Trading and Exchanges

Market Microstructure for Practitioners

RK

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Outline I

Outline II

Outline III

- Liquidity
- Volatility

7 Evaluation and Prediction
- Liquidity and Transaction cost measurement
- Performance evaluation and prediction

8 Market Structures
- Index and Portfolio Markets
- Specialists
- Internalization, Preferencing and Crossing
- Competition within and among markets

9 Takeaway

Outline I

Outline II

Outline III

Scope of the book

Market Microstructure

It is the branch of financial economics that investigates trading and organization of markets.

- The book presents the economics of market microstructure in simple English.

Objectives of the book

- The primary objectives of the book are to understand the origins of the following characteristics of market quality :
  - Liquidity
  - Transaction costs
  - Informative prices
  - Volatility
  - Trading profits
- The secondary objective of this book is to understand how market structure - trading rules and information systems - affect each of the above market characteristics.

Recurrent themes of the book

- Information asymmetries.
- Option to trade.
- Externalities.
- Market structure.
- Competition with free entry and exit.
- Communications and computing technologies.
- Price correlations.
- Principal-agent problems.
- Trustworthiness and creditworthiness.
- Zero-sum game.

Outline I

Outline II

Outline III

Trading Stories

- Sample scenarios for trades are presented in this chapter. The scenarios include :
  - Retail trade in a NYSE listed stock.
  - Retail trade in a NASDAQ listed stock.
  - Institutional trade in a NYSE listed stock.
  - Institutional trade in a NASDAQ listed stock.
  - A very large block stock trade.
  - Cash commodity and associated futures market traders.
  - Options market trade.
  - Bond market trade.
  - Foreign exchange trade.

Outline I

Outline II

Outline III

Players

- *Proprietary traders*.
- *Brokers* (Agency traders / Commission traders/ Commission merchants).
- *Investment sponsors* - pension funds, mutual funds, trusts, endowments, and foundations that invest money.
- Investment sponsors employ *Investment advisers* (Investment managers / Portfolio managers) to manage their funds.
- Investment advisers employ traders to implement their strategies and these traders are called *buy side traders*.
- The people who will ultimately benefit from the funds that investment sponsors hold are *beneficiaries*.
- *Dealers* accommodate trades that their clients want to make, by trading with them when clients want to trade.
- *Brokers* trade on behalf of their clients.
- *Broker-Dealers* or *Dual traders* - traders who both deal and broker traders.

Buy Side

Trader type	Examples
Investors	Individuals
	Pension funds
	Insurance funds
	Charitable and legal parts
	Mutual funds
	Money managers
Borrowers	Individuals
	Corporations
Hedgers	Farmers
	Miners
	Financial Institutions
Asset Exchangers	International corporations
	Manufacturers
Gamblers	Individuals

Sell Side

Trader type	Examples
Dealer	Market makers
	Specialists
	Floor traders
	Locals
	Day traders
	Scalpers
Brokers	Retail Brokers
	Discount brokers
	Full-service brokers
	Institutional brokers
	Block brokers
	Futures commission merchants
Brokers	Wire houses

Trade Facilitators

- Exchanges
  - Order driven trading systems.
  - ECNs - order driven trading systems that are not regulated as exchanges.
  - Over the counter market.
- Back office
  - Clearing agents.
  - Settlement agents.
  - Clearing houses - clear and settle all traders in derivative contracts.
  - Depositories and Custodians hold cash and securities on behalf of their clients. They help settle traders by quickly delivering cash and security certificates to settlement agents.

Trading instruments

Class	Instrument
Real Assets	Spot commodities
	Intellectual properties
	Real estate
	Pollution emission rights
Financial assets	Stocks and Warrants
	Bonds
	Trust units
	Currencies
Derivative contracts	Futures contracts
	Forward contracts
	Options
	Swaps
Insurance contracts	Insurance policies
	Reinsurance contracts
Hybrid instruments	Warrants

Trading Markets

- Despite the tremendous attention given to the stock market in the media, stocks represent only about 20 % of the capital wealth of the country.
- Most of the wealth is in real estate, which rarely trades.
- Derivative contracts represent no wealth because they are all in zero net supply and do not represent ownership of real assets.

US Regulators

SEC	Securities and Exchange Commission
CFTC	Commodities and Futures Trading Commission
NASD	National Association of Securities Dealers
NFA	National Futures Association
FASB	Financial Accounting Standard Boards
AIMR	Association of Investment Management and Research

Outline I

Outline II

Outline III

Orders

- Orders are instructions that traders give to the brokers and exchanges which arrange their trades.
- Trader's jargon :
  - making bids and offers.
  - firm quote and soft quote.
  - best bid, best offer, market bid, market offer, National Best Bid and Offer.
  - bid/ask spread.
  - insider spread.
  - offers liquidity.
  - supplies liquidity.
  - standing orders.
- Traders who want to trade immediately demand *immediacy*
- *Agency orders* are orders that brokers represent as agents for their clients.
- *Proprietary orders* are orders that traders represent for their own accounts.

Market Orders

- These are orders that are traded at the best price currently available in the market.
- You pay the bid/ask spread in a round trip.
- *Price Improvement* - Market orders may sometimes trade at better prices than market bid and offer.
- *Price Concessions* - The premiums that large buyers pay, and the discounts that large sellers offer, are price concessions.
- *Market Impact* - When traders move prices to fill their orders, they have market impact.
- Market orders are characterized by execution price uncertainty

Limit Orders

- A limit order is an instruction to trade at the best price available, but only if it is no worse than the limit price specified by the trader.
- For buy orders, the trade price must be at or below the limit price. For sell orders, the price must be at or above the limit price.
- Buy limit orders with high prices and sell limit orders with low prices are *aggressively priced*. These are easiest limit orders to fill.
- Traders classify limit orders by where they place their limit prices relative to the market.
- A *marketable limit order* is an order that the broker can execute immediately when the trader submits. The limit is usually at or just above the best bid / ask depending on the trade.
- These are different from market orders as they limit the price concessions that brokers can make to fill them.
- Traders *make a new market* when they submit orders that improve the current best bid or offer.

Order Preference

- Marketable limit orders are the most aggressively priced limit orders.
- The next most aggressive orders are those which make a new market.
- They are followed by order that match the market at the best bid or offer.
- The least aggressive limit orders stand behind the market.

Standing Limit Orders

- Sell limit orders are call options that give othe traders opportunities to buy when they want to buy. Buy limit orders likewise are put options that give other traders opportunities to sell when they want to sell.
- The option value depends on the limit price, how long the orders will stand, and price volatility.
- The compensation that limit order traders hope to receive for giving away free trading options is a better price.
- If the markets move against them, the traders who shoot limit orders might be *chasing the price*.
- Two risks of using limit orders - Execution uncertainty & ex post regret.
- ex post regret happens when price moves towards and through the limit prices.

Stop Orders

- A stop instruction stops an order from executing untile price reaches a stop price specified by the trader.
- Buy only after price rises or Sell only after price falls a certain limit.
- There is a difference between stop order and limit order. A stop instruction provides for the activation of an order when the market price reaches or passes a specified stop price. In contrast, a limit order can be executed only at a price equal to or better than a specified limit price.
- Stop Limit order attaches a stop price and limit price for an order. The former decides when the trade is activated and the latter decides the min/max price that order needs to be executed.
- These orders add momentum to the market - panic selling in times of crisis.

Market-If-Touched orders

- It is activated when the prices reaches a preset touch price.
- In contrast to stop orders, traders submit these orders to buy when prices fall to their preset prices or sell when prices rises to their preset prices.
- They are different from limit orders as they become regular market orders and can get executed at any price.
- They are quite uncommon as the trader who does not want execution price uncertainty would choose a limit order instead.

Tick Sensitive Orders

- Price is on *uptick* if the current price is higher than the the last price, a *downtick* if lower, a *zero tick* if the same.
- A zero tick price is on a *zero downtick* if the last different price was higher and a *zero uptick* if it was lower.
- Traders who want to condition their orders on the last price change submit *tick-sensitive orders*
- A *buy down tick order* must be filled only on a downtick or zero downtick price. The trade price must be lower than the last different price.
- A *sell up tick order* can be filled only on a uptick or zero uptick. The trade price must be higher than the last different price.

Tick Sensitive Order Properties

- The tick condition ensures that tick-sensitive orders have no market impact. A broker holding a buy downtick order cannot bid up prices to encourage sellers.
- A broker cannot fill a sell uptick order by offering the market down.
- These orders are essentially limit orders with dynamically adjusting limit prices.
- The strategy is attractive to traders who want to keep their limit orders close to the market when prices move away from them.
- Tick-sensitive orders are essentially limit orders with dynamically adjusting limit prices.
- The *minimum price increment* also called the *tick* or *minimum price variation* is the smallest amount by which two prices can differ. It is usually set by exchange regulations.
- *Market not held orders* are order that brokers do not need to fill immediately

Validity and Expiration instructions based orders

- Open orders.
- Good orders.
- Day orders.
- Good-till-cancel(GTC) order.
- Good-until-orders.
- Immediate-or-cancel orders(IOC).
- Good-after orders.
- Market-on-open orders.
- Market-on-close orders.

Other orders

- Spread orders : Traders want to buy one instrument and simultaneously sell another instrument.
- Hidden orders , Iceberg orders : Based on the display instruction given by the traders, these orders come in to existence.
- Substitution orders : Traders give these orders to their brokers when they want to invest or divest a specified amount of money by trading any of the several securities.

Outline I

Outline II

Outline III

Why understand Market Structures ?

- It determines what people can know and do in a market.
- To trade effectively, you need to know the structure of every market in which you trade.
- You must understand market structure, and how it affects trader behavior, in order to understand
  - the origins of market liquidity
  - price efficiency
  - volatility
  - trading profits

Types of Trading Sessions

- In *continuous markets*, traders may trade anytime the market is open.
- In *call markets*, all traders trade at the same time when the market is called. The market may call all securities simultaneously, or it may call the securities one at time, in rotation.
- Many continuous order driven exchanges open their trading sessions with call market auctions and then switch over to continuous trading.
- Typically F&O section does not have market auction and starts continuous trading immediately when they open.
- Markets with batch execution systems arrange all trades at the same time matching orders with order precedence rules.
- The main advantage of call markets is that they focus the attention of all traders interested in a given instrument at the same time and place.
- The main advantage of continuous trading is that it allows traders to attempt to arrange their trades whenever they want.

Quote driven markets

- Dealers participate in every trader. Anyone who wants to trade has to go via dealer.
- They are called so, because dealers quote the prices at which they will buy and sell.
- NASDAQ is quote driven system in which dealer often broker trades among public traders
- These are very common. Almost all the bond and currency markets are quote driven markets

Order driven markets

- Buyers and sellers regularly trader with each other without the intermediation of dealers.
- Most order driven markets are auction markets.
- Order driven markets structures vary considerably. Some markets conduct single-price auctions in which they arrange all trades at the same price following a market call.
- Other markets conduct continuous two-sided auctions.
- They vary considerable in how they implement trading rules. Two types are *open-outcry auctions* and *rule based order matching systems*.

Hybrid markets

- Brokers actively search to match buyers and sellers in a brokered markets
- Two types of traders offer liquidity in brokered markets, *concealed traders*, *latent traders*
- These markets mix characteristics of quote-driven and order-driven markets. NYSE, NASDAQ are hybrid markets

Summary

- Markets differ most in how they arrange trades(quote driven / order driven).
- Markets differ significantly in when and where they trade(call/ continuous/physically convened).
- Markets differ in how traders negotiate with each other(screen based / oral auctions / telephone).
- Markets differ in transparency level.

Outline I

Outline II

Outline III

Introduction

- Order driven markets use trading rules to arrange their trades.
- These markets include oral auctions, single price auctions, continuous electronic auctions, and crossing networks.
- Almost all of the most important exchanges in the world are order driven markets.
- All order-driven markets use *price precedence* rules to match buyers to sellers and *trade pricing rules* to price the resulting trades.
- Variations in trading rules distinguish order-driven markets from each other.

Oral Auctions and Precedence Rules

- The largest oral market auction market is the U.S government long treasury bond futures market. This market regularly attracts 250 floor brokers.
- In an oral auction, traders arrange their traders face-to-face on an exchange trading floor.
- The first rule of an oral auction is the *open-outcry* rule. Traders must publicly express all bids and offers so that all traders can act on them. It also requires traders to express their acceptances publicly.
- In oral auctions, the primary order precedence rule is always *price priority*. The secondary precedence rules depend on the market.
- Future markets use *time precedence*. US stock exchanges use *public order precedence* and then time precedence.
- The *price priority* rule gives precedence to the traders who bid and offer the best prices

Price Priority and Time Precedence

- The *time precedence* rule gives precedence to traders whose bid or offer first improves the current best bid or offer. Traders retain their time precedence as long as they maintain their bid or offer, or until another trader accepts it. Afterward, anyone may bid or offer at the new price, and all traders at that price will have equal standing.
- Time precedence is meaningful only when the minimum price increment / tick size is not small.
- Time precedence is not self-enforcing rule and hence traders having time precedence should defend it.
- Exchanges adopt public order precedence rule to give public traders more access to their markets and to weaken the informational advantages that floor traders have.
- Trade pricing rule - Every trade takes place at the price proposed by the trader whose bid or offer is accepted. Economists call it *discriminatory pricing rule*

Rule-based Order-Matching Systems

Procedure

Every rule-based order matching system uses the same sequence of procedures when attempting to arrange trades. They first match orders using their order precedence rules. They then determine which matches can trade. Trades will occur only if at least one buy order terms acceptable to at least one seller. Finally, they price the resulting trades using the trade pricing rules.

Order precedence rules

- Primary precedence rule - price priority.
- Secondary precedence rule.
  - Time precedence.
  - Floor time precedence.
  - Display precedence.
  - Size precedence.
- Systems that rank orders based only on price priority and strict time precedence are *pure price-time precedence systems*.

Trade pricing rules

- Single price auctions use *uniform pricing rule*.
- Continuous two-sided auctions and a few call markets use *discriminatory pricing rule*.
- Crossing networks use *derivative pricing rule*.

Uniform Pricing Rule and Single Price Auctions

- Most markers open their trading sessions with a single price call market auction. These markets use a single price call market auction to restart trading following a halt.
- In a single price auction,all traders take place at the same clearing price
- The last match that leads to a feasible trade determines the clearing price
- Single price auctions maximize the volume of trade by setting the clearing price at the price where demand equals supply.
- The *trader surplus* is the difference between trade price and seller's/buyer's valuation of the item.
- The single price auction maximizes the benefits that traders derive from participating in an auction.

Discriminatory Pricing Rule and Continuous Two-Sided Auctions

- Continuous rule-based order matching systems use discriminatory pricing rule to price their trades.
- Under the discriminatory pricing rule, the limit price of the standing order determines the price of each trade.
- For a given set of standing orders, large impatient traders prefer the discriminatory pricing rule to uniform pricing rule.
- Limit order traders tend to issue more aggressively priced orders when trading under the uniform pricing rule than under the discriminatory pricing rule.
- Continuous markets cannot enforce uniform pricing. Large traders can split the orders and submit them thus subverting uniform pricing rule.
- To effectively switch to a uniform pricing rule, continuous trading markets must stop trading.

Discriminatory Pricing Rule vs. Uniform Pricing Rule

- Uniform pricing rule creates maximum trader surplus but the price to pay is the *immediacy*.
- Discriminator pricing rule produces less trade surplus but it allows traders to trade when they want to trade.
- For a given order flow, the single price auction will trade a lower volume than the continuous markets. Volume is a poor measure of the ability of a market to produce trader surplus.

Derivative pricing rule and Crossing Networks

- Crossing networks are the only order-driven markets that are not auction markets
- All trades take place at prices determined elsewhere.
- Crossing networks obtain their *crossing prices* from other markets that trade at the same instruments
- Since the prices are derived elsewhere, crossing networks use *derivative pricing rules*
- Crossing networks do not discover prices as auction markets do. They only discover whether traders are willing to buy or sell at the crossing prices
- Since crossing networks do not choose market clearing prices, they invariably have excess demand or supply at their crossing prices.

Crossing networks issues

- Crossing networks work well only if traders will trade at their crossing prices. Traders must trust the crossing prices.
- Successful crossing networks take their prices from markets that produce credible prices.
- Problems with Derivative pricing.
  - Stale prices - Adverse selection problem.
  - Price manipulation - Networks use random times in a time window for selecting crossing prices.

Current Issues in market structure

- Should oral auctions covert to automated auctions ?
- Should crossing networks exist ?
- Should crossing networks be integrated with the markets from which they derive the prices ?
- Should markets organize single price auctions and should they encourage traders to participate in them ?
- How large should the minimum price increment be ?

Summary

- Order-driven include oral auctions, single price auctions, continuous rule-based auctions and crossing networks.
- These markets use order precedence rule to match buyers to sellers and trade pricing rules to price the resulting trades.
- The first precedence rule at all markets is price priority.
- Various second precedence rules then follow - time/display/size/public order.
- Trade pricing rules vary by market types.
- Continuous trading auction markets use discriminatory pricing rule and this favor large liquidity demanding traders.
- Crossing networks use derivative pricing rule and this favors well-informed traders over uniformed traders.

Outline I

Outline II

Outline III

Introduction

- Brokers are agents who arrange trades for their clients. They search for traders who are willing to trade with their clients; they represent their clients at exchanges; they arrange for dealers to fill their clients orders; they introduce their clients to electronic trading systems; and they match their clients buy and sell orders
- Activities where broker finds a place
  - Order flow markets
  - Block markets
  - New and seasoned offerings
  - Mergers and Acquisitions
- Brokers take care of credit risk involved in clearing and settlement problem.
- Brokers provide access to exchanges.
- Brokers provide access to dealers.
- Brokers represent limit orders.

The Structure of a Brokerage firm

- Front office operations.
  - Sales and Trading department.
  - Customer service agents
- Backoffice operations.
  - Accounting systems.
  - Market data and Order routing systems.
  - Credit management.
  - Corporate reorganizations.
  - Compliance.
- Proprietary operations.

The Principal Agent Problem

- Agents are supposed to do what their principals want them to do, but the agents often do what the agents want to do.
- Performance measurement to a certain extent solves this problem for the clients.
- *Best execution* measurement becomes slightly tricky.
- Dual trading problem - When brokers acts as dealers also, the principal agent problem aggravates.
- Order preferencing agreements might go against the best execution standard implicitly desired by clients.
- Dealers and brokers involved in order-preferencing arrangements are aware of the conflict of interest. Brokers generally demand, and dealers generally promise, certain level of service.

Summary

- Brokers help arrange and settle trades for their clients.
- Brokers and exchanges compete with each other to arrange trades.
- Cash management is significant source of profits for many brokers.
- The principal-agency problem can be a significant problem in the brokerage industry because quality of service is hard to measure.
- Soft commissions allow institutional funds to use trading commissions to finance their expenses and thereby report lower expense ratio
- Many aspects of brokerage operations and of clearing and settlement mechanisms reduce the potential for fraud among traders.

Outline I

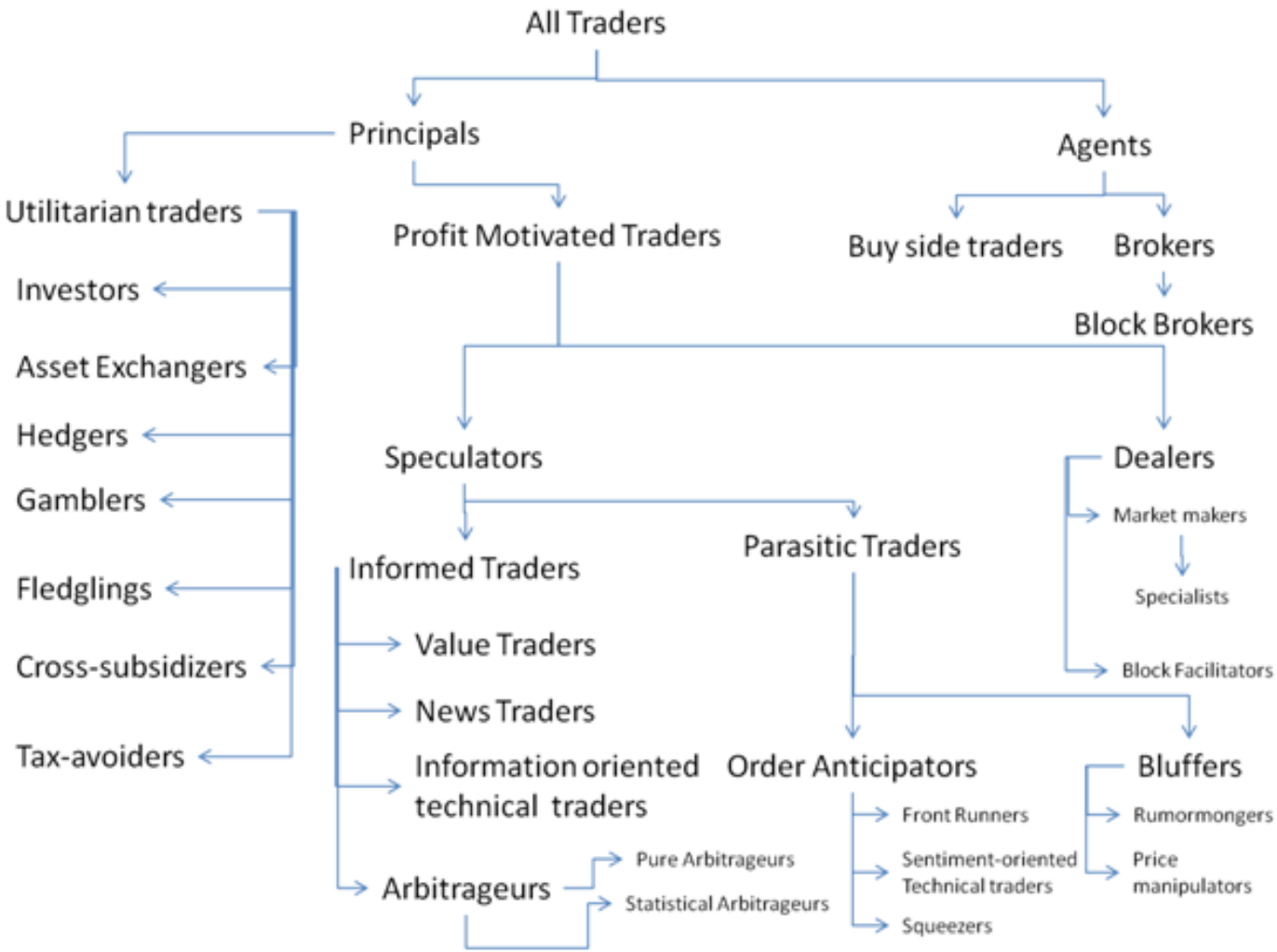
Outline II

Outline III

Introduction

- I think this is one of the chapters that is the highlight of the entire book. By classifying traders in to various categories, one gets a better idea of the market behavior.
- The key message of this chapter is that markets behave in reaction to the interactions between various types of traders.
- The first level of classification is
  - Profit-motivated traders - They trade only because they rationally expect to profit from their trades
  - Utilitarian traders - They trade because they expect to obtain some benefits from trading besides trading profits
  - Futile traders - They believe that they are profit-motivated but they are not.

Taxonomy of traders



Utilitarian Traders

- *Investors and Borrowers* : Move money forward or backward in time.
- *Asset Exchangers* : To exchange assets that they own for other assets that are of greater immediate use to them.
- *Hedgers* : To reduce their exposure to substantial financial risk.
- *Gamblers* : Provides entertainment value.
- *Fledglings* : Trade to learn whether they can trade profitably.
- *Cross subsidizers* : Trade to produce commission revenues for their brokers in return for various services that they otherwise might purchase themselves.
- *Tax Avoiders* : Trade to take advantage of tax loopholes in order to minimize their taxes.

Profit Motivated traders

- *Speculators* : Speculators predict future changes from information that they collect, analyze and in some cases produce. Two types of traders speculate.
  - *Informed traders* trade on information about fundamental values.
  - *Parasitic traders* profit from the traders that other traders do.
- *Dealers* : Dealers make themselves available so that other traders can trader when they want to trade. They supply liquidity.
  - *Market makers* provide liquidity on demand in small quantities.
  - *Block facilitators* provide liquidity to large traders.

Summary

- Utilitarian traders trade because they expect to obtain some benefits from trading besides profits.
- Investors and Borrowers move money through time.
- Hedgers exchange risks.
- Asset exchangers trade to obtain assets of greater value to them than the assets that they tender.
- Gamblers trade for entertainment.
- Profit-motivated traders trade only because they expect to obtain profits.
- Speculators trade on information about future price changes.
- Dealers profit from offering liquidity to other traders.
- Futile traders believe that they are profit-motivated traders, but they cannot trade successfully enough to profit in the long run.
- Pseudo-informed traders trade on stale information.

Outline I

Outline II

Outline III

Questions to Ponder

- Should regulators consolidate all orders in to a central limit order book ?
- Should markets use quote-driven or order-driven systems ?
- Should regulators allow internalization and preferencing ?
- Should regulators impose price limits or halts on trading ?
- Should trading use floor-based or screen-based systems ?
- Should dealers yield to their customers ?
- Should regulators require that markets be linked electronically ? How fast should they be ?
- What trading hours should market adopt ?
- Who should be able to see the limit order book ?
- Who owns market data ?
- What securities and contracts should regulators allow exchanges to trade?

Market Structure impact

Impact

Any change in the market structure will have significant economic effects on our markets. Trading rules, Trading systems, and Information protocols all affect

- liquidity
- transaction costs
- volatility
- quality of prices
- distribution of trader profits

Opinions galore- Whose actions impact the structure ?

- Legislators.
- Regulators.
- Govt administrators.
- Judges.
- Exchanges, brokers, clearing agencies and information providers.
- Issuers.
- Traders.
- Investors.
- Leaders of trade organizations, public interest groups and watch dog agencies.

Framework

Welfare economics

Debate generally is most productive when conducted within a framework of making decisions. Welfare economics provides such a framework for making decisions. It is the branch of economics that considers how we should organize our economy. It usually involves two kinds of analysis

- Positive economic analysis - Analysts use economic theory and empirical evidence to predict the consequences of various economic policies.
- Normative economic analysis - Analysts argue for specific economic policies. The arguments are qualitative in nature.

Economic benefits that markets produce

- Private benefits of Trading - These accrue directly to traders.
  - Utilitarian traders trade because they hope to obtain some benefit from trading besides profits.
  - Profit motivated traders trade only because they expect to profit from trading.
  - Since trading is a zero-sum game, markets exist only if there are Utilitarian traders in the market.
- Public benefits of trading - These accrue to public through externalities
  - *Public benefits of Informative prices* : Production and allocation decisions are fair, Capital allocation in the primary markets, Secondary markets solve the manager allocation problem.
  - *Public benefits of Liquid markets* : Hedging, risk sharing, attracting Utilitarian traders in to the market.

Some objectives for evaluating markets

- Public policy should first promote the private interests of those traders whose needs cause markets to exist in the first place. These are Utilitarian traders.
- Public policy should strive to maximize the public benefits we all obtain from liquid markets that produce informative prices.
- Public policy should support the interests of profit-motivated traders only when necessary to purse the above two objectives.
- Public policy should be hostile to the efforts of profit-motivated traders who design trading strategies to exploit other traders(HFT players).

Summary

- Profit-motivated traders cannot profit from each other if they trade only with each other.
- Markets ultimately exist only because Utilitarian traders benefits from trading.
- Markets produce information used in production decisions and allocation decision.
- Informative primary market prices help ensure that only the most promising projects receive new capital.
- Informative secondary market prices help allocate the best managers to existing capital.
- Many schemes that investors use to motivate their managers work best when secondary markets are highly informative.
- The public benefits of the economy of well-functioning markets are largely responsible for the prosperity of market based economies.
- Most people believe that markets work best when transaction costs are low and prices are informative.

Outline I

Outline II

Outline III

Introduction

- Informed traders are speculators who acquire and act on information about the fundamental values.
- Informed traders include
  - Value traders
  - News traders
  - Information oriented technical traders
  - Arbitrageurs
- The *market value* of an instrument is the price at which traders can buy or sell the instrument. The *fundamental value* is the true value of the instrument
- Understanding informed trading helps in understanding whether prices are informative. A price is informative when it is near its corresponding fundamental value.
- *Perfect foresight values* depend on all the current and future information about values. Fundamental values are not perfect foresight values.

Informed Traders

- Informed traders compare their value estimates with the corresponding market prices. Depending on whether the instrument is undervalued or overvalued, traders buy or sell the assets.
- Informed traders make prices informative.
- Styles of informed trading
  - Value traders estimate the entire fundamental value of an instrument by using all valuable information.
  - News traders estimate only the changes in fundamental values. They predict how fundamental values will change in response to new information.
  - Information oriented technical traders identify price patterns that are inconsistent with prices that fully reflect fundamental values.
  - Arbitrageurs estimate relative differences in fundamental values.
- To avoid estimation errors, large value traders usually have pyramid shaped organizations.
- News traders often poorly estimates the sizes of the changes.

Information oriented technical traders

- Information oriented technical traders attempt to predict the future course of prices by identifying recurrent themes. Either they trade on the mistakes done via value traders or front run the uninformed traders or supply liquidity to uninformed traders. When they supply liquidity they act as dealers.
- Patterns arise when informed traders make systematic mistakes or when uninformed traders have predictable impacts.
- Commonly look at pirce volume charts. Not effective as we are biologically programmed to see where there are no patterns.. Misclassifying a random pattern in the nature as some pattern is a Type I error. Since the downside to it was not high, our brain evolved to see patterns when there are none.

Competition Trading Profits and Informative prices

- Profits of informed traders depend on their ability to predict future prices and on the impact their trading has on prices.
- Precision and orthogonality are the key to consistent profits.
- Market Paradox Uninformed traders move markets, so do informed traders. If the prices are quite informative, informed trading will not be profitable. But if informed trading is not profitable, informed traders will not trade and prices will not be informative
  - Paradox Resolution - Informed traders make prices informative but prices are not always informative
- Informed traders cannot survive in the market without the presence of Utilitarian traders and uninformed traders

Summary

- Informed traders make prices informative. They move prices closer to their estimates of value and thereby make prices more informative
- Four types of informed traders try to profit from information about fundamental values.
  - Value traders estimate fundamental values by using all available information.
  - News traders estimated changes in fundamental values from new information.
  - Information oriented technical traders identify patterns that are inconsistent with prices which reflect fundamental values
  - Arbitrageurs estimate relative differences in fundamental values.

Summary

- Informed traders make markets efficient.
- Informed traders compete with each other to profit from acquiring and acting upon information. Prices become more informative when informed traders push prices towards values. Prices become less informative when values change or when uninformed traders move prices. News traders tend to make money when values change. Value traders tend to make money when uninformed traders move prices.
- Traders who intend to speculate should carefully consider why they expect to be successful.

Outline I

Outline II

- Order Anticipators
- Bluffers and Market Manipulation

5 Liquidity Suppliers
- Dealers
- Bid/Ask Spreads
- Block traders
- Value Traders
- Arbitrageurs
- Buy side Traders

6 Origins of Liquidity and Volatility
- Liquidity
- Volatility

7 Evaluation and Prediction
- Liquidity and Transaction cost measurement

Outline III

Introduction

- Order anticipators are speculators who try to profit by trading before other traders trade.
- They make money when they correctly anticipate how other traders will affect prices or when they can extract option values from the order that other traders offer to the market.
- Who are they?
  - Front runners.
  - Sentiment oriented technical traders.
  - Squeezers.
- Order anticipators are parasitic traders. They profit only when they can prey on other traders.
- Trading by order anticipators often makes prices more volatile and markets less efficient.

Front runners

- Front runners collect information about trades that other traders have decided to arrange. They then trade before those traders complete their trades
- Front running strategies depend on the type of trader that they front run.
  - *Front running Aggressive traders* - Legal way to do is to infer from the order flow and take away liquidity from aggressive traders.
  - *Front running Passive traders* - Use quote matching strategies to extract option values from passive limit orders.
- Front runners make prices more or less informative based on whether they front-run informed traders or uninformed traders.
- Long term effect is that they drive informed traders out of the market and make prices less informative
- Front runners generally make the market less liquid.

Sentiment Oriented Technical traders

- These traders try to predict the trades that uninformed traders will decide to make. They then try to trade before the uninformed trader does.

Beware of Value traders

Sentiment oriented technical trading can be quite risky because it involves front running uninformed traders. The impact that uninformed traders have on prices often move prices away from their fundamental values. Such movements attract value traders to the other side of the market. If the value traders trade aggressively, they may drive prices back towards fundamental values, and sentiment oriented technical traders then will lose. Hence these traders must be skillful in closing out their positions.

- To avoid value traders, these traders trade *hard to value* instruments.
- These traders make the prices less informative and market less liquid.

Squeezers

- Squeezers try to monopolize one side of a market so that anyone who must liquidate a position on the other side must negotiate with them. If they successfully corner the market, they can demand any price.
- Squeezers are order anticipators but differ in a particular way - they deliberately design situations that force other people to trade with them.
- Squeezer can employ *gunning the market* strategy to push prices up or down to active stop orders. The stop orders then accelerate those price changes. The manipulators close their positions at a profit by trading with the stop orders.

Summary

- Order anticipators profit when they can exploit information about other traders orders.
- Since they do not offer liquidity or make prices more informative, order anticipators are parasitic traders.
- Front runners front-run orders that other traders have submitted.
- Quote matchers front-run traders who offer liquidity.
- Sentiment-oriented technical traders anticipate the orders that other traders will submit.
- Squeezer anticipate traders that other traders must make.
- Traders who are aware of stop orders may manipulate them.

Outline I

Outline II

- Order Anticipators
- Bluffers and Market Manipulation

5 Liquidity Suppliers
- Dealers
- Bid/Ask Spreads
- Block traders
- Value Traders
- Arbitrageurs
- Buy side Traders

6 Origins of Liquidity and Volatility
- Liquidity
- Volatility

7 Evaluation and Prediction
- Liquidity and Transaction cost measurement

Outline III

Bluffers and Market Manipulation

- Bluffers are profit-motivated traders who try to fool other traders into trading unwisely.
- Bluffers use two techniques to fool their victims - *Rumormongers*spread false information, *Price manipulators* arrange trades at prices, volumes and times that they hope will change people's opinions about instrument values.
- Value traders are the one who spoil bluffer's plans. If they are on the opposite of the bluffer, then they provide liquidity and profit. If they are on the same side of bluffer, they take the liquidity that might make a bluffer profitable, if his bluff pans out.
- Liquidity suppliers can lose money if they do not adjust prices up or down at the same rate per quantity traders, regardless of whether the quantity traded is large or small.
- Bluffing is not profitable when the price impact per unit traders is the same for buys and sells.
- Momentum traders must be careful of bluffers.

Outline I

Outline II

Outline III

Introduction

- Dealers buy from and sell to their clients.
- All dealers face the same problems regardless of what they trade. They must set prices, they must market their services to acquire clients, they must manage their inventories and they must be careful that they do not trade with informed traders.
- Dealers in financial markets supply liquidity. They generally do not know whom they are going to sell the stock that they have bought and whom they are going to buy the stock that they have sold.
- Dealers assume significant risks when they trade.
- Dealers are passive traders. Since passive traders do not control the timing of their traders, they must be very careful about how they offer to trade and to whom they offer to trade

Who are dealers ?

- Profit motivated traders who allow other traders to trade when they want to trade. The liquidity service they sell is immediacy.
- Dealers profit when they buy from impatient traders and sell to impatient traders.
- Any passive traders issuing a limit order is offering liquidity.
- Dealers are known by many names, scalpers, day traders, locals or market makers.
- In addition to offering liquidity, dealers also speculate. In many markets that are competitive, the dealers cannot survive by merely offering liquidity. They must speculate.
- Dealers who speculate besides offering liquidity are called *position traders*. Dealers who exclusively make money by offering liquidity are called *spread traders*.

Dealer Spreads

- The realized spread is the difference between the prices at which dealers actually buy and sell. Realized spreads are usually smaller than quoted spreads because dealers often trade at better prices than they quote.
- Dealers who quote both bid and ask quote a two-sided market. Their quotes make a market.
- Dealers who quote only one side quote a one-sided market.
- The inside spread is the difference between highest bid and the lowest ask. The inside spread is usually much narrower than the average spread.
- Dealers who offer firm quotes must trade at their quoted prices. This is not the case for soft quotes.

Trading with dealers

- Many institutional traders trade directly with dealers as they do not charge commissions. Instead they incorporate in to the net price.
- When a broker sends an order to a specific dealer, the broker *preferences* the order to that dealer.
- Wholesales are dealers who trade primarily with traders introduced by retail brokers.
- Dealers must attract order flow in order to trade profitably.
- The most important decisions that dealers make concern their quotations. They must decide where to place their bid and offer prices, what the spread between them should be, and what sizes they will trade at their bid and offer.

Dealer Inventories

- The position that dealers have in the instruments they trade are their inventories.
- *Target inventories* are the positions that dealers want to hold. Dealer inventories are in balance when they are near their target levels and out of balance otherwise.
- A *dealers inventory imbalance* is the difference between the actual inventory position and his target inventory position.

Inventory control

- Dealers control their inventories primarily by influencing the buying and selling decisions of their clients.
- When dealers want to decrease inventories, they decrease their bid ask. When dealers want to increase inventories, the increase the bid ask levels.
- Dealers must control their inventories to trade profitably. Large positions are difficult to finance. They expose dealers to *inventory risk*.
- Dealers set prices so as to obtain two sided order flows. The search for prices that produce a two sided order flow is called *price discovery process*.
- Dealers try to discover the prices which ensure buying and selling quantities are just in balance. In a sense they are trying to determine *market values*.

Inventory Risk

- If future prices are independent of their inventory imbalances, the risk is a diversifiable inventory risk. If they are inversely correlated, the risk is an adverse selection risk.
- Dealers face *adverse selection risk* when they trade with informed traders. The risk is not benign.
- Informed trading causes dealer inventories to diverge from their target values.
- The losses from trading with informed traders are called adverse selection losses because informed traders select the side of the market that is adverse to dealer profits.
- Dealers can avoid adverse selection risk by shunning away from informed traders. But it is not always possible.
- Most dealers devote much attention to discovering the market values that produce two-sided order flows than discovering fundamental values.

Dealer response to adverse selection

- Raise or lower bid ask prices depending on whether the informed trader has bought or sold stocks.
- Avoid informed traders by setting bid ask close to fundamental values. Rarely do they know these values and hence must infer from the orders, prices and quotes.
- In general dealers cannot infer whether they are trading with an informed trader or not. Hence they monitor the order flow carefully and then take a decision.
- Dealers are often proactive. The probability that the next trader is an informed trader is built in to the bid ask quotes. They base their ask price on their estimate of fundamental values conditional on the next trader is a buyer. They base their bid price on their estimate of fundamental values conditional on the next trader is a seller.
- Dealers quote wide spreads for big orders as they assume that big orders are generated by informed traders.

Pricing mistakes of a dealer

- Two kinds of mistakes when adjusting their quotes.
- They may fail to adjust their quotes adequately when they have traded with informed traders.
- They may adjust their quotes too much, thinking they have traded with informed traders

Summary

- Dealers sell immediacy the ability to buy or sell quickly when you want to- to their clients.
- Bid ask spread is the price of liquidity they sell. Dealers sell immediacy the ability to buy or sell quickly when you want to- to their clients.
- Bid ask spread is the price of liquidity they sell.
- Dealers P&L depends on how quick he turns over the inventory.
- Two sided order flow keeps the inventory at the target level.
- Dealers lose to informed traders, who can predict the future price movement.
- Dealers adopt a number of methods to avoid adverse selection risk.
- When setting the bid ask, they estimate based on a conditional probability model .
- The adverse selection component increases with order size.
- Dealers learn about values from their order flow and adjust their quotes accordingly.

Outline I

Outline II

Outline III

Introduction

- The bid/ask spread is the price impatient traders pay for *immediacy*.
- Impatient traders buy at the ask price and sell at the bid price. The spread is the compensation dealers and limit order traders receive for offering immediacy.
- Optimizing order submission strategies entails knowing the determinants of bid/ask spread.
- Spreads too narrow might drive dealers out of business.

Dealer Bid/Ask Spreads

- Spreads can't be too thin because there isn't much revenue in turning over the inventory. They can't be too wide because then no one would trader with them
- Revenues depend on effective spreads on the round trip trades, how often they churn their inventory and how much they lose to informed traders
- Transaction Spread component is the part of bid/ask spread that compensates dealers for their normal costs of doing business.
- Adverse selection spread component is the part of the bid/ask spread that compensates dealers for the losses they suffer when trading with well-informed traders. This component allows dealers to earn from uninformed traders what they lose to informed traders

Dealer Bid/Ask Spreads

- *Transaction cost component* This is called transitory spread component because price changes associated with this component are transitory. Transitory price changes regularly reverse. This bouncing between bid/ask is termed as the *bid/ask bounce*.
- *Adverse selection spread component* This is temporary component as the price changes due to adverse selection spread component are permanent in the sense that they do not systematically reverse
- From an information perspective, the adverse selection spread component is the product of pricing error and probability of trading with an informed trader
- The decomposition of the bid ask spread is usually in two components, first is a *mean reverting component*, i.e. transaction cost component. The second component is the *random walk* component which is adverse selection spread component

Adverse Selection and Uninformed Traders

- Uninformed traders lose to informed traders regardless of whether they trade with limit or market orders.
- When uninformed traders submit limit orders, their orders fill quickly if they overprice their bids or under price their offers. The outcome is *uninformed trader regret*. When limit order traders and informed traders compete on the same side of the market, their limit orders do not get filled. Since informed traders get their forecasts right, the price moves away from the limit orders submitted and thus uninformed traders do not get their orders filled. Thus they regret using limit orders.

Adverse Selection and Uninformed Traders

- Uninformed traders who use market orders ensure that they trade, but they still suffer the effects of *adverse selection*. Since dealers widen their spreads to recover from uninformed traders what they lose to informed traders, uninformed market orders trade at a wider bid/ask spreads than they would if there were no informed trading.
- Uninformed traders lose to informed traders regardless of how they trade.

Factors driving Equilibrium spreads

- Degree of information asymmetry among traders.
- Time to cancel limit orders.
- Volatility.
- Limit order management costs.
- Value of trader time.
- Difference between limit and market order trade commissions.
- Degree of trader risk aversion.

Public traders vs Dealers

- Public limit order traders do not have the same business costs that dealers have. They therefore can quote more aggressive prices.
- Dealers however can see more of order flow and hence can engage in speculation, employ quote matching, order anticipation and trade timing strategies.

Cross sectional spread predictions

- The primary spread determinants are information asymmetries among traders, volatility and utilitarian trading interest.
- Asymmetric Information : When traders are asymmetrically informed, liquidity suppliers set their prices far from the market to recover from uninformed traders that they lose to well-informed traders.
- Volatility : Volatile instruments should have wide spreads. Spreads should be widest when limit order traders and dealers cannot easily adjust their orders.
- Volatility has a strong secondary effect on spreads because it is a good proxy for asymmetric information. The adverse selection component will be large for volatile instruments.
- Utilitarian trading interest The more the interest, the less the spreads. Adverse selection spread component is small when utilitarian trading is strong. Utilitarian traders reduce the information in the order flow.

Asymmetric information proxies

- Information Disclosure Rules.
- Market condition reports.
- Analysts.
- Information vendors.
- Major commodity contracts.
- Diversified Portfolios.
- Diversified stocks.
- Established vs Emerging industries.
- Age of the firm.
- Insider trading rules.

Proxies for Utilitarian trading interest

- Trading activity.
- Firm Size.
- Risk replication.
- Volatility.

Summary

- Bid ask spreads depend on numerous factors. The most important are asymmetric information, volatility and utilitarian trader interest.
- In a market with informed traders, the dealers usually set the spreads wider so as to protect from adverse selection.
- Higher volatility implies higher spreads.
- Utilitarian trader interest ultimately determines market trading activity.
- Actively traded instruments have narrow spreads because dealers can spread their costs of doing business over more trades.
- Measures of market activity such as trading volumes, trading, frequency vary inversely with spreads.

Summary

- Factors such as firm size, hedging suitability and volatility are inversely correlated to spreads.
- Adverse selection helps us understand why uninformed traders lose whether they submit limit or market orders. Uninformed traders thus lose however they trade.
- Asymmetric information is extremely important in trading.
- When all traders are identical, limit order strategies produce better prices on average than market order strategies because traders value their time and do not like risk failing to trade.
- On average limit order strategies will execute at slightly better prices than market order strategies because market order traders must compensate limit order traders for the additional management time, price risk and timing options associated with limit order strategies.

Outline I

Outline II

Outline III

Introduction

- Block trades result from orders that are too large to fill easily using standard trading procedures. Such orders generally demand more liquidity than is normally available at exchanges or in dealer networks.
- Block traders include *block brokers* and *block dealers*.
- Block dealers arrange block trades when they fill their clients large orders.
- Block brokers arrange block trades when they find other traders who are willing to fill their clients orders.
- Trades are arranged in the *upstairs block market*.
- Traders who initiate block traders are called *block initiators*.
- Traders who supply liquidity are called *block liquidity suppliers*.
- Block trades represent a small fraction of total trades but volume wise they represent a significant portion of trading volume.

What's a block trade?

- Orders that represent more than a day's normal trading volume are block trades.
- Exchanges designate block trades based on the size.
- Exchanges set aside specific trading session for block trades.

Block trading problems

- Latent Demand Problem
  - Traders who are willing to trade if asked, but who have not yet issued trading orders, have latent trading demands. Block traders must discover the latent demands of responsive traders.
  - Traders who are willing to trade but do not initiate their traders are responsive traders.
  - Block initiators give price concessions to block liquidity suppliers so as to encourage them to trade.

- *Price discrimination problem* : Block initiators have trouble finding liquidity because block liquidity suppliers are afraid that they will price discriminate among them. Block liquidity suppliers do not want to be the first to offer liquidity to a large traders only to see prices move against them when the large trader continues to trade.
- *Asymmetric Information problem* : Block initiators have trouble finding liquidity because block liquidity suppliers suspect that block initiators are well informed.

Order Exposure problem

- When looking for liquidity, block traders should be careful about disclosing the order size. Traders who know about impending blocks often use that information when trading, to the disadvantage of the block traders.
- Block traders shop the block when they expose their orders while searching for liquidity.
- Widely shopped blocks hang over the market as information about them leaks out.
- Block traders spoil their market when prices run away from their orders because they have foolishly exposed them.
- Strategies clever traders pursue when a block is hanging over the market
  - Front running trade on the same side before the block trades.
  - Same side traders accelerate their intended trades.
  - Opposite side traders delay their intended trades.

Sunshine trading

- Traders who announce to the market who they are, what they intend to do, the full extent of their orders, and whey they intend to trade are sunshine traders.
- Sunshine trading generally does not work well because it is hard to determine whether sunshine traders are indeed uninformed traders and whether they have indeed uninformed traders and whether they have indeed revealed their trading interests.
- Also by exposing their intended trades, sunshine traders have higher transaction costs, thanks to front runners.

The Upstairs market

- The upstairs market serves large traders who cannot convey credible information about their trading motives and intentions to traders in the regular market.
- Block dealers fill large client orders when they trade for their own accounts. Because they take their client positions, block dealers are also known as block positioners. They are also called block facilitators.
- Block brokers help block initiators identify traders who fill their orders. Since they often must assemble many traders to fill a large order, block brokers are also known as block assemblers.
- Dual traders, i.e. traders who act as brokers and dealers can better serve their clients than can pure brokers or pure dealers.
- Rules that require full and timely trade reporting favor block brokers over block dealers.

Why are block sells more than block buys ?

- Block sellers can sell their block to any interested traders. Block buyers generally can buy large blocks only from traders who own the securities in which they are interested.
- Block sellers often credibly reveal the full size of the orders if they cannot sell short. Few buyers operate under such constraints.
- Sellers can offer more convincing stories about why they are uninformed than buyers.

Regulation between block markets and regular markets ?

- Regulators must ensure that neither market has an negative impact on the other.
- What if there is a price priority in the normal market? How does the regulator handle this?
- When should the block traders disclose their trades?
- What about the possible price ranges that a security can trade in the block market as compared to the regular market?
- What about the timings for the block market?
- Since block trading generally involves trades arranged away from the exchange, futures markets historically have had either no block trading procedures .

Summary

- Block traders are trades that are too large to arrange easily using normal trading methods
- Four problems make block trades costly
  - Block liquidity suppliers may be hard to find.
  - Block initiators are reluctant to advertise their interest for the fear of spoiling the market.
  - Block liquidity suppliers fear that block initiators will try to price discriminate.
  - Block liquidity supplier fear that block initiators may be well informed.

Summary

- Block traders solve these problems by keeping track of who might be interested in trading, by selectively exposing block orders, by determining the full size of their clients orders, and by determining whether their clients are well informed.
- Block trading works well only when traders know each other well.
- Block traders must be careful when they agree to help a block initiator find liquidity. They should decide whether it is better to act as block broker or block dealer or both.

Outline I

Outline II

Outline III

Introduction

- Value traders are speculators who form opinions about instrument values by using all information available to them.
- Value traders are ultimate suppliers of liquidity.
- Dealers often trade with value traders when they want to restore their target inventories. Dealer therefore have mixed feelings about value traders. On the one hand, they compete with them to provide liquidity. On the other hand, they depend upon them for liquidity when they are unwilling to carry large inventory problems.

Value traders supply liquidity

- Value trading is profitable when prices differ from fundamental value in two ways
  - When new information causes fundamental value to change (news traders profit)
  - When uninformed traders push price away from fundamental value(value traders profit)
- Value traders indirectly supply liquidity to the uninformed liquidity suppliers through the intermediation of the dealers.
- When uninformed traders cannot change prices substantially, the market is resilient to trading.
- Value traders make markets resilient by standing ready to trade when prices move away from fundamental values.

Outside spreads and its determinants

- The prices at which a value trader is willing to trade defines his or her outside spread.
- Value traders face two serious risks when they trade : adverse selection and winner's curse.
- *Adverse selection*: Value traders are subjected to adverse selection risk because they offer liquidity in reponse to other traders who demand it. They must be particularly careful that they do not trader with news traders
- The outside spread of value traders is typically more than dealer's spread.
- Value traders and news traders often profit at each other's expense. Value traders lose to news traders when they mistake news traders for uninformed traders. News traders lose to value traders when they do not realize that the information upon which they are trading is already in the price.

Winner's curse

- Can affect buyers and sellers.
- Buyers suffer the winner's curse when they pay more for an item than it is worth.
- There is no winner's curse in two sided single auction market.
- In continuous markets though, the process of aggregation is sequential and not simultaneous. Hence the traders who significantly over estimate or underestimate bear losses due to winner's curse.

Summary

- Value traders supply liquidity to uninformed traders whose trading pushes prices away from fundamental values.
- Value traders are liquidity suppliers of last resort.
- Since they allow uninformed traders to trade large positions, they supply depth.
- Value traders can afford to take large positions only by being the best informed traders in the market.
- They suffer from adverse selection and winners curse and hence widen their spreads.

Outline I

Outline II

Outline III

Types of arbitrage

- Pure arbitrage (Mean reverting spreads).
  - Delivery arbitrage.
  - Shipping arbitrage.
  - Conversion arbitrage.
- Speculative arbitrages (Non stationary spreads).
  - Maturity spreads.
  - Credit spreads.
  - Calendar spreads.
  - Yield curve spreads.
  - Risk arbitrage.

Arbitrage risks

- Implementation risk.
- Basis risk.
- Model risk.
- Carrying cost risk.
- Unexpected costs of carry.
  - Unexpected price increase.
  - Slow convergence.
  - Unexpected Buy-ins.

Outline I

Outline II

Outline III

Order Submission Strategy

- Order submission strategy is the most important determinant of execution quality that traders control.
- The following are some of the decision elements
  - Market order or Limit order ?
  - Whether to show their full interest or hide it ?
  - Whether to break up their orders and spread them over time or bring their whole orders to market at once ?
  - Whether to employ single broker or use multiple brokers to hide their total interest ?
  - Whether to trader in one market or in many markets ?
  - How to defend against parasitic trading strategies that order anticipators may exercise against them?

Market vs. Limit Orders

- Bid ask spread is a key factor that decides whether a trader uses market order or limit order.
- Wide spreads make it attractive to offer liquidity, Narrow spreads make it attractive to take liquidity
- The prices at which traders place their limit orders depend on how they value the trade-off between *execution price* and *execution probability*
- Traders often acquire the relation between the limit order prices and execution probability using econometric models.
- Numerous vendors sell access to optimized order generators that suggest order strategies based on current market conditions.

Order Exposure Decision

- Benefits of Exposure.
  - Exposure may attract traders with *latent trading interest*.
  - Attract liquidity from reactive traders.
- Costs of Exposure.
  - Exposure may reveal trader's motives.
  - Exposure may reveal future price impacts.
  - Exposure may reveal valuable trading options.

Defensive strategies

- Evasive strategies.
  - Identify the best sequence of traders to whom to display interest.
  - Use order indications at various exchanges.
  - Break the orders in to smaller sizes.
- Deceptive strategies.
  - Make a small trade on the opposite side.
  - Cancel order that they want to fill so as to create uncertainty.
- Offensive strategies.
  - Sting strategy.

How markets help traders control exposure costs ?

- Markets can reduce front running costs by adopting a time precedence rule to make it impossible for traders to trade before a standing order at the same price. A large minimum price increment then would make front running expensive.
- Markets can protect large traders by allowing them to submit undisclosed orders. These facilities allow large traders to make firm offers to trader that other traders can discover only by committing to trade with them.
- Control front running frauds.
- Sometimes allowing delayed trade reporting for some types of traders is a good measure to control exposure costs.

Outline I

Outline II

Outline III

Liquidity

- Liquidity is the ability to trade large size quickly, at low cost, when you want to trade it. It has three elements; *immediacy*, *size*, *width*.
- Everyone (Traders, Exchanges, Regulators) likes liquidity.
- Everyone (Dealers, Impatient traders, limit order traders, speculators) has some affect on liquidity.
- Surprisingly (given its importance), liquidity means different things to different people. The confusion is mainly due to many dimensions of liquidity.
- Liquidity is the object of *bilateral search*, in which buyers and sellers look for each other.
- Measuring liquidity is one of the key tasks as a trader, dealer, market maker, broker, regulator. Hence one of the primary objectives of the book is to make the reader understand liquidity.

The Search for Liquidity

- In a *Unilateral search*, you actively search for a good match - a good price, for example. The main decision that you must make is when to stop the search. The general rule is to continue searching as long as the expected benefit from an additional inquiry is greater than the expected cot of the inquiry.
- In an *Bilateral Search*, you may search actively or passively. Whatever be your search strategy, you may not always be able to return to the best match that you identified during the course of your search
- Large traders either actively search for liquidity among traders who post firm quotes or become passive searchers who do not display their trading interests.
- The search strategies that traders employ to find liquidity vary by their trading objective. Impatient traders generally search actively. Patient traders are usually passive searchers.

The most important Bilateral Search

Marriage and Order Exposure

For many people, finding a life partner is the most important bilateral search problem that they encounter.

The most important Bilateral Search

Marriage and Order Exposure

For many people, finding a life partner is the most important bilateral search problem that they encounter.

Order Exposure

Many people are unwilling to expose that they are looking for a spouse for fear of appearing needy. Rightly or wrongly, people may make inference about your position from how you search. Matchmakers are marriage brokers who help solve this problem by confidentially proposing matches among people who indicate that they are interested in getting married. Matchmakers must know their clients well to propose successful matches.

Dimensions of Liquidity

- *Immediacy* refers to how quickly trades of a given size can be arranged at a given cost. Traders generally use market orders to demand immediate traders
- *Width* refers to the cost of doing a trade of a given size. Width is the cost per unit of liquidity.
- *Depth* refers to the size of a trader that can be arranged at a given cost. Depth is measured in units available at a given price of liquidity
- Impatient trades focus primarily on immediacy and its cost, which for small traders is represented by width. Large traders focus on width.

Probabilistically speaking..

Liquidity

The probability of trading a given size at a given price, given the time we are willing to put in our search.

Search objective	What it means?
Quickly	immediacy
Size	depth
price	width

The Who, How and Why of Liquidity

- Liquidity offering traders - Market makers, block dealers(offer depth), buy-side institutions, individual investors.
- Passive liquidity suppliers - Dealers(supply immediacy).
- Value traders(supply depth).
- Precommitted liquidity suppliers (supply immediacy) - they would demand liquidity if they did not offer it.
- Arbitrageurs connect liquidity suppliers and providers in different markets.

Summary

- Liquidity has size, time and cost dimension. Traders refer to these as depth, immediacy and width.
- Impatient small traders easily solve the bilateral search problem.
- Patient small traders offer limit orders. For large traders, the bilateral search is more complex. Many traders are reluctant to expose their orders.
- Five types of traders offer liquidity.
  1. Market makers offer immediacy at narrow spreads to small anonymous traders.
  2. Block dealers offer depth to large uninformed traders.
  3. Value traders offer depth to all the traders.
  4. Precommitted traders offer immediacy at very narrow spreads in an effort to lower the costs that they already intend to.
  5. Arbitrageurs move liquidity from one market to another market and thereby ensure that traders can find depth wherever they trade.

Outline I

Outline II

Outline III

Volatility

- Volatility is the tendency for prices to change unexpectedly. Prices change in response to new infromation about values and in reponse to the demands of impatient traders for liquidity.
- Volatility itself can change over time. Changing over specific intervals of time can be termed as *episodic volatility*.
- Two types of volatility
  1. *Fundamental volatility* is due to unanticipated changes in instrument values.
  2. *Transitory volatility* is due to trading activity of uninformed traders.
- Regulators cannot have lasting say on fundamental volatility but have a large say on transitory volatility.

Fundamental and Transitory Volatility

- Values change when the fundamental factors that determine them change. Prices therefore should change when people learn that fundamental factors have unexpectedly changed. Such prices changes contribute to fundamental volatility.
- Stocks with high P/E tend to be more volatile than low P/E stocks.
- Transitory volatility results when the demands of impatient uninformed traders cause prices to diverge from fundamental values.
- The simplest form of Transitory volatility is bid/ask bounce.
- Transitory volatility includes both the price changes that impatient uninformed traders vause and the subsequent reversals of those price changes.
- Transitory volatility models are *mean reverting models*.
- One of the models to measure volatility in the form of two components, fundamental and transitory volatility is the *Roll's model*.

Regulators and Transitory Volatility

- Regulators are concerned about transitory volatility because high transitory volatility indicates market are illiquid.
- Transitory volatility is correlated with transaction costs and hence regulatory pay close attention to this type of volatility.

Summary

- Fundamental volatility is due to unexpected changes in fundamental valuation factors
- Fundamental price changes are correlated with volume when only a few traders know new information about fundamental values
- Fundamental volatility may be scary, but it is necessary for the efficient allocation of resources.
- Prices must change as the world changes if they are to reflect all the current information about information values.

Summary

- Transitory volatility consists of price changes caused when impatient uninformed traders seek liquidity.
- Transitory volatility consists of price changes caused when impatient uninformed traders seek liquidity.
- Transitory volatility and transaction costs are closely related. Both are high in illiquid markets.
- The price changes associated with transitory volatility tend to revert.
- Transitory volatility is identified by the negative serial correlation due to price reversals.

Outline I

Outline II

Outline III

- Performance evaluation and prediction

8 Market Structures
- Index and Portfolio Markets
- Specialists
- Internalization, Preferencing and Crossing
- Competition within and among markets

9 Takeaway

Introduction

- For most active traders, transaction costs are the most important components of their total returns.
- Traders estimate future transaction costs to predict the costs of implementing various trading strategies.
- Who are interested in TCA?
  - Exchanges conduct TCA to document the quality of the markets.
  - Brokers conduct TCA to monitor their performance.
  - Investment sponsors must ensure that they obtain value for the commissions that their investment managers spend on their behalf.
  - Regulators often tend to promote policies that lower transaction cost. They conduct transaction cost measurements to characterize the performance of various market structures.

Transaction cost components

- Transaction costs = explicit costs + implicit costs + missed trade opportunity costs.
- Explicit transaction costs are all costs that a cost accountant would easily identify.
- Implicit transaction costs are the costs of trading that arise because traders generally have an impact upon prices.
- Missed trade opportunity costs arise when traders fail to fill their orders or fail to fill their orders in a timely manner.
- Explicit costs are easiest to compute whereas the latter costs are harder to estimate.

Implicit transaction cost estimation methods

- Traders estimate implicit transaction costs by using *specified price benchmark methods* and *econometric transaction cost estimation models*.
- Specified price benchmark methods : Most commonly used, easier to implement than the econometric methods and generally more useful when trades evaluate transaction costs for specific trades
- Estimated cost = Trade size $*$ Trade sign (Trade price $-$ Benchmark price)
- Commonly benchmark prices used are VWAP, opening price, closing price, average of open+high+low and closing prices, average of bid and ask near the time of the trade.

Implicit transaction cost estimation methods..

- Econometric transaction cost estimation methods use statistical methods to estimate transaction costs. Simplest models extract information from price reversals that traders cause when they have an impact on price.
- To analyze transaction costs in trades which they have not participated, the traders usually take the side of that demands liquidity. The side to take depends on the market impact that each trade makes.
- Lee and Ready Algorithm - Common algorithm for measuring transaction costs. Following are two limitations
  - Overestimate costs because traders do not exclusively demand liquidity.
  - It cannot identify when an orders has been filled with multiple trades.

Measuring Transaction costs with price benchmarks

- Many traders estimate cost of trading by the signed difference between the traded price and quotation midpoint.
- The quotation midpoint that prevailed at the time of spread produces a transaction cost estimate that is usually called effective spread.
- The liquidity premium is the signed difference between trade price and the time-of-trade quotation midpoint. The effective spread is twice the liquidity premium.
- The realized spread is the twice the signed difference between trade price and the quotation midpoint observed at some specified point following the trade.
- Realized spreads often tend to be smaller than effective spreads.

Measuring Transaction costs with price benchmarks

- The difference between effective spreads and realized spreads measures dealers losses to well-informed traders.
- Implementation shortfalls can be interpreted as the difference in values between an actual portfolio and a corresponding paper portfolio. The quotation midpoint at the time they decide to trade produces an easy-to-interpret measure of transaction cost.
- VWAP, opening and closing prices can also be used as benchmark prices.

Measuring Transaction costs with price benchmarks

- Analysts break the total implementation shortfall in to components. The breakdown depends on whether the order was filled.
  - If a trade occurred, the shortfall is the total trade size times the signed difference between the average trade price and the quotation midpoint at the decision time.
  - If the trade is not filled, the shortfall is the unfilled size multiplied by the difference between the current price and the benchmark price. The first component estimates the transaction costs of completed trades. The second component estimates the missed trader opportunity costs.

Properties of Transaction price benchmark estimators

- Estimates based on quotation midpoints have heavy data requirements as intraday data has to be considered.
- *Random events* : If the benchmark price is based on closing price and for some random event occurring after the trade ,the closing price is far less than the traded price, then attributing the transaction costs to this vast gap is incorrect. Such estimates are noisy.
- Estimates that allow traders to identify whether their brokers are skilled trade timers is difficult.
- Biased transaction cost estimators often produce cost estimates that depend on how or why the trade is made.

Properties of Transaction price benchmark estimators

- Biases arise when
  - Orders are split.
  - Strategy dependent Momentum or contrarian trader.
  - Informed traders move the market and the benchmark price based on realized spread clearly underestimate the transaction costs.
  - Brokers who can affect their evaluations without delivering better prices to their clients are able to game the measure.

Measuring Implicit Transaction costs with econometric methods

- Statistical methods to measure the impact that trades have upon prices.
- These models examine either price reversals or the relation between order flow and price changes.
- Futures pit based markets do not record bid/ask and hence use methods that do not depend on bid-ask prices.
- Price Reversal model
  - The simplest cost model measure the price reversals that traders cause when they buy and sell.
- Order Flow model.
  - Regression models to characterize how prices change in response to order flow.
  - Lee and Ready algo

Measuring Implicit Transaction costs with econometric methods

- Total performance depends on portfolio selection and trade implementation.
- Transaction costs lower portfolio performance.
- Traders estimate costs so that they can better manage them.
- TCA depends on price benchmarks.
- Reliable inferences about transaction costs require reasonable benchmarks and many trades.
- Informed trading, contrarian trading, order splitting and gaming may bias cost estimates.
- Brokers often can game a transaction cost measure by deferring trades or mimicking their benchmarks.

Summary

- Which price benchmark analysts use when evaluating implementation performance determines what they measure.
- Analysts who use quotation midpoint at the time of trade learn nothing about the cumulative impact of split orders. They learn little about whether traders can exercise valuable timing discretion.
- Analysts who use price benchmarks long after the trade may learn about these issues, but they also measure whether portfolio managers made good portfolio composition decisions.
- Analysts who use price benchmarks before the trade measure the degree to which their portfolio composition decisions depend on past prices.
- No price benchmark is perfect. Implementation shortfall does not have problems such as split orders, strategy dependent, gaming etc.
- Retail traders typically use the effective spread transaction cost estimator
- Institutional investment sponsors often use VWAP

Outline I

Outline II

Outline III

The performance evaluation problem

- Portfolios that perform well can be managed by skilled managers or by lucky managers. Likewise, poorly performing portfolios may be managed by unskilled managers or unlucky managers.
- The investment policies that govern many portfolios often have a substantial effect on portfolio performance
- Whether the factors that determined a managers past performance will continue to determine his or her future performance depends on three fundamental conditions
  - Past performance must reflect the managers skill
  - Managers skill will continue to generate good future returns
  - Manager still has skills necessary for success
- Performance evaluation is tricky as one needs to untangle skill and luck
- IRR is the compounded rate of return that a savings account would have to earn to exactly replicate the capital flows into and out of the portfolio

The performance evaluation problem

- Holding period returns and IRR differ when the capital additions and distributions do no occur on a pro rata basis within the measurement period.
- Analysts often separate total return into its current yield component and capital gains component
- Realized alpha Managers who construct low beta portfolios tend to underperform the market when it is rising and outperform it when it is falling. Likewise, those who construct high beta portfolios tend to outperform the market when it is rising and underperform when it falls. To account for these effects, analysts compute risk-adjusted excess returns by subtracting the average portfolio beta times the market return from the raw portfolio return. The resulting measure is *realized alpha*
- Raw Return = (Raw Return Beta $*$ Market returns) + (Beta $*$ Market return Market Return) + Market Return = Excess return + Market Timing return + Market Return.

Statistical performance evaluation

- For a particular test confidence level , given a specific data for returns, one can compute the power of t test. Confidence level gives the probability of identifying an unskilled manager as a skilled manager. Power of the test measure the probability of choosing a skilled manager given he is a skilled manager.
- In practice, more than 20 years of returns data are typically required to obtain useful results for a given investment manager.
- Even more data are required to determine whether the most successful investment managers, selected from a large group of managers, was skilled or was just lucky.

How much of data is required ?

- The tests that analysts most commonly used use to determine whether managers are skilled is the t-test. It is the ratio between the managers average market adjusted return and measure of average size(standard error of the mean). This is proportional to the average size of the market-adjusted return that we would expect to observe if only luck was responsible for the managers returns.
- Suppose the skilled manager can beat the market by 2% on an average, a test that does not identify skilled managers as skilled managers 75% of the time, and identifies skilled manager as skilled manager requires 22 years of monthly return. If skilled managers were extraordinary skillful, so that they beat the market by 4% on an average, we still need about 6 years of data.

How much of data is required ?

- More than 20 years of returns data are typically required to obtain useful results for a given investment manager.
- Even more data is required to determine whether the most successful investment manager, selected from a large group of managers , was skilled or just lucky.
- t-test is powerful when statisticians are likely to conclude that the manager is skilled , given the manager is indeed skilled. What does the the power of a test depends on ?
  - Power increases when confidence level of the test decreases.
  - Power increases with the skill of the manager.
  - Power decreases with the importance of luck as a factor that determines returns.
  - Power increases with number of years analyzed.

How to test ?

- How to sensibly choose power of a test and confidence levels ?
  - If we expect large losses, the test confidence level should be high.
  - If we expect high profits, the power of test should be high.
  - If expected index returns are high, confidence level should be high.
- Statistical argument for indexing - Start with the payoff matrix. Given a test, what is the return that on investment by investing in a fund vis--vis an index fund? Test result(skilled/unskilled) and True manager status(skilled/unskilled). There are 4 values for portfolio returns for each of the states and there are probabilities associated with these states. The chapter shows that even with 50 years of monthly returns, it pays to invest in index returns.

Summary

- In large group of people, extreme luck can produce impressive results.
- Exceptionally lucky managers perform very well in comparison to skilled managers of average luck.
- Choosing among many managers requires even more data.
- In practice, investors rarely decide only between just one active manager and an index fund when choosing whether to invest with an active manager. Instead they consider many managers and typically who have done well. Survivorship bias.
- In a large group of people, extreme luck creates impressive results.
- Whether a given manager is skilled and Whether the best performing manager among a group of managers is skilled, are different questions. One needs two different tests.

Summary

- The signal whether the manager is skilled is hard to find because it is lost in noise.
- There are two ways to increase data points, increasing the historical period for analysis, increasing the sampling interval.
- In performance evaluations, statistical power depends primarily on the length of the sample period and not on the frequency of sampling with in the period.
- Economic approach suggests another approach for performance prediction - comparative advantage. Players have a comparative advantage when they have greater skills or greater resources than their opponents.
- Traders who appreciate the importance of comparative advantage consider both why their trading strategy should work, and why they expect other traders will lose to them.
- Evaluating a fund manager - Past performance, absolute advantage and relative advantage

Outline I

Outline II

Outline III

Price indexes

- People use price indexes to characterize the values of lists of instruments. The instruments upon which a price index is based are the index components.
- A *price weighted index* is proportional to the sum of the prices of index components.
- A *value weighted index* is proportional to the total capital value of all index components.
- *Equal weighted indexes* measure the returns from investing an equal dollar amount in each index component.
- *Geometrically weighted indexes* average logarithmic returns than prices.

The Argument for indexation

- Most active managers cannot beat the market because of transaction costs.
- In any given quarter, only one-fourth of all mutual funds beat the markets. If there were no transaction costs, if mutual funds represent a random sample of all mutual funds, then we would expect half of the funds to beat the market.
- The set of winners varies from quarter to quarter.
- Many uninformed investors employ buy and hold strategies to avoid the difficulties of selecting skilled active managers and the costs of investing with unskilled active managers.
- Although index funds slightly underperform their indexes, they regularly beat three fourths of all active managers.
- Index returns can easily audit whether the managers are doing what they expect them to do.

Factors that ensure index products have low transaction costs

- Index dealers face little risk of trading with well-informed traders. Few traders have valuable insights in to the future direction of the entire market.
- Index markets tend to be very active because most people trader the same index products.
- Traders of index products generally need to arrange, clear and settle only one transaction.

Summary

- Indexes characterize the average price performance of a set of index stocks.
- Index funds hold portfolios designed to replicate the returns of a price index.
- Index funds have very low turnover rates because managers rarely need to rebalance index portfolios.
- Investors hold index products to avoid transaction costs and to eliminate losses often associated with active management.
- Index markets provide low-cost ways to trade index risk.
- Index dealers are generally unconcerned about security-specific risks.

Outline I

Outline II

Outline III

Introduction

- Exchanges assign special responsibilities to members they designate as specialists.
- Specialists must continuously quote two-sided markets so that markets always exist in their specialties.
- Exchanges believe that specialist trading systems enhances market quality and thereby attract traders to their exchanges. The believe that continuous and orderly markets increase investor confidence.

Overview

- Specialist trading systems are found primarily at US stock and options exchanges.
- Specialists go by different names - designated primary market makers, designated sponsors.
- Most specialists are dual traders who act as brokers and dealers.
- Some exchanges use a designated multiple market maker trading system for trading their securities.
- CBOE uses a designated multiple market maker trading system for its most actively traded index option series.
- Most specialists trade only a few securities.

Roles

- Specialist trading systems are found primarily at US stock and options exchanges
- Specialists play three roles - dealers, brokers and exchange officials
- Dealer role
- Two sets of regulations govern specialist trading - *Affirmative obligations* and *Negative obligations*

Roles

- Affirmative obligations.
  - Price continuity, traders of last resort .
- Negative obligations.
  - Cannot trade at a given price unless no public traders are willing to trade at that price and no other traders are willing to trade at a better price. Bound by public order precedence rule and price priority rule.
  - Exchanges also discourage their specialists from trading with limit orders on their books.
  - They are not subject to public liquidity preference principle.

- Brokers - Often broker orders for other brokers.
- Auctioneers At markers that open with a single price auction , the specialists are responsible for conducting those auctions

Specialist Privileges

- Speculative Strategies.
- Quote matching strategies.
- Cream Skimming strategies.
- Order anticipation strategies.
- Controlling market quotes.
- Exercising stopping stock power and thus having a lookback timing option.

Outline I

Outline II

Outline III

Introduction

- *Internalizing* : Dealers internalize orders when they fill their clients orders.
- *Preferencing* : Brokers preference orders when they route their clients marketable orders to dealers in exchange for various monetary and nonpecuniary payments for order flow. Brokers also preference when they route the clients limit orders to ECN that pay them liquidity fees when standing limit orders execute.
- *Internal crossing* : Brokers cross orders internally when they arrange trades among their clients
- The above three activities, internalizing , preferencing and internal crossing arrange trades away from the organized markets. These give rise to fragments markets

Best Execution practices

- Brokers who internalize and accept payments for orderflow have a significant conflict of interest that concerns clients and regulators. Brokers address these concerns by trying to provide best execution to their clients.
- Definitions of best execution are controversial because execution involves both price and time.
- In US equity markets, dealers claim that they provide best execution when they fill the marketable orders at NBBO(National Best Bid and Offer price).
- Best execution standards for standing limit orders are also difficult to define.

Economics of best execution

- In perfectly competitive markets, if brokers or regulators demand that dealers provide higher execution quality, wholesale payments for order flow and retail inducements for order flow will fail. A trade-off exists between execution quality and the price and level of brokerage services offered.
- In most of the cases, the best execution cannot be measured and hence there is a tendency of brokers to advertise for lower commissions than best execution.
- Preferencing or internalization sucks out liquidity from the system at the organized venue and hence increases bid/ask spread.
- Internalization and preferencing shift power from public limit order traders to dealers.
- Internalization and preferencing decreases the incentives to quote aggressively.

Internal order crossing

- Brokers cross internally when they arrange trades among their clients.
- Regulatory concerns about internal crossing involve order exposure and agency problem.
- Order exposure problem - Makes the trade search problem difficult.
- Agency problem Brokers favor certain clients over the others.
- Order preferencing can be viewed as internal crosses.

Outline I

Outline II

Outline III

Introduction

- Many exchanges, brokers, electronic communications networks, and dealers have created innovative trading systems to provide traders with better services at lower costs.
- Proliferation of market centers has some worrisome features. It has fragmented market and hence
  - Search costs have gone up.
  - Transaction costs have gone up.
- Most futures markets are consolidated.
- The competition among traders to obtain the best price works best in consolidated markets. The competition among market centers to provide low-cost services to traders implies fragmented markets.

Order flow externality

Strong/Weak externality

Markets are consolidated when all traders trade in the same place. Markets naturally consolidate. Since traders are easiest to arrange on good terms in liquid markets, traders gravitate to the most liquid market. Each trader who joins a market adds liquidity to that market. The additional liquidity then attracts ore traders, who add more liquidity. This phenomenon is called the order flow externality

- Order flow externality is the strongest when traders are uncertain about what orders and quotes are available in the market.
- Facilities that allow traders to control the exposure of their orders strengthen the order flow externality where it is strongest.
- Order flow externality is strong at NYSE, It is weak at NASDAQ.

Why different market structures?

- Unequal sizes.
- Asymmetric information.
- Unequal patience.
- Unequal access.
- Unequal creditworthiness and trustworthiness.

Mechanisms for Market consolidation

- Within each market segment, traders adjust their orders to reflect information that traders reveal in other segments.
- Traders route their orders to market segments where they expect to obtain the best prices.
- Arbitrageurs specialize in moving liquidity.

Externalities in the competition among market centers

- *Order flow externality* : Makes it very difficult to compete against effectively incumbent markets.
- *Secondary Precedence rules* : An externality problem arises when market segments compete with each other because a market segment cannot meaningfully enforce secondary precedence rules when other segments trading the same do not.
- *Regulatory services*: Traders might gravitate towards markets that do not provide these regulatory services. The promotion of price continuity and the regulation of insider trading, manipulative trading practices, and capital structures are examples of services that produce public benefits.

What can one expect from this book ?

This book was published in 2003. In the last 10 years, US markets have changed dramatically and so have other markets all over the world. The dominant form of trading is via Electronic Order Book. Open outcry markets have been almost completely taken over by Screen based trading. Specialists roles have become less prominent with HFT players acting as middlemen.

Given all these rapid developments, this book still does an awesome job of piecing together various elements of a market microstructure. The highlight of this book is that it introduces various stylized traders and analyzes market microstructure mechanisms via the eyes of these traders. In this way, the text provides a superb insight in to the various interactions of market participants, that ultimately define a market and its microstructure.