

# The Value of Off-Exchange Data

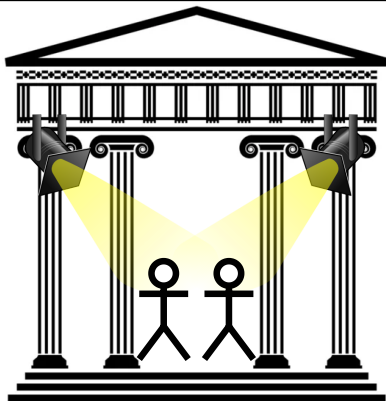
Thomas Ernst,<sup>1</sup> Jonathan Sokobin,<sup>2</sup> and Chester Spatt<sup>3</sup>

<sup>1</sup>University of Maryland, Robert H. Smith School of Business

<sup>2</sup>Financial Industry Regulatory Authority

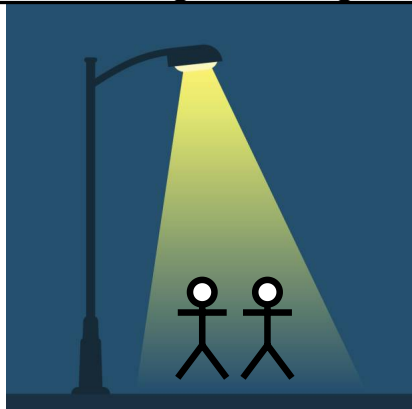
<sup>3</sup>Carnegie Mellon University, Tepper School of Business

## Exchange Trading



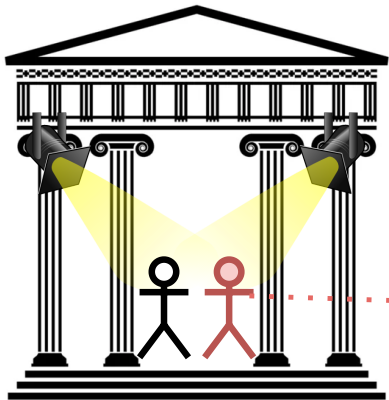
- Exchange data is a high margin business
- Rapid growth in post-NMS world

## Off-Exchange Trading

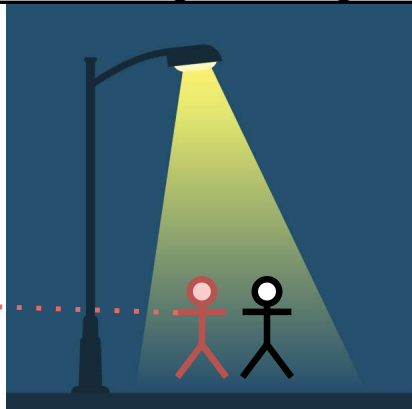


- Almost half of all trades happen off-exchange
- What is the value of off-exchange data?

## Exchange Trading



## Off-Exchange Trading



- Off-exchange trades are reported with considerable delay
- Off-exchange trades contain information
- Same participants trade in both venues

# Value of Off-Exchange Data

- **Off-exchange trades reported with a delay:**
  - Trades are reported thousands of microseconds after they happen
  - Latency is an important element of post-trade transparency
- **Off-Exchange trades cause market reactions:**
  - Document a flurry of trades and quotes in response to publication of off-exchange data
  - Exploit geographic variation in data centers to pinpoint reactions to off-exchange data
  - Trades appear informed: buy orders following buy orders; earn negative realized spreads
- **Complex Information Flow:**
  - Investors trade both on and off exchanges
  - Off-exchange trades potentially influence on-exchange trading behavior
  - Internal value of data

# Place in Literature

- Exchange Data Value: Spatt (2021). Glosten (2020). Brogaard Brugler Rosch (2020).
- Dark Trading: Zhu (2014). Comerton-Forde and Putnins (2015). Buti, Rindi, Werner (2017).
- Payment for Order Flow: Yang and Zhu (2019) Comerton-Forde, Malinova, and Park (2018).
- Post-Trade Transparency: Seppi (1990). Bessembinder, Maxwell, and Venkataraman (2006).
- Low-Latency Strategies: Foucault, Roell and Sandas (2003). Aquilina, Budish, O'Neill (2020).
- Low-Latency Price Discovery: Hasbrouck (2019). Bartlett McCrary (2019). Hu, Pan, and Wang (2017).

Here: **off-exchange data** as it pertains to:

- Post-trade transparency
- Low-latency trading
- Data Value

# **1. Trade Reporting Process**

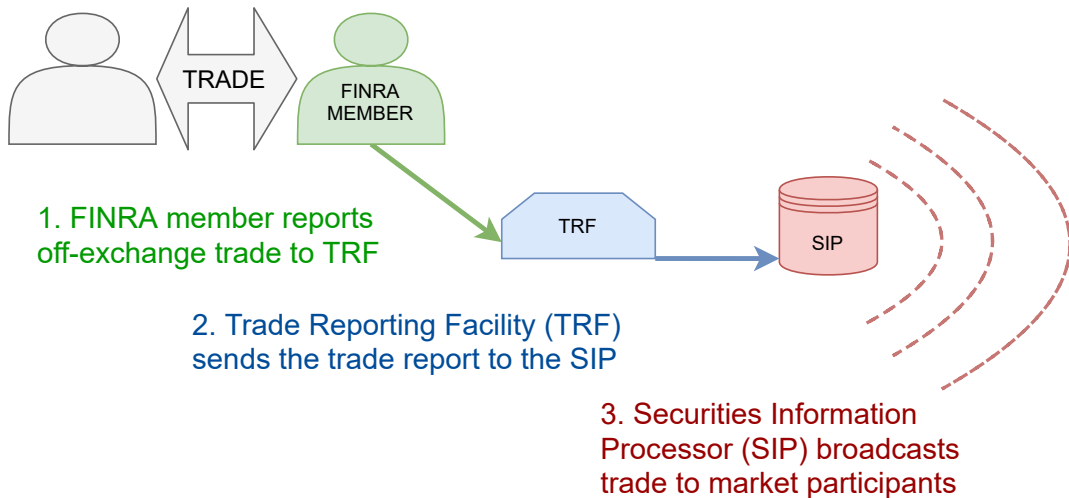
## 1.1 Facilities

## 1.2 Embedded Latencies

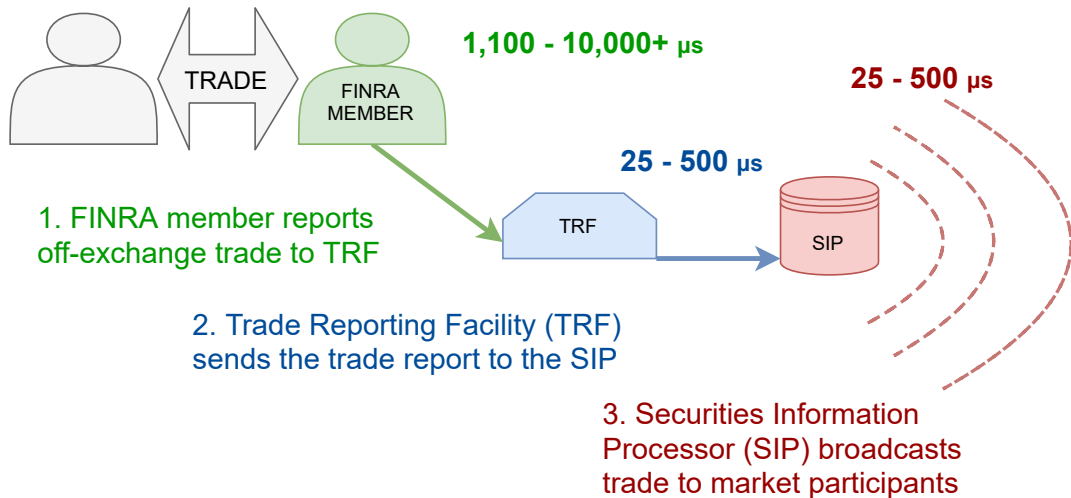
# 2. Market Reactions to Off-Exchange Trades

# 3. Complex Information Flow

# Data Reporting: Structure

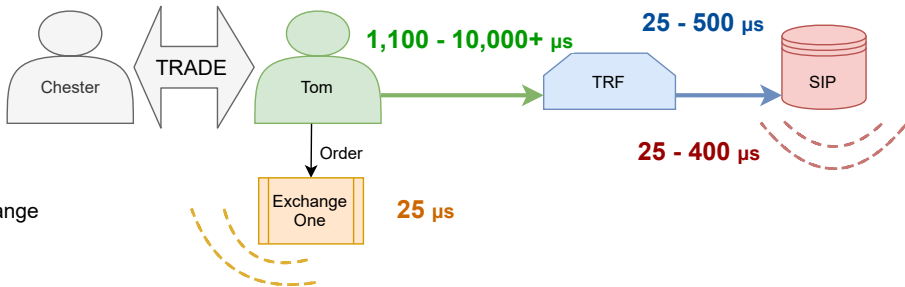


# Data Reporting: Structure

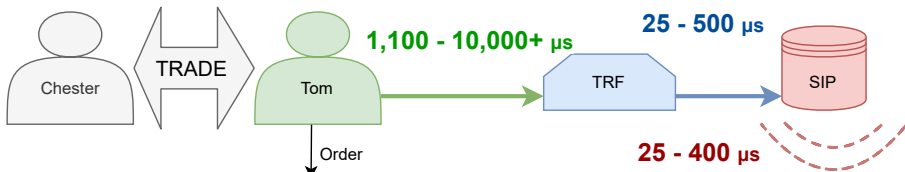




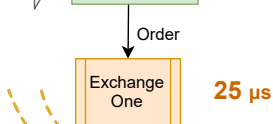
A: Chester buys stock  
from Tom off-exchange



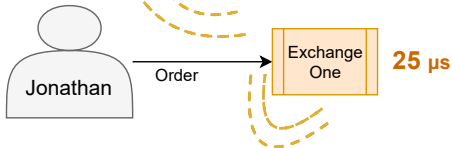
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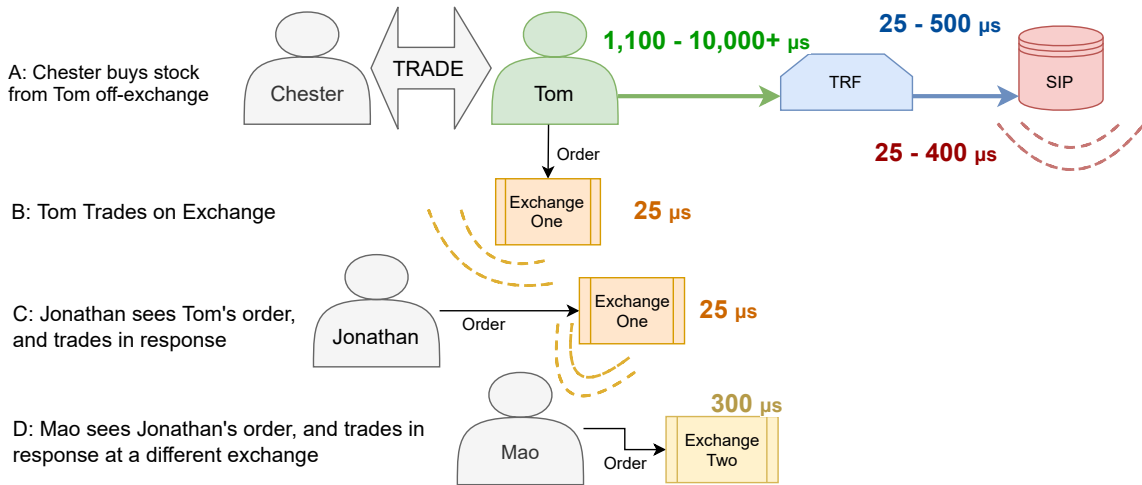


B: Tom Trades on Exchange

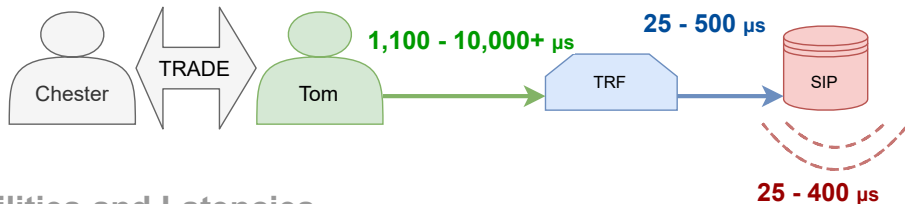


C: Jonathan sees Tom's order, and trades in response









## 1. Facilities and Latencies

## 2. Market Reactions to Off-Exchange Trades

- Trade and Quote Response to Off-Exchange Trades
- Trade Responses Appear Informationally-Driven

## 3. Complex Information Flow

- Investors trade on and off exchange

# TRF Responses

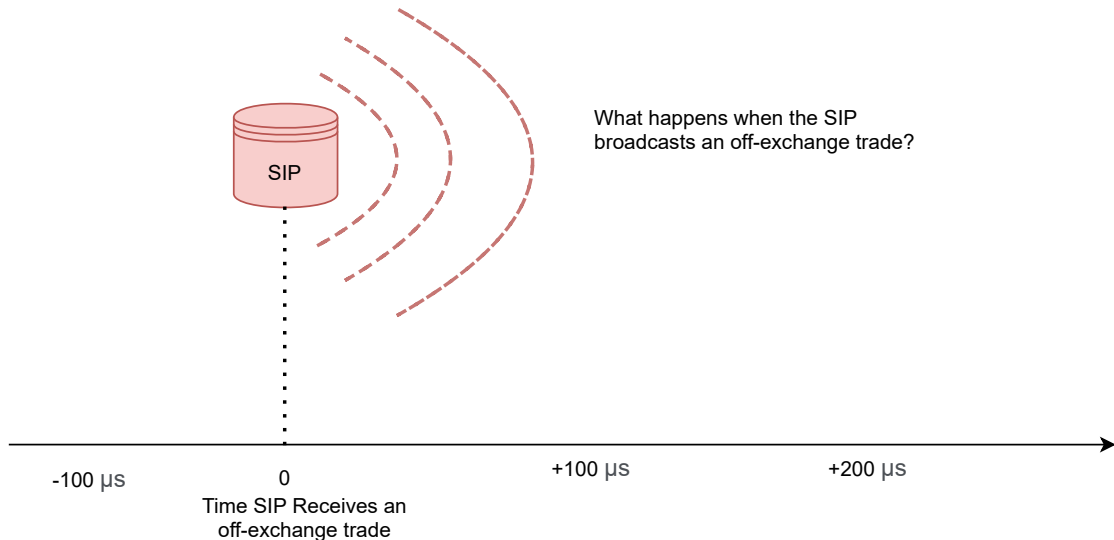
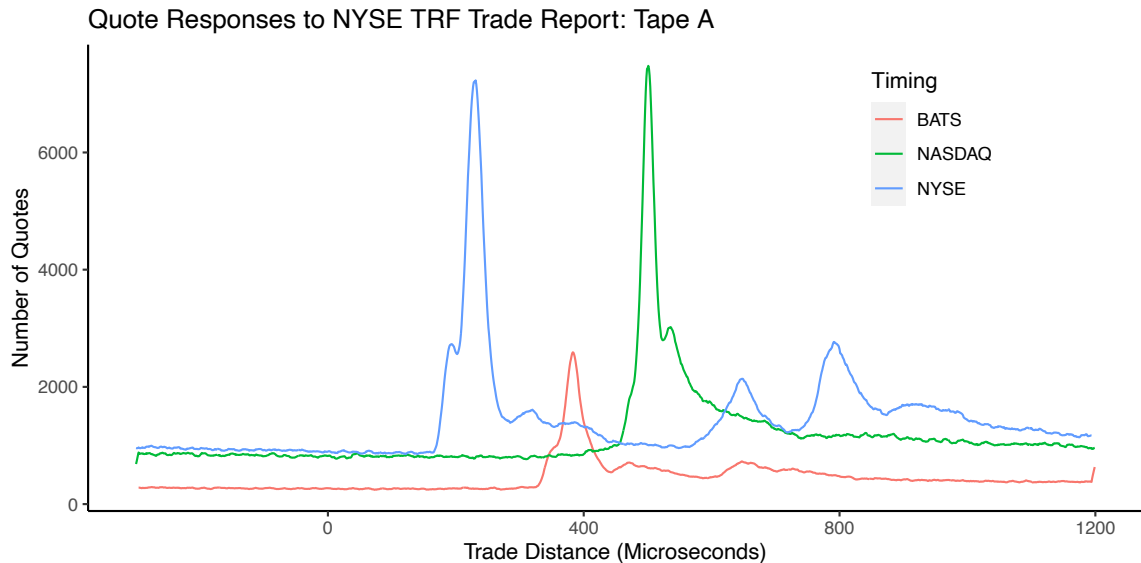
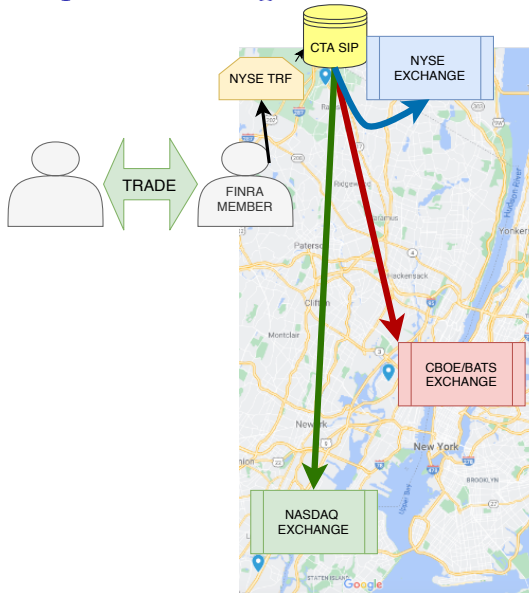


Figure 7A



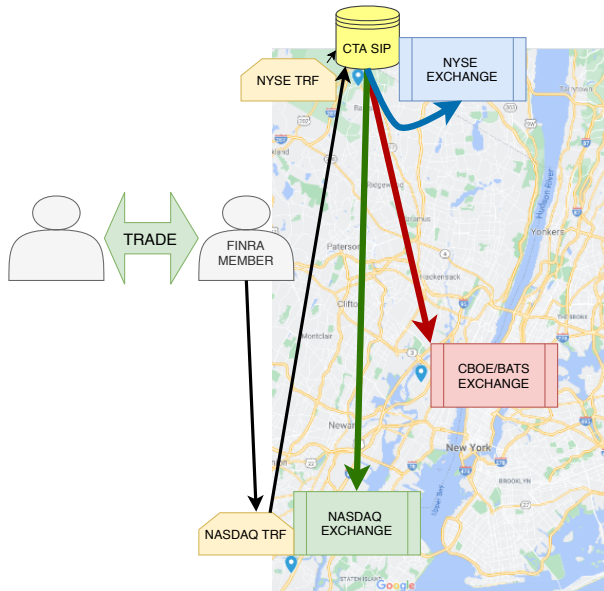
# Map: How a Signal Reaches the Market



- The SIP broadcasts the off-exchange trade.
- Broadcast comes from northern New Jersey.
- Staggered arrival due to geographic latency:
  - 1 NYSE first
  - 2 BATS second
  - 3 NASDAQ third



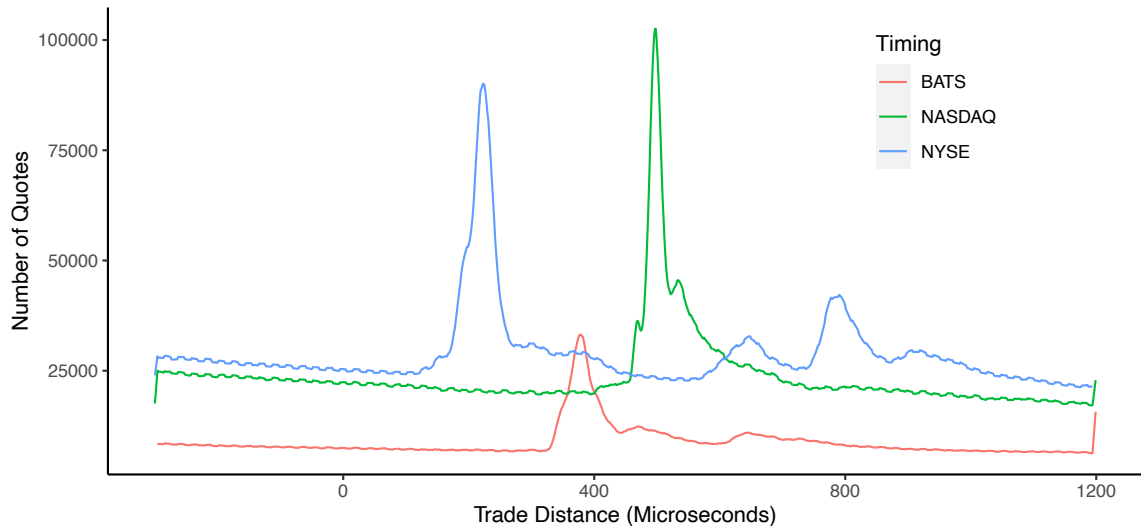
## NJ Equity Triangle (Figure 5)



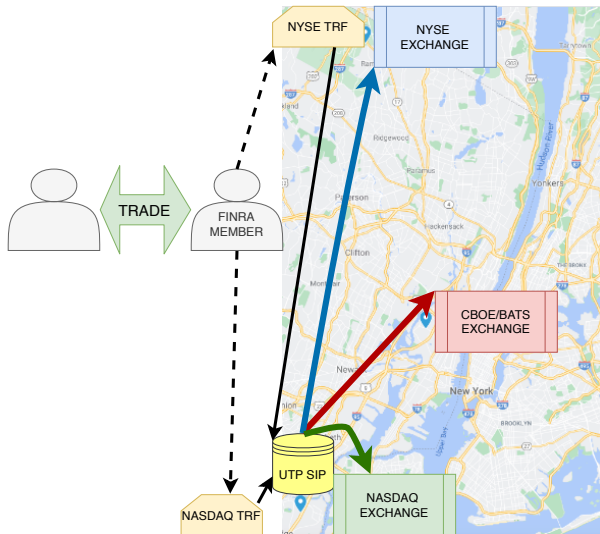
- There are two major Trade Reporting Facilities:
  - NYSE TRF
  - NASDAQ TRF
- FINRA member can report to either TRF
- Tape A Securities only reported by CTA SIP

Figure 7B

Quote Responses to NASDAQ TRF Trade Report: Tape A



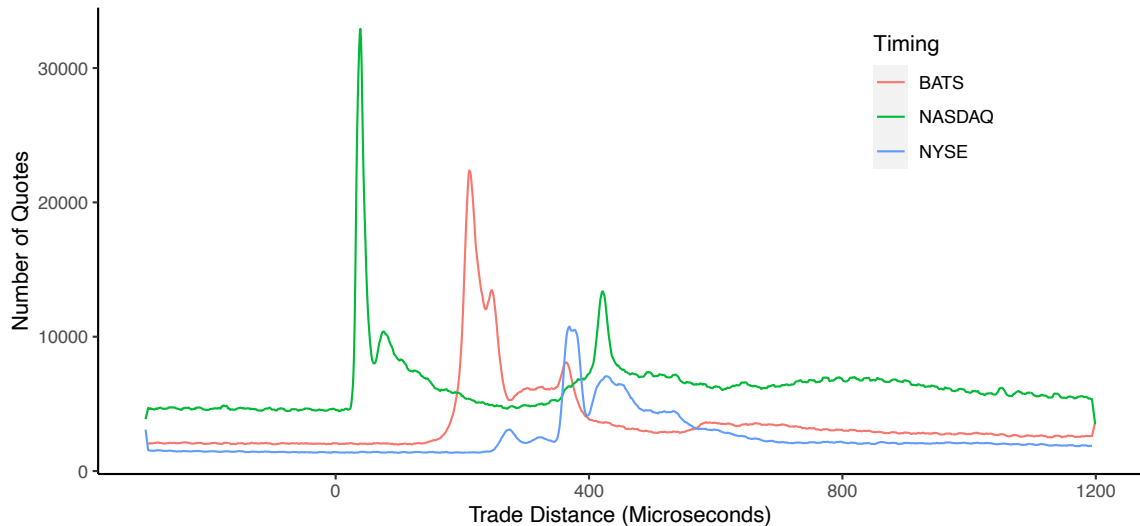
## NJ Equity Triangle (Figure 6)



- Tape C Securities are published by the UTP SIP located in central NJ.
- Signal is going to arrive in the reverse order:
  - ① NASDAQ first
  - ② BATS second
  - ③ NYSE third

Figure 8A

Quote Responses to NYSE TRF Trade Report: Tape C



# Characterizing Responses

Identify market responses to publication of off-exchange information:

- Rapid, sharp increases in response to SIP publication of trade
- Match geographic pattern across two TRFs, two SIPs, and three exchanges

Low-latency race:

- Update quotes before trades come in: avoid being “picked off”
- Trade before quotes are updated “sniping stale quotes”
- Aquilina, Budish, O’Neill (2020): Low-latency races are 17% of liquidity costs
- Yang and Zhu (2019): Trading on public information of past institutional orders

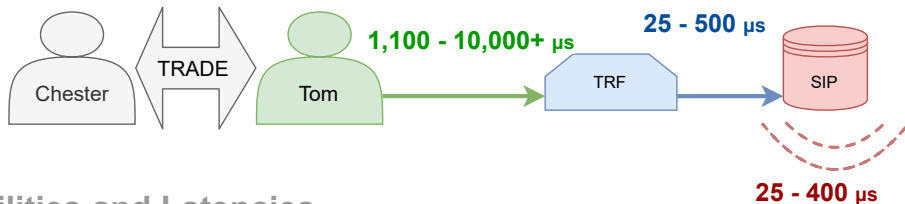
# Characterizing Responses

Sizable overall reaction in this low-latency race:

- Around 2% of off-exchange trades trigger response trade
- \$650 Billion per year in quote updates
- \$160 Billion per year in trading volume
- More off-exchange volume leads to larger spikes

Trades appear informationally motivated:

- Trades earn negative realized spreads on average
- 60 to 70% of response trades are same-direction trades (eg buy follows buy)



## 1. Facilities and Latencies

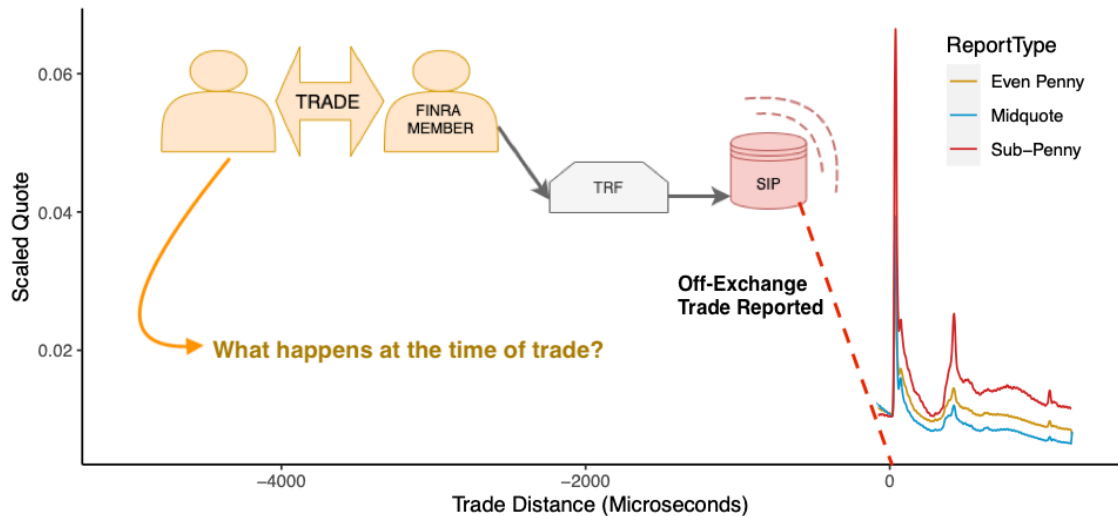
## 2. Market Reactions to Off-Exchange Trades

- Trade and Quote Response to Off-Exchange Trades
- Trade Responses Appear Informationally-Driven

## 3. Complex Information Flow

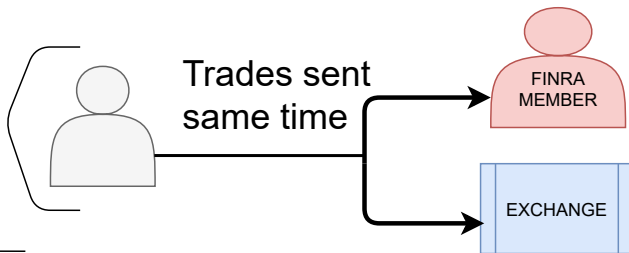
- Investors trade on and off exchange
- Off-exchange trades can influence on-exchange behavior

# Trade and Information Flow

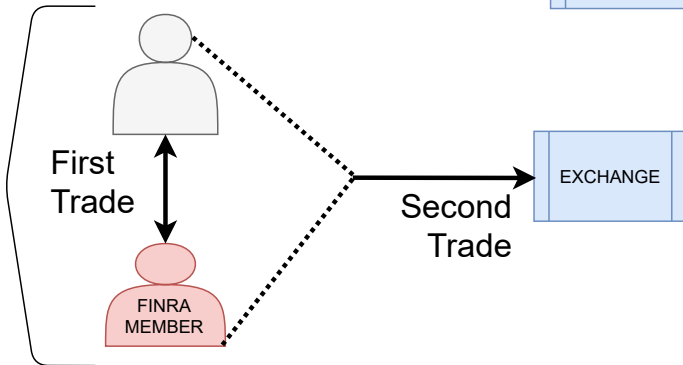




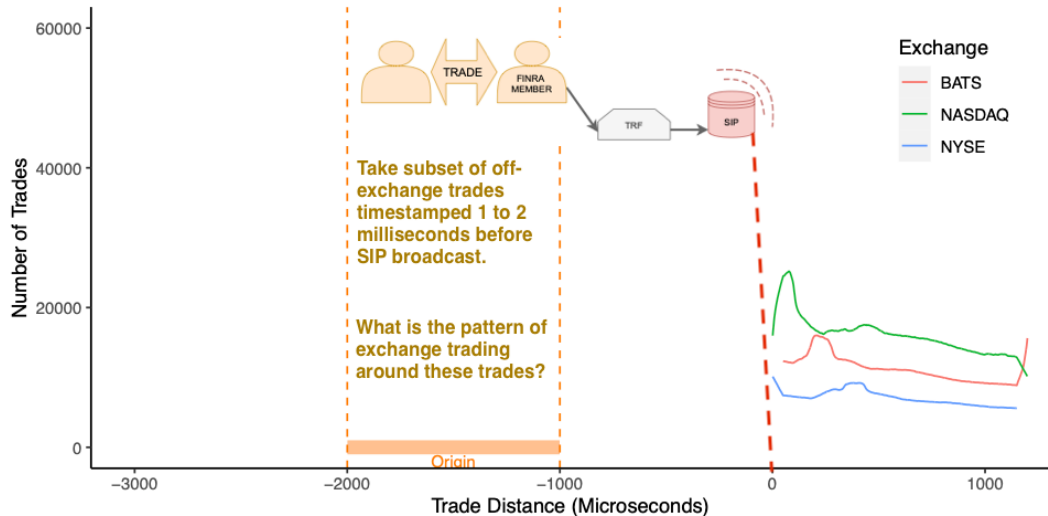
## Simultaneous Routing



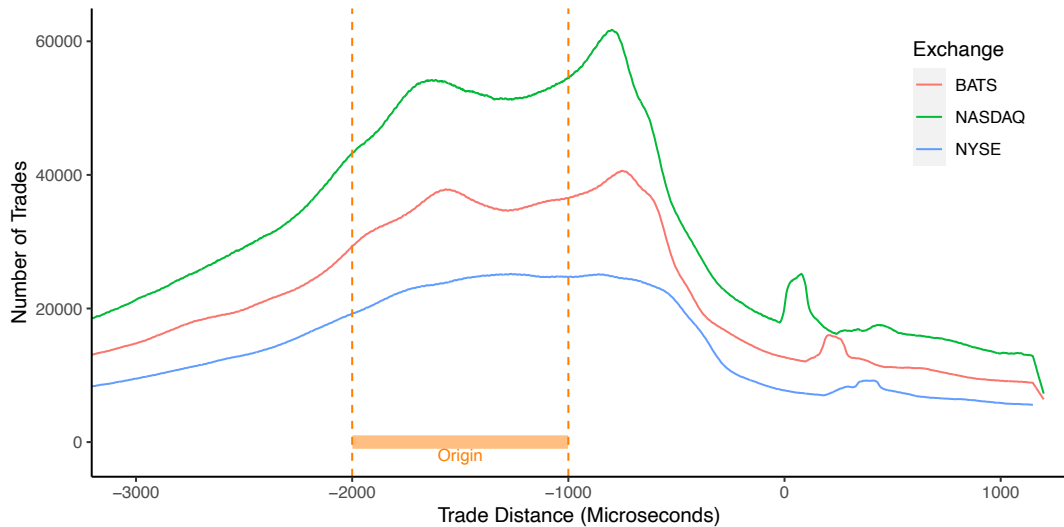
## Subsequent Routing



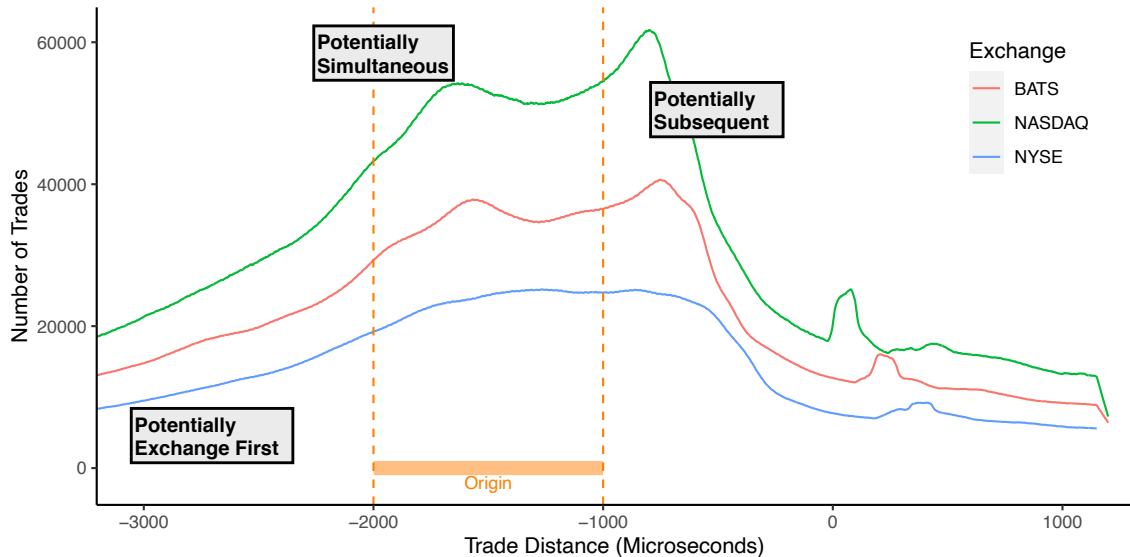
# Trade Timing At Origination



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  - Document a flurry of trades and quotes in response to publication of off-exchange data
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  - Trades appear informed: buy orders following buy orders; earn negative realized spreads
- **Complex Information Flow:**
  - Trades before publication, quotes after publication
  - Simultaneous vs. Subsequent trade timing
  - Off-exchange trades influence on-exchange behavior