

EC371 Economic Analysis of Asset Prices

Topic #10: Asset Market Microstructure

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Reading: *Economics of Financial Markets*, chapter 2

1 Financial markets: functions & participants

Markets: functions and participants

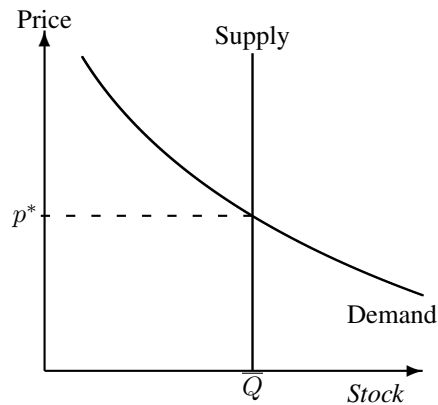
- What is a market? Any set of arrangements which enables *voluntary agreements* to be reached between its participants.
- Functions of a market:
 1. *Price discovery*
 2. Provide a *trading mechanism*
 3. Enable the *execution* of agreements
- Participants:

1. *Public investors*
2. *Brokers*
3. *Dealers*

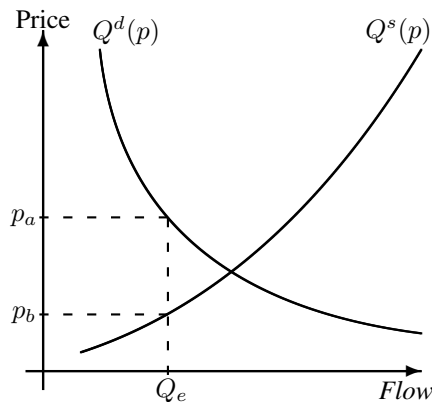
In practice the three groups are not mutually exclusive: some public investors may occasionally act on behalf of others; brokers may act as dealers as well as holding assets of their own; dealers often hold assets in excess of the inventories needed to facilitate their trading activities. There may be several categories of brokers and dealers distinguished by their access to, or ownership of, the market institutions. Also, in many markets there are designated dealers who have particular obligations to ensure that the trading mechanism functions smoothly. These are the so-called *market-makers* or *specialists*. In return for fulfilling their obligations, market-makers are normally granted privileged access to certain administrative procedures or market information.

1.1 Stock and flow approaches

Stock and flow approaches



The “*stock*” approach to market equilibrium.



The “*flow*” approach to market equilibrium.

2 Trading mechanisms

2.1 Quote-driven markets

Quote-driven markets

- Dealers quote bid and ask prices at which they will buy and sell.
- Quote driven markets need a mechanism for publicising dealers' price quotations and guaranteeing settlement
- But otherwise don't need much formal organisation.
- Trades take place sequentially so that transaction prices depend on whether a sale or purchase occurs.

2.2 Order-driven markets

Order-driven markets

- Order-driven markets: sometimes known as 'agency' or 'auction' markets.
- Public investors issue instructions to buy or sell according to specified conditions, perhaps at a given price.
- Example: 'limit order': an order to buy (sell) if the asset price is no greater than (no lower than) a specified 'limit' value.
- Call markets: prices set at *discrete* points of time perhaps as a result of an auction.
- Continuous auction market: orders to buy or sell are entered in a 'limit order book' – orders are matched automatically according to a rule determined by the exchange.

2.3 Order- & quote- driven markets compared

Order- & quote- driven markets compared

- Criteria for comparison: *liquidity* and *transparency*.
- *Liquidity*: 'interchangeability of assets and money'
- *Transparency*: ability to observe recent trades (prices and quantities).
- Quote driven markets: more liquid but less transparent than order driven markets.
- Are liquidity and transparency always desirable? Not necessarily, because they could be disruptive.

Keynes in the *General Theory* boldly voiced his reservations about market liquidity:

Of the maxims of orthodox finance none, surely, is more anti-social than the fetish of liquidity, the doctrine that it is a positive virtue on the part of investment institutions to concentrate their resources upon the holding of 'liquid' securities. It forgets that there is no such thing as liquidity of investment for the community as a whole. (Page 155 of the General Theory)

Keynes highlighted what more recent literature would call an externality: a difference between private and social benefits. Liquidity might be beneficial for any individual investor but — because of its consequences for asset price fluctuations — costly for investors in general, and perhaps for non-investors too. Keynes clearly thought he knew the right objective, if not the best policy: 'The social object of skilled investment should be to defeat the dark forces of time and ignorance which envelop our future' (p. 155 of the General Theory) . A few pages later he makes a hesitant proposal but then seems to withdraw his endorsement of it:

The spectacle of modern investment markets has sometimes moved me towards the conclusion that to make the purchase of an investment permanent and indissoluble, like marriage, except by reason of death or other grave cause, might be a useful remedy for our contemporary evils. For this would force the investor to direct his mind to the long-term prospects and to those only. But a little consideration of this expedient brings us up against a dilemma, and shows us how the liquidity of investment markets often facilitates, though it sometimes impedes, the course of new investment. (Page 160 of the General Theory)

3 Industrial Organisation of Financial Markets

Industrial Organisation of Financial Markets

- Main types of control of markets:
 1. *Mutually owned* (members' co-operatives)
 2. *Shareholder* owned companies
- Forces for change:
 1. advances in information *technology*;
 2. regulatory reform – *liberalization* – in financial markets
- Trend is from mutually owned towards shareholder companies, then for the companies to merge or to be taken-over.

3.1 Competition within and among exchanges

Regulation and competition

- Regulation: often *self-regulation*.
 - For whose benefit? – members of the public or members of the exchange?
 - Supposed to benefit members of the public
 - But may restrict competition – thus benefiting the members of the exchange.

- Competition within exchanges is often restricted
 1. by imposing *capital guarantees*
 2. by designating *monopoly specialists*
 3. restricting off-floor trading.
- Competition between exchanges:
 - Encouraged by liberalization & technological advances
 - Restricted by mergers

4 Asset prices in a call market

Asset prices in a call market

- Kyle divides investors into 3 groups:
 1. Informed investors
 2. Uninformed investors ('noise traders')
 3. Market makers (who set prices).
- Market makers observe aggregate demand but not the identity of each trader
- Hence, the market price reflects information, but only partially because of the informational asymmetry.
- Kyle's solution:

$$p(y) = \mu_v + 2\frac{\sigma_v}{\sigma_u}y, \quad x(v) = \frac{\sigma_u}{\sigma_v}(v - \mu_v). \quad (1)$$

In Kyle's model uninformed investors' actions are exogenous and random. The total amount they trade, U , is assumed to be a Normally distributed random variable with expectation zero and variance σ_u^2 — in shorthand: $U \sim N(0, \sigma_u^2)$. (The upper-case letters U and V are used to label random variables, while their lower-case counterparts, u and v , denote the respective outcomes, i.e. values drawn from the probability distributions.)

It is assumed that there exists exactly one informed investor, whose motivate is to profit from information, albeit imperfect, about the price of the asset. Both the market-makers and the informed investor believe (correctly) that the value of the asset, V , is determined according to a Normal distribution with expectation μ_v and variance σ_v^2 , i.e. $V \sim N(\mu_v, \sigma_v^2)$. The informed investor's advantage is knowledge of the outcome v (i.e. not merely knowledge of the distribution from which it is drawn, information which is available also to market-makers).

The market-makers do not observe v but do observe the *aggregate* trade, y , of the informed and uninformed investors. Neither the informed investor nor market-makers observe the amount traded by uninformed investors but both know the distribution from which it is drawn. Market-makers are assumed to be competitive in the sense that the price is chosen to maximize expected profit (conditional on y) such that the *level* of expected profit is zero — zero expected profit is the highest that can be achieved. (This implication would follow from assuming free-entry into the market-making business.)

The steps in price formation are as follows:

1. The informed trader learns v and chooses the amount of the asset to trade, x , so as to maximize expected profits (being uncertain about the size of the uninformed investors trade and the price chosen by the market-makers, but knowing the market-makers' behavioural rule).
2. The trade of the uninformed investors, u , is determined randomly as a drawing from $N(0, \sigma_u^2)$.
3. Upon the receipt of the batch of market orders from investors, $y = u + x$, the market-makers set the price.

Kyle's model: implications

- Asymmetry of information generates trade.
- When the informed trader is 'important', (σ_v large relative to σ_u) price is very sensitive to aggregate demand but the informed trader restricts the volume of trade.
- The market is semi-strong form efficient.

5 Bid-ask spreads: inventory-based models

Bid-ask spreads: inventory-based models

- Main influences on bid-ask spread:
 1. Dealers' costs of holding inventories
 2. Dealers' market power (power to influence prices)
 3. Dealers' risk aversion
- Two implications:
 1. Changes in transactions prices are negatively correlated: increases tend to be followed by falls
 2. Size of the spread is inversely related to volume of inventory.

6 Bid-ask spreads: information-based models

Bid-ask spreads: information-based models (1)

- Ignore the cost of holding inventories and explore an information-based reason for the bid-ask spread.
- Assume that market-makers receive orders sequentially but cannot distinguish informed from uninformed investors.
- Informed investors profit at the expense of market-makers but – on average – market-makers neither gain nor lose in trade with uninformed investors.
- Hence, market-makers quote ask prices higher than bid prices to compensate for their imperfect information.

Not only is it possible to account for a non-zero spread, but *learning* can be built into the evolution of prices. The orders to buy or sell received by market-makers contain partial information about the value of the asset, information that the market-makers exploit in revising their bid and ask prices over time.

Before trading commences at each date, every market-maker begins with a *prior* belief about the asset's value. This prior belief is an input into the setting of bid and ask prices. An order to buy or sell is then observed and the market-maker's beliefs are updated. Formally, the market-maker is assumed to behave in accordance with Bayes' Law to obtain updated, or *posterior*, beliefs about the asset's value. These updated beliefs form the prior beliefs at the next trading date.

Bid-ask spreads: information-based models (2)

- As time passes, market-makers learn about the proportion of informed investors in the market.
- Implications:
 1. Transaction prices follow a martingale.
 2. Market-makers beliefs eventually converge to the 'true' distribution of the asset value.
 3. The market may fail altogether: bid-ask spread is too large to allow trade.

It is possible for the market to fail altogether in the sense that the market-makers set the bid-ask spread so wide that no trade takes place. This can occur if there are too many informed investors relative to uninformed investors. Given that the dealer always makes a loss when trading with informed investors, it is possible that the bid-ask spread needed for the dealer to break even on average, would have to be so wide that no one would wish to trade. This is an extreme example of 'adverse selection' in which the existence of asymmetric information destroys opportunities for mutually beneficial trades. Herein lies a possible explanation for the emergence — and disintegration — of asset markets.

Summary

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1. Markets enable price discovery, they provide a trading mechanism and support settlement of contracts.
2. Two main mechanisms: quote-driven and order-driven markets.
3. Industrial organisation: there may be a trade-off between competition and quality of service.
4. Asymmetries of information may have a major impact on prices.
5. Inventory approach emphasizes costs of doing business on bid-ask spreads.
6. Information approach emphasizes importance of asymmetric information.