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Trading with informed investors
NEW YORK STOCK EXCHANGE
LIVERMORE

Outline

- Informed traders
- Market efficiency
- Market liquidity
- Summary

Traders in the market

- A number of traders receive information about the future value of an asset
- Before the information is publicly revealed, they can make a several of trades
- Informed traders are choosing their trades as to maximize their total profits
- In addition, noise traders are trading for exogenous reasons without optimizing their behaviour

Price determination

- The information is only known to informed investors, other investors can only observe orders that have been submitted
- Whether an order originates from an informed trader or noise trader is not known
- Prices are set such that it reflects the value based the information from the total demand over time demand of the informed traders and noise traders
- $P_t = \mathsf{E}\left[V | \sum_{\tau=1}^{N} Q_\tau + \sum_{\tau=1}^{M} U_\tau\right]$
- We assume prices are linear in the total demand
- $P_t = \mu_t + \lambda_t \left(\sum_{\tau=1}^{N} Q_\tau + \sum_{\tau=1}^{M} U_\tau\right)$
- A high value of λ_t implies that prices are reaction sensitively to any additional order submitted, which is referred as low liquidity

Order determination for informed traders

- Profits from a trade arise from the difference between the asset value and the price paid, for each asset traded, plus any future profits the traders will receive
- $\Pi_t^i = (V - P_t) Q_t^i + \Pi_{t+1}^i$
- We assume that orders are linear in the value of the asset
- $Q_t^i = \alpha_t + \beta_t V$
- We assume that profits are quadratic in the difference between the value and price of the asset
- $\Pi_t^i = \delta_t + \gamma_t (V - P_t)^2$
- The total demand by informed traders is $Q_t = \sum_{i=1}^N Q_t^i$

Solution of the model

- Informed investors will maximize their profits by choosing an optimal order size for each time period until the information is revealed publicly
- Conducting this optimisation, we can determine the parameters as
- $\lambda_t = \frac{N\beta_t\sigma_{t-1}^2}{N^2\beta_t^2\sigma_{t-1}^2+t\sigma_U^2}$

  $\beta_t = \frac{1-2\gamma_t\lambda_t}{\lambda_t(1+N(1-\gamma_t\lambda_t))}$

  $\mu_t = P_{t-1}$

  $\alpha_t = -\beta_t P_{t-1}$

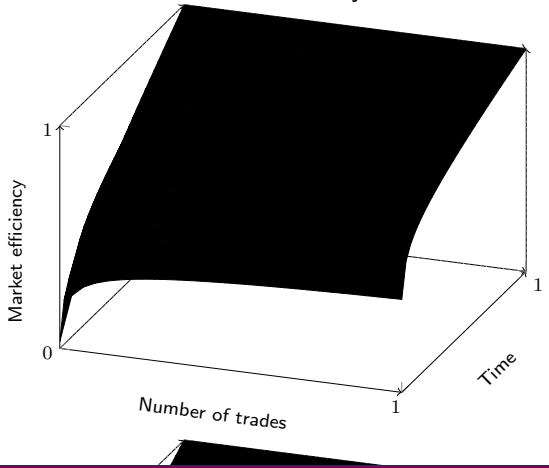
  $\gamma_{t-1} = \frac{1-\gamma_t\lambda_t}{\lambda_t(1+N(1-2\gamma_t\lambda_t))^2}$
- $\sigma_t^2 = \mathrm{Var}\left[V|P_t\right] = (1 - N\lambda_t\beta_t)\,\sigma_{t-1}^2$
- These parameters can only be solved numerically

Measuring market efficiency

- Of interest is the variance of the value, given the price
- $\sigma_t^2 = \text{Var}\left[V|P_t\right] = \left(1 - N\lambda_t\beta_t\right)\sigma_{t-1}^2$
- This reflects the uncertainty an uninformed trader has about the value of the asset when observing the price
- σ_0^2 is the uncertainty without any price information
- We can interpret $1 - \frac{\sigma_t^2}{\sigma_0^2}$ as a measure of market efficiency
- If the variance on observing the price does not reduce, $\sigma_t^2 = \sigma_0^2$, the market is inefficient
- If the variance on observing the price is zero, $\sigma_t^2 = 0$, the market is perfectly efficient

Market efficiency

Few informed investors and many informed investors



Market efficiency develops over time

- Markets become efficient over time as information is incorporated into prices with each trade informed traders conduct
- Informed investors trade strategically and hide their trades among the random trades of noise traders
- Uninformed market participants do not know whether the demand is from noise traders or informed traders
- The larger the demand, the less likely it is from noise traders, and hence the more the price would be adjusted
- This reduces the profits of informed traders and they will submit smaller orders

More frequent trading increases market efficiency

- If informed investors can trade more frequently, the market will be more efficient more quickly
- With more frequent trades, there is more information available at any time and the market incorporates this information more quickly into the price
- Informed traders will spread their trades over time optimally, but at any given point of time will trade more

More informed traders increases market efficiency

- Informed traders obtain an informational advantage over noise traders and will exploit this advantage like an oligopoly
- The more informed traders are in the market, the more they will compete with each other
- This competition leads to traders submitting larger orders to obtain more profits now, given that other traders can reduce future profits by submitting larger order now
- Submitting larger orders now implies that the observed demand is more likely to come from informed traders, revealing information and adjusting the price more
- This also reduces future profits as the price adjusts more
- The increased competition between more informed traders increases demand and markets become more efficient
- If competition was perfect, markets would be instantly efficient

The impact of noise trading and asymmetric information

- The amount of noise trading and asymmetric information does not affect market efficiency
- More noise trading allows informed traders to hide their orders better and the market should be come less efficient as less information is revealed
- Informed traders compensate for this by submitting larger orders, offsetting the effect of more noise traders
- Markets with higher asymmetric information, a higher initial variance of the value, will see larger trades by informed investors
- This implies that prices will adjust more, giving rise to the same market efficiency

Measuring liquidity

- A noise trader submitting an order will affect the price as it is not known whether he is informed or not
- The amount by which prices move when uninformed traders submit orders is referred as market liquidity
- This market liquidity was captures by the parameter $\lambda_t = \frac{N\beta_t\sigma^2_{t-1}}{N^2\beta^2_t\sigma^2_{t-1}+t\sigma^2_U}$
- It measures how much the price changes per unit of demand by traders

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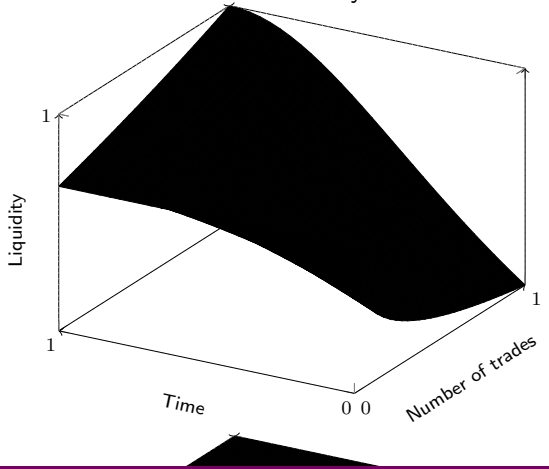

Markets become more liquid over time

- Market liquidity increases over time as λ_t reduces
- Potential losses from trading with informed traders are selling undervalued assets or purchasing overvalued assets
- With more information being available and the market becoming more efficient, this risk reduces
- Uninformed investors will adjust their expected value of the asset less, and hence the price adjusts less, as they must get closer to the value of the asset
- With prices adjusting less to demand, the market becomes more liquid

The effect of the number of trades

- If informed traders can trade more frequently, this will initially reduce the liquidity of the market
- Informed traders have more opportunities to obtain profits from trading and will trade less aggressively
- This makes the market less efficient and the higher asymmetric information will reduce the liquidity of the market
- Over time, more frequent trades accumulate more information, market efficiency increases and liquidity improves the more trades are conducted

More informed traders increase liquidity

- More competition between informed traders increases informed trading and reduces liquidity
- With information being revealed quickly through competition, asymmetric information reduces quickly as well
- This allows liquidity to increase much faster than with fewer informed traders

The impact of noise trading and asymmetric information

- Markets with more noise trading are more liquid as informed traders are less dominating the market
- Even though they submit larger orders in consequence, this does not fully compensate for this effect
- Markets with higher asymmetric information, a higher initial variance of the value, will be less liquid
- The informational advantage of informed traders is higher and they will submit larger orders
- With more informed trading, the likelihood of demand coming from them is increased and prices adjust more

Informational efficiency is not instant

- Markets become efficient over time as information is included in the price trade-by-trade
- The more informed traders are present and the more they can trade, the more efficient markets are
- Informationally efficient markets are not possible instantly as informed investors will seek to exploit their informational advantage over time

Liquidity increases over time after an information event

- The liquidity of a market can be used as a measure of the degree of informational asymmetry in the market
- If prices react sensitively to orders, the liquidity is low and the market believes that informational asymmetry is high
- As information is included into the price over time, the liquidity of markets improves
- Uninformed investors not wanting to adversely affect the price by their orders, might want to wait until market efficiency has improved before submitting any order

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