Internalization, Clearing and Settlement, and Stock Market Liquidity

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Motivation

- Financial transactions involve different steps and costs

Trading → clearing → settlement → custody

Trade costs (front office)

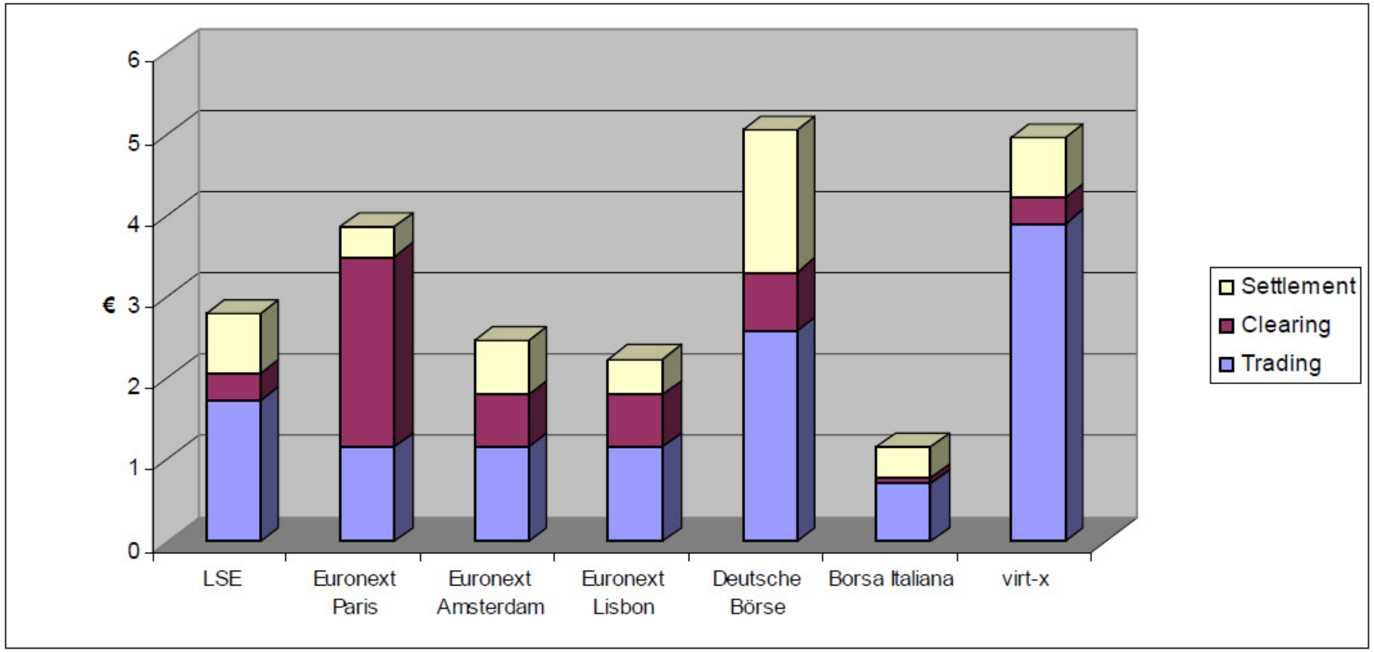
Post-trade costs (back office)

- Literature mostly focuses either on
  - "trading" (see e.g. Biais, Glosten and Spatt (2005), De Jong and Rindi (2009)), or Foucault (2009)), or
  - "clearing and settlement" (see e.g. Holthausen and Tapking (2007))
  - Improved liquidity and "unbundling" makes role of post-trade costs relatively more important?

- This paper links stock market liquidity to post-trade costs
  - We study the impact of *different pricing schemes* of the post-trade infrastructure
  - Motivated by recent behavior in US and Europe

Motivation: are post-trade costs important?

- Issues paper DG Comp European Commission



Decomposition of costs per trade, 2004

Source: Published fee schedules

■Source graph: Issues Paper, DG COMP European Commission (2006)

- See also comparison (May 2010) of LSE-BATS-Chi-X by Oxera

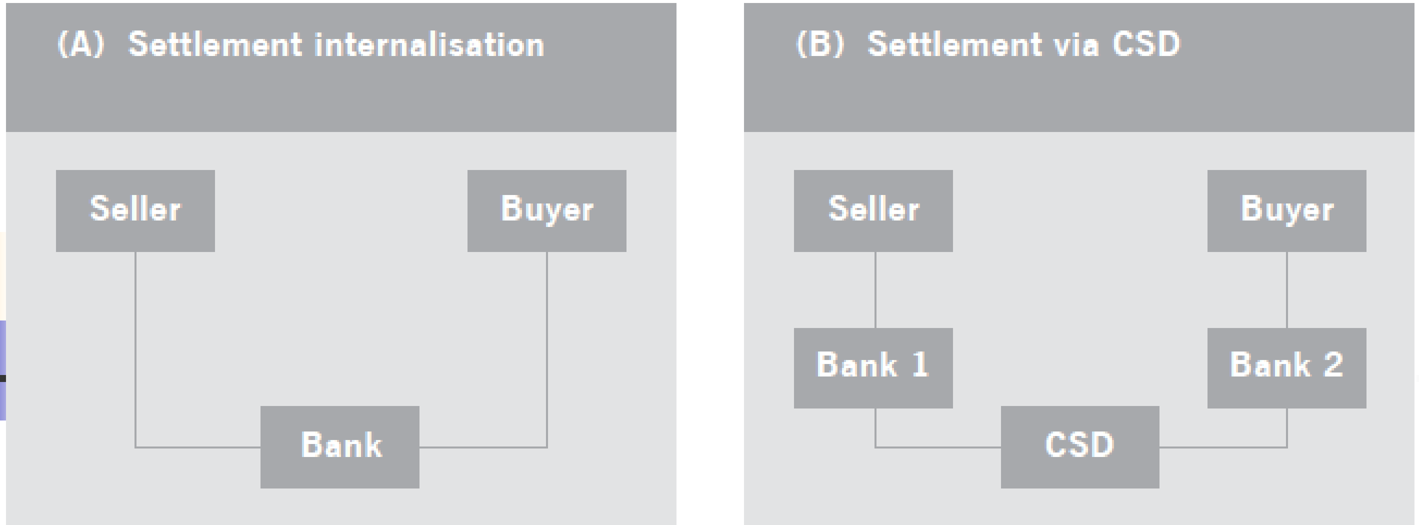
Motivation

- Trades at same quotes should be identical. They are not!
  (see also Foucault, Kadan and Kandel (2009) on *make and take* fees)

- Three examples:
  - London Stock Exchange started “SETS internalizer” in April 2007.
    - order book executions where both sides of the trade originate from the same investment firm do not pass through to clearing and settlement: tariff charged is 87.5% lower than the headline rate

  - Euronext introduced algorithm that allows buy and sell orders originating from the same investment firm to avoid the cost of clearing and settlement.

  - In the US, the DTCC (Depositary Trust and Clearing Corporation) observed that an increasing number of investment firms pre-netted their trades => clearing and settlement fees were adapted in order to remove pre-netting (DTCC (2003)).



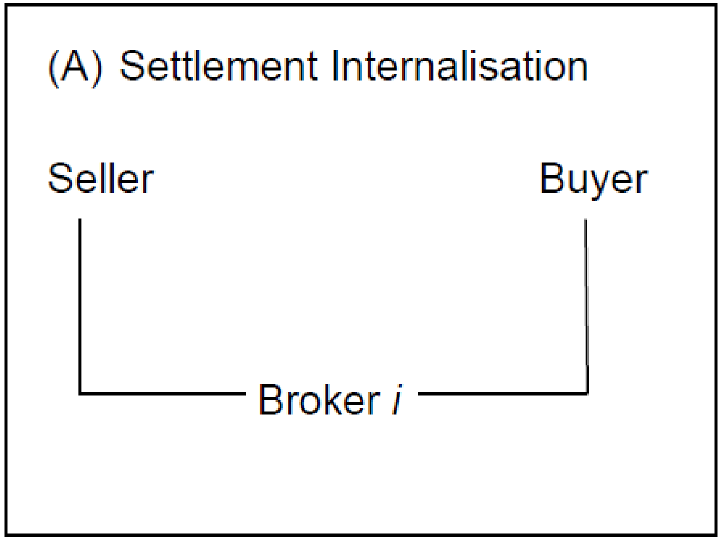
Source: white paper Deutsche Börse

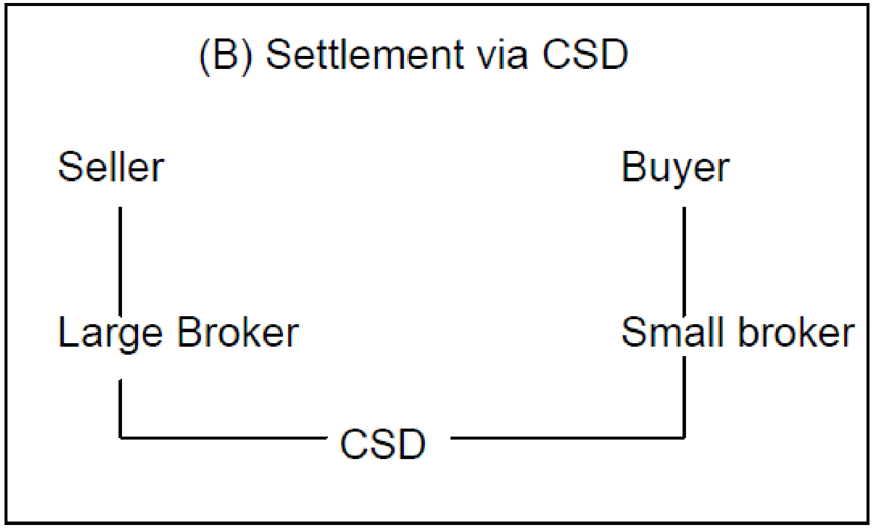
(A) Seller and buyer from *same bank*: bank "**internalizes** clearing and settlement"

"structural" cost per leg normalized to 0

(B) Seller and buyer from *different bank*: **non-internalized** settlement (banks require CSD for clearing and settlement)

"structural" marginal cost per leg of the trade $c > 0$





Two brokers *i* = large, small (market share of traders γ, 1- γ; at both buyers and sellers)

(A) Seller and buyer from same broker: price c^I (for each leg of the transaction)
(B) Seller and buyer from different broker: price c^{NI} (for each leg of the transaction)

- Pricing schemes of post-trade infrastructure

Uniform	$c^I_{large} = c^{NI}_{large} = c^I_{small} = c^{NI}_{small}$
Broker-Specific	$c^I_{large} = c^{NI}_{large}$ and $c^I_{small} = c^{NI}_{small}$
Trade-Specific	$c^I_{large} = c^I_{small}$ and $c^{NI}_{large} = c^{NI}_{small}$

Timing of Model

- Before trading starts:
  - Post-trade infrastructure (CSD) announces price according to pricing scheme (uniform or trade-specific)
  - CSD operates in a perfectly competitive environment => breakeven pricing
  - Buyers and sellers are affiliated to a broker (small or large)
- Trading:
  - Each period in time t=0,1,... + ∞, a single trader arrives willing to trade one unit of the asset
  - With equal probability it is a buyer or a seller
    - Buyer has valuation V_h
    - Seller has valuation V_l ($V_h > V_l$)
  - Traders can submit either a *market order* or *limit order*; limit order remains in book for one period (as in e.g. Foucault (1999), Handa, Schwartz and Tiwari (2003), Parlour (1998))
  - Limit orders are optimally chosen such that targeted trader type chooses to go for market order
- Clearing and settlement takes place after each trade (so no intertemporal netting)

Possible "strategies" for limit order traders

I. traders of the large broker aim to address counterparties of all brokers, traders of the small broker also aim to address counterparties of all brokers: $\{all, all\}$

II. traders of the large broker aim to address counterparties of her own brokers, traders of the small broker aim to address counterparties of all brokers: $\{own, all\}$

III. ~~traders of the large broker aim to address counterparties of *both* brokers, traders of the small broker only aim to address counterparties of their *own* broker:~~ $\cancel{\{all, own\}}$

IV. traders of both brokers only aim to address counterparties of their *own* broker: $\{own, own\}$.

Uniform pricing of post-trade

$$c^I_{large} = c^{NI}_{large} = c^I_{small} = c^{NI}_{small} = c^U \boxed{= 2\gamma\left(1-\gamma\right)c}$$

- **{all, all} strategy** is the only one possible
- Suppose empty limit order book and a *buyer* arrives: submits a bid B such that next arriving seller is indifferent between selling at B or submitting a LO herself at A

$$B^{U,\{all,all\}} - V_l - c^U = \frac{1}{2}\left[A^{U,\{all,all\}} - V_l - c^U\right]$$

- Similarly for a *seller* arriving

$$V_h - A^{U,\{all,all\}} - c^U = \frac{1}{2}\left[V_h - B^{U,\{all,all\}} - c^U\right]$$

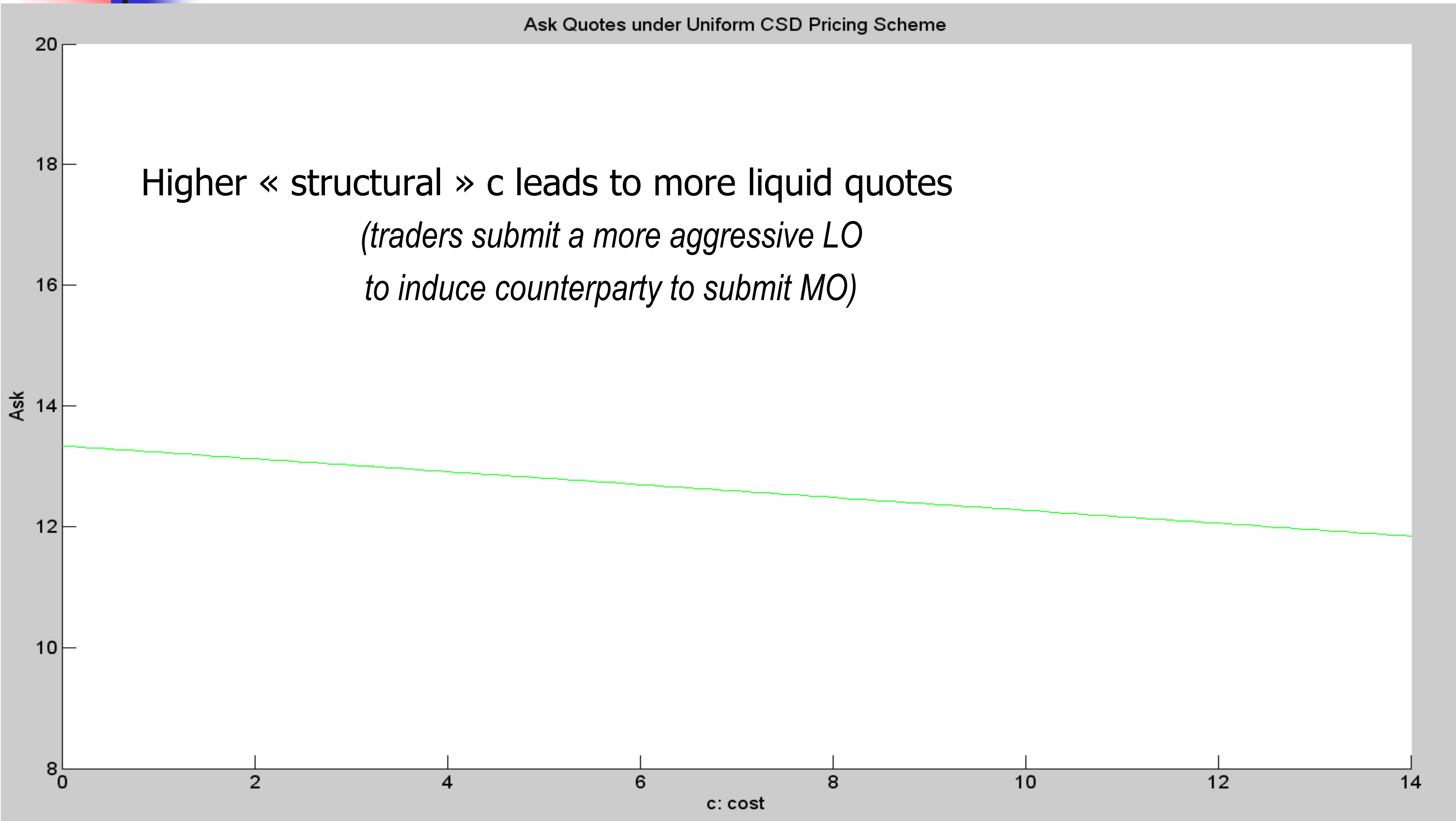
- Resulting in

$$A^{U,\{all,all\}} = \frac{2V_h + V_l - 2\gamma\left(1-\gamma\right)c}{3}$$

$$B^{U,\{all,all\}} = \frac{V_h + 2V_l + 2\gamma\left(1-\gamma\right)c}{3}$$

Uniform pricing of post-trade: illustration

$V_h = 20$; $V_l = 0$; $\gamma = 0.8$



Trade-specific pricing of post-trade

$$c^I_{large} = c^I_{small} = 0$$
$$c^{NI}_{large} = c^{NI}_{small} = c$$

{All, All}

- Buyer of **large** broker arrives: submits B such that next arriving seller of **small** broker is indifferent between selling at B or submitting a LO herself at A **addressing all counterparties**

$$B^{TS,\{all,all\}}_{large} - V_l - c = \frac{1}{2}\left[A^{TS,\{all,all\}}_{small} - V_l - \gamma c\right]$$

- Similarly for **small** broker

$$B^{TS,\{all,all\}}_{small} - V_l - c = \frac{1}{2}\left[A^{TS,\{all,all\}}_{large} - V_l - (1-\gamma)c\right]$$

- Resulting in

$$A^{TS,\{all,all\}}_{large} = \frac{2V_h + V_l}{3} - (1-\gamma)c$$
$$B^{TS,\{all,all\}}_{large} = \frac{V_h + 2V_l}{3} + (1-\gamma)c$$
$$A^{TS,\{all,all\}}_{small} = \frac{2V_h + V_l}{3} - \gamma c$$
$$B^{TS,\{all,all\}}_{small} = \frac{V_h + 2V_l}{3} + \gamma c$$

Large broker posts **less** liquid quotes as outside option of small broker is less attractive

Trade-specific pricing post-trade

$$
\begin{aligned}
c^{I}_{large} &= c^{I}_{small} = 0 \\
c^{NI}_{large} &= c^{NI}_{small} = c
\end{aligned}
$$

{Own, All}

- Buyer of **large** broker arrives: submits B such that next arriving seller of **large** broker is indifferent between selling at B or submitting a LO that **addresses own counterparties** only

$$
B^{TS,\{own,all\}}_{large} - V_l = \frac{\gamma}{2}\left[A^{TS,\{own,all\}}_{large} - V_l\right]
$$

- Buyer of **small** broker arrives: keeps arriving seller of **large** broker indifferent who addresses **own counterparties** only

$$
B^{TS,\{own,all\}}_{small} - V_l - c = \frac{\gamma}{2}\left[A^{TS,\{own,all\}}_{large} - V_l\right]
$$

- Resulting in

$$
\begin{aligned}
A^{TS,\{own,all\}}_{large} &= \frac{2V_h + \gamma V_l}{2+\gamma} \\
B^{TS,\{own,all\}}_{large} &= \frac{\gamma V_h + 2V_l}{2+\gamma} \\
A^{TS,\{own,all\}}_{small} &= \frac{2V_h + \gamma V_l}{2+\gamma} - c \\
B^{TS,\{own,all\}}_{small} &= \frac{\gamma V_h + 2V_l}{2+\gamma} + c
\end{aligned}
$$

Large broker posts **less** liquid quotes as small broker needs to fully compensate large broker for costs

Trade-specific pricing post-trade

$$c^{I}_{large} = c^{I}_{small} = 0$$
$$c^{NI}_{large} = c^{NI}_{small} = c$$

{Own, Own}

- Buyer of **large** broker arrives: submits B such that next arriving seller of **large** broker is indifferent between selling at B or submitting a LO that **addresses own counterparties** only

$$B^{TS,\{own,own\}}_{large} - V_l = \frac{\gamma}{2}\left[A^{TS,\{own,own\}}_{large} - V_l\right]$$

- Buyer of **small** broker arrives: keeps arriving seller of **large** broker indifferent who addresses **own counterparties** only

$$B^{TS,\{own,own\}}_{small} - V_l = \frac{(1-\gamma)}{2}\left[A^{TS,\{own,own\}}_{small} - V_l\right]$$

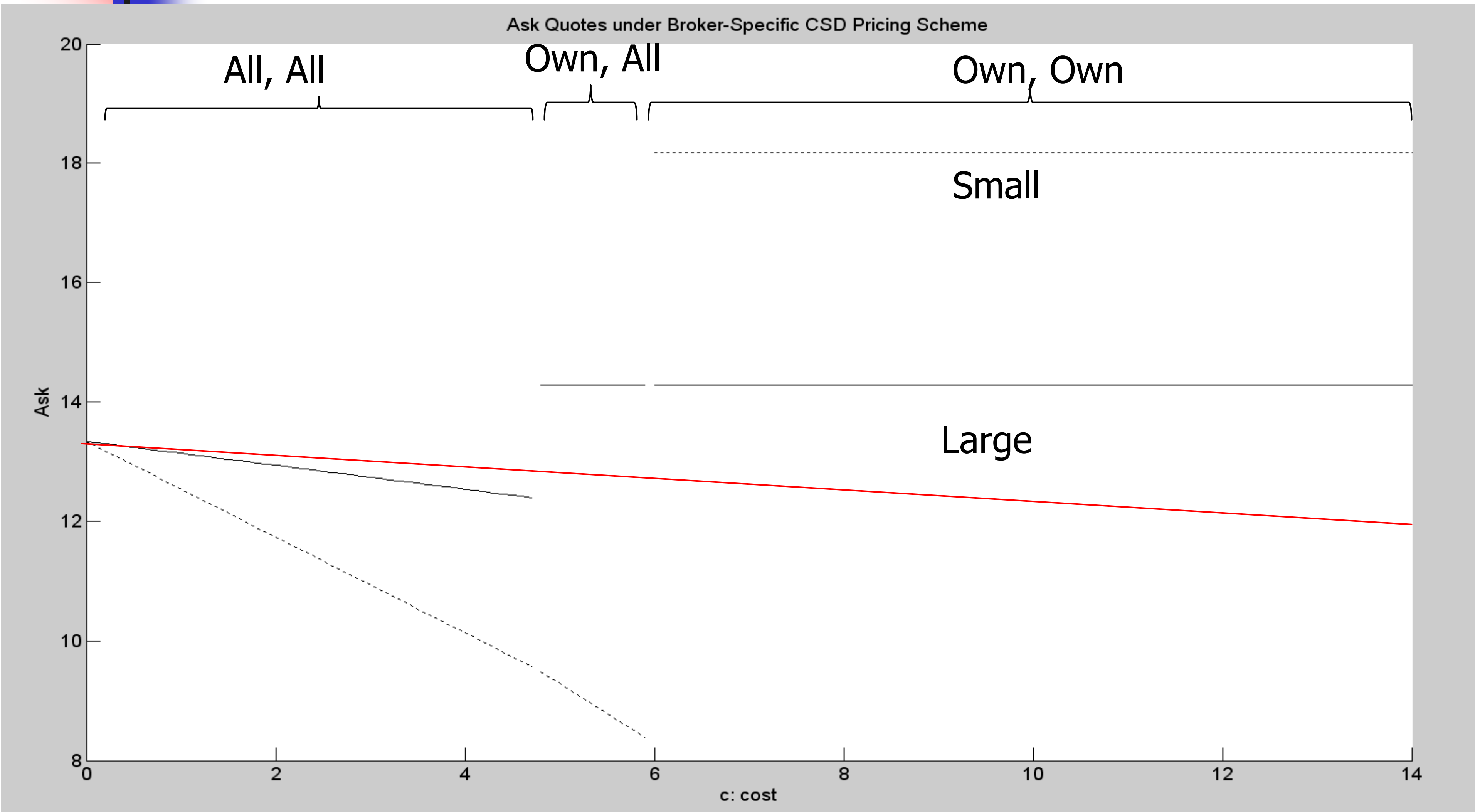
- Resulting in

$$A^{TS,\{own,own\}}_{large} = \frac{2V_h + \gamma V_l}{2+\gamma}$$
$$B^{TS,\{own,own\}}_{large} = \frac{\gamma V_h + 2V_l}{2+\gamma}$$
$$A^{TS,\{own,own\}}_{small} = \frac{2V_h + (1-\gamma)V_l}{3-\gamma}$$
$$B^{TS,\{own,own\}}_{small} = \frac{(1-\gamma)V_h + 2V_l}{3-\gamma}$$

Large broker posts **more** liquid quotes as outside option of his own type is attractive

Trade-specific pricing by CSD: illustration

$V_h = 20$; $V_l = 0$; $\gamma = 0.8$



Social Welfare

- When trading gains are larger than CSD costs => maximize probability of trading => {all, all} equilibrium is preferable
- Higher CSD costs lead to higher liquidity but lower social welfare => higher liquidity may not be good indicator of social welfare
- When c is very high, trade-specific (marginal cost based) pricing allows to create a market: internalization creates a market (without internalization the market would collapse)

Concluding Remarks

- Post-trading costs as wells as their pricing schemes influence stock market liquidity
- Quotes are not sufficient indicators of liquidity
  - Quotes are trader specific
- “transaction specific pricing” improves liquidity as long as we have {all,all} equilibrium
- Higher liquidity may entail lower social welfare
- Internalization “creates a market” when clearing and settlement costs are prohibitively high