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
- E.g., Glosten and Milgrom (1985), Kyle (1985), Easley and O'Hara (1987), Glosten (1994)

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

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
- $\Rightarrow$ 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
   - $\Rightarrow$ we can analyze
     - liquidity

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2. $\Rightarrow$ 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

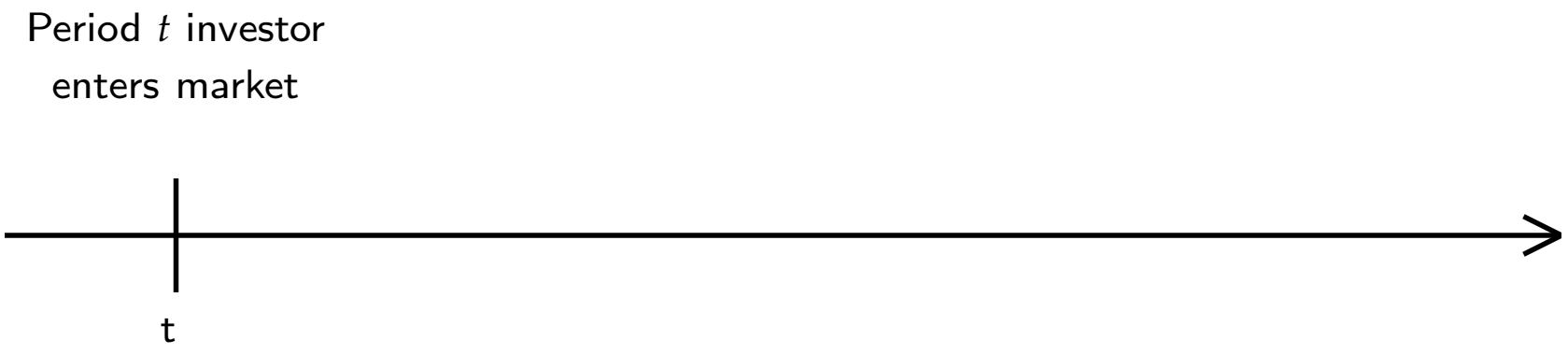
The Model Ingredients

- 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

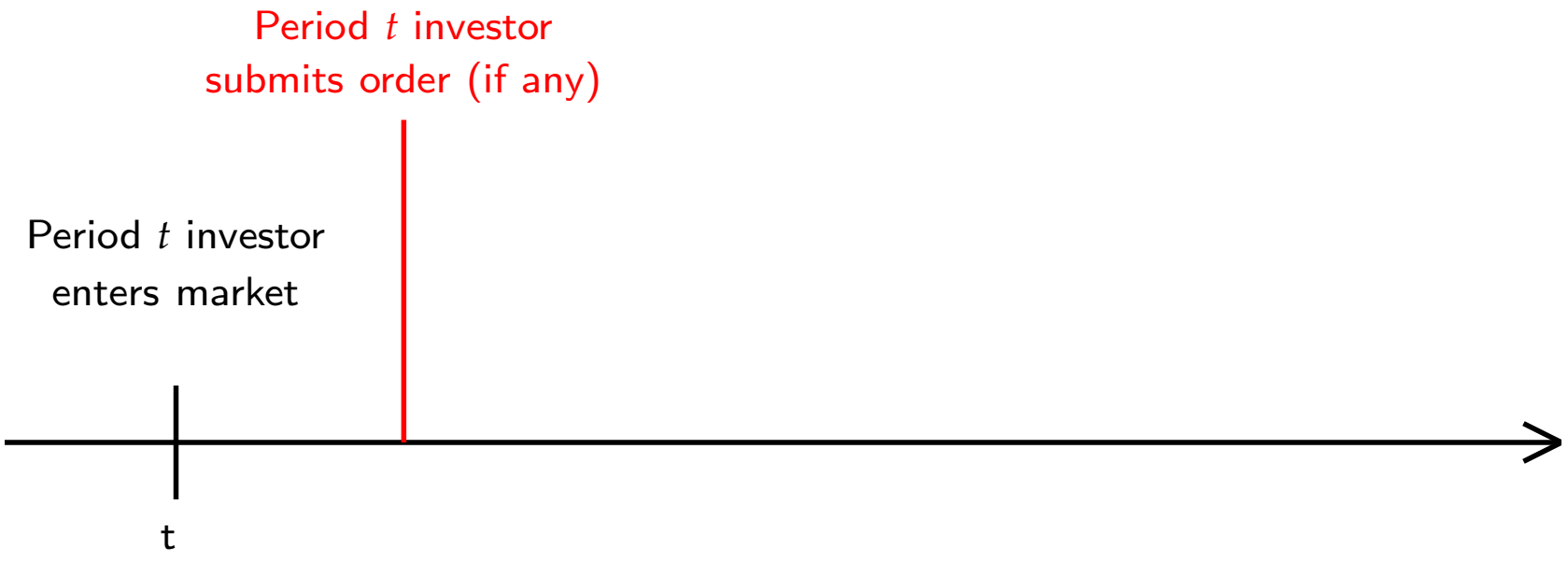
The Model Ingredients

- 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

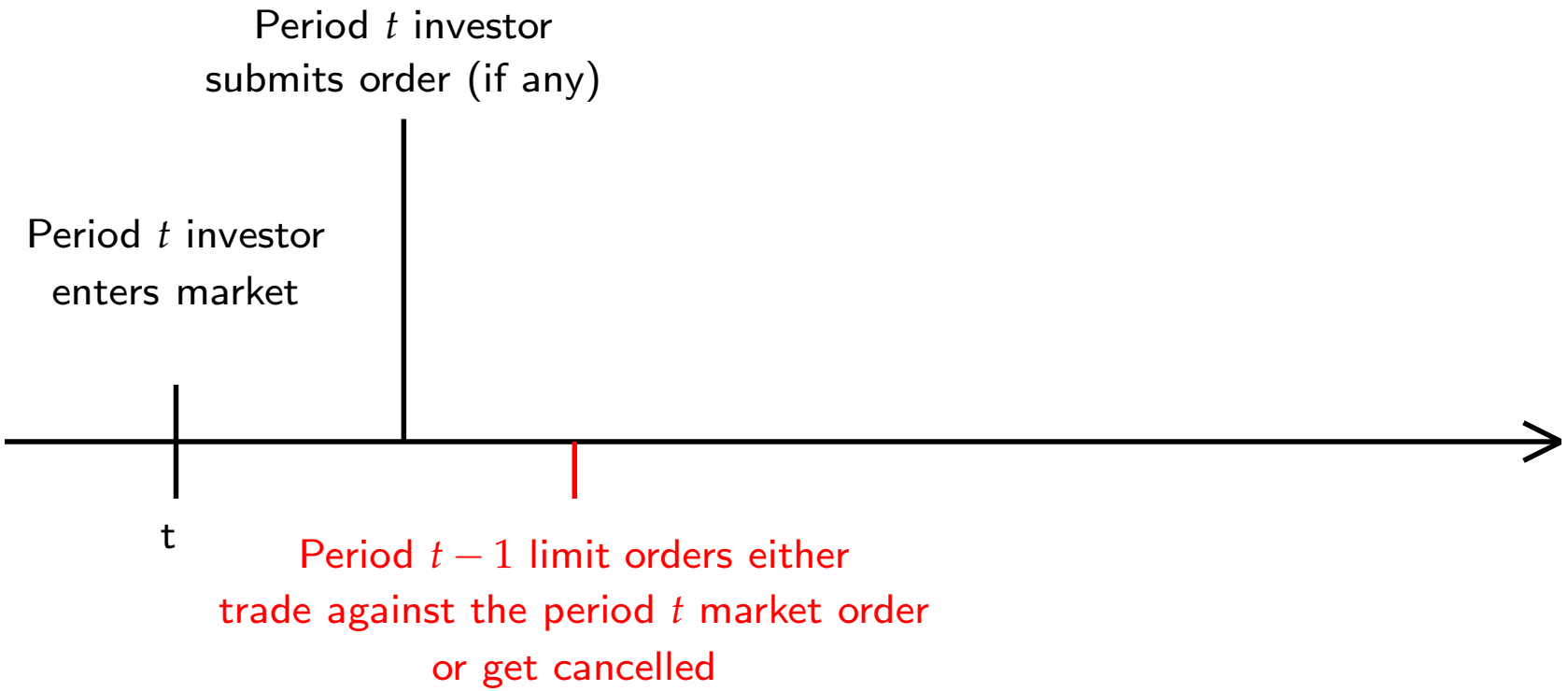
Timeline



Timeline


Period t investor
submits order (if any)
Period t investor
enters market
t

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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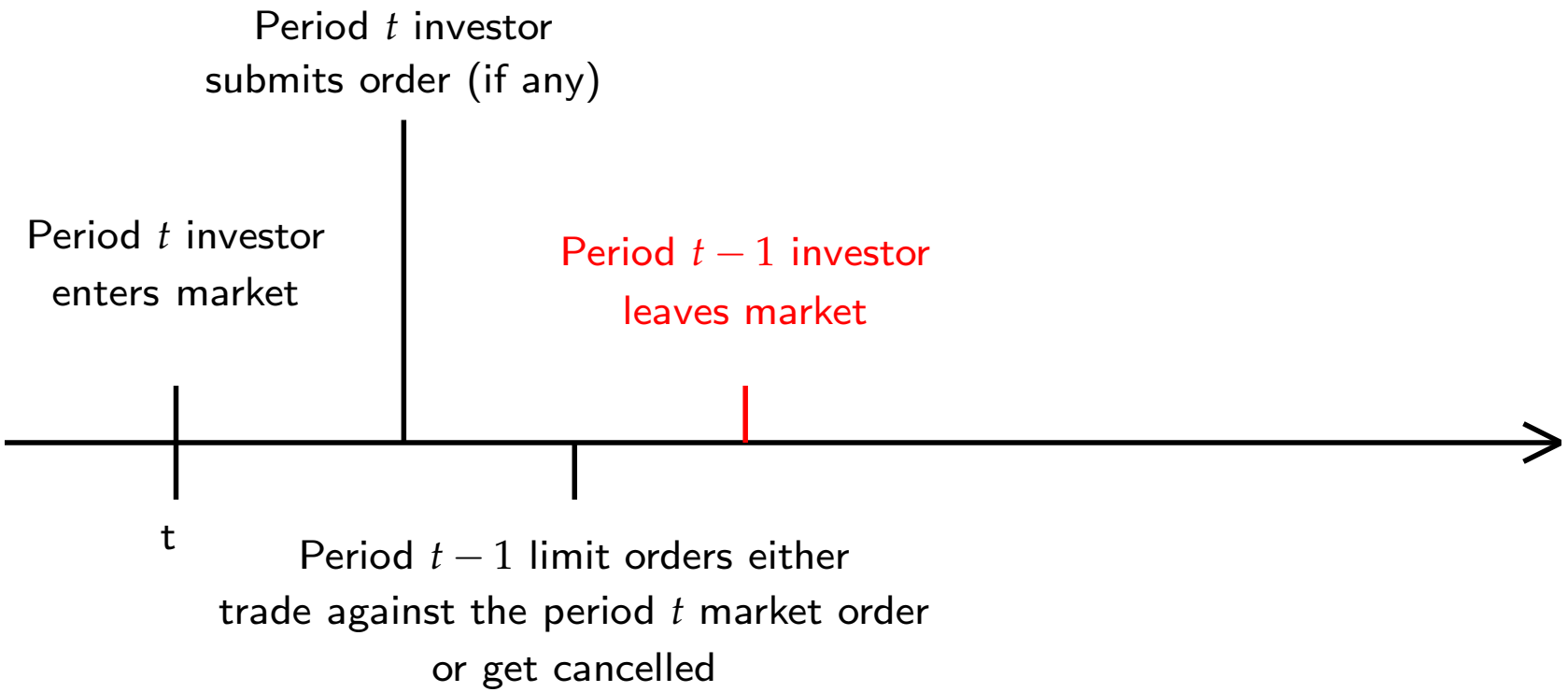
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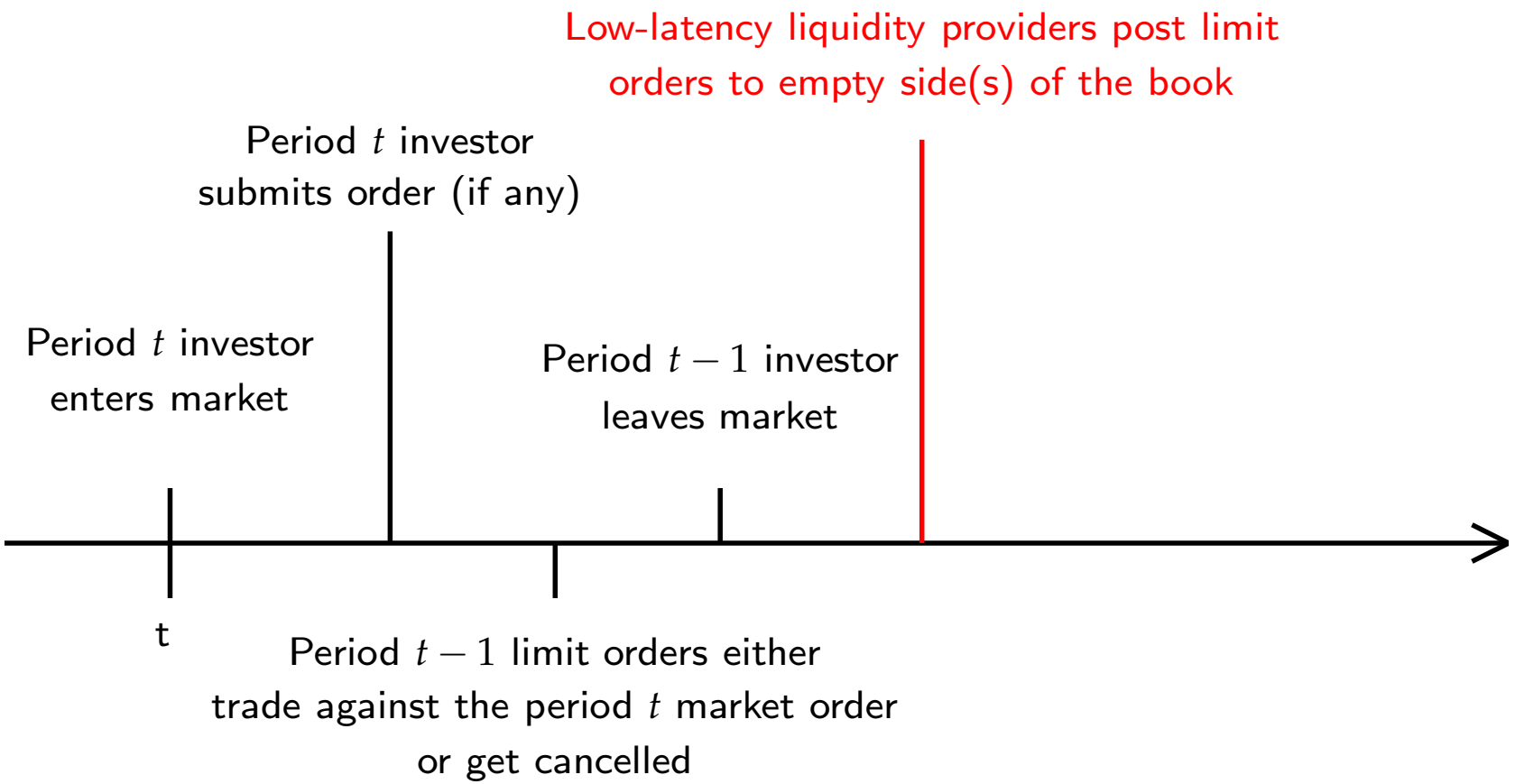
Low-latency liquidity providers post limit orders to empty side(s) of the book
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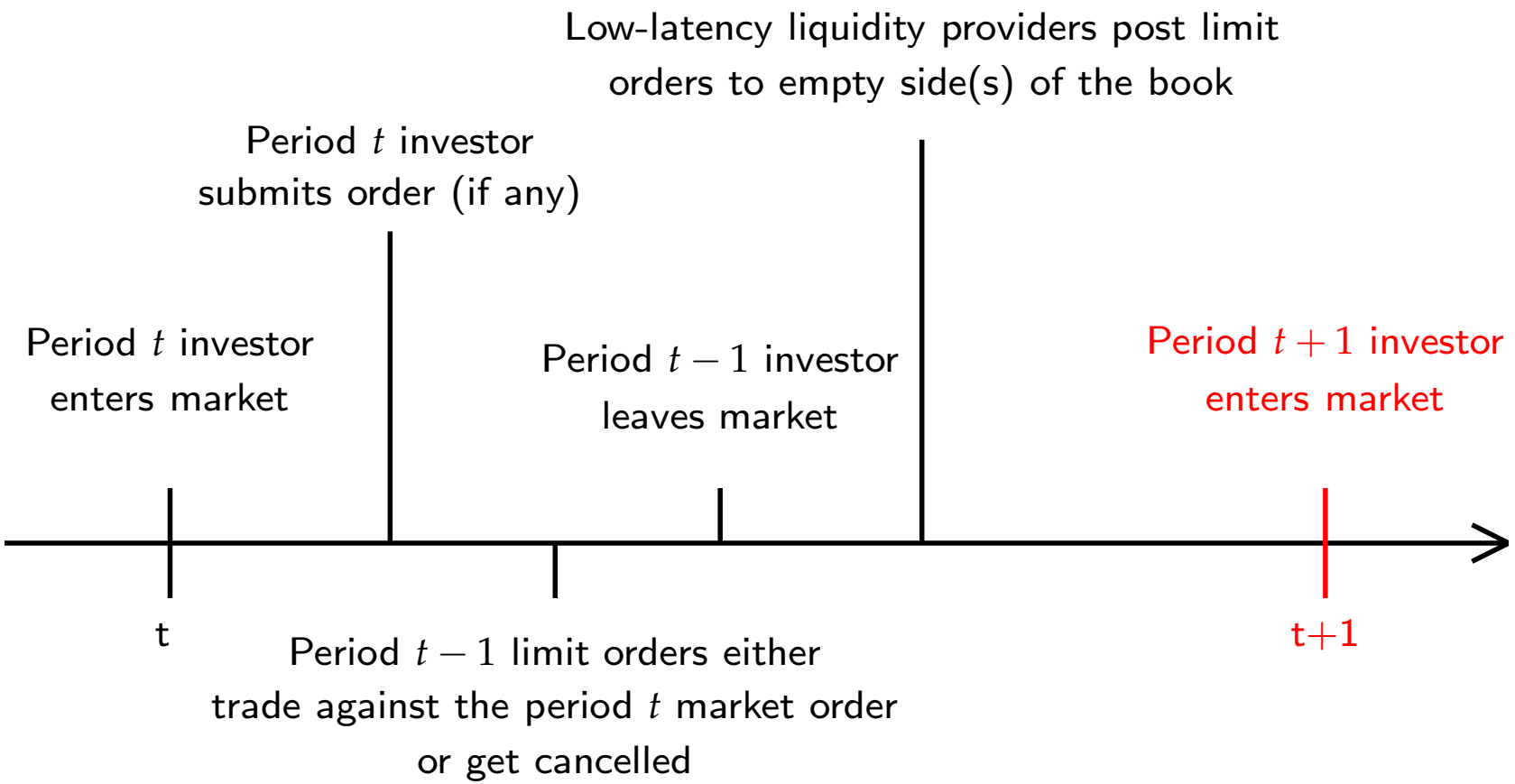
Low-latency liquidity providers post limit orders to empty side(s) of the book
Period t investor submits order (if any)
Period t investor enters market
Period $t-1$ investor leaves market
Period $t+1$ investor enters market
t
Period $t-1$ limit orders either trade against the period t market order or get cancelled
t+1

Equilibrium: Competitive Prices

- Market orders at t execute at:

$$\begin{aligned} \text{ask}_t &= \mathrm{E}[\text{fundamental}_t \mid \text{market buy}_t, \text{history}_t] \\ \text{bid}_t &= \mathrm{E}[\text{fundamental}_t \mid \text{market sell}_t, \text{history}_t] \end{aligned}$$

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- Limit orders (by investors) at t are posted at:

$$\begin{aligned} \text{ask}_{t+1} &= \mathsf{E}[\text{fundamental}_t \mid \text{market buy}_{t+1}, \text{limit sell}_t, \text{history}_t] \\ \text{bid}_{t+1} &= \mathsf{E}[\text{fundamental}_t \mid \text{market sell}_{t+1}, \text{limit buy}_t, \text{history}_t] \end{aligned}$$

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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)

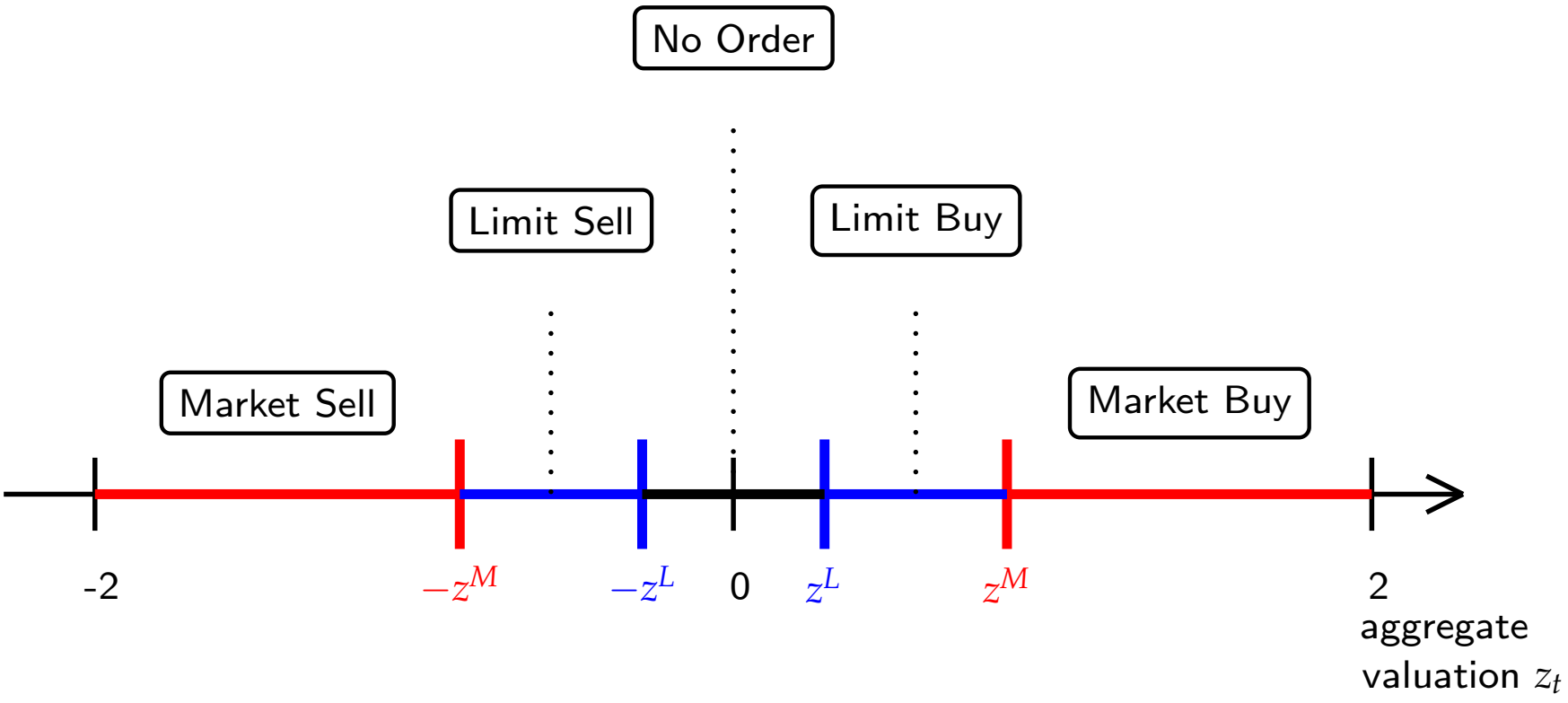
Equilibrium: Decisions

- 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



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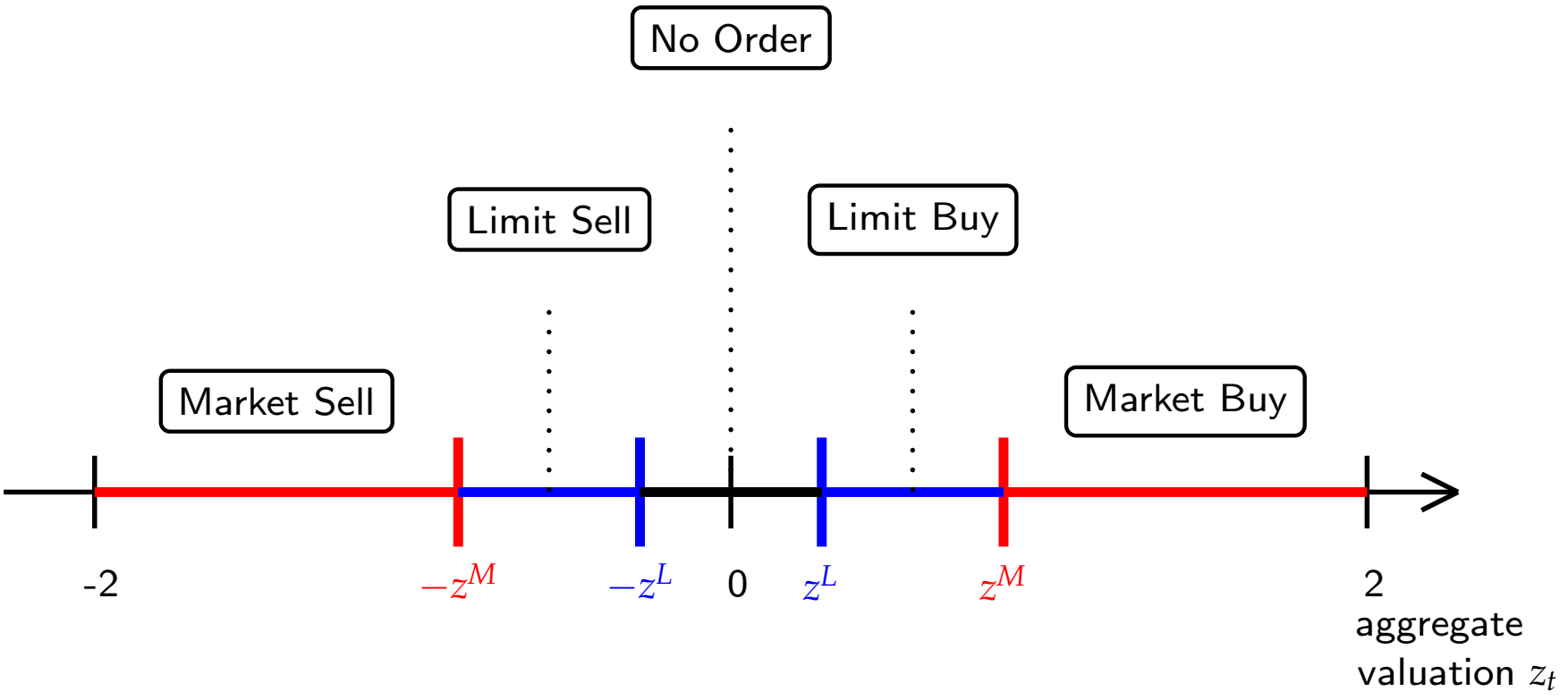

Existence Theorem: There exist thresholds z^M and z^L and out-of-equilibrium beliefs that constitute an equilibrium

Application: Maker-Taker Pricing

Benchmark: all traders pay maker-taker fees.

- All pay taker fees and receive maker rebates
- Competitive pricing $\Rightarrow$

$$\begin{aligned} \text{ask}_t &= \mathrm{E}\left[\text{fundamental}_t \mid \text{market buy}_t, \text{history}_t\right] - \text{maker rebate} \\ \text{bid}_t &= \mathrm{E}\left[\text{fundamental}_t \mid \text{market sell}_t, \text{history}_t\right] + \text{maker rebate} \end{aligned}$$

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- A market (buy) order submitter pays

$$\begin{aligned} \text{ask}_t + \text{taker fee} &= \mathrm{E}[\text{fundamental}_t \mid \text{market buy}_t, \text{history}_t] \\ &\quad + \underbrace{\text{taker fee} - \text{maker rebate}}_{\text{total fee}} \end{aligned}$$

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- $\Rightarrow$ prices adjust and only the total fee matters. (As in Angel, Harris, and Spatt (2011), Colliard and Foucault (2012))

Evidence: Not Everybody Receives Rebates

Interactive Brokers' Webpage

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.

Flat RATE	Cost PLUS
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.	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):

$$\text{flat fee} = \mathrm{E}[\text{average exchange fee on investor trades}]$$

- 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 $= 0 \Rightarrow$ 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

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- When maker fee < 0 (i.e., maker rebate): flat fee $<$ taker fee

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- $\Rightarrow$ Incentive to submit market orders

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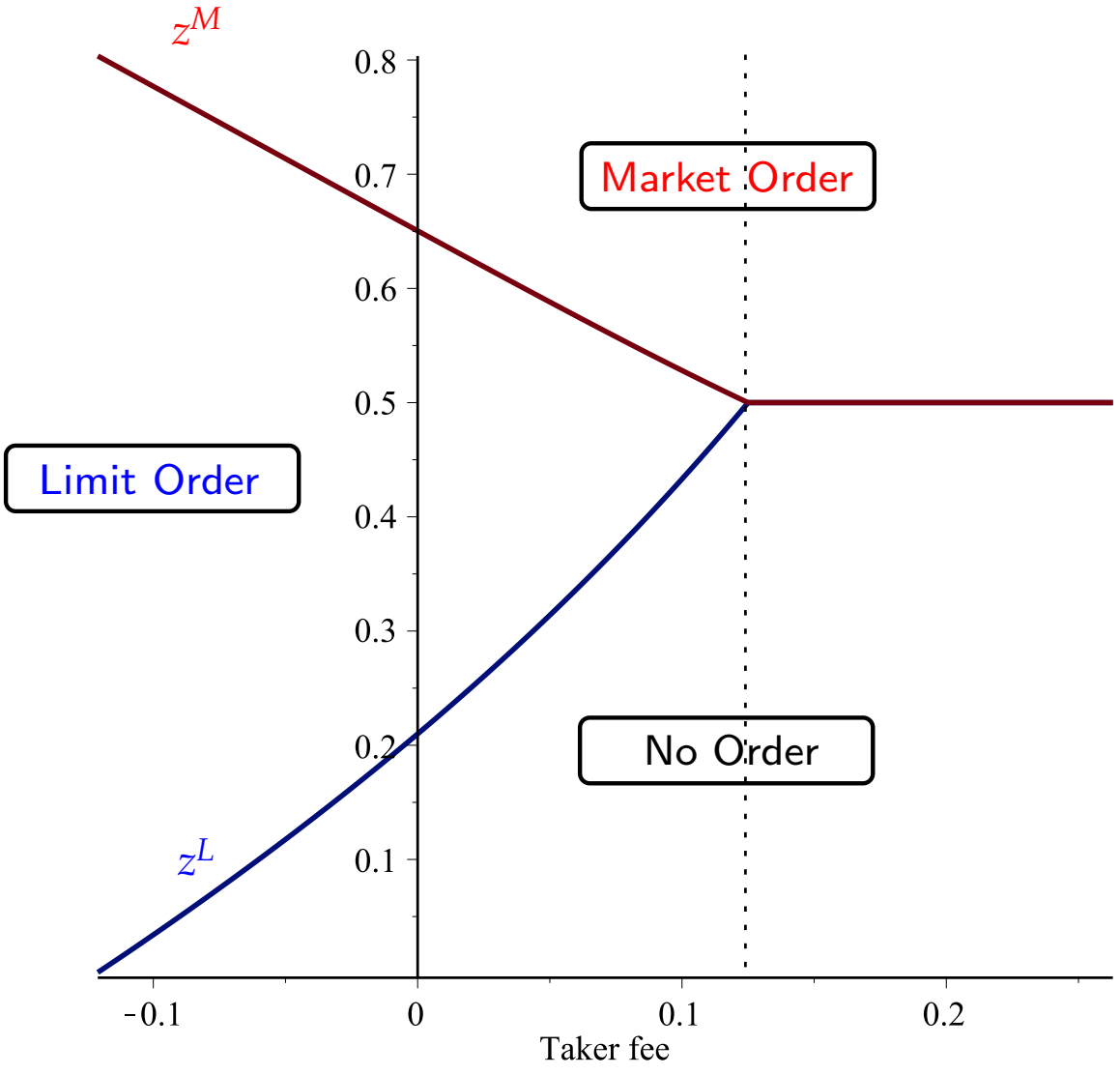
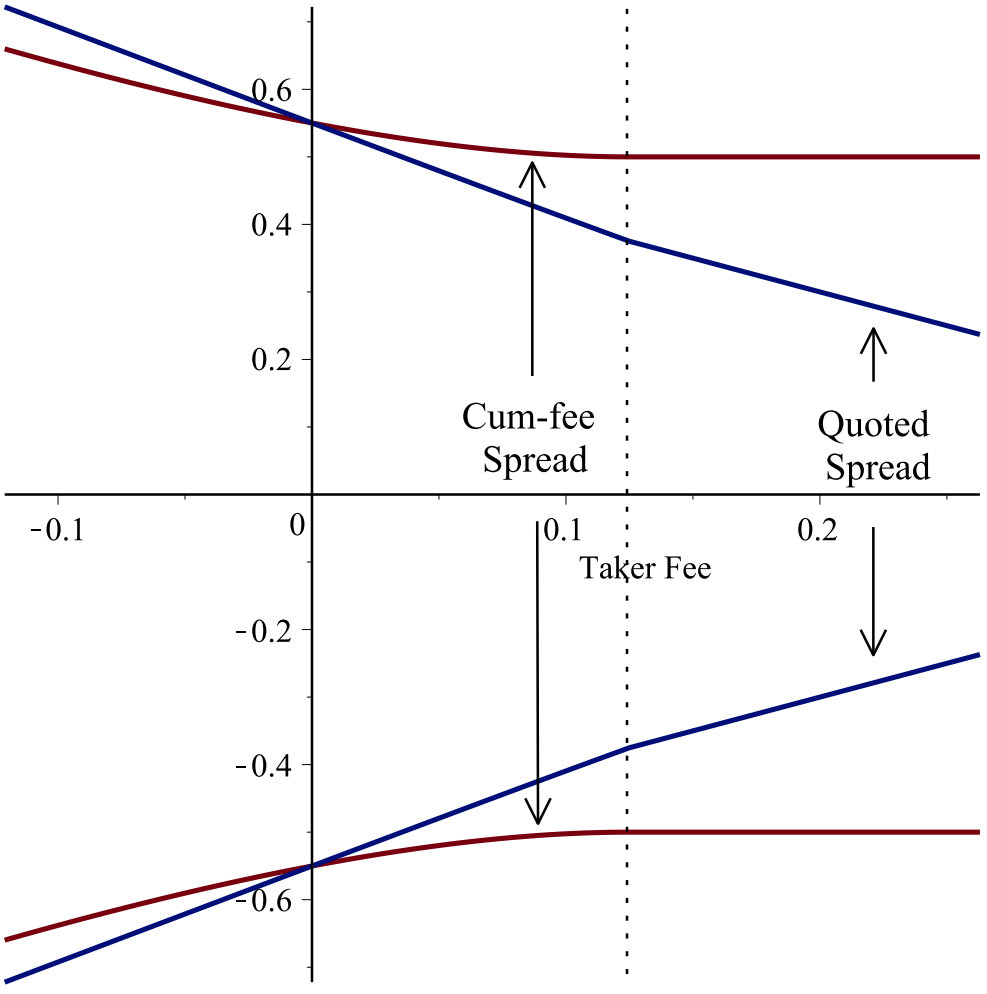
- $\Rightarrow$ Incentive to submit market orders
- $\Rightarrow$ Similarly: disincentive to submit limit orders (less obvious)

Thresholds


z^M
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Market Order
Limit Order
No Order
z^L
-0.1
0
0.1
0.2
Taker fee

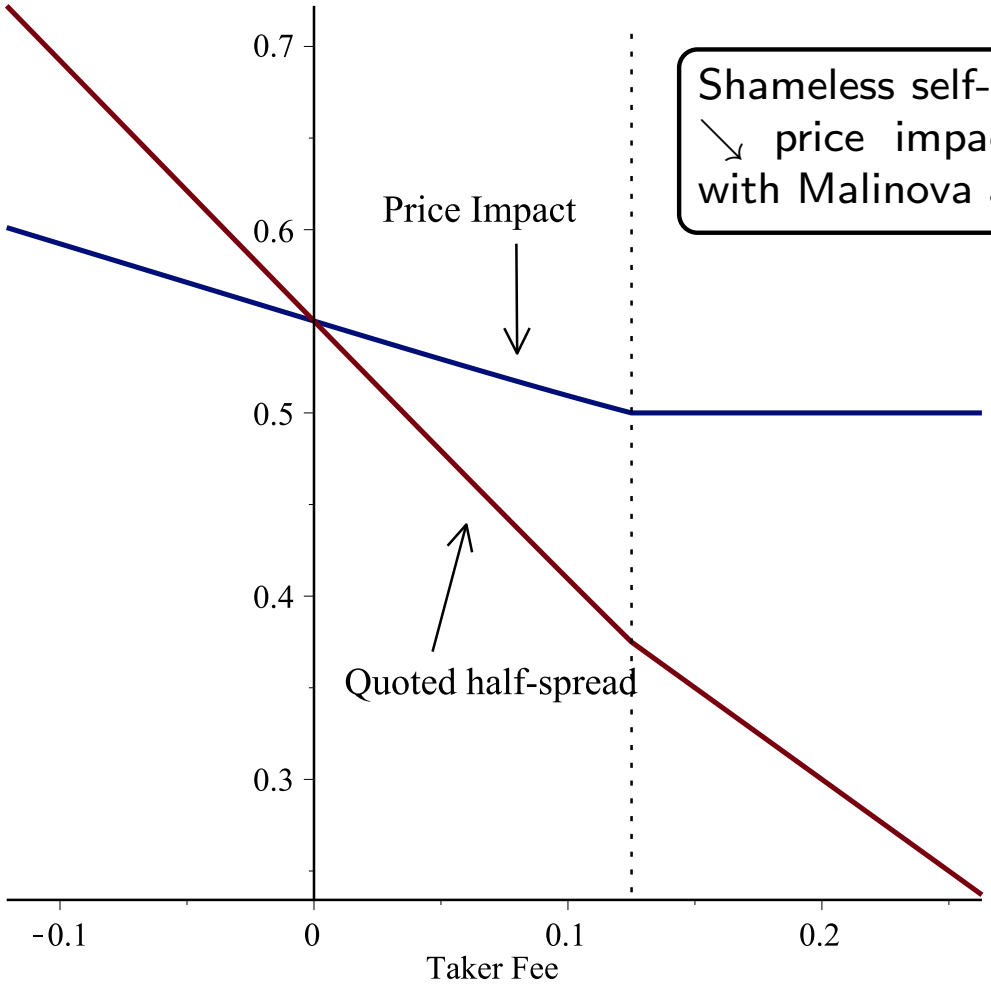
Quoted vs. Cum-Fee Spreads

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



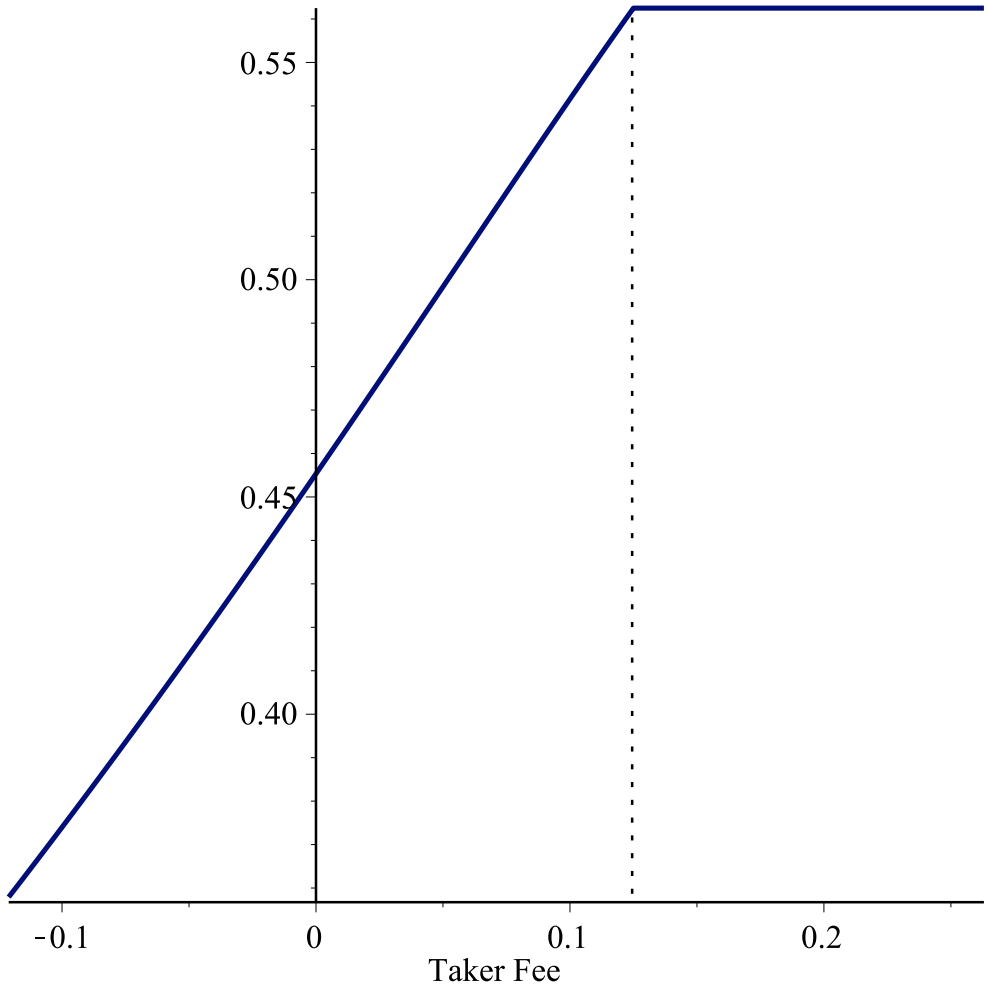
Price Impact

Price Impact (of a buy) = ask − E[fundamental | market buy]



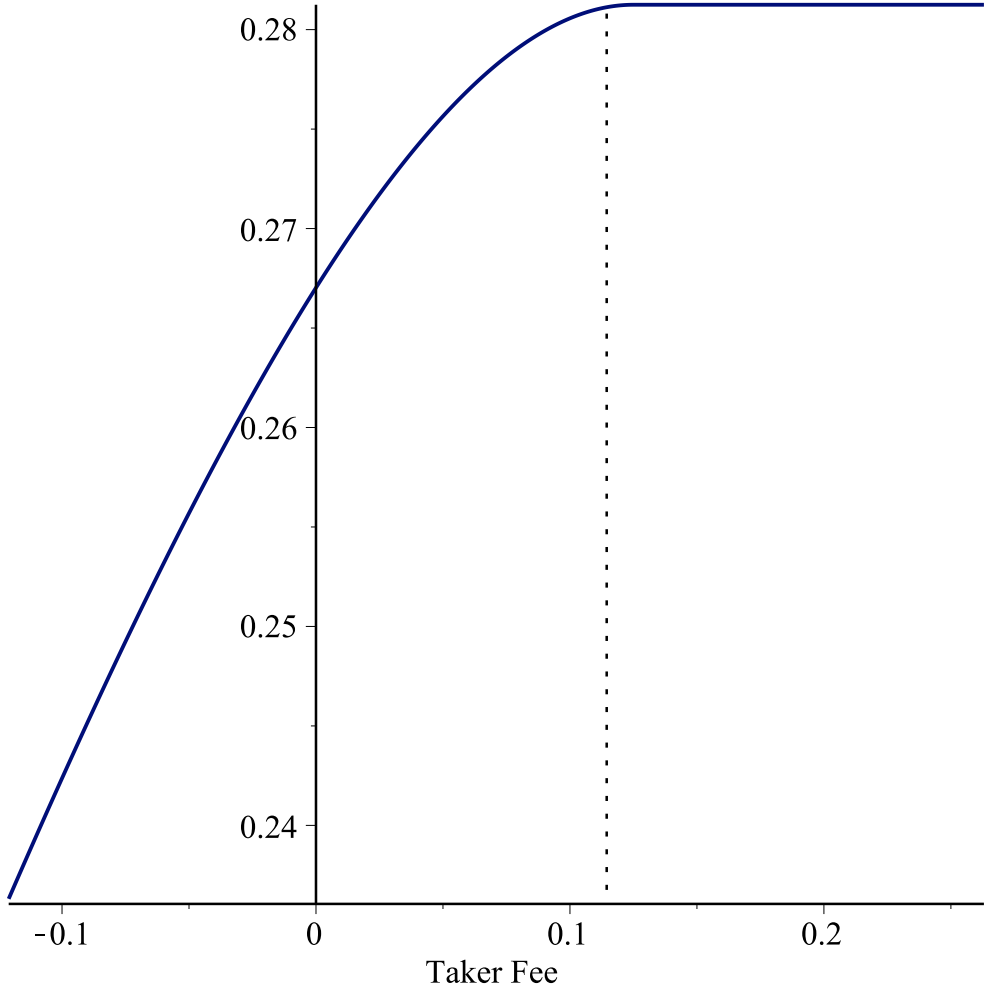
Shameless self-promotion:
↘ price impact is consistent with Malinova and Park (2011)

Volume



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
    $\rightarrow$ higher participation of low-latency liquidity providers
  - higher welfare