Maker-Taker Fees and Informed Trading in a Low-Latency Limit Order Market

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Background

- Equity trading worldwide relies on voluntary liquidity provision in limit order books.
- How do you get people to supply liquidity?
- Trading venues’ answer: maker-taker trading fees.
  - subsidize producers, or makers, of liquidity (limit orders)
  - charge consumers, or takers, of liquidity (marketable orders)
- SEC (2010): “Highly automated exchange systems and liquidity rebates have helped establish a business model for a new type of professional liquidity provider [...] [who] take[s] advantage of low-latency systems.”
- To compete with HFTs, need to have better information.
**Background**

**Specialist/Market Maker Markets**
- Uninformed, competitive liquidity supply

**Limit Order Markets**
- Strategic liquidity supply
- Uninformed liquidity supply: e.g., Parlour (1998), Foucault (1999), Foucault, Kadan, and Kandel (2005), Goettler, Parlour, and Rajan (2005), and Rosu (2009)
- Informed liquidity supply: e.g., Kaniel and Liu (2006), Goettler, Parlour, and Rajan (2009), and Rosu (2011)

**Limit Order Markets with Professional Liquidity Providers**
- Informed and competitive liquidity supply: this paper
Introduction
The Model
Equilibrium
Application: Maker-Taker Fees
Summary

Background

Limit Order Books: Modelling Challenges

- Informed trading + limit vs. market order choice:
  - optimal order type + strategic limit order price choice
  - limit order price = signal about (private) information
- ⇒ a difficult dynamic problem
- Objective: build a simple model
  - to capture trade-off between market and limit orders
  - to allow informative limit and market orders
- Competitive pricing reduces complexity by removing the price choice.
What Do We Add?

1. A model of a limit order book, with informed, competitive liquidity provision:
   - Choice: a market order, a limit order, or no order
   - Private values + fundamental information
   - ⇒ we can analyze
     - liquidity
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2. ⇒ Apply to analyze the impact of maker-taker fees
The Model Ingredients

• Fundamental = sum of i.i.d. innovations:
  • one innovation per period
  • symmetric on [-1,1]
  • extreme values are less likely than moderate ones
The Model Ingredients

- Fundamental = sum of i.i.d. innovations
- Traders:
  - Investors:
    - one per period
    - knows the innovation to the fundamental
    - private value: uniform on [-1,1]
    - order choice: market, limit, no trade
The Model Ingredients

- **Fundamental** = sum of i.i.d. innovations
- **Traders:**
  - Investors
  - **Low-latency liquidity providers:**
    - permanently monitor prices and quotes
    - competitive (zero-expected profit)
    - only limit orders
    - no private value, no fundamental info advantage
    - speed advantage in reacting to new trades and quotes
Period $t$ investor enters market
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Period $t$ investor submits order (if any)
Timeline

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Period $t - 1$ limit orders either trade against the period $t$ market order or get cancelled
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Low-latency liquidity providers post limit orders to empty side(s) of the book.

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Period $t - 1$ investor leaves market

Period $t + 1$ investor enters market
Equilibrium: Competitive Prices

- **Market** orders at $t$ execute at:

  \[
  \text{ask}_t = \mathbb{E}[\text{fundamental}_t | \text{market buy}_t, \text{history}_t] \\
  \text{bid}_t = \mathbb{E}[\text{fundamental}_t | \text{market sell}_t, \text{history}_t]
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- Limit orders (by investors) at $t$ are posted at:

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- What if a limit order is posted at the “wrong” price?
  - $\Rightarrow$ gets undercut by a low-latency liquidity provider!
  - $\Rightarrow$ zero probability of execution

(Appendix: out-of-equilibrium beliefs)
Equilibrium: Decisions

- Observing independent innovations:
  - $\Rightarrow$ all agree on history interpretation
  - $\Rightarrow$ all agree on probabilities of future order submissions
- $\Rightarrow$ Investors trade on their informational advantage, over the information revealed by their own actions
- Order choice based on the aggregate valuation $z_t$:
  $z_t := \text{private value}_t + \text{innovation}_t$
- Look for a stationary, symmetric equilibrium
Equilibrium: A Threshold Strategy

- \( z^M \)
- \( z^L \)
- \( z_t \)
- \( z^M \)
- \( z^L \)
- Market Buy
- Limit Buy
- Limit Sell
- Market Sell
- No Order

2 aggregate valuation \( z_t \)
Equilibrium: A Threshold Strategy

Existence Theorem: There exist thresholds $z^M$ and $z^L$ and out-of-equilibrium beliefs that constitute an equilibrium.
Application: Maker-Taker Pricing

Benchmark: all traders pay maker-taker fees.

- **All** pay taker fees and receive maker rebates
- Competitive pricing ⇒

\[
\text{ask}_t = \mathbb{E}[\text{fundamental}_t \mid \text{market buy}_t, \text{history}_t] - \text{maker rebate}
\]
\[
\text{bid}_t = \mathbb{E}[\text{fundamental}_t \mid \text{market sell}_t, \text{history}_t] + \text{maker rebate}
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- **All** pay **taker fees** and receive **maker rebates**
- Competitive pricing \( \Rightarrow \)

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\]

- A market (buy) order submitter pays

\[
\begin{align*}
\text{ask}_t + \text{taker fee} &= E[\text{fundamental}_t \mid \text{market buy}_t, \text{history}_t] \\
&+ \text{taker fee} - \text{maker rebate} \tag{total fee}
\end{align*}
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- ⇒ prices adjust and only the total fee matters. (As in Angel, Harris, and Spatt (2011), Colliard and Foucault (2012))
### Introduction

The Model

Equilibrium

Application: Maker-Taker Fees

Summary

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### Evidence: Not Everybody Receives Rebates

Interactive Brokers’ Webpage

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**Stocks, ETFs and Warrants / Overview**

IB offers two pricing structures, Flat Rate and Cost Plus, to calculate commissions for stocks and ETFs in the US, Canada, Europe and Hong Kong. Portfolio Margin customers can pre-borrow US stocks for shorting when they join the IB Pre-Borrow program, and can borrow and lend stocks on AQS. Click the Borrow/Lend link above for fee details.

<table>
<thead>
<tr>
<th>Flat RATE</th>
<th>Cost PLUS</th>
</tr>
</thead>
</table>

- **Flat Rate**: In the Flat Rate pricing structure, you will be charged either a fixed amount per share or a set percent of trade value, which includes commissions and all exchange and regulatory fees.

- **Cost Plus**: In the Cost Plus pricing structure, you will be charged a fixed IB fee, based on volume, that does not include exchange, regulatory or other third-party fees. You will be charged separate fees that are intended to approximate the costs incurred by IB from exchanges, regulators or other third parties to execute your order.
Application: Maker-Taker Pricing

Flat Fee Model

- Investors pay a flat fee per trade (brokers break even, on average):
  \[
  \text{flat fee} = E[\text{average exchange fee on investor trades}]
  \]

- Low-latency liquidity providers receive maker rebates
Application: Maker-Taker Pricing

- Colliard and Foucault (2012) cover the impact of the total fee
- From now on:
  - set: total fee = 0 ⇒ taker fee = maker rebate
  - focus on the impact of the maker-taker split
  - comparative statics w.r.t. the taker fee
Application: Maker-Taker Pricing

Flat Fee Model

- Flat fee = weighted average (taker fee, maker fee)
- When maker fee < 0 (i.e., maker rebate): flat fee < taker fee
Application: Maker-Taker Pricing

Flat Fee Model

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- When maker fee < 0 (i.e., maker rebate): flat fee < taker fee
- A market (buy) order submitter pays:

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\text{ask}_t + \text{flat fee} = \mathbb{E}[\text{fundamental}_t | \text{market buy}_t, \text{history}_t] \\
+ \underbrace{\text{flat fee} - \text{maker rebate}}_{<0}
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- \Rightarrow Incentive to submit market orders
Application: Maker-Taker Pricing

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  \]

- ⇒ Incentive to submit market orders
- ⇒ Similarly: disincentive to submit limit orders (less obvious)
Thresholds

- Market Order
- Limit Order
- No Order

\( z^M \)

\( z^L \)

Taker fee
Quoted vs. Cum-Fee Spreads

Cum-fee half-spread = half-spread + flat fee

[Graph showing the relationship between cumulative and quoted fees]
Price Impact

Price Impact (of a buy) = \text{ask} - \mathbb{E}[\text{fundamental} \mid \text{market buy}]

Shameless self-promotion: 
price impact is consistent with Malinova and Park (2011)
Welfare

Expected gains from trade, based on private values
Summary

- A simple model of a limit order book with
  - informed limit orders
  - competitive liquidity provision
- Apply the model to study maker-taker fees
- When all pay maker-taker fees, only the total exchange fee matters (consistent with the literature)
- When investors pay only the average exchange fee (aka a flat fee, paid to their broker), a higher maker rebate leads to
  - more market orders, fewer limit orders
  - lower (cum-fee) costs of market orders, lower price impact
  - higher volume, lower participation of investors
    → higher participation of low-latency liquidity providers
  - higher welfare