# Trading and market microstructure

FN 451



# Today's outline

I) What affects equity price movements?
II) What affects real rates of returns?
III) Market microstructure
- Trading systems: Limit order on SET and ASEAN linkage
- Liquidity measures
- Trading equity on SET

IV) What moves the Thai equity market?: An empirical exercise



# WHAT AFFECTS PRICE MOVEMENTS



# Example – Pure price-time precedence

| Time | Trader | Buy/Sell | Size | Price |
|---|---|---|---|---|
| 12:02 | Sammy | Sell | 100 | $20.05 |
| 12:06 | Steve | Sell | 200 | $20.06 |
| 12:15 | Bern | Buy | 500 | $20.06 |
| 12:16 | Susie | Sell | 300 | $20.08 |
| 12:20 | Ben | Buy | 200 | Infinite |
| 12:21 | Bob | Buy | 100 | $20.08 |
| 12:24 | Sandy | Sell | 500 | $20.12 |
| 12:25 | Bev | Buy | 500 | $20.08 |
| 12:27 | Bill | Buy | 200 | $20.05 |
| 12:27 | Seth | Sell | 200 | $20.10 |

# Discussion

- Why do these people have different bidding and selling prices?
- Why are they submitting at different timing?



# Discussion

- Adverse selection in financial markets
- Different utility ie. Different level of risk aversion, and different liquidity needs.



# Example – the order book

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | 100 | $20.05 | 200 | Bill |
| Steve | 200 | $20.06 | 500 | Bern |
| | | $20.08 | 100 | Bob |
| Susie | 300 | $20.08 | 500 | Bev |
| Seth | 200 | $20.10 | | |
| Sandy | 500 | $20.12 | | |
| | | Infinite | 200 | Ben |

# Continuous trading @12:02

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | 100 | $20.05 | | |
| | | $20.06 | | |
| | | $20.08 | | |
| | | $20.08 | | |
| | | $20.10 | | |
| | | $20.12 | | |
| | | Infinite | | |

# Continuous trading @12:06

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | 100 | $20.05 | | |
| Steve | 200 | $20.06 | | |
| | | $20.08 | | |
| | | $20.08 | | |
| | | $20.10 | | |
| | | $20.12 | | |
| | | Infinite | | |



# Continuous trading @12:15

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | ~~100~~ 0 | $20.05 | | |
| Steve | ~~200~~ 0 | $20.06 | ~~500~~ 200 | Bern |
| | | $20.08 | | |
| | | $20.08 | | |
| | | $20.10 | | |
| | | $20.12 | | |
| | | Infinite | | |



# Continuous trading @12:16

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | ~~100~~ 0 | $20.05 | | |
| Steve | ~~200~~ 0 | $20.06 | ~~500~~ 200 | Bern |
| Susie | 300 | $20.08 | | |
| | | $20.08 | | |
| | | $20.10 | | |
| | | $20.12 | | |
| | | Infinite | | |



# Continuous trading @12:20

| Sellers | | | Buyers | |
|---|---|---|---|---|
| Trader | Size | Price | Size | Trader |
| Sammy | ~~100~~ 0 | $20.05 | | |
| Steve | ~~200~~ 0 | $20.06 | ~~500~~ 200 | Bern |
| Susie | ~~300~~ 100 | $20.08 | | |
| | | $20.08 | | |
| | | $20.10 | | |
| | | $20.12 | | |
| | | Infinite | 200 0 | Ben |

# Supply and Demand

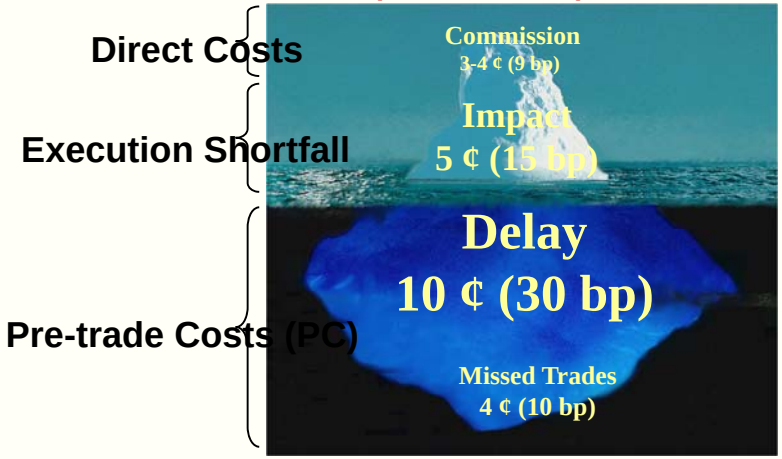
- The single-price auction clears at the price where supply equals demand.
  - At prices below the market clearing price, there is excess demand.
  - At prices above the market clearing price, there is excess supply.



# WHAT AFFECTS RATES OF RETURNS

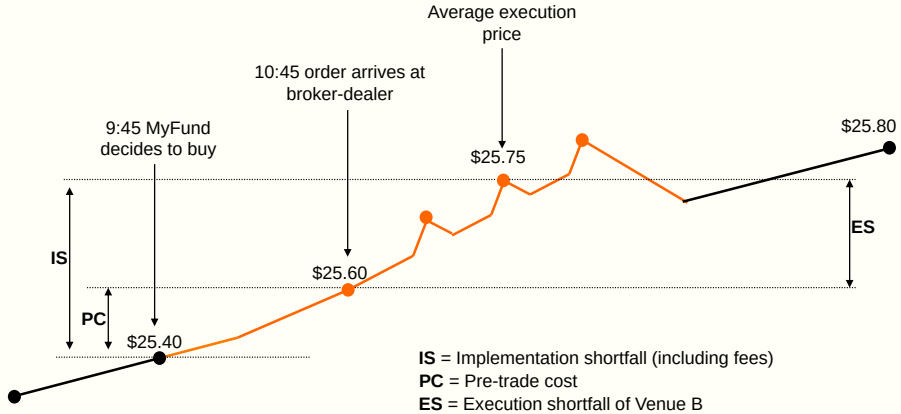


# The Plexus Iceberg of Transaction Costs (US, 2007)



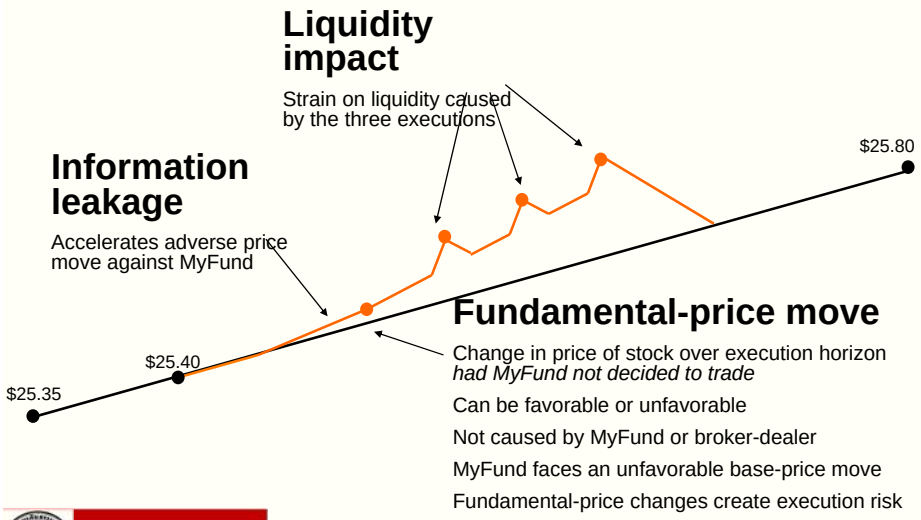



# Implementation Shortfall




Source: Goldman Sachs, Trading and Market Structure Analysis

## Factors affecting Implementation Shortfall




Source: Goldman Sachs: Trading and Market Structure Analysis



## Computing volume weight avg price (avg execution price)

- You have received an order to buy 1 mn shares of stock A. Compute VWAP and the end of the day profit/loss position.

| Time | Execution price | Quantity | Unfilled | Q x P |
|---|---|---|---|---|
| 9.00 am | 100 | 100,000 | 900,000 | 10,000,000 |
| 10.00 am | 101 | 150,000 | 750,000 | 15,150,000 |
| 11.00 am | 102 | 300,000 | 450,000 | 30,600,000 |
| 12.00 pm | 105 | 100,000 | 350,000 | 10,500,000 |
| 2.00 pm | 104 | 200,000 | 150,000 | 20,800,000 |
| 3.00 pm | 103 | 100,000 | 50,000 | 10,300,000 |
| 4.00 pm | 101 | 50,000 | - | 5,050,000 |
| 4.30 pm | 99 | | | |
| **VWAP** | | | | 102.4 |
| **Profit/loss per share** | | | | -3.4 |



## Price impact

- Thin (illiquid) markets results in larger price impact. What happens to market price when customer submits limit order of Rps 120 to buy 500 shares

| Sell | Quantity |
|---|---|
| 120 | 500 |
| 110 | 300 |
| 100 | 200 |



## Price impact

- Deep (liquid) markets results in smaller price impact. What happens to market price when customer submits limit order to buy 500 shares at Rps 120?

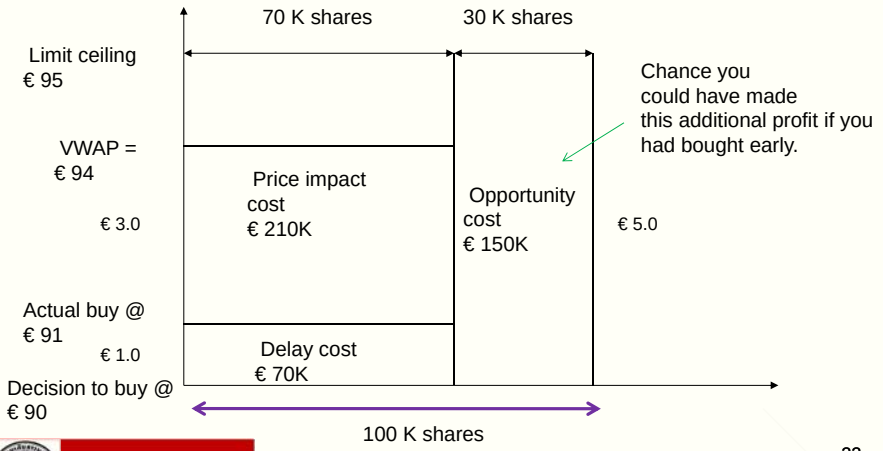
| Sell | Quantity |
|---|---|
| 114 | 500 |
| 112 | 300 |
| 110 | 600 |
| 109 | 300 |
| 108 | 400 |

# A closer look at liquidity and transaction costs

- A fund manager wishes to buy 100,000 shares of **LVMH Moet Hennessy Louis Vuitton SA (MC.PA)**
- Observing last transaction price at €90.50, he places a buy order at € 90.0 at 10.01 am.
- However, **LVMH** price kept climbing, at 10.30 am, fund manager revises a limit order to buy from € 91 (current market price) and not exceeding € 95.
- By the time the market closed, at 4.30 pm, the fund manager only obtained 70,000 shares. The last trading hour price was € 96.0 above the limit ceiling.



# What are the costs from implementation shortfall?






# Trading cost with implementation shortfall

| | |
|---|---|
| Delay | 70,000 |
| Price impact | 210,000 |
| Commissions (0.1% of VWAP) | 6,580 |
| Opportunity cost | 150,000 |
| | 436,580 |

Your VWAP cost = 94 x 70K = 6.58 mn



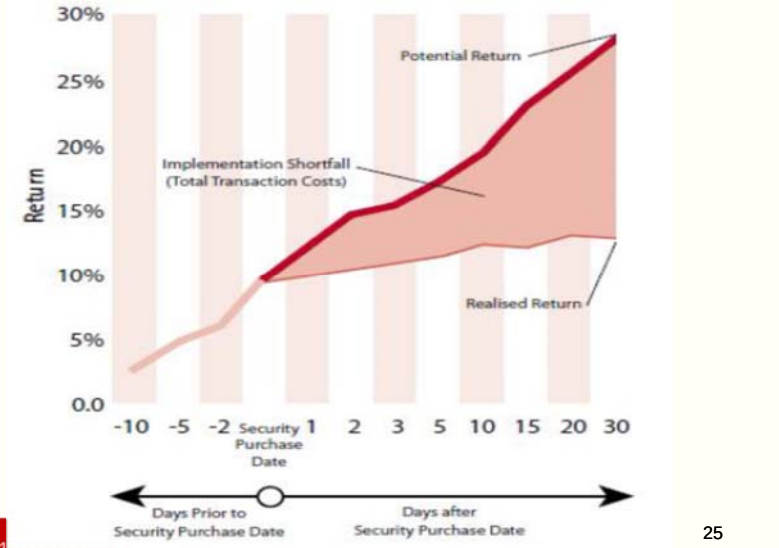
# Which scenario has higher price impact?

| Time | Sell | Quantity |
|---|---|---|
| 10.05 | 90.5 | 2,000 |
| | 91 | 4,000 |
| | 91.5 | 6,000 |

| Time | Sell | Quantity |
|---|---|---|
| 10.05 | 90.5 | 5,000 |
| | 91 | 7,000 |
| | 91.5 | 9,000 |

- You would like to buy 5,000 shares at market prices?
- Top scenario: VWAP = 90.5*2,000 + 91*3,000 = 454 K
- Bottom scenario: VWAP = 90.5 * 5000 = 452.5 K

# Realized return and potential return






# MARKET MICROSTRUCTURE



# Microstructure and efficient prices

- Microstructure research rejects the hypothesis that the transaction process and the organisation of markets have no effect on the prices of securities
- The microstructure literature argues that both information risk due to asymmetric information and differences in liquidity over time and between companies impact on long-term equilibrium prices in the market.



# Microstructure and efficient prices

- The microstructure literature challenges the hypothesis of efficient markets by studying how prices can deviate from (or converge towards) informationally efficient equilibrium prices as a result of rational participants behaving strategically (Biais et al., 2004)

# Trading system on SET

- Automatic order matching (AOM) trading performs the order matching process according to price, then time, priority, without human intervention. After brokerage houses electronically send buy or sell orders from their offices to the SET mainframe computer, the CONNECT system queues the orders and arranges them according to a price-then-time priority.

# Order driven market

- Most important exchanges are order-driven markets.
- Most newly organized trading systems are electronic order-driven markets.
- All order-driven markets use *order precedence rule* and *trade pricing rule*.



# Examples of pure order-driven markets

- Tokyo Stock Exchange,
- KRX (previously KSE, KOSDAQ)
- ASEAN markets
- Paris Bourse,
- Toronto Stock Exchange,
- Most Future Markets,
- Most European Exchanges for equities (Milan, Barcelona, Madrid, Bilbao, Zurich,….)

# Sources of liquidity

- More than 70% of trading in developed markets is done by institutions. In emerging market, this patter is reversed.
- A block trade is defined (somewhat arbitrarily) as trades > 10K shares.
- Block orders (institutional orders) are in practice significantly larger.
- Institutional traders need liquidity!!!
  - The quote size is typically not sufficient to satisfy their trading needs.
- Displaying large order will result in adverse price impact.
  - How do you tease out non-displayed liquidity without incurring price impact?

# A Definition of Liquidity

A market is *liquid* if

| | |
|---|---|
| uninformed traders can | (Who) |
| quickly | (Immediacy) |
| buy or sell | (Symmetry) |
| large size | (Depth) |
| when they want | (Availability) |
| at low transaction cost | (Spread) |

# Other Variables Affecting Liquidity

- Security characteristics
- Recent trading history
  - Resiliency
- The trader
  - Informed or uninformed
- The market structure
  - Competitive or oligopolistic dealers
  - Order- or quote-driven

# Liquidity is Valuable

- Liquidity helps traders solve cash flow problems.
  - People and firms will save more and thereby decrease corporate costs of capital.
- Liquidity facilitates hedging strategies.
  - More risks will be shifted between natural hedgers and production will be more efficient.
- Liquidity facilitates risk sharing schemes.
  - More extremely large risky positive NPV projects will be undertaken.
- Positive externalities…

# Measuring Liquidity

- Quoted spread
- Price impact
- Depth
- Trading volume/Trading value
- Turnover
- Free float
- Frequency of trading
- Etc.

# Who supplies Liquidity?

- Market makers
  - Exchange specialists
  - ETF's market makers
  - Day traders (algo trade)
- Upstairs trading/Block Trading
  - Institutional trade crossing
- Patient pre-committed traders
  - Buy-side institutions
  - Individual traders
- Value-motivated traders
  - Individuals
  - Institutions
- Arbitrageurs
  - Pure arbitrageurs
  - Index enhancement funds
  - Pairs traders

# Who uses Liquidity?

- Institutional traders
- Retail traders
- Professional/Proprietary traders
- Foreign investors

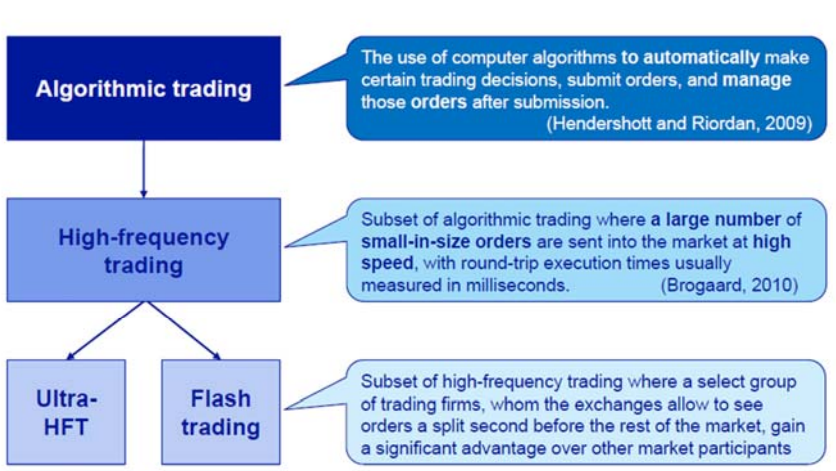
**WHY AM I BETTER UNDERSTANDING MICROSTRUCTURE?**



# My clients wants to know

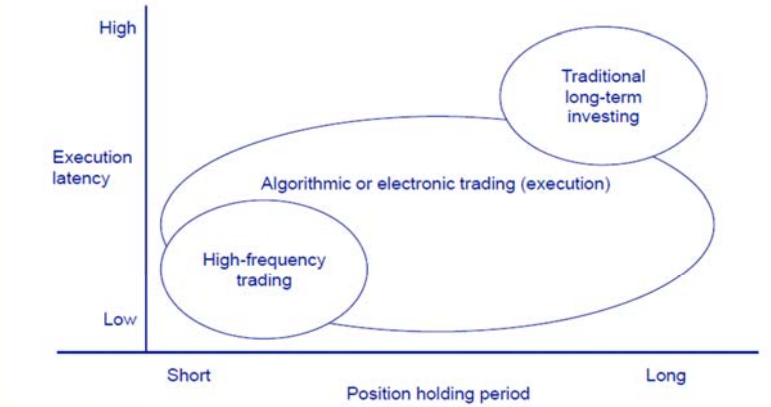
- Does the stock have sufficient liquidity for investment?
- What is the daily volatility of the stock?
- Do you know who has recently been trading in a stock?
- Is there a way to take advantage of high volatility or large mispricing errors?

# Key terms






# Traditional investing vs AT vs HFT




Source: Aldridge 2010



# Algorithmic trading strategies

| Name | Description of strategy |
|---|---|
| **Trade execution algorithms** | Designed to minimise the price impact of **executing trades of large volumes** by 'shredding' orders into smaller parcels and slowly releasing these into the market. |
| **Strategy implementation algorithms** | Designed to read real-time market data and **formulate trading signals** to be executed by trade execution algorithms. This may involve automatically **rebalancing portfolios** when certain pre-specified tolerance levels are exceeded, **searching for arbitrage opportunities**, automatic quoting and hedging in a **market maker-type role**, and producing trading signals from technical analysis. |
| **Stealth/gaming algorithms** | Designed to take advantage of the price movement caused when large trades are filled, and also to **detect and outperform other algorithmic strategies**. |

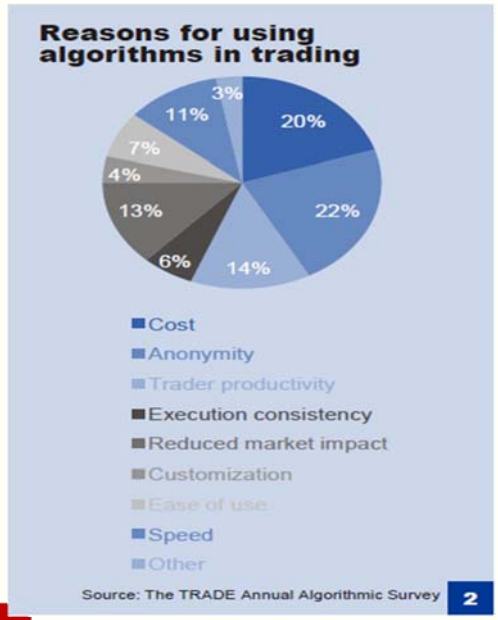
Source: Aldridge 2010 High-Frequency Trading: A Practical Guide to Algorithmic Strategies and Trading Systems. John Wiley & Sons.



# HFT Strategies

| Name | Description of strategy |
|---|---|
| **Electronic market making** | **Liquidity-providing strategies** that mimic the traditional role market makers once played. These strategies involve making a two-sided market aiming at **profiting by earning the bid-ask spread**. This has evolved into what is known as Passive Rebate Arbitrage. |
| **Statistical arbitrage** | Traders look to correlate prices between securities in some way and trade off of the **imbalances in those correlations**. |
| **Liquidity detection** | Traders look to **decipher whether there are large orders** existing in a matching engine by sending out small orders ("pinging") to look for where large orders might be resting. When a small order is filled quickly, there is likely to be a large order behind it. |

Source: Aldridge 2010 High-Frequency Trading: A Practical Guide to Algorithmic Strategies and Trading Systems. John Wiley & Sons.






## Drivers of change on developed demutualized markets: Case of TSE

chi-X JAPAN

- The rise of non-centralized electronic exchanges
- About 60 percent of equity volume in the United States is from high-frequency trading, significantly higher than Japan. Just 10 percent of global financial firms with high-frequency businesses are active in Tokyo (Reuters)



## Drivers of change for SET

- Algo trading on SET is driven by proprietary trading accounts of brokerages and the need to provide investors with timely execution with better cost control.