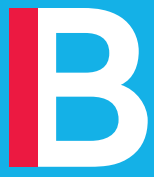
Imperial College Business School

Lecture 8

Transparency



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Outline

- What is transparency about?
  - Pre-trade information: quotes, identities, order flow
  - Post-trade information: past trades and prices, identities
- Why does it matter? Because it affects
  - liquidity
  - price discovery
  - wealth distribution across market participants
  - competition among market makers and trading platforms
- Why are market so opaque?

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Pre-trade transparency

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1. Pre-trade transparency: overview

- **Quote** transparency:
  - competition among market makers ⇒ liquidity
  - customers' control over execution risk ⇒ market participation
- **Order flow** transparency:
  - market makers may better spot insiders ⇒ both liquidity and price discovery improve
- Transparency of traders' **identities**: effect depends on type of traders whose identity is disclosed
  - liquidity increases if informed are more likely to be recognized
  - It decreases if uninformed are more likely to be recognized

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1.1 Quote transparency: effect on competition

- We already know that imperfect competition among market makers can contribute to illiquidity: recall that
  - parameter γ in the bid-ask spread may also capture rents
  - in Kyle's model, market makers' rents reduce depth
- Now consider a simple setting with no adverse selection and no risk aversion $\Rightarrow$ rents are the only source of illiquidity
- We will show that these rents can exist only if the market is opaque, in the sense that customers can observe a dealer's quotes only at a cost: **search cost** *c*

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Quote opaqueness = search cost

- Suppose some investors value a security more than others, e.g. due to investor-specific hedging motives:
  - some (buyers) value it at $\mu + \tau$
  - others (sellers) value it at $\mu - \tau$

μ= common value
$\pm\tau$ = private value

- *Transparent quotes* = all quotes are visible at no charge $\Rightarrow$ all customers go for best quotes $\Rightarrow$ $s = a - b = 0$
- *Opaque quotes* = checking a dealer's quotes costs *c*:

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Quote opaqueness lead to monopoly pricing

- Suppose all dealers quote **monopoly** ask and bid:
  - $a = \mu + \tau$
  - $b = \mu - \tau$

$\Rightarrow$ bid-ask spread $s = a - b = 2\tau$

- This is an **equilibrium**:
  - customer: not worth checking out another dealer's quotes (pay c) just to get the same price
  - dealer: not worth giving a discount, since he would not be able to attract clients – the discount would not be visible!
- It is the **unique** equilibrium: if $a = \mu + \tau - \Delta$, any dealer could raise it a bit, yet not lose clients $\Rightarrow$ not an equilibrium!

Evidence about quote transparency and rents

- In the U.S. market for municipal bonds ("munis"), dealers' quotes are hard to find out:
  - trading costs are much larger than in the stock market
  - higher for retail than for wholesale investors (presumably reflecting different search costs or bargaining power)
  - dispersion of prices charged by different dealers on the same day, especially for trades with retail customers (again possible reflection of different search costs)
  - in 2004, NASD sanctioned dealers: it found that one bond was bought from a customer at a price less than half of its price later in the day

1.2 Quote transparency: effect on execution risk

- If you cannot see prices when placing an order, you may trade "at the wrong time" or "the wrong amount"
- Suppose that a customer who faces random liquidity
  - Is a buyer: wants to trade q and his personal valuation is $\mu + \tau$
  - places a market order at the price (as in Kyle, 1985):

$$p = \mu + \lambda q$$

note: now λ is random

- *Opaque quotes*: customer picks q to maximize expected gains from trade *without knowing* λ:

$$\max_q \mathrm{E}\left[(\mu+\tau)q - pq\right] = \mathrm{E}\left[(\mu+\tau)q - (\mu+\lambda q)q\right]$$
$$= \tau q - E(\lambda)q^2$$

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Trading with opaque vs. transparent quotes

- So if quotes are opaque, the customer solves:

$$\max_q \ \tau q - \mathrm{E}(\lambda)q^2 \quad \Rightarrow \boxed{q^O = \frac{\tau}{2\mathrm{E}(\lambda)}}$$

$\Rightarrow$ order size is:

- increasing in the stock's subjective valuation τ
- decreasing in the expected price pressure $\mathrm{E}(\lambda)$, i.e. in expected trading costs

- If instead quotes are known when choosing q

$$\max_q \ \tau q - \lambda q^2 \quad \Rightarrow \boxed{q^T = \frac{\tau}{2\lambda}} \qquad \boxed{\mathrm{E}(q^T)} = \mathrm{E}\left(\frac{\tau}{2\lambda}\right) \boxed{> q^O}$$

note: q^T is **random** (q^O is not)

i.e., on average more trading with transparency: why?

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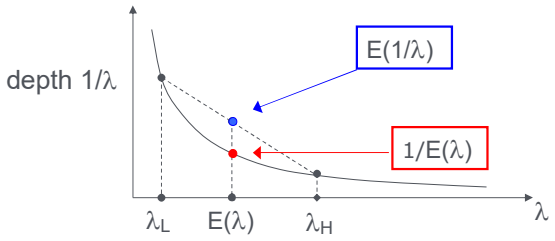
Why does quote transparency increase trading?

- Math: Jensen's inequality = expectation of convex function exceeds convex function of expectation, and $1/\lambda$ is convex
- Graphically:



- Intuition: if you know λ, you trade a lot if market is deep (λ_L) and little if it is thin (λ_H), but proportionally more when deep than when thin $\Rightarrow$ on average you trade more than you do if trade always the same (based on average depth)

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Welfare with transparent vs. opaque quotes

- Quote transparency also raises investors' expected welfare: replace the optimal trading policies in the objective function:
  - with opaque quotes:

$$\tau q^O - \mathrm{E}(\lambda)(q^O)^2 = \frac{\tau^2}{2\mathrm{E}(\lambda)} - \mathrm{E}(\lambda)\frac{\tau^2}{(2\mathrm{E}(\lambda))^2} = \frac{\tau^2}{4\mathrm{E}(\lambda)}$$

  - with transparent quotes:

$$\mathrm{E}\left(\tau q^T - \lambda (q^T)^2\right) = \mathrm{E}\left(\frac{\tau^2}{2\lambda} - \lambda\frac{\tau^2}{(2\lambda)^2}\right) = \mathrm{E}\left(\frac{\tau^2}{4\lambda}\right)$$

larger!

- Intuition: you trade relatively more when market is deeper $\Rightarrow$ save on trading costs = face less execution risk (argument even stronger if investors were risk averse!)

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1.3 Order flow transparency

- Opaque market (e.g., OTC): every dealer observes only his own order flow (not that hitting other dealers)
- Transparent market (e.g. open outcry auction on CBOT): all market participants see all orders channeled to the market
- To contrast these settings, modify the Glosten-Milgrom model only to allow for multiple orders:
  - prob. π: 2 informed traders, each placing equal size-1 order
  - prob. $1-\pi$: 2 uninformed traders, placing offsetting orders
- Reflects the idea that information-based orders are more likely to be correlated than orders placed by liquidity traders

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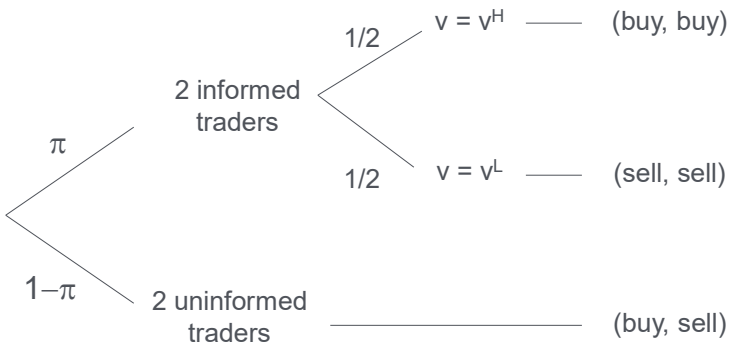
Order arrival process



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Opaque order flow: bid-ask spread and price dispersion

- Each dealer sets prices expecting a buy or sell order but without knowing the order that other dealers are getting
- Being competitive and risk neutral, it sets ask and bid quote according to the zero-profit condition:

$$a^O = \mu + \pi(v^H - \mu), \qquad b^O = \mu + \pi(v^L - \mu)$$

- So the bid-ask spread is

$$s^O = \pi(v^H - v^L) = 2\pi(v^H - \mu)$$

$\Rightarrow$ trading cost (half-spread)

$$TC = (\pi / 2)(v^H - v^L)$$

- Price dispersion (inverse measure of price discovery) is

$$E\left[(p^O - v)^2\right] = (1 - \pi^2)(v^H - \mu)$$

note: as usual, illiquidity is increasing in π and price dispersion is decreasing in π

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Computing price dispersion under opaqueness

$$E\left[(p^O - v)^2\right] = \frac{\pi}{2}(a^O - v^H)^2 + \frac{\pi}{2}(b^O - v^L)^2$$ informed orders

uninformed order if v = v^H

$$+\frac{1-\pi}{2}\left[\frac{1}{2}(a^O - v^H)^2 + \frac{1}{2}(b^O - v^H)^2\right]$$

uninformed order if v = v^L

$$+\frac{1-\pi}{2}\left[\frac{1}{2}(a^O - v^L)^2 + \frac{1}{2}(b^O - v^L)^2\right]$$

$$a^O - v^H = -(1-\pi)(v^H - \mu)$$
$$b^O - v^L = -(1-\pi)(v^L - \mu) = (1-\pi)(v^H - \mu)$$
$$a^O - v^L = (\mu - v^L) + \pi(v^H - \mu) = (1+\pi)(v^H - \mu)$$
$$b^O - v^H = (\mu - v^H) + \pi(v^L - \mu) = -(1+\pi)(v^H - \mu)$$

...substituting **these 4** in expression above, we get result on previous slide

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Transparent order flow: bid-ask spread

- Each dealer sets prices expecting a buy or sell order but knowing the order that other dealers are getting:
  - 2 buys ⇒ they must be from the informed: $p^T = v^H$
  - 1 buy, 1 sell ⇒ they must be from the uninformed: $p^T = \mu$
  - 2 sells ⇒ they must be from the informed: $p^T = v^L$
- Order flow transparency ⇒ dealers identify traders perfectly ⇒ uninformed investors face **no** bid-ask spread:

$$s^T(B,S) = 0$$

⇒ better off than under opaqueness

- Instead, informed face maximum bid-ask spread $v^H - v^L$

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Transparent order flow: price dispersion

- Since dealers identify informed investors, they learn more ⇒ better price discovery:
  - when informed investors trade, the price equals the true value of the security: $p^T = v$
  - when uninformed investors trade, it is uninformative: $p^T = \mu$
- So price dispersion is

$$E\left[(p^T - v)^2\right] = (1-\pi)\left[\frac{1}{2}(v^H - \mu)^2 + \frac{1}{2}(v^L - \mu)^2\right]$$

$$= (1-\pi)(v^H - \mu)^2 < (1-\pi^2)(v^H - \mu)^2$$

note: difference in price dispersion between the two regimes is **maximal** for $\pi = ½$ (i.e., maximum uncertainty about presence of informed trading)

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Post-trade transparency

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2. Post-trade transparency

- Speed of publication of past trades – highly controversial:
  - dealers strongly oppose fast publication
  - trading platform often oppose it too
  - reason: post-trade transparency would redistribute trading profits to other market participants
- Let us explore this issue by simply giving a time dimension to the Glosten-Milgrom-style model just analyzed:
  - prob. π: sequence of 2 identical orders by informed traders
  - prob. $1-\pi$: sequence of 2 offsetting orders placed by uninformed traders in random sequence

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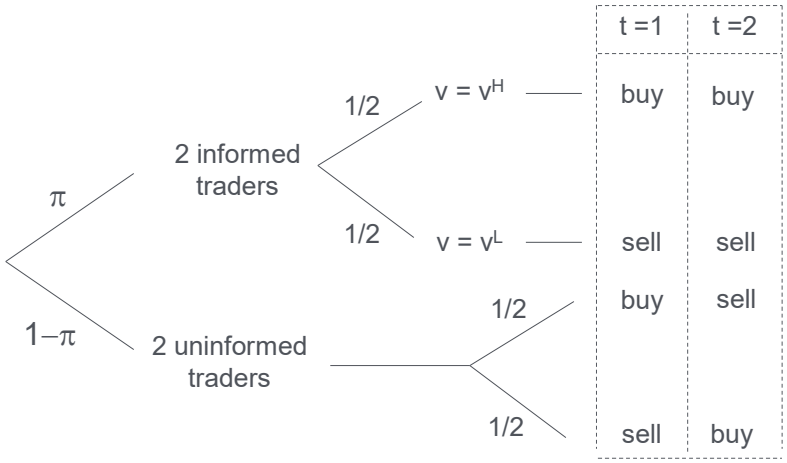
Order arrival process



Post-trade transparency: bid-ask spread

- At *t* =1: dealers have no previous order flow information ⇒ same situation as in opaque market analyzed before:

$$s_1^T = \pi(v^H - v^L) = 2\pi(v^H - \mu)$$

- At *t* =2: dealers know previous order ⇒ same situation as in transparent market analyzed before:
  - after buy, can get either informed buy (⇒ $a = v^H$) or uninformed sell (⇒ $b = \mu$): spread is $v^H - \mu$
  - after sell, can get either uninformed buy (⇒ $a = \mu$) or informed sell ($b = v^L$) : spread is $\mu - v^L$

$$s_2^T = \frac{1}{2}(v^H - v^L) = v^H - \mu$$

Post-trade transparency: total trading cost

- But notice that at t = 2 uninformed traders buy and sell at the price $\mu \Rightarrow$ face a zero bid-ask spread
- Total trading cost (half-spread) to uninformed traders over 2 periods:

$$TC^T = \frac{s_1^T}{2} + 0 = \pi(v^H - \mu) = \frac{\pi}{2}(v^H - v^L)$$

$\Rightarrow$ per-period average trading cost = $\frac{\pi}{4}(v^H - v^L)$

- Intermediate between their trading cost under pre-trade transparency (0) and their trading cost under pre-trade opaqueness ($(\pi/2)(v^H - v^L)$) $\Rightarrow$ post-trade transparency is **imperfect substitute** for pre-trade transparency!

Post-trade opaqueness

- At t =2: the dealer who has received the order at t =1 has an informational advantage relative to all other dealers:
  - if it was a buy, true v is likely to be high
  - if it was a sell, true v is likely to be low
- Assume that this dealer posts his ask and bid after all the others have (irrevocably) done so, i.e. he is a "Stackelberg follower":
  - others set $a = v^H$ and $b = v^L$, otherwise they make losses ("winner's curse": he would leave them just the bad deals)
  - if at t = 1 he gets a sell, he will set $a = v^H - \varepsilon$ (undercut ask) and $b = v^L$ (match bid) $\Rightarrow$ make profit with probability $1-\pi$

Post-trade opaqueness: bid-ask spread at *t*=1 and *t*=2

- Since ε can be infinitesimal, the bid-ask spread at *t* =2 is as large as possible:

$$s_2^O = v^H - v^L$$

- Rents, as under quote opaqueness!
- But competition for order flow at *t* =1 may compensate such period-2 rents with offsetting period-1 losses:

$$a_1^O = \underbrace{\mu + \pi(v^H - \mu)}_{\text{1-period competitive ask}} - \underbrace{(1-\pi)(v^H - \mu)}_{\text{ask-side rent at } t=2} = \mu + (2\pi - 1)(v^H - \mu)$$

$$\Rightarrow s_1^O = (2\pi - 1)(v^H - v^L) < s_2^O = v^H - v^L$$

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Post-trade opaqueness: bid-ask spread at *t*=1 and *t*=2

- Notice that:
  - this may require a negative spread at *t* =1 ⇒ arbitrage ⇒ dealers "must" earn positive profits over the two periods
  - even if they don't (i.e. if they make zero profits over the 2 periods), the total trading costs to uninformed traders is **twice** its size under post-trade transparency:

$$TC^O = \underbrace{(2\pi - 1)(v^H - \mu)}_{t=1} + \underbrace{(v^H - \mu)}_{t=2} = 2\pi(v^H - \mu)$$

- memo:

$$TC^T = \pi(v^H - \mu)$$

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Who gains and who loses from post-trade opaqueness?

- **Uninformed investors** lose
- **Informed investors** gain
- **Dealers** *may* gain: when competing *ex ante* for sub-sequent non-competitive rents, they may not dissipate all their profits over both periods...
  - either because this would require a negative bid-ask spread initially
  - or because there is not enough *ex ante* competition
- Explains (i) why dealers dislike post-trade transparency and (ii) also why they engage in "payment for the order flow" = payments to brokers to channel order flow to them

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Revealing traders' identities

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3. Revealing traders' identities

- Information on the **identity** of potential counterparties is price-relevant if it helps guessing their **trading motives**, especially about whether they are informed or not:
  - mutual fund selling because its retail clients are withdrawing funds = uninformed
  - top executives of a company selling their shares in the company = informed
- This form of transparency is highest in floor markets (physical contact) and dealer markets (phone contact), lowest in LBO markets (there it depends on market design, e.g. whether brokers codes are visible or not)

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Reducing anonimity

- Sometimes *traders want* to be recognized:
  - "Upstairs market" in New York: if you want to sell a large blocks of shares, you contact directly "block broker", who contacts large liquidity suppliers disclosing your identity and trading motive
  - Sunshine trading": you announce in advance a trade and its execution date and time
- Sometimes *regulators want* them to be recognized:
  - In Switzerland since 1997 companies that wish to buy back their own shares (typically informed) use a "second trading line", to reduce adverse selection on the main market

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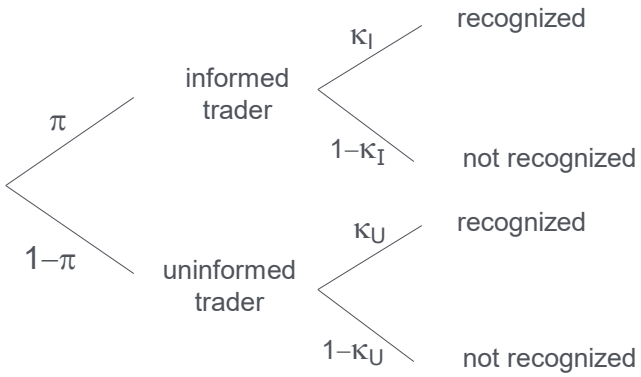
Order arrival process and traders' anonimity

Allow for "partial recognition" of traders in Glosten-Milgrom model:



"Recognized traders" get different prices

- If you are recognized as uninformed, you get highest liquidity: always trade at $\mu \Rightarrow$ bid-ask spread = 0
- If you are recognized as informed, you get lowest liquidity: buy at v^H, sell at $v^L \Rightarrow$ bid-ask spread = $v^H - v^L$
- If you are *not recognized*, then the price you get depends on the probability that you are informed, conditional on you not being recognized:

$$\pi' = \frac{\pi(1-\kappa_I)}{\pi(1-\kappa_I)+(1-\pi)(1-\kappa_U)}$$

π′ plays same role as π in basic G-M model

- π' is decreasing in κ_I (recognized as informed) and increasing in κ_U (recognized as uninformed)

Prices faced by "unrecognized traders"

- So if you are *not recognized*, the prices that you get are:

$$a = \mu + \frac{\pi(1-\kappa_I)}{\pi(1-\kappa_I)+(1-\pi)(1-\kappa_U)}(v^H - \mu)$$

$$b = \mu - \frac{\pi(1-\kappa_I)}{\pi(1-\kappa_I)+(1-\pi)(1-\kappa_U)}(v^H - \mu)$$

$$s = \frac{\pi(1-\kappa_I)}{\pi(1-\kappa_I)+(1-\pi)(1-\kappa_U)}(v^H - v^L)$$

$\Rightarrow$ the bid-ask spread you face is decreasing in κ_I (Swiss "2nd trading line") and increasing in κ_U ("sunshine trading")

Do uninformed traders gain from being recognized?

- On average, uninformed traders gain: their "average bid-ask spread" is decreasing in κ_U:

$$\kappa_U \cdot 0 + (1-\kappa_U)\frac{\pi(1-\kappa_I)}{\pi(1-\kappa_I)+(1-\pi)(1-\kappa_U)}(v^H - v^L)$$

lower prob. of paying the spread — higher spread if unrecognized

…but effect 1 dominates 2!

- Note: uninfomed traders gain *only if* their identity is disclosed to all market participants: if it is disclosed only to their dealer, he may appropriate part or all of the gain!
- Even their broker may appropriate part of the gain, and split it with the dealer: "cream skimming" of uninformed trades by broker in exchange for "payment for order flow"!

Why are markets so opaque?

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4. Why are markets so opaque?

- Many real-world securities markets are very opaque. Even if you want to trade a blue-chip stock, such as IBM, getting up-to-date price quote information is costly and not easy
- Indeed, execution costs for munis fell by 50% after the Trace trade reporting system was introduced
- Puzzling: if transparency generally raises liquidity and improves price discovery, why there is not more of it?
  - Rent-extraction by market makers and finance professionals (often informed) at expense of uninformed investors $\Rightarrow$ lobbying for opaqueness ("Wall Street against Main Street")
  - Trading platforms make big money by selling trade/price data

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Why does competition not deal with it?

- Opaqueness can withstand competition: if other dealers disclose the orders that they receive, I still make more profits by not disclosing mine!
- Hard to enforce post-trade transparency: use of “protected trades” in the U.K. to delay trade reporting (Franks and Schaefer, 1995)
- Opaqueness can also have a bright side:
  - Liquidity from hidden orders: encourage limit order placement (allow limit order placers to “avoid giving a free option” to better informed traders)
  - Same for anonimity: under certain conditions, it may encourage more aggressive trading by uninformed investors

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