Latency Arbitrage, Market Fragmentation, and Efficiency: A Two-Market Model

Background Presentation
Kingston Pung
▪ Propose a model to capture the effects of latency across 2 markets for a single security
  ▪ Capture interplay of latency and fragmentation
  ▪ One proposed regulatory environment (Switching from call to continuous market)

Goals of this paper
Securities: A security is a tradable financial asset
- Debt Securities: Banknotes, bonds etc.
- Equity Securities: Common Stock
- Derivatives: Futures, Options, etc.

Markets
- Call Market
- Continuous Market
Market Fragmentation

- Where a single security can be traded on multiple exchanges
  - HP, Walgreens

- Increases stock’s liquidity
- Bid-ask spread tends to decrease
- Increases opportunities for arbitrage
- Taking advantage of misinformation across fragmented markets to make a profit
- Misinformation arises due to latency between cross-market communication

Arbitrage
• Regulation NMS
  • Mandates cross-market communication
  • Opportunity for arbitrage

Current Failsafe against fragmentation
“Characterized by large numbers of small orders in compressed periods, with positions held for extremely short durations”

- Accounted for 78% of total trading volume in 2009
- Cause of multiple incidences of major market turbulence
- Latency Arbitrage
  - “The Slow Market Arbitrage”
The Two Market Model
- Mechanism for matching buyers and sellers
- Bid orders (Buy)
- Ask orders (Sell)
- Outstanding orders kept on order book

<table>
<thead>
<tr>
<th>Bid</th>
<th>Ask</th>
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<tbody>
<tr>
<td>Qty.</td>
<td>Price</td>
</tr>
<tr>
<td>25</td>
<td>33.5</td>
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<tr>
<td>50</td>
<td>33.4</td>
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<tr>
<td>275</td>
<td>33.0</td>
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<tr>
<td>27</td>
<td>32.7</td>
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<tr>
<td>28</td>
<td>32.4</td>
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Latency Arbitrageur:
- First obtains current price quotes in both markets
- Checks whether an arbitrage situation exists
- Submits order exploiting price differential to the two markets simultaneously

Background Traders
- Activity drives prices in model
- Private valuation
  - Reflects individual difference in marginal value
- Zero intelligence strategy
Time $t$

- Background trader $i$ primary market: 1
  - Sell @ 105
  - NBBO (104, 110)
  - Market 1
    - ASK: 111
    - BID: 102
  - Market 2
    - ASK: 110
    - BID: 104
  - SIP
  - Latency arbitrageur (LA)

Time $t + 1$

- Background trader $i+1$ primary market: 2
  - Buy @ 109
  - NBBO (104, 110)
  - Market 1
    - ASK: 105
    - BID: 102
  - Market 2
    - ASK: 110
    - BID: 104
  - SIP
  - LA

- NBBO (104, 110)
  - Market 1
    - ASK: 105
    - BID: 102
  - Market 2
    - ASK: 110
    - BID: 109
  - SIP
  - LA: arbitrage opportunity found!
Propose a model to capture the effects of latency across 2 markets for a single security

- How much better or worse do the background traders perform in
  - Fragmented vs Non-fragmented markets
  - Call Vs Continuous
  - Presence of Arbitrageur

Goals of this paper