

Competition between financial trading systems

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What is going on? A lot, a lot, a lot!!

Mergers and alliances

- NYSE acquired Euronext, and allied with Tokyo Stock Exchange.
- LSE and Borsa Italiana have just completed their merger.
- NASDAQ bought OMX and Dubai bourse bought stake in NASDAQ and LSE

Tough competition: newcomers are many and strong!

- BATS in 2 years has captured nearly 1/10 of trades in NASDAQ-listed securities, and has started to trade NYSE securities.
- Instinet Europe has launched Chi-X (ECN trading platform) and BlockMatch, designed for institutions' trading.
- American big banks plan to set up a new electronic trading venue, to make transactions in a cheaper way than on NYSE/NASDAQ.

Consolidation of stock exchanges

There is an increasing consolidation in stock exchanges. Why?

- No definitive answer yet...
- Network externalities: consider exchanges as “firms” that produce and sell a “good”, the exchanging of securities. Ideal merge? Exchange strong on the listing side and exchange strong on the trading side.
- Economy of scale

Who benefits from stock exchange consolidation?

- No definitive answer yet...
- On the one side exchanges should increase their market power, on the other side investors could take advantage of networks effect and higher liquidity.

Our focus: Competition between Financial Market Structures

Why are financial market structures important?

- They influence market liquidity: traders look for market liquidity and listed firms want a liquid market.
- They determine transaction costs, and hence influence portfolio choice and rebalancing.
- There is a clear difference between Europe and U.S.
- Competition is going on, we would like to predict the winner...

Questions:

- Which is the better market structure in providing liquidity to traders?
- Which market will survive?

Financial Trading Platforms

AREA	MARKET STRUCTURE	EXECUTION SYSTEM	EXAMPLES
EUROPE	Electronic Limit Order Book (LOB)	Order-driven	Euronext, OMX, Xetra
U.S.	Hybrid Market	Order-driven and Quote-driven	NYSE, NASDAQ

The Limit Order Book

LAST MATCH		TODAY'S ACTIVITY	
Price	29.0500	Orders	9,106
Time	12:58:22.751	Volume	237,547

BUY ORDERS		SELL ORDERS	
SHARES	PRICE	SHARES	PRICE
100	29.0500	500	29.1000
500	29.0500	400	29.1100
100	29.0500	100	29.1200
1,012	29.0000	100	29.1500
100	29.0000	400	29.2000
300	28.9900	700	29.2000
300	28.9700	100	29.3500
300	28.9400	2,000	29.4000
900	28.9400	300	29.4500
300	28.9400	200	29.5500
300	28.9400	200	29.6500
300	28.9300	1,000	29.8000
300	28.9300	100	29.9800
300	28.8300	200	30.0000
300	28.9300	100	30.0000

- Automated and anonymous system
- Orders are executed at different prices (discriminatory auction)
- Three priority rules:
 1. Price
 2. Time
 3. (Public)

How does the LOB work?

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300	28.9400	200	29.6500
300	28.9300	1,000	29.8000
300	28.9300	100	29.9800
300	28.8300	200	30.0000
300	28.9300	100	30.0000
1000	28.9300		

Buy #1000 shares, two choices:

LIMIT BUY ORDER

You specify a price.

Example: buy 1000 at 28.93

⇒ You offer liquidity to LOB

MARKET BUY ORDER

Execute at three different prices:

#500 at 29.1

#400 at 29.11

#100 at 29.12

⇒ You take liquidity from LOB

Hybrid Market 1: NASDAQ



The screenshot shows the NASDAQ NDAQ trading interface. It includes a 'LAST MATCH' section with 'Price' at 28.0000 and 'Time' at 12:58:22.751. The 'TODAY'S ACTIVITY' section shows 'Orders' at 9,106 and 'Volume' at 237,547. Below these are two order books: 'BUY ORDERS' and 'SELL ORDERS'. The 'BUY ORDERS' table lists shares and prices, with the top entry being 100 shares at 28.0500. The 'SELL ORDERS' table lists shares and prices, with the top entry being 500 shares at 28.1000. At the bottom, there are small indicators for '(31 mops)' and '(14 mops)'.

BUY ORDERS		SELL ORDERS	
SHARES	PRICE	SHARES	PRICE
100	28.0500	500	28.1000
500	28.0500	400	28.1100
100	28.0500	100	28.1200
1,012	28.0000	100	28.1300
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300	28.9300	100	28.9800
300	28.9300	200	30.0000
300	28.9300	100	30.0000

+



Buy #1000 shares, two choices:

Go to LOB

As before...

GO TO A DEALER

The dealer can:

1. send the order to the LOB
2. fill the order out of his inventory
3. find a natural cross with another institution

Hybrid Market 2: NYSE



+



Buy #1000 shares, two choices:

Go to LOB

As before...but the specialist can stop your market order if he offers price improvement!

GO TO A BROKER

The broker can:

1. send the order to the LOB
2. bring the order to the floor (the specialist)

LOB or HYBRID MARKET?

DIFFERENCE 1

LOB: completely automated, order crossed directly.

NYSE/NASDAQ: not automated.

DIFFERENCE 2

LOB: very competitive.

NYSE/NASDAQ: specialist/dealers have market power.

⇒ Ellis et al. (JF, 2002), Simaan et al. (JF, 2003)

DIFFERENCE 3

LOB: anonymous.

NYSE/NASDAQ: trading is not anonymous, repeated interactions.

Should we go for a LOB?

- Fees: lower, since the market is completely automated.
- It is very competitive, lower trading cost (spread).
- Traders are anonymous, should encourage info acquisition.

Theory: **Glosten (JF, 94)**

- **Result:** no other anonymous exchange can improve on a LOB.
- **Idea:** orders are already broken in smaller transactions, no further cream-skimming is possible.

Empirics: **Venkataram (JF, 01)**

- **Result:** ceteris paribus, the NYSE (Hybrid Market) is more liquid than the Paris Bourse (LOB).

Advantage/disadvantage of NYSE

ADVANTAGE: RELATIONSHIP TRADING

Benveniste et al. (JFE, 1992): the specialist can extract information from brokers thanks to relationship trading and offer a better spread.

⇒ Battalio et al. (2007, JF) shows that the breaking of the specialist and broker relationship increases the spread.

DISADVANTAGE: COMPETITION DISTORTION

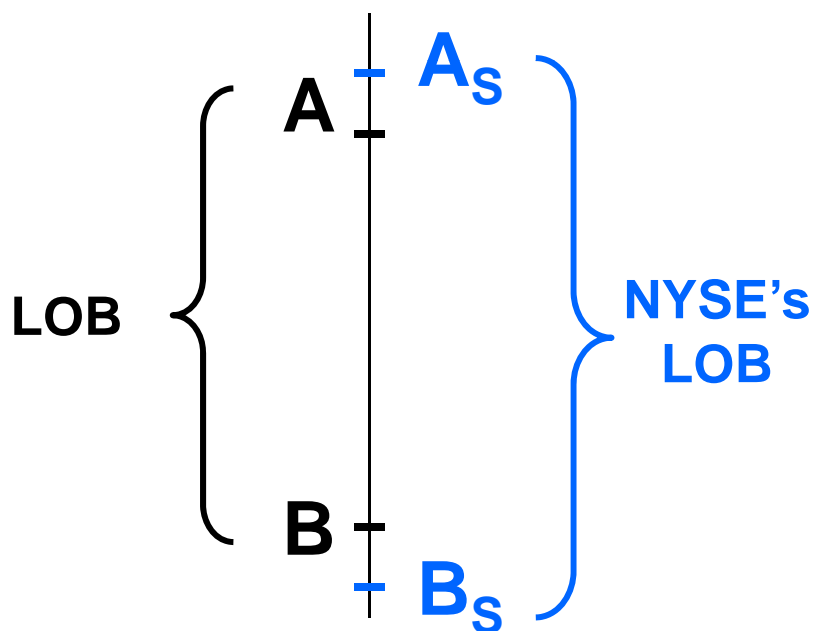
Rock (WP, 1990): Specialist increases adverse selection on the LOB by stopping “good orders”.

⇒ Ready (RFS, 1999) shows that stopped orders are more profitable than orders allowed to trade on the LOB.

The Two Effects

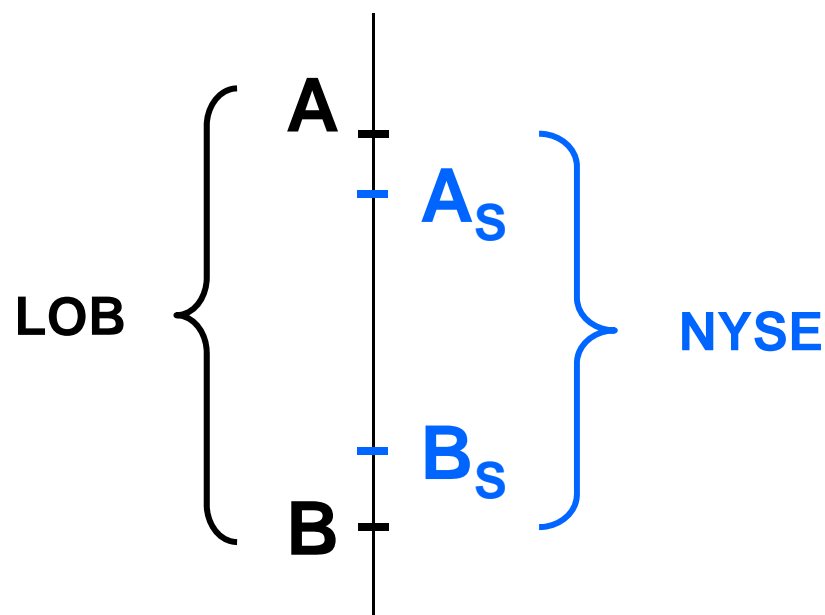
ROCK (90) EFFECT:

Lower quoted spread on a LOB than on NYSE.



BENV. (92) EFFECT:

Higher effective spread on a LOB than on NYSE.



Buti (WP, 2007) analyzes the interaction between these two effects.

The Model

- Three risk-neutral agents (brokers, competitive liquidity suppliers and a specialist) and risk-averse clients.
- Infinitely repeated game.
- Each period t a client arrives on the market to trade a risky asset v_t .
- Two market structures: a LOB and a hybrid market (LOB + specialist).
- Liquidity suppliers post quotes on the LOB ex-ante.
- Specialist deals directly with brokers ex-post.
- Clients submit their orders to the broker in both market structures.

Market Structures: Timing

The Pure LOB

- Liquidity suppliers post quotes.
- A client goes to a broker to submit his order.
- Brokers look at the LOB and hit the quotes (passive).

The Hybrid Market

- Liquidity suppliers post quotes.
- A client goes to a broker to submit his order.
- Broker looks at the LOB, asks for specialist quotes, selects the best offer.
- Specialist observes the broker's information at the end of the period, and commits to never trade again with the untruthful broker.

The Client

The client can have informational (his private signal, s), and/or risk sharing motivations (his endowment, I) to trade.

His wealth is:

$$W_t = (Q_t + I_t)v_t - P_t(Q_t)Q_t$$

Q_t = traded quantity

$P_t(Q_t)$ = average price

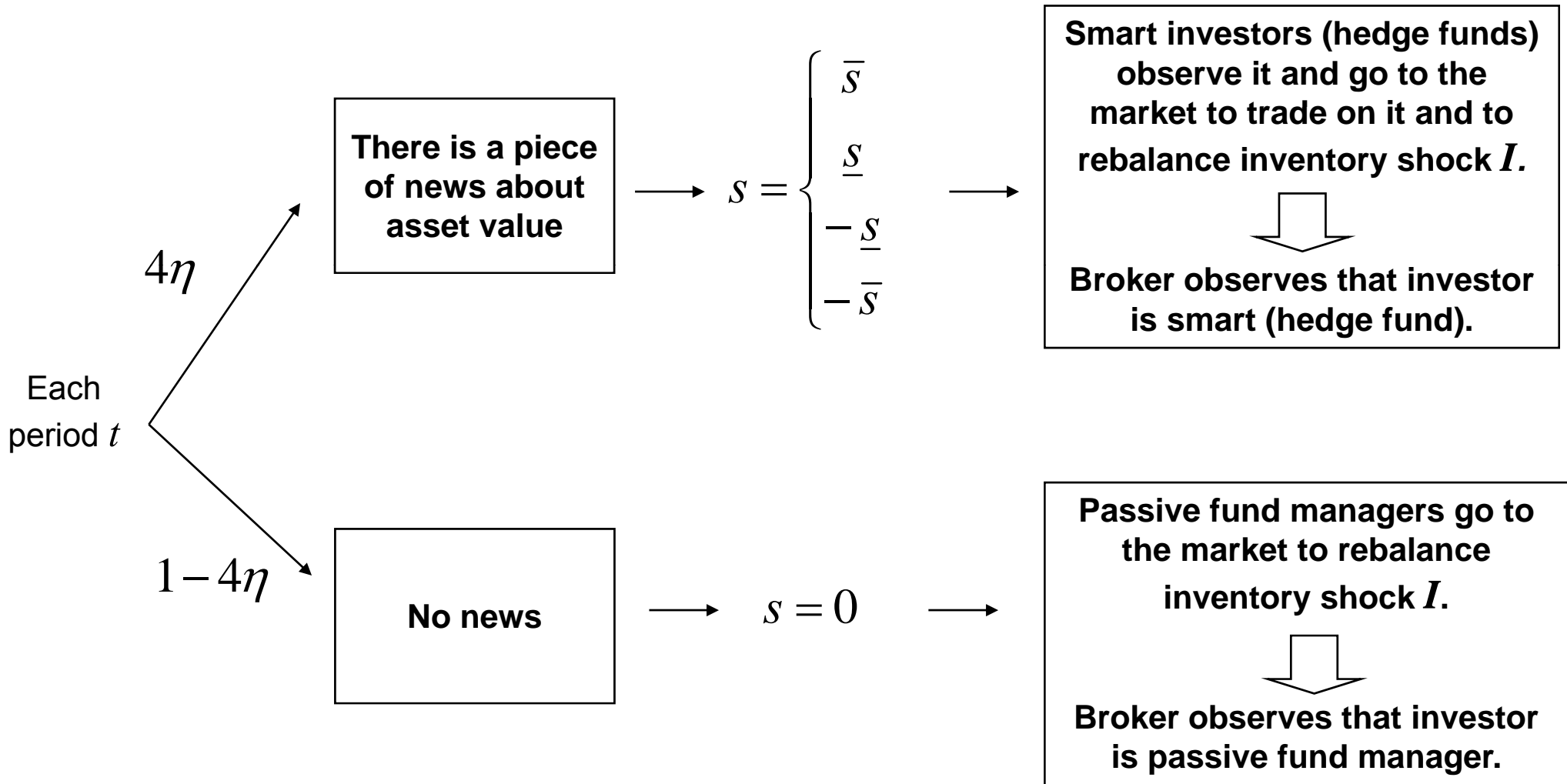
$v_t = s_t + \varepsilon_t$, $\varepsilon_t \sim (0, \sigma^2)$

$s_t \perp s_{t+i}$, for $i = 1, 2, \dots, \infty$

He has mean-variance preferences, with a risk-aversion coefficient γ :

$$U_t = \underbrace{\left(I_t s_t - \frac{\gamma \sigma^2}{2} I_t^2 \right)}_{\text{Reservation utility}} + \underbrace{\left(\theta_t Q_t - \frac{\gamma \sigma^2}{2} Q_t^2 - P(Q_t) Q_t \right)}_{\text{Gains from trade, } GT_t} \quad \text{where } \underbrace{\theta_t = s_t - \gamma \sigma^2 I_t}_{\text{Willingness to trade}}$$

Information Structure (1)



Information Structure (2)

	Clients	Brokers	Liquidity Suppliers	Specialist
Informative Signal	YES	NO	NO	NO
Inventory Signal	YES	NO	NO	NO
Client's Identity	YES	YES	NO	NO

- The broker knows the trader's identity, whether informed or not. But knowing this does not tell him the trader's private signal.
- Specialist has no informative advantage compared to liquidity suppliers.
- Specialist has a non anonymous repeated interaction with brokers.

Willingness to Trade Distribution: Ask Side

$$\theta_t = s_t - \gamma\sigma^2 I_t$$

where :

$$I_t = \begin{cases} I & 1/3 \\ 0 & 1/3 \\ -I & 1/3 \end{cases}$$

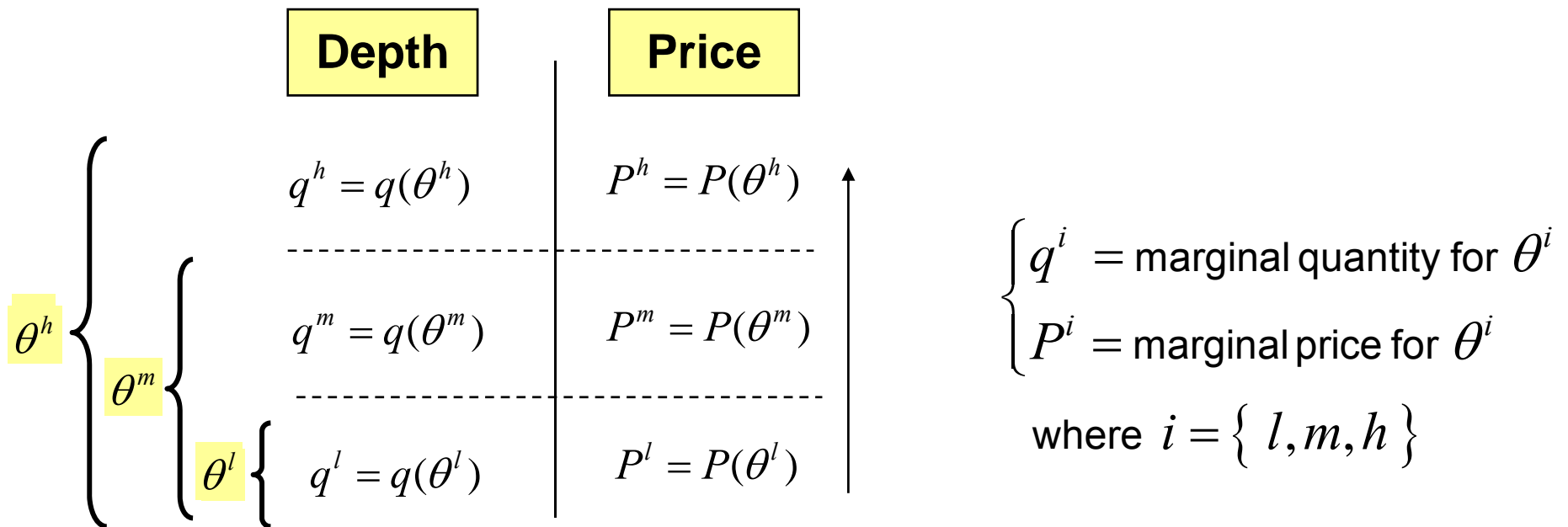


Trader's type	Signals	Prob.
θ^h	$(\bar{s}, -I)$	p^h
θ^m	$(\bar{s}, 0), (\underline{s}, -I)$	p^m
θ_i^l	$(\underline{s}, 0), (\bar{s}, I)$	p_i^l
θ_{ni}^l	$(0, -I)$	p_{ni}^l

with $\theta_{ni}^l = \theta_i^l = \theta^l$

Pure LOB

- LOB is modelled in Glosten (JF, 1994)'s spirit, using Biais et al. (Eca, 2000) contract theory approach.
- Liquidity suppliers select quantities to maximize trader's gains from trade, considering that traders buy at lower levels of the LOB first.



Hybrid Market: LOB + Specialist

- LOB is modelled as in the previous case.
- Specialist can improve on LOB trading terms for uninformed traders, thanks to relationship trading.
- Specialist observes at the end of the period the broker's informative signal.
- Specialist can commit to quote the same price and quantity for the future.
- Specialist can commit to never improve on LOB trading terms for a misreporting broker.

Brokers in the Hybrid Market

- Brokers extract a fraction b of clients' gains from trade:

$$V_t(\tilde{\theta}, \hat{\theta}) = \sum_{t=0}^{\infty} \left(\frac{1}{1+r} \right)^t b E_{\theta} [GT_t(\tilde{\theta}, \hat{\theta})]$$

b = broker's share of GT

r = discount rate

$\tilde{\theta}$ = true type

$\hat{\theta}$ = reported type

- Brokers play an active role.
- Gains from trade are:

$$GT_t^S(\tilde{\theta}, \hat{\theta}) = \begin{cases} GT^{LOB}(\tilde{\theta}_t) & \text{if } \hat{\theta} \in \{\theta^h, \theta^m, \theta_i^l\} \\ \tilde{\theta}_t Q_t^S - \frac{\gamma \sigma^2}{2} (Q_t^S)^2 - P_t^S Q_t^S & \text{if } \hat{\theta} = \theta_{ni}^l, \text{ no deviation} \end{cases}$$

Specialist's quantity

Specialist's price

The Specialist's Problem

The specialist solves the following problem:

$$\max_{Q^S, P^S} p_{ni}^l P^S Q^S$$

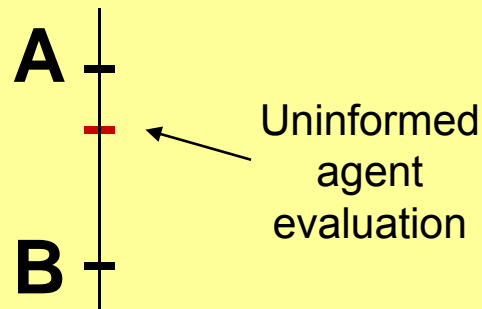
$$s.t \quad \begin{aligned} (IC^h) \quad & GT^S(\theta^h, \theta^h) + \sum_{t=1}^{\infty} \left(\frac{1}{1+r} \right)^t [p_{ni}^l GT^S(\theta_{ni}^l, \theta_{ni}^l)] \geq GT^S(\theta^h, \theta_{ni}^l) \\ (IC^m) \quad & GT^S(\theta^m, \theta^m) + \sum_{t=1}^{\infty} \left(\frac{1}{1+r} \right)^t [p_{ni}^l GT^S(\theta_{ni}^l, \theta_{ni}^l)] \geq GT^S(\theta^m, \theta_{ni}^l) \\ (IC_i^l) \quad & GT^S(\theta_i^l, \theta_i^l) + \sum_{t=1}^{\infty} \left(\frac{1}{1+r} \right)^t [p_{ni}^l GT^S(\theta_{ni}^l, \theta_{ni}^l)] \geq GT^S(\theta_i^l, \theta_{ni}^l) \\ (IR_{ni}^l) \quad & GT^S(\theta_{ni}^l, \theta_{ni}^l) \geq GT^S(\theta_{ni}^l, \theta_i^l) \end{aligned}$$

NYSE vs. LOB: Results

1. There is a **trade-off** between the good aspect of the LOB (competition) and the good aspect of a specialist hybrid market (relationship trading).
 - ⇒ Many informed traders on the market, relationship trading is better.
 - ⇒ Few informed traders on the market, competition is better.
2. The specialist has an **externality** on the LOB: he increases asymmetric information. This implies that even if a pure LOB is better, the specialist can survive.

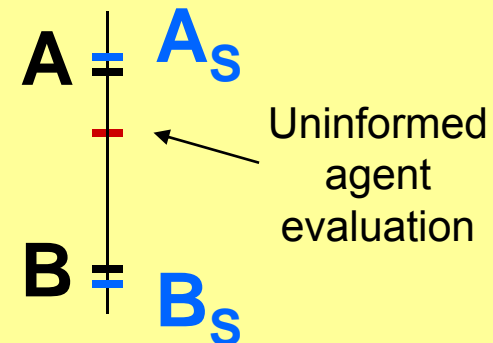
NYSE vs. LOB: Many Informed Traders

LIMIT ORDER BOOK



- Spread is large since liquidity suppliers fear picking-off.
- Uninformed traders are out of the market.

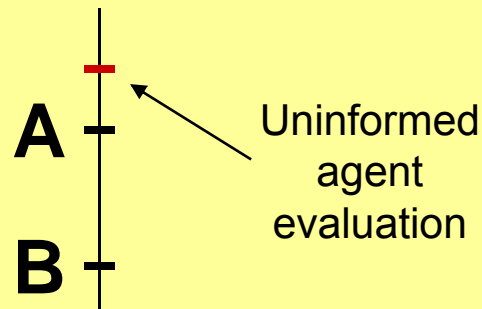
HYBRID MARKET



- Spread is not much worsened since liquidity suppliers were already scared.
- Uninformed traders are trading with the specialist.

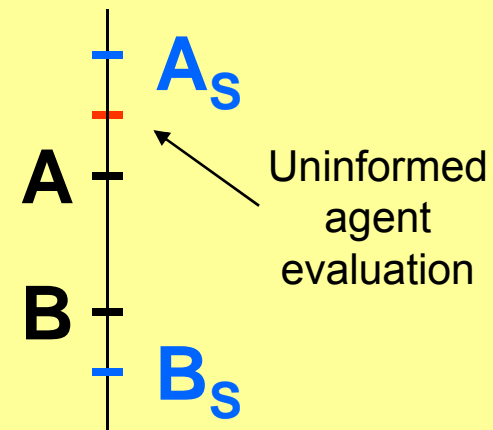
NYSE vs. LOB: Few Informed Traders

LIMIT ORDER BOOK



- Spread is small since picking-off probability is low.
- Uninformed traders are in the market.

HYBRID MARKET



- Spread is worsened, as if there was no uninformed on the market
- Uninformed traders are trading with the specialist, LOB is not competing.

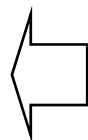
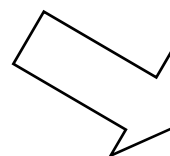
Competition selects the better structure?

**NYSE
Hybrid Market**

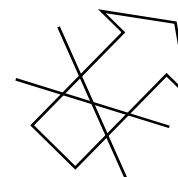
Pure LOB



Informed Traders



Uniformed Traders



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300	28.8300	100	28.8800
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Policy Implications

- The hybrid market is welfare increasing and offers a better liquidity compared to a pure LOB if adverse selection costs are high and/or if the specialist/broker relationship is stable.
- specialist is beneficial for stocks thinly traded or in their initial quotation phase.
- The hybrid market can not be overcome by a competing pure LOB even when suboptimal.
- trade and liquidity concentrate on the hybrid market, competition could not be sufficient to select the best market structure.

What about Empirical Evidence?

Buti (WP, 07) suggests that an anonymous LOB can not actively compete with a hybrid system, since the LOB will attract mainly informed trades.

GENERAL VIEW: if a secondary market skims order from the primary market, it skims the least informed and more profitable trades.

⇒ Easley, Kiefer and O'Hara (JF, 96) for NYSE and Cincinnati SE.

⇒ Bessembinder and Kaufman (JFE, 97) for regional exchanges.

NEW POINT: if the secondary market is a LOB, it will attract the most informed and least profitable trades.

⇒ Huang (JF, 02) and Barclay et al. (JF, 03) for ECN and NASDAQ.

No hope for Europe? The “Upstairs”

Upstairs Market = informal market where block trades are facilitated by search and negotiation.

Seppi (JF, 90)

- An institution can signal if it is uninformed by taking commitments beyond terms of trading.

HSE: Booth et al. (RFS, 02)

- 22% trades (but 51% volume) on the upstairs.
- Upstairs has lower info content and lower price impact.

Paris Bourse: Bessembinder and Venkataram (JFE, 04)

- 67% of block volume upstairs.
- Evidence that upstairs brokers certify traders as uninformed.

Hybrid European or Hybrid U.S. Market?

- European stock exchanges are hybrid markets where the LOB and the upstairs market coexist.
- Both market structures allow for cream-skimming of uninformed traders.
- Upstairs market have matching costs: if the broker does not execute the order against its own inventory, he must look for a counterpart.
- Specialist system has no competition in the ex-post offer of liquidity.

Who has indeed the “winning” financial trading system?

....well, left for future research!

But is the Hybrid Market a real winner?

The hybrid market offers anonymous and non-anonymous trading, allowing for “cream-skimming” of uninformed traders.

- Cream-skimming increases the proportion of trades that originate with informed traders on the anonymous market (LOB), hence the “official” spread, but allows uninformed traders to get better execution.
- **DANGER: larger spreads on the LOB can increase costs off the LOB as well, since LOB quotes are generally the best intermarket quotes that the “non-anonymous platforms” (specialist, upstairs) promise to match.**
- Which are the effects on NBBO or MiFID best execution requirements?

Do we really want “cream-skimming”?...not always!!

Conclusions

- The anonymous automated LOB seems vulnerable from competition by non-anonymous hybrid market structures: BATS competitiveness versus NYSE/NASDAQ is probably limited.
- Can we fight uninformed investor's desire of skimming? Hard, even Instinet is launching a “hybrid market”...but we should be aware that cream-skimming is not costless!
- If we believe that the future is in automated markets, we need to think of a new type of LOB: the actual LOB does NOT seem the winner!
- The one who will manage to get the new “LOB” first, could be the final winner of the trading platform game!!
- Indeed, markets are trying to explore new forms of LOB...