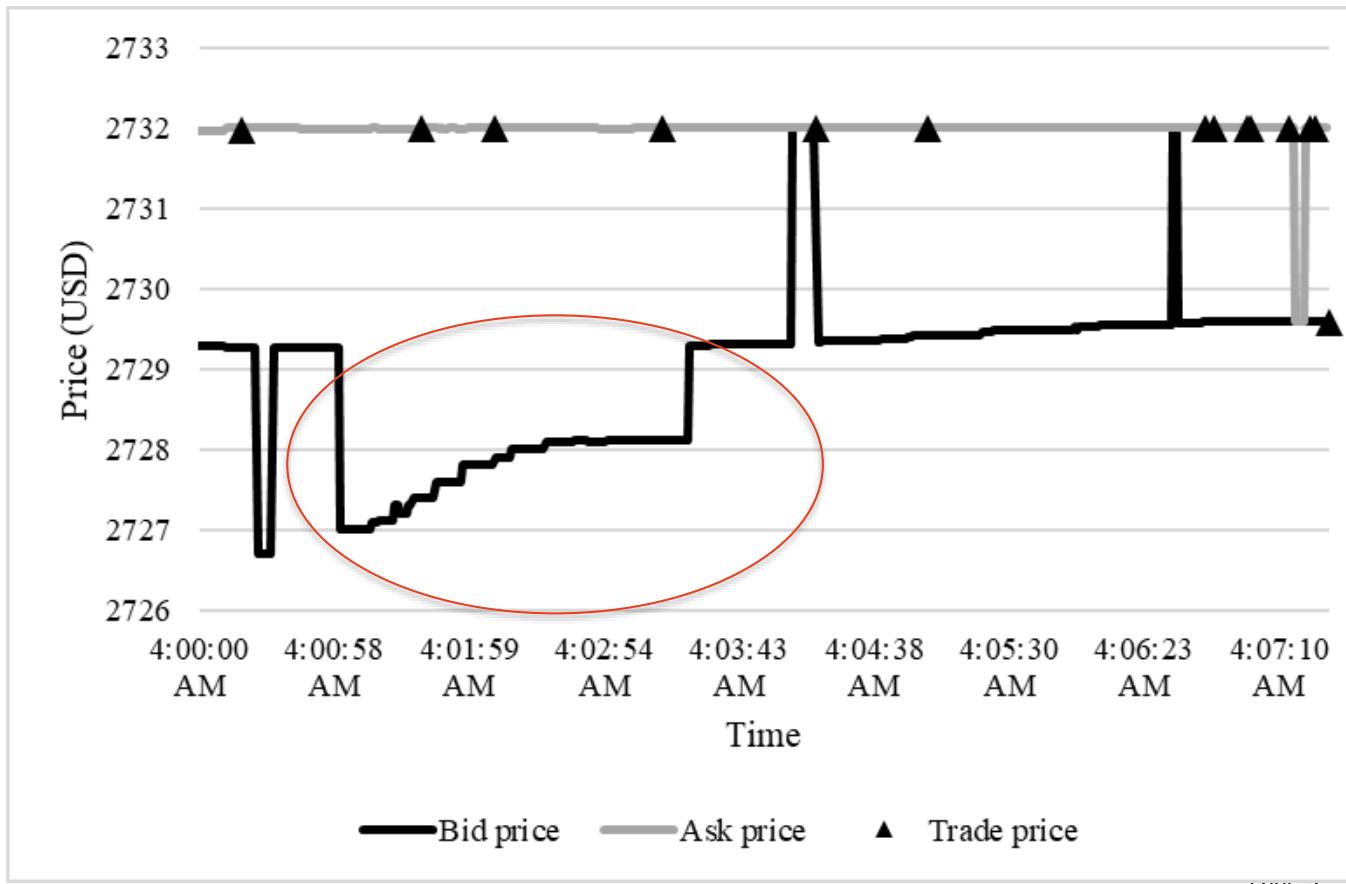
Trade size importance

Relative tick size



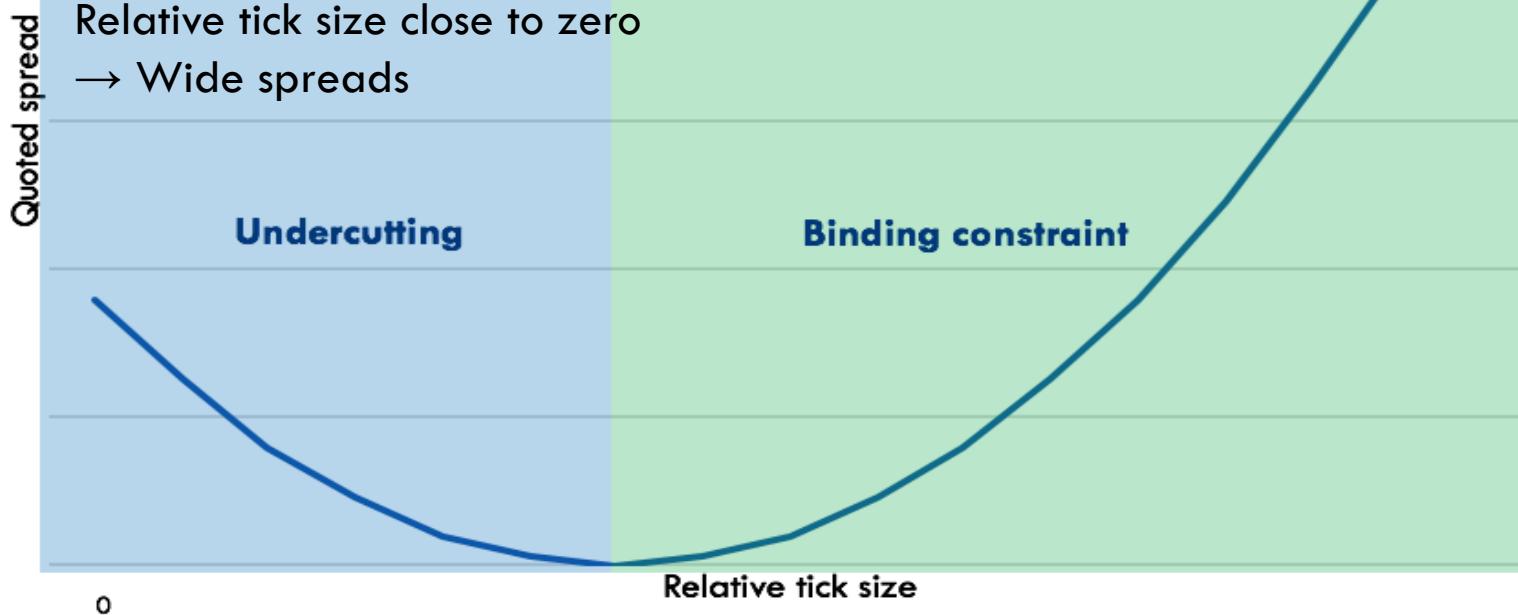
# Undercutting - an example

| Price        | ETH         |
|--------------|-------------|
| 210.40940000 | 2.16960480  |
| 210.08979033 | 0.49168813  |
| 210.08979032 | 5.99000000  |
| 210.04000003 | 0.12551583  |
| 209.91818734 | 19.63800000 |
| 209.91818733 | 7.10000000  |
| 209.91818700 | 8.00000000  |
| 209.78217253 | 0.11741054  |
| 209.78153596 | 0.04630284  |
| 209.77155855 | 5.10000000  |
| 209.76982000 | 0.52438430  |
| 209.74000000 | 12.00000000 |
| 209.68020784 | 12.29768200 |
| 209.67967906 | 6.11316737  |
| 209.60953630 | 11.50000000 |
| 209.60833476 | 0.01441000  |



## Foucault, Kadan and Kandel (2005)

- High waiting costs
- Impatient traders
- High order arrival rate
- Relative tick size close to zero
- Wide spreads



# kraken

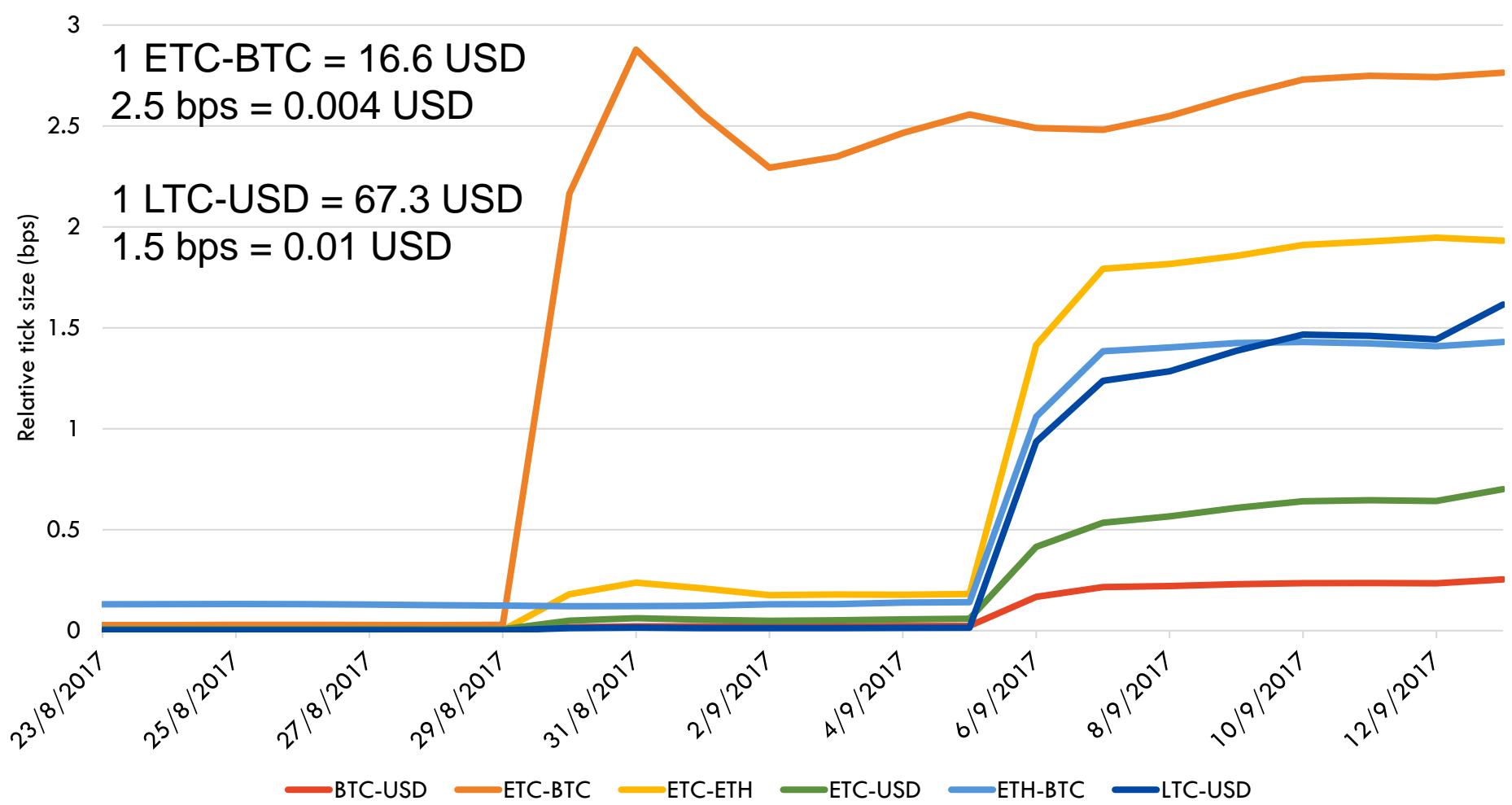


Assumptions of the theoretical model:

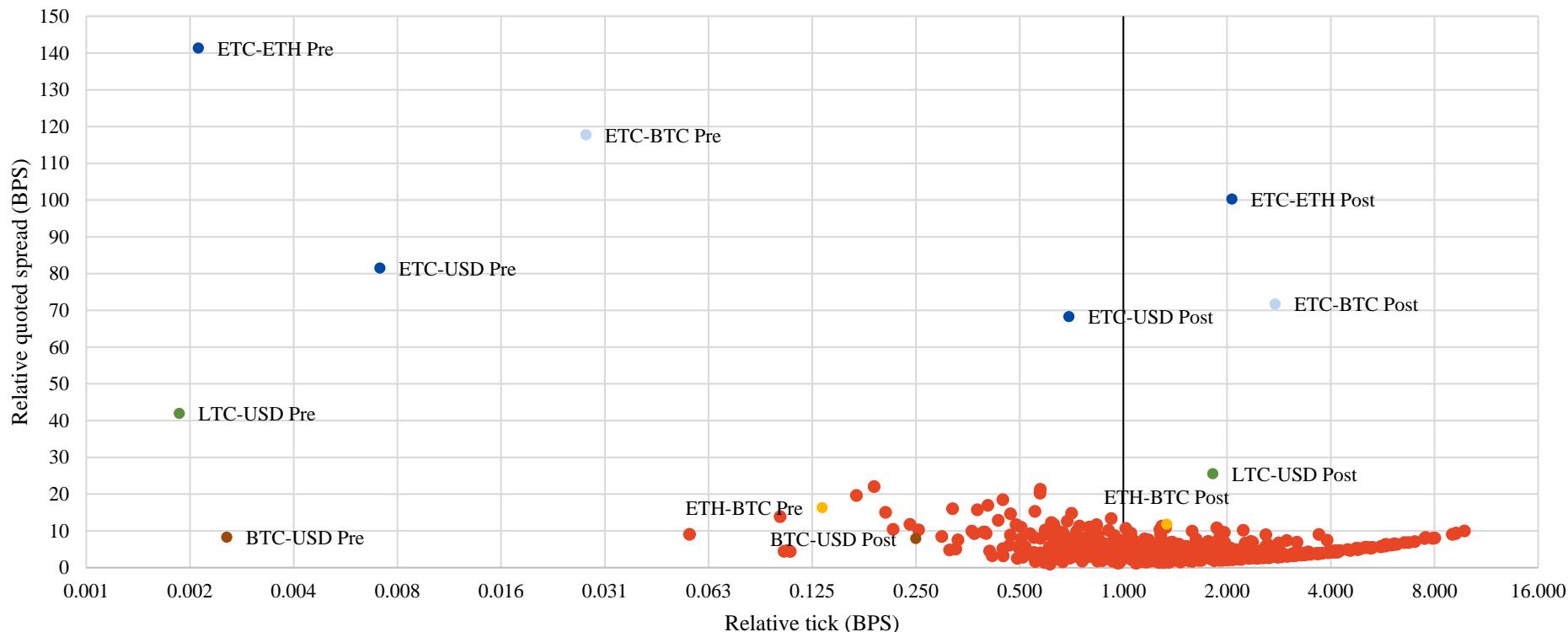
- Continuous market without intermediaries
- No asymmetric information
- Impatient traders

High frequency TAQ data

Tick size increase on  
August 30<sup>th</sup> 2017  
September 6<sup>th</sup> 2017



# Relative tick size and relative quoted spread



# 2SLS Estimator

Endogeneity problem due to mechanical effect between tick sizes and spreads

→ Use instrumental variable

First stage

$$\widehat{\text{Relative Tick}}_{it} = \alpha_i + \beta_1 \text{PercentChange}_{it} + \beta_2 \$\text{Volume}_{it} + \beta_3 \text{Trades}_{it} \\ + \beta_4 \text{Volatility}_{it} + \beta_5 \text{MeanPrice}_{it} + \varepsilon_t$$

Second stage

$$\text{Metric}_{it} = \alpha_i + \beta_1 \$\text{Volume}_{it} + \beta_2 \text{Trades}_{it} + \beta_3 \text{Volatility}_{it} + \beta_4 \text{MeanPrice}_{it} \\ + \beta_5 \widehat{\text{Relative Tick}}_{it} + \varepsilon_t$$

# More, Larger Limit and Market Orders

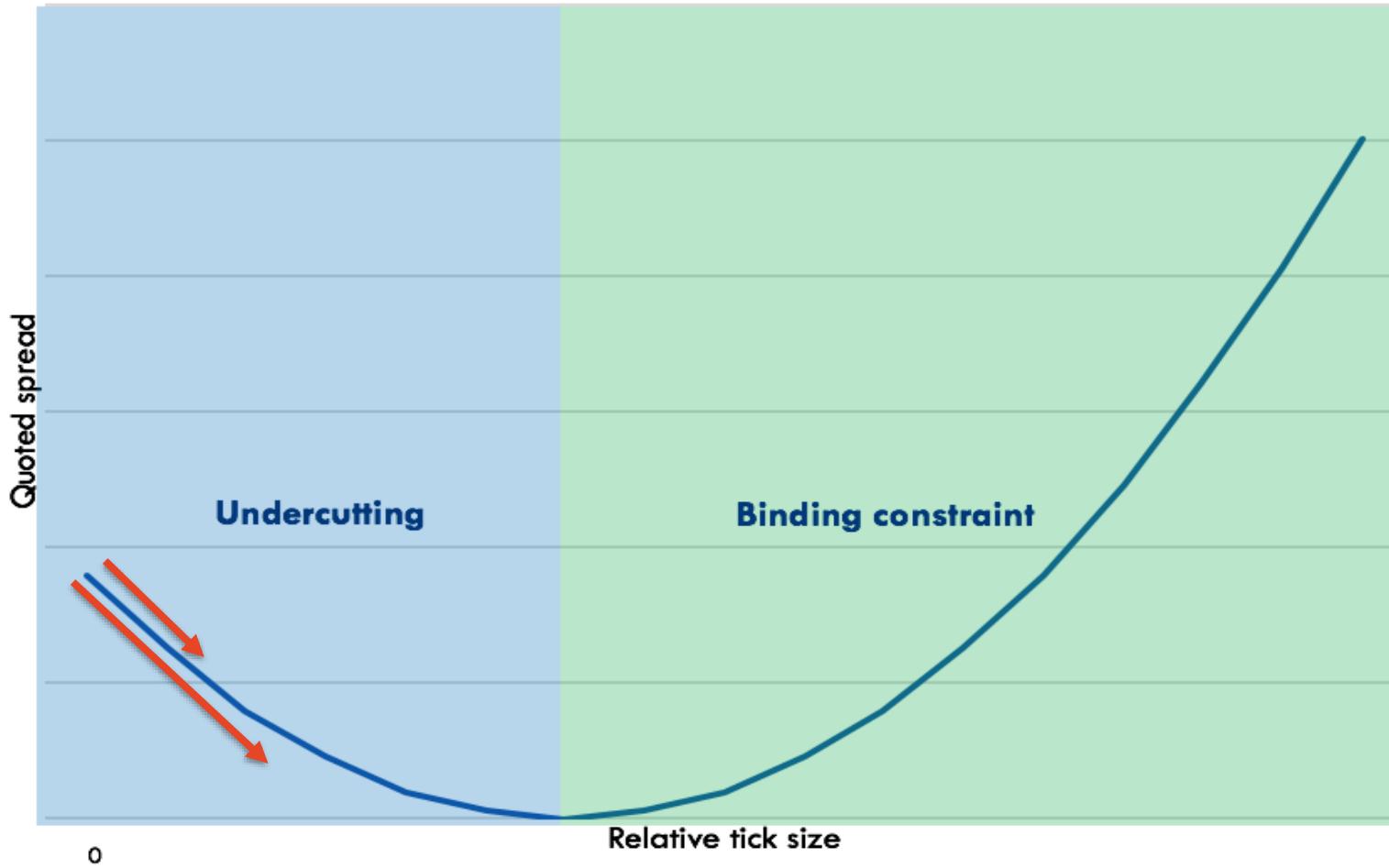
| Variable                         | RelativeTick <sub>it</sub> | Limit order volume <sub>it</sub> | Resting limit orders <sub>it</sub> | Market order volume <sub>it</sub> | Price steps <sub>it</sub> |
|----------------------------------|----------------------------|----------------------------------|------------------------------------|-----------------------------------|---------------------------|
| PercentChange <sub>it</sub>      | 2.14e-05***<br>(2.56e-06)  |                                  |                                    |                                   |                           |
| <i>RelativeTick<sub>it</sub></i> |                            | 1.030***<br>(0.333)              | 0.0428***<br>(0.00481)             | 1.709*<br>(0.889)                 | -0.0163***<br>(0.00459)   |
| \$Volume <sub>it</sub>           | 0.00227<br>(0.00209)       | 0.144<br>(0.126)                 | 0.00243***<br>(0.000744)           | 0.361<br>(0.328)                  | 0.00435***<br>(0.00159)   |
| Trades <sub>it</sub>             | -0.00207<br>(0.00122)      | -0.0324<br>(0.0251)              | 0.000520***<br>(0.000103)          | -0.117<br>(0.0784)                | -0.00237***<br>(0.000791) |
| Volatility <sub>it</sub>         | -0.00106<br>(0.000825)     | 0.0116***<br>(0.00449)           | 0.000130**<br>(6.39e-05)           | 0.0577***<br>(0.0140)             | 0.000755***<br>(6.93e-05) |
| Mean Price <sub>it</sub>         | -0.000108<br>(7.18e-05)    | -0.000602<br>(0.000459)          | 6.44e-05***<br>(6.08e-06)          | -0.00217<br>(0.00150)             | -3.29e-05<br>(2.26e-05)   |
| Observations                     | 30,447                     | 30,447                           | 25,065                             | 30,447                            | 30,447                    |
| Adjusted R <sup>2</sup>          | 0.470                      | 0.004                            | 0.023                              | 0.009                             | 0.044                     |
| Currency pair fixed effects      | Yes                        | Yes                              | Yes                                | Yes                               | Yes                       |
| F-statistic                      | 69.70                      |                                  |                                    |                                   |                           |

# Narrower spreads, more depth, less volatility

| Variable                    | Quoted<br>spread <sub>it</sub> | Effective<br>spread <sub>it</sub> | Realized<br>spread <sub>it</sub> | Effective<br>spread<br>\$500 | Effective<br>spread<br>\$200K | Depth at<br>best <sub>it</sub> | Depth at X<br>bps <sub>it</sub> | Short-term<br>volatility <sub>it</sub> |
|-----------------------------|--------------------------------|-----------------------------------|----------------------------------|------------------------------|-------------------------------|--------------------------------|---------------------------------|--|
| <i>RelativeTickit</i>       | -12.95***<br>(1.268)           | -10.00***<br>(1.743)              | -11.19***<br>(2.385)             | -16.01***<br>(2.900)         | -2,461***<br>(630.7)          | 0.00525<br>(0.356)             | 16.59***<br>(1.231)             | -0.249***<br>(0.0444)                  |
| \$Volume <sub>it</sub>      | 0.134<br>(0.165)               | 0.150<br>(0.187)                  | 0.165<br>(0.200)                 | 0.0550<br>(0.163)            | 24.89<br>(21.60)              | 0.414***<br>(0.0403)           | 1.609***<br>(0.283)             | -0.0241*<br>(0.0144)                   |
| Trades <sub>it</sub>        | -0.262*<br>(0.134)             | -0.302**<br>(0.138)               | -0.322**<br>(0.144)              | -0.295**<br>(0.150)          | -20.15<br>(12.53)             | 0.0353*<br>(0.0211)            | -0.304***<br>(0.105)            | 0.0129*<br>(0.00751)                   |
| Volatility <sub>it</sub>    | 0.209***<br>(0.0348)           | 0.367***<br>(0.0296)              | 0.338***<br>(0.0348)             | 0.274***<br>(0.0453)         | 3.845<br>(6.421)              | -0.0188**<br>(0.00814)         | -0.170***<br>(0.0631)           | 0.0246***<br>(0.000993)                |
| Mean Price <sub>it</sub>    | -0.00576<br>(0.00363)          | -0.00480<br>(0.00348)             | -0.00455<br>(0.00361)            | -0.00635<br>(0.00430)        | -1.653***<br>(0.455)          | 0.00529***<br>(0.000933)       | 0.0212***<br>(0.00282)          | 0.000307<br>(0.000212)                 |
| Observations                | 33,120                         | 30,013                            | 30,013                           | 33,120                       | 33,120                        | 33,120                         | 32,622                          | 33,120                                 |
| Adjusted R <sup>2</sup>     | 0.213                          | 0.332                             | 0.260                            | 0.207                        | 0.005                         | 0.080                          | 0.007                           | 0.481                                  |
| Currency pair fixed effects | Yes                            | Yes                               | Yes                              | Yes                          | Yes                           | Yes                            | Yes                             | Yes                                    |

# Effect depends on size of shock

|                                      | (1)<br>2SLS           | (2)<br>Large relative<br>tick | (3)<br>Small relative<br>tick |
|--------------------------------------|-----------------------|-------------------------------|-------------------------------|
| <i>Quoted spread (bps)</i>           | -12.95***<br>(1.268)  | -12.32***<br>(0.547)          | -4.746***<br>(0.503)          |
| <i>Effective spread (bps)</i>        | -10.00***<br>(1.743)  | -11.58***<br>(0.759)          | -4.351***<br>(1.326)          |
| Realized spread (bps)                | -11.19***<br>(2.385)  | -11.21***<br>(0.808)          | -9.328***<br>(1.612)          |
| <i>Depth at best (1,000 USD)</i>     | 0.00525<br>(0.356)    | -0.300***<br>(0.102)          | 4.965<br>(3.038)              |
| <i>Depth at X bps (1,000 USD)</i>    | 16.59***<br>(1.231)   | 8.711*<br>(5.044)             | 58.37***<br>(20.49)           |
| <i>Short – term volatility</i>       | -0.249***<br>(0.0444) | -0.0714*<br>(0.0382)          | -0.938***<br>(0.120)          |
| <i>Effective spread \$500 (bps)</i>  | -16.01***<br>(2.900)  | -12.84***<br>(0.609)          | -6.412***<br>(0.586)          |
| <i>Effective spread \$200K (bps)</i> | -2,461***<br>(630.7)  | -644.2***<br>(44.08)          | 4,802<br>(4,868)              |



# Thank you!

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