

# Market Architecture

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Fall 2010

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## A conceptual framework of market architecture

**Market architecture** refers to the set of rules governing the trading process, determined by choices regarding

- **Market type**
  - Degree of continuity: Periodic or continuous systems
  - Reliance on market makers: Order- or quote-driven markets
  - Degree of automation: Floor or screen-based electronic systems
- **Price discovery**: The extent of the market providing independent price discovery.
- **Order forms**: Market, limit, stop, upstairs crosses, baskets...
- **Protocols**: Rules regarding program trading, choice of minimum risk, ...
- **Transparency**: The quantity and quality of information provided to market participants.

## Market types

Market structures can be classified according to both the order execution systems and to the type of trading sessions. As far as *execution systems* are concerned, markets can be classified as follows:

- **Order-driven markets**: Markets based on the direct interaction of agents' orders.
- **Quote-driven markets**: Markets where contracts must be fulfilled through intermediaries.
- **Hybrid markets**: Markets where both systems are used.

Most financial markets today are hybrid.

## Order-driven markets

- The prices at which contracts are executed may be determined either at the same time the orders are transmitted to the market-place or afterwards.
- Investors' buy and sell orders are matched directly, without intermediaries; liquidity is guaranteed by a constant flow of orders from market participants.
- There are no designated market makers; the only intermediary on the market is the broker, who transmits clients' orders.
- Based on order precedence rules that rank and match orders for execution (but not all use the same pricing rule), order-driven markets can be organized as **auctions** or as **crossing networks**.

## Auction markets — Limit and market orders

- **Auction market** is the prevailing type of market in the leading financial centres at present. There are two types of order in auction markets: **limit orders** and **market orders**.
- A **limit order** specifies both a quantity and a maximum price or minimum price for execution depending on whether it is a buy or sell order. A market order will be executed as long as there is sufficient supply or demand, but the price may be unfavourable.
- Limit orders have a guaranteed price, but immediate execution is not guaranteed unless there are matching orders on the opposite side of the market. If immediate execution is not possible, the limit order will be placed in the *limit order book* and remain there until it is either executed against a new incoming order or cancelled.
- **Market orders** are suitable for impatient traders who want to execute the order immediately but are less sensitive to price.

## Auction markets — Call markets and continuous auctions

- Auction markets take two forms: **call markets** or **continuous auctions**. In call (or batch) auctions, orders are submitted simultaneously; in continuous auctions agents can submit orders at any time during the *trading phase*.
- In **call markets**, orders entered for the call can be publicized either orally or electronically. In *oral call auctions* (or *open-outcry auctions*), agents cry their offers to trade face-to-face on a trading floor. In *electronic call auctions*, orders are submitted to a computerized system during a predetermined period of time, and all trades in a stock take place at the same time and at the same equilibrium price under the uniform pricing rule.

## Auction markets — The price rule in oral auctions

- The rules governing oral auctions are quite simple: (1) it is compulsory for traders to communicate both prices and executions publicly; (2) traders with the highest bid and lowest ask gain precedence for order execution (**price priority**); (3) traders who bid the best prices earlier gain precedence over those who bid the same prices later (**time priority**).
- Order matching rules are hierarchical, with price priority primary and time priority secondary.
- Equilibrium trade prices in oral auctions are determined either by an auctioneer who minimizes net demand imbalances, or by brokers on the floor who match orders for different investors.
- The most prominent example of an open-outcry auction is the futures market organized by the **Chicago Board of Trade**.

## Auction markets — The price rule in electronic continuous auctions

- The price rule governing electronic continuous auctions is discriminatory. Prices are formed over time as traders observe the order flows, and orders are executed one by one as submitted, at the available prices. Market participants observe past transactions before submitting an order. This kind of market is generally automatic and is the most frequent mode of trading derivatives and stocks.
- This is currently the most common form of order-driven market, and is structured as an **open limit order book** (OLOB).
- **Electronic communication networks** (ECN) work as open limit order books. The *Securities and Exchange Commission* (SEC) defines an ECN as any electronic system that widely disseminates orders entered into it by the subscribers to third parties, and permits such orders to be executed in whole or in part.

## Auction markets — Open limit order book

- In a platform organized as an OLOB, orders are accumulated in an electronic book. A limit order is registered in the book and executed when an order of opposite sign and identical or better price is entered.
- An 'at best' order is carried out at the best price available in the order book. Price and time priority rules govern the order book.
- If there are several orders for a given price, the first one to be executed can be selected in a number of ways. The most common rule is time priority: first submitted, first executed. There are also other rules. For instance, size priority considers the number of shares in the order. Another type of priority rule is based on origin: for example, at the NYSE orders from the public are filled first, those from specialists only afterwards.



## Hybrid markets

- Market structures often combine elements from both order- and quote-driven protocols, and so are called hybrid.
- In the United States, such markets as the NYSE, AMEX (American Stock Exchange), and the regional stock exchanges are organized by specialists who play a dual role, namely ensuring liquidity and managing the order book.
- NASDAQ takes on some characteristics of a hybrid structure, namely that of a quote-driven market, where, however, the dealers have the option of transmitting their clients' limit orders to the electronic trading system.

## Market transparency

- **Market transparency** is defined as the capability of market participants to obtain information regarding the trading process. The market transparency can be either **pre-trade** or **post-trade**.
- Post-trade transparency refers to the rules of disclosure on the size and direction of the orders executed and the identity of the traders.
- Pre-trade transparency refers to the quoted prices and quantities and/or to the market participants' identities, and may be directed either to all the agents present in the market or to some only (i.e., brokers/dealers).
- The level of transparency influences traders' strategies and consequently the pricing process.

## Orders and order properties

- Orders are traders' statements of their intention to trade.
- In centralized electronic markets organized as an open limit order book, orders are standardized in order to enhance immediacy and price discovery.
- The minimum information in the orders is type of instrument, sign (i.e. the buy/sell indicator) and the size of the trade.
- In addition, orders may contain more detailed information regarding their execution conditions, such as price- and quantity-related instructions, duration of commitment, time of expiration, visibility and the terms of any principal-agent obligation.
- There are two categories of order, market orders and limit orders.

## Orders and order properties

- Market orders are 'at best' orders and are usually submitted by impatient traders who care about minimizing execution time more than the price at which the contract is executed. These orders take liquidity from the book and then disappear.
- Limit orders are submitted by patient traders, who care about price terms and add an indication of the limit price to the order. Limit orders therefore supply liquidity and increase the depth of the limit order book.
- Limit order submitters are usually more concerned with price risk than execution risk. The price risk is the risk a trader runs when his order is executed at unfavourable prices; this risk is maximized when a trader submits a market order. The latter is the risk a trader runs when his order is not executed; the larger the price premium or discount required by the limit order price, the greater the execution risk.

## Market traders — Active versus passive

- Some traders are active (and normally employ market orders), while others are passive (and normally employ limit orders).
- Active traders demand immediacy and push prices in the direction of their trading, whereas passive traders supply immediacy and stabilize prices.
- Dealers are typically passive traders. Passive traders tend to earn profits from active traders.

## Market traders — Liquidity versus informed

- Liquidity traders trade to smooth consumption or to adjust the risk-return profiles of their portfolios. Informed traders trade on private information about an asset's value.
- Liquidity traders tend to trade portfolios, whereas informed traders tend to trade the specific asset in which they have private information.
- Liquidity traders lose if they trade with informed traders. Hence they seek to identify the counterparty; on the other hand, informed traders seek to hide their identity.

## Market traders — Individual versus institutional

- Institutional investors (pension funds, mutual funds, foundations and endowments) are the dominant actors in stock and bond markets. They hold and manage the majority of assets and account for the bulk of share volume. They tend to trade in larger quantities and face special problems in minimizing trading costs and in benefiting from any private information.
- Individual investors trade in smaller amounts and account for the bulk of trades.

## Market traders — Public versus professional

- Public traders trade by placing an order with a broker. Professional traders trade for their own accounts as market makers or floor traders and in that process provide liquidity.
- Computers and high speed communications technology have changed the relative position of public and professional traders.
- Regulators have drawn a distinction between professional and public traders and have imposed obligations on professional traders. Market makers are obligated to maintain fair and orderly markets and to post firm quotes.

## The trading process — Four components

- **Information:** A market provides information about past prices and current quotes.
- **Routing orders:** Brokers take orders and route them to an exchange or other market center.
- **Execution:** Dealers prefer to delay execution to determine if any information or additional trades arrive. Automated execution systems have been exploited by speedy customers to the disadvantage of dealers. The distinction between dealers and customers decreases since customers can get nearly as close to “the action” as dealers.
- **Clearing and settlement:** Clearing involves the comparison of transactions between buying and selling stocks. Settlement in equities markets is done electronically by book entry transfer of ownership of securities and cash payment of net amounts to the clearing entity.

## Issues related to market heterogeneity

Real-world trading systems exhibit considerable heterogeneity in market structures, which affects price formation and the costs of trading. The following are two related issues.

- **The network externality puzzle** refers to the fact that many markets are fragmented and remain so for a long periods of time. Two aspects on sources and impact of market fragmentation includes the failure of a single market to consolidate trading in time and the failure of diverse markets to consolidate in space (or cyberspace) by sharing information on prices, quotes and order flows.

## Issues related to market heterogeneity

- **The dealer puzzle** refers to the particular functions of dealers that they can provide in certain markets, in contrast to the public auction markets? For instance, in continuous markets, trading can be accomplished using designated dealers or as a limit order market without intermediaries, however, most markets rely on market makers to act as intermediaries.

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