

How Does High-Frequency Trading Affect Low-Frequency Trading?

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High-Frequency Trading

Securities and Exchange Commission (2010)

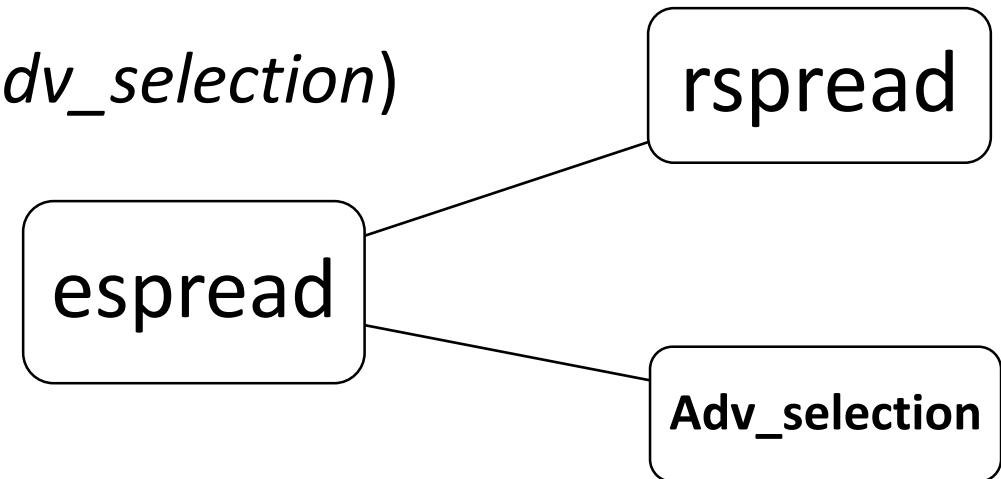
- the use of extraordinarily high-speed and sophisticated computer programs
- very short time-frames for establishing and liquidating positions
- not carrying significant, unhedged positions over-night

Objective

- Examine whether HFT benefits LFT in two dimensions
 - Liquidity
 - Execution Quality
- Examine the HFT's intermediary effect on LFT.

Liquidity Measures

- Trade Frequency per minute (*Freq*)
- Average size (*Avg_qty*)
- Effective Half-Spread (*espread*)
- Realized Half-Spread (*rspread*)
- Price Impact by Adverse Selection (*Adv_selection*)



Execution Quality Measures

- Average Waiting Time (*Time_gap*)
- Frequency Ratio of Execution (*FR*)
- Quantity Ratio of Execution (*QR*)

Data

- Dow Jones Industrial Average 30 stocks, 134 trading days during Nov. 2010 – May 2011
- Micro-second time stamped
- 3 types of orders:
 - 440 million HFT limit orders (*HFT*) ,
 - 107 million LFT limit orders (*LO*)
 - 54 million LFT market orders (*MO*).
- Group order messages by minute.

Explore the impact of HFT on LFT

Independent Variables

- HFT-Related
 - $Freq_{HFT}$
 - Avg_qty_{HFT}
 - $rspread_{HFT}$
 - $Adv_selection_{HFT}$
- LFT-Related
 - $espread_{MO}$
 - $rspread_{LO}$
 - $Adv_selection_{LO}$

Dependent Variables

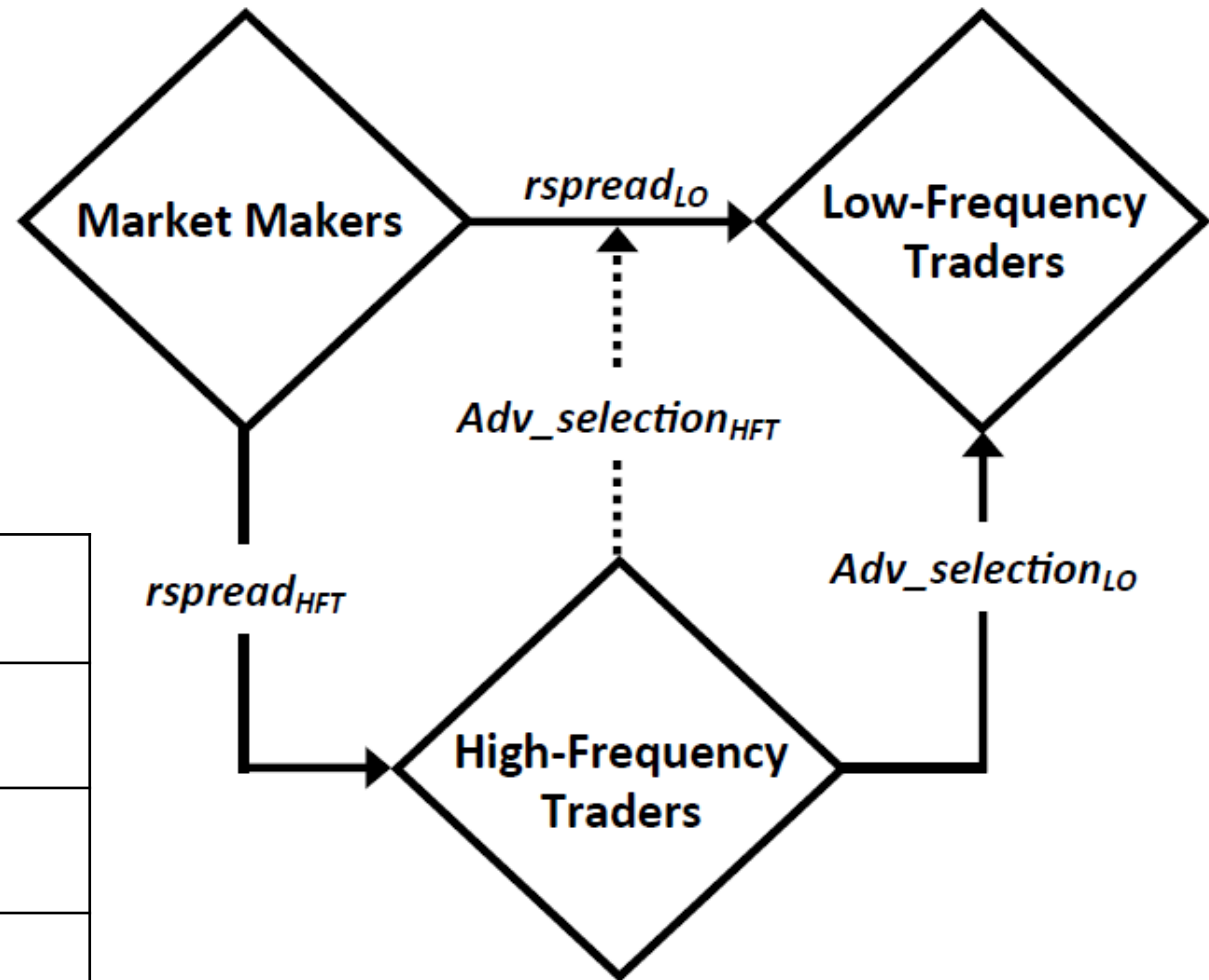
- LFT Limit Orders
 - $Freq_{LO}$
 - Avg_qty_{LO}
 - $Time_gap$
 - FR
 - QR
- LFT Market Orders
 - $Freq_{MO}$
 - Avg_qty_{MO}

We find that HFT activity:

- Increases the trade frequency of LFT orders.
- Increases the size of LFT orders.
- Reduces the waiting time of LFT limit orders.
- Improves the execution of LFT limit orders.

| Dependent Variables | | Independent Variables |
|---------------------|-------------------|-----------------------|
| | | <i>Freq_HFT</i> |
| LFT Limit | <i>Freq_LO</i> | 0.2402 |
| | <i>Avg_qty_LO</i> | 0.0317 |
| | <i>Time_gap</i> | -0.0651 |
| | <i>FR</i> | 0.0495 |
| | <i>QR</i> | 0.0055 |
| LFT Market | <i>Freq_MO</i> | 0.5878 |
| | <i>Avg_qty_MO</i> | 0.0807 |

Intermediary Effect of HFT on LFT Limit Orders



| | |
|------------------------|---|
| $rspread_{HFT}$ | Direct Cost to HFT due to Market Makers |
| $Adv_selection_{HFT}$ | Direct Cost to HFT due to competition |
| $rspread_{LO}$ | Direct Cost to LFT due to Market Makers |
| $Adv_selection_{LO}$ | Direct Cost to LFT due to HFT |

Intermediary Effect of HFT on LFT Limit Orders

- To LFT, the cost due to HFT ($Adv_selection_{LO}$) has larger impact than the cost due to market makers ($rspread_{LO}$).
- To HFT, both cost components increase the trade frequency and likelihoods of execution, and reduce the waiting time.
- The cost to HFT due to competition ($Adv_selection_{HFT}$) has larger impact than the cost due to market makers ($rspread_{HFT}$).

| LFT Limit Orders | Dependent Variables | | | | |
|--------------------------|---------------------|-------------------|-------------------|-----------|-----------|
| Independent Variables | Liquidity | | Execution Quality | | |
| | <i>Freq_LO</i> | <i>Avg_qty_LO</i> | <i>Time_gap</i> | <i>FR</i> | <i>QR</i> |
| <i>rspread_HFT</i> | 0.326 | -0.0273 | -0.4056 | 0.2324 | 0.2476 |
| <i>Adv_selection_HFT</i> | 0.6752 | -0.0758 | -0.6603 | 0.3267 | 0.3556 |
| <i>rspread_LO</i> | 1.9913 | -0.2206 | -0.3175 | 1.1931 | 0.7622 |
| <i>Adv_selection_LO</i> | 2.1877 | -0.2224 | -0.0842 | 1.4393 | 0.9182 |

Conclusion

- More HFT activity benefits LFT with
 - More frequency and larger size of orders
 - Higher likelihood to execution and shorter waiting time
- HFT plays as an intermediary on liquidity transportation to LFT.
 - HFT improves the liquidity and execution quality of LFT.
 - HFT's intermediary effect becomes dominant by comparison with the traditional market makers.