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Impact of Market Fragmentation on Liquidity

Thierry Foucault,

HEC, Paris

Colloque du Conseil Scientifique de l'AMF

Fragmentation of European Equity Markets

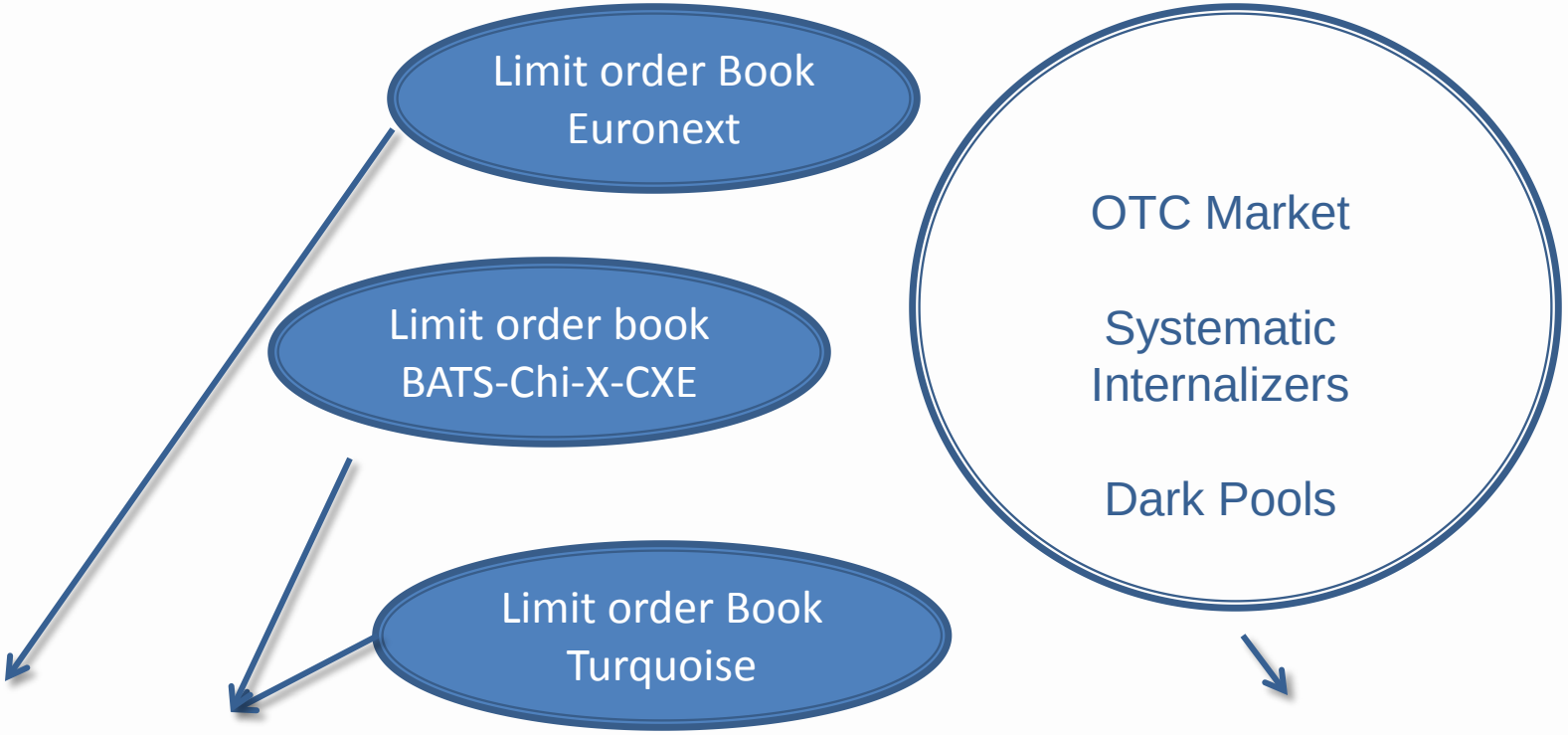
Fragmentation: One stock, many markets

Market		Market Share
	CAC40 Stocks	FTSE100 Stocks
LSE		58.82%
NYSE-Euronext	63.8%	
BATS-Chi-X-CXE	19.15%	18.97%
Turquoise	12.41%	15.41%
BATS-Chi-X-BXE	2.8%	6.63%

Source: Fidessa (http://fragmentation.fidessa.com/); April 2014

Lit and OTC Markets

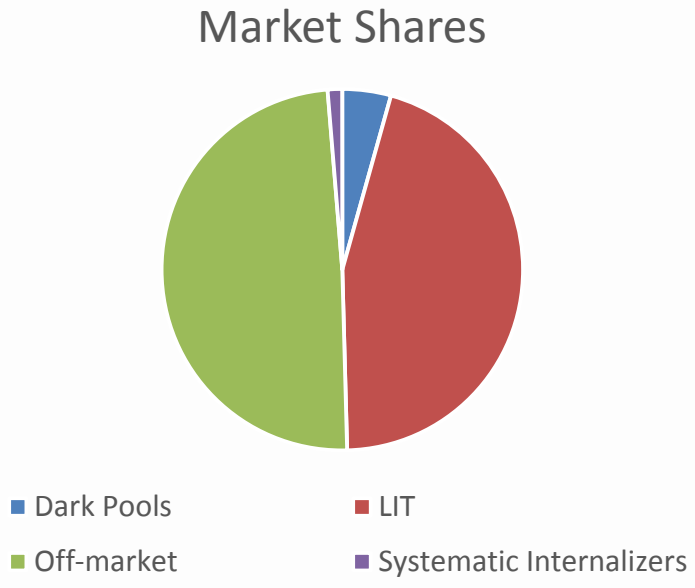
Stock XYZ



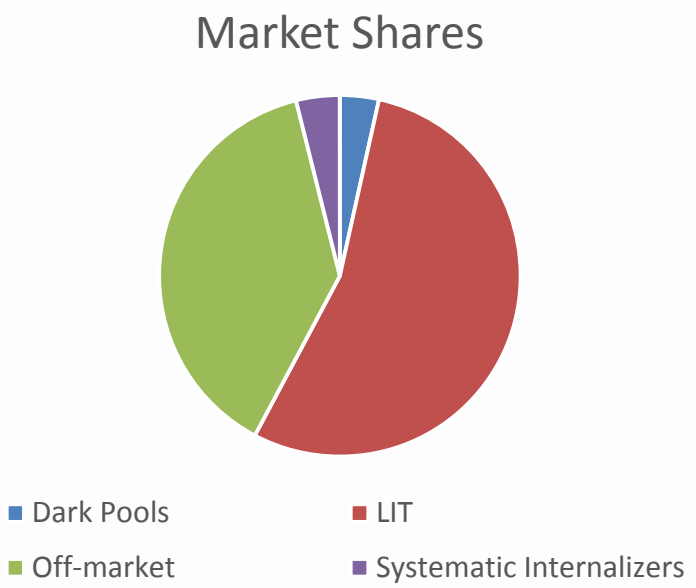
«Lit Market; High pre trade transparency»

«Dark Markets: Low pre trade transparency»

LIT vs. OTC market



FTSE 100 Stocks



CAC40 Stocks

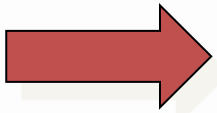
Source: Fidessa (http://fragmentation.fidessa.com/); April 2014

Causes

- Technological changes:
  1. Substitution of floor/open outcry markets with electronic limit order book markets (e.g., Paris Bourse in 1986).
  2. Decrease in costs of launching and operating new electronic trading platforms.
  3. Decrease in costs of multi-market trading (algo trading, smart routers, book aggregators etc.).
- Lack of competition in the provision of trading services: attract new entrants (ECNs in the U.S., MTFs in Europe).
- Regulatory changes:
  1. RegNMS in the US (2006).
  2. MiFID 1 in Europe (2007).

Effects

- ✓ Loss of market shares for incumbent markets.
- ✓ Escalation of competition among trading platforms.
- ✓ New business models (Maker/Taker pricing; etc…).
- ✓ New technologies (smart routing, data aggregators, high frequency trading, etc…).
- ✓ Innovations in market design (dark pools, etc…).



Concerns about the current market structure

Impact on liquidity

- Is market fragmentation good or bad for liquidity?

- Which liquidity?
  - That of one market (« local » liquidity) or consolidated liquidity?
  - That for traders accessing all markets or that for traders « locked-in» one market?
  - That for fast (high frequency) traders or slow traders?

Consolidated vs. Individual Platform Liquidity

Ask/Qtity 3	43-700
Ask/Qtity 2	42.97-5000
Ask/Qtity 1	42.96-4900
Bid/Qtity 1	42.93-1000
Bid/Qtity 2	42-500

NYSE-Euronext

Ask/Qtity 3	43-500
Ask/Qtity 2	42.97-1000
Ask/Qtity 1	42.96-500
Bid/Qtity 1	
Bid/Qtity 2	42-500

BATS-Chi-X-CXE Stock XYZ

Consolidated Book-Stock XYZ

Ask/Qtity 3	43-1200
Ask/Qtity 2	42.97-6000
Ask/Qtity 1	42.96-5400
Bid/Qtity 1	42.93-1000
Bid/Qtity 2	42-1000

Two distinct questions:

- Would consolidated liquidity be higher in a CLOB («Centralized Limit Order Book»)?

- Does entry of a new market Reduce/increase the liquidity of incumbent market?

Theory

Conventional wisdom

1. «Liquidity externalities» (economies of scale or network effects) ⇒ Market fragmentation is bad for liquidity.

2. But inter-market competition is good ⇒ Lower trading fees and more efficient trading technologies.

⇒ **Regulatory conundrum**: how to curb exchanges' pricing power without destroying the benefits of liquidity externalities?

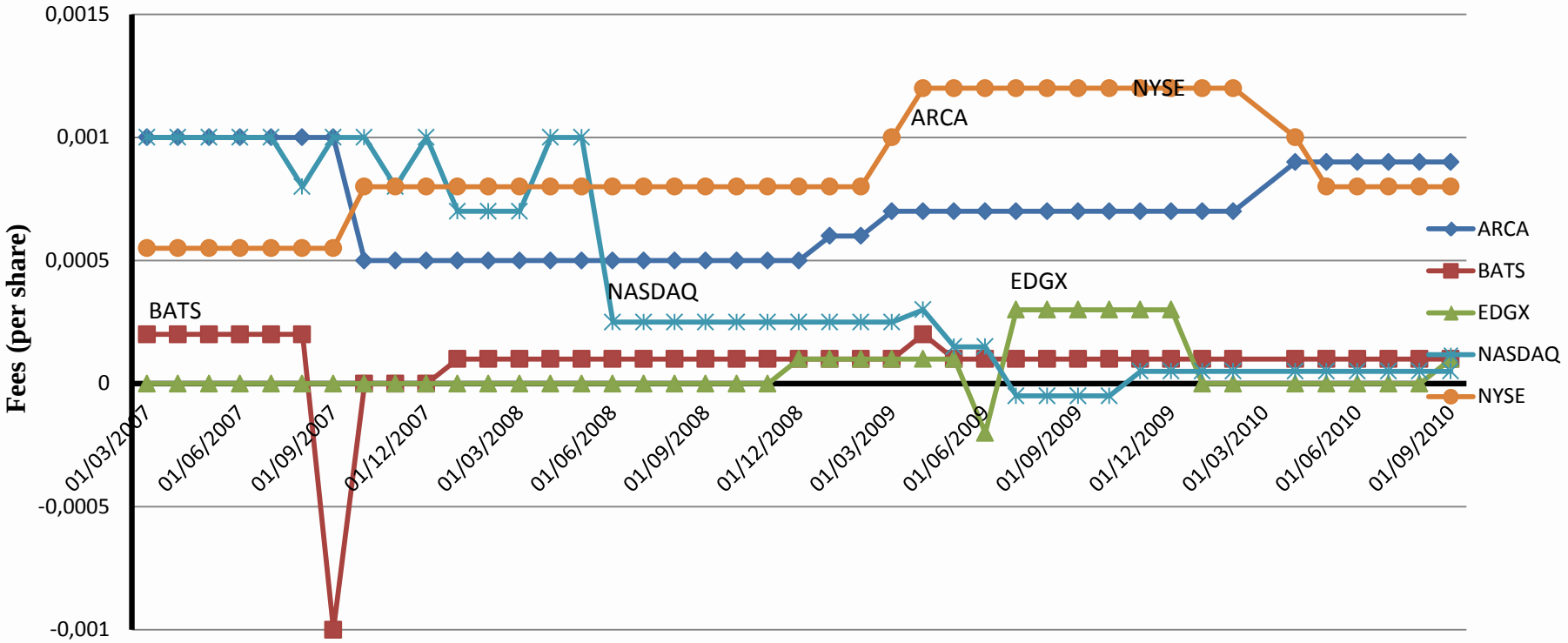
Example: RegNMS

« The NMS is premised on promoting **fair competition among individual markets**, while at the same time assuring that all of these **markets are linked together**,[…]. Accordingly the commission […] has sought to avoid the **extremes of: (1) isolated markets** that trade an NMS stock without regard to trading in other markets and thereby fragment the competition among buyers and sellers in that stock; and (2) **a totally centralized system** that loses the benefits of vigorous competition and innovation among individual markets. **Achieving this objective and striking a the proper balance is clearly a difficult task.** » (Reg NMS, SEC Release n°34-51808).

Competition and Fees

Figure 1: Competition and Trading Fees.

This figure shows the evolution of trading fees (in dollar per share) for trades in NYSE stocks on various U.S. Equity Markets (ARCA, BATS, EDGX, Nasdaq, NYSE)) from March 2007 to October 2010.



Source: Colliard and Foucault (2013).

Evidence

Authors	Market	Methodology	Main Finding
DeFontnouvelle et al.(2003)	U.S option markets	Compare measures of liquidity after and before the advent of competition for order flow in US option listings	Spreads decline and depth increase when options become listed on multiple markets
Mayhew (2002)	U.S option markets	Compare options traded on a single market with options traded in multiple markets	Options with multiple listings have smaller bid-ask spreads
Boehmer and Boehmer (2003)	U.S ETFs markets	Compare measures of liquidity after and before entry of the NYSE in the trading of 30 ETFs	Significant reductions in bid-ask spreads and increases in depth after entry of the NYSE.
Fink et al.(2006)	U.S equity markets	Evolution of measures of liquidity for Nasdaq stocks from 1996 and 2002	Decline in bid-ask spreads, in part due to increased competition from ECNs.
Foucault and Menkveld (2008)	Dutch stocks	Compare measures of consolidated liquidity before and after the entry of a new platform in Dutch stocks	Significant increase in consolidated depth at all price points in the consolidated limit order book

Evidence

Authors	Market	Methodology	Main Finding
Biais, Bisière and Spatt (2010)	Nasdaq stocks	Compare measures of liquidity providers' profits in Island and Nasdaq before and after decimalization on Nasdaq	Competition among limit order traders is imperfect, even if the pricing grid is very thin
O'Hara and Ye (2011)	U.S equity markets	Regress measures of market liquidity on an index of market fragmentation in U.S. equity markets (January-June 2008)	The higher the level of index market fragmentation, the higher is market liquidity
Degryse et al. (2011)	52 Dutch stocks	Regress measures of consolidated liquidity for these stocks on an index of market fragmentation (2006-2009)	Moderate level of market fragmentation enhances consolidated liquidity. Too high levels can impair liquidity.
Gresse (2011)	European stocks (CAC40, FTSE100, SBF120)	Regress measures of market fragmentation for these stockson an index of market fragmentation (Sep-Nov 2009)	The higher the level of index market fragmentation, the higher is market liquidity

(See Foucault (2012) for a survey).

Is a CLOB good or bad for liquidity?

- **Ideal Experiment: Compare the same stock in a CLOB and in a fragmented market.**

- **May, 23 2004 :** Introduction of EuroSETS by the LSE in the Dutch market.

- **Goal of the LSE was to**

1. Capture order flow in Dutch « Blue-chips » traded on Euronextc (NSC).
2. Encouraged by Dutch brokers.

- **NSC et EuroSETS**

1. Two electronic limit order markets.
2. Same clearing and settlement system.
3. Almost same membership.
4. No Trade-through rule.

Data

- ✓ Limit order book snapshots
- ✓ Every 5 minutes
- ✓ For all AEX stocks (25 stocks)
- ✓ April 2004-January 2005

Ask/Qtity 3	43-700
Ask/Qtity 2	42.97-5000
Ask/Qtity 1	42.96-4900
Bid/Qtity 1	42.93-1000
Bid/Qtity 2	42-500

Euronext (NSC)-Royal Dutch-9:10

Ask/Qtity 3	43-500
Ask/Qtity 2	42.97-1000
Ask/Qtity 1	42.96-500
Bid/Qtity 1	
Bid/Qtity 2	42-500

LSE (EuroSETS)-Royal Dutch-9:10

Ask/Qtity 3	43-1200
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Bid/Qtity 1	42.93-1000
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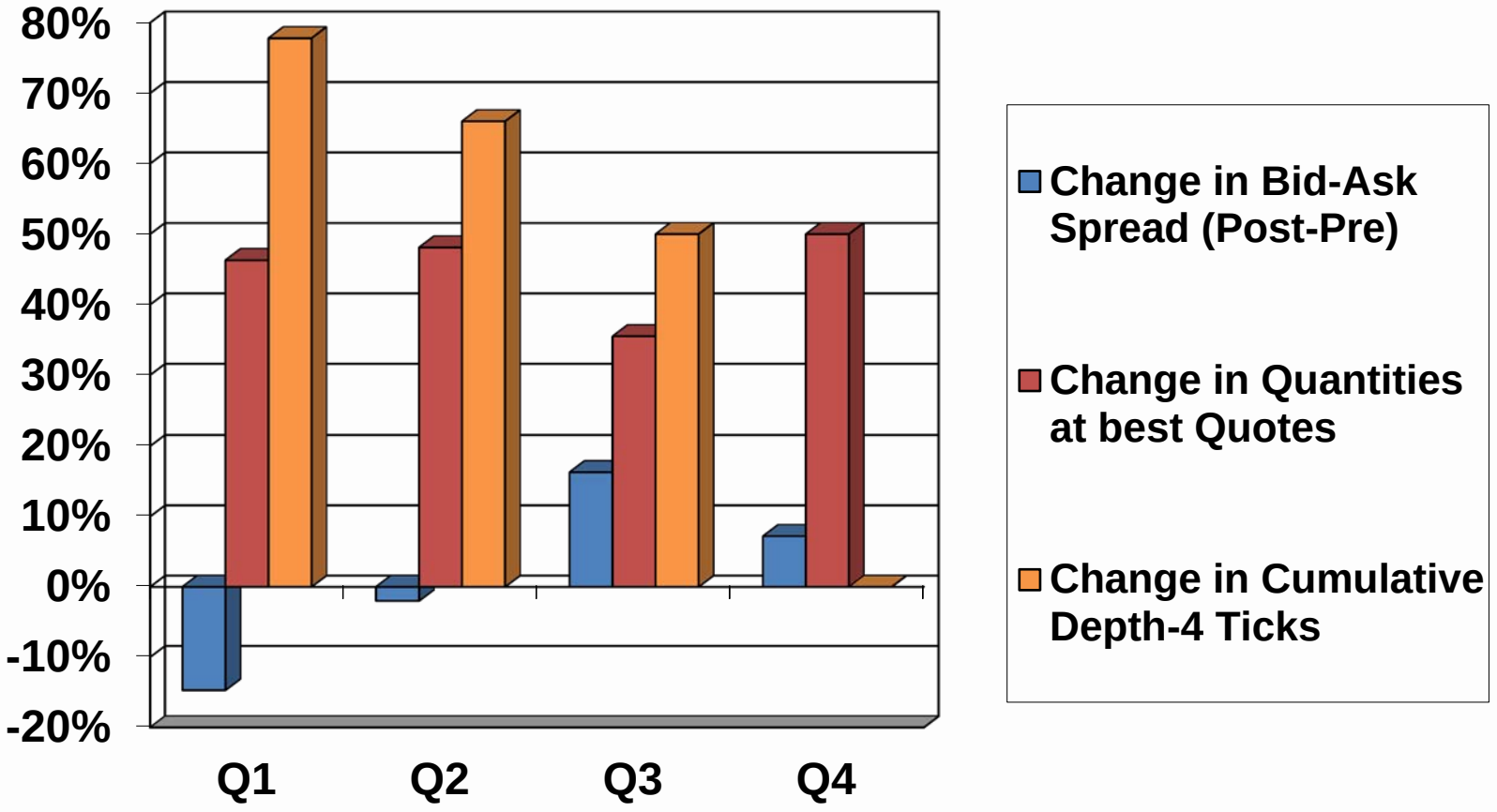
Consolidated Book-Royal Dutch-9h10

Effect of EuroSETS entry on liquidity



Source: Foucault and Menkveld (2008)

Market Fragmentation and Liquidity

- Degryse et al. (2011) :
  - Same Dutch stocks.
  - More Trading venues (post MiFID).
  - More lit fragmentation → More consolidated liquidity.
  - More lit fragmentation → Lower **local** liquidity.
- Implication:
  - Traders who can access all trading venues (use smart order routing systems) are better off.
  - Traders who do not or cannot might be worse off.

Summary

- Academic findings so far suggest that fragmentation enhances consolidated liquidity.
- But not necessarily «local» liquidity.
- Caveat: Empirical findings are mostly for U.S. markets:
  - Mainly for a period that predates the growth of high frequency trading.
  - Inter-market linkages are different in Europe and in the U.S.

New Risks

- Built-in information asymmetries.
- Best execution is more difficult/Trade-Throughs.
- Growth of dark trading.

Built-In Informational Asymetries

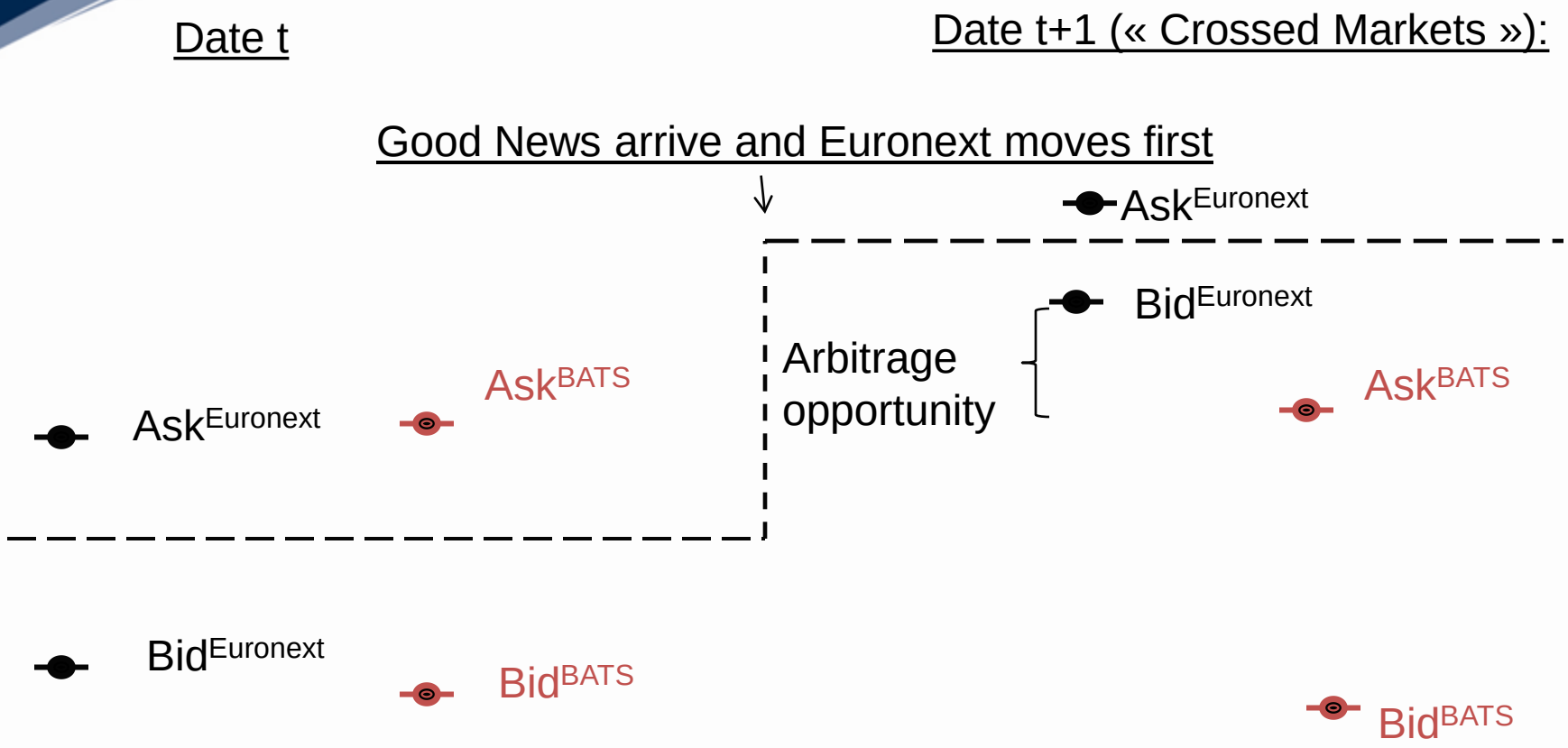
- **Fragmentation of trading also means fragmentation of trading data (pre and post trade).**

- **A fragmented market environment provides an advantage to fast traders (HFTs) because they can more easily and more quickly:**

  - ✓ Use information on quote updates in one platform to trade in another platform (« latency arbitrage ») ⇒ «Built-in» informational asymmetries… not good for liquidity (Biais, Foucault, Moinas (2013)).

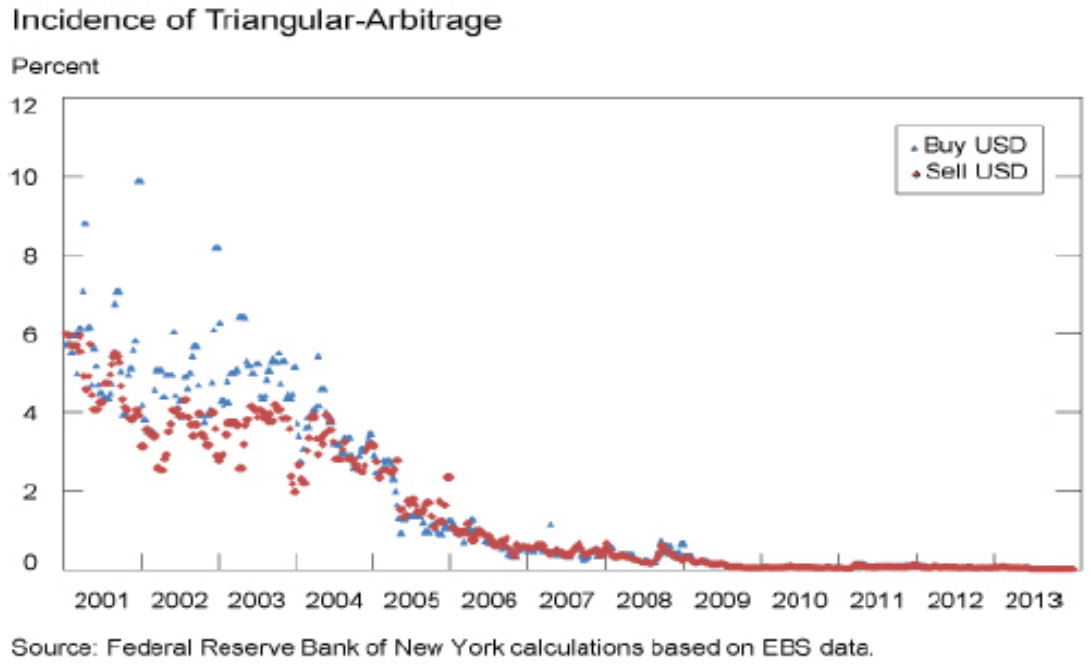
  - ✓ Get access to good quotes before other traders ⇒ fleeting or « ghost» liquidity.

Example: latency arbitrage



- For LSE stocks, Storkenmaier and Wagener (2010) find that locked (crossed) market situations appear in 4.8% (3.2%) of their observations.

High Frequency Arbitrage: faster integrated markets



Source: Schaumburg (2014), New York FED.

Not necessarily good for liquidity

- **Evidence: Foucault, Kozhan, Tham (2014):**
  - Data from Reuters D-3000 (a trading platform in the FX market).
  - 40,000 triangular arbitrage opportunities over 2 years (2003-2004).
  - July 2003: Introduction of algo trading (automated order entry or «API»)) on Reuters $\Rightarrow$ faster arbitrage.
  - **Finding:** After introduction of automated order entry: (i) arbitrageurs become faster (the likelihood that they close an arbitrage increase by 4%), (ii) arbitrage opportunities become shorter (by about 6 milliseconds) and (iii) bid-ask spreads increase (by about 3 to 6%).

Best execution is more difficult

- **Best execution is more difficult to achieve as:**
  - It is difficult to know where is the best quote.
  - It is difficult to account for «take fees» in routing decisions.
- **May give rise to violations of price priority («trade-throughs») across platforms.**
- **The «no-trade through rule» plays a very important role in current organization of US equity markets (see RegNMS).**
- **No such rule in Europe.**

Trade-Throughs-Definition

Ask/Qtity 2	42.97-5000
Ask/Qtity 1	**42.96-4900**
Bid/Qtity 1	42.93-1000
Bid/Qtity 2	42-500

Euronext-Stock XYZ

Trade-through

Buy Market Order for 500 shares

Ask/Qtity 2	42.97-1000
Ask/Qtity 1	**42.95-500**
Bid/Qtity 1	
Bid/Qtity 2	42-500

BATS-Chi-X-CXE-Stock XYZ

No Trade Through

Trade-Throughs In Europe

- **Foucault and Menkveld (2008): very high trade-through rate at the expense of EuroSETS (pre-MiFID).**

- **More recent studies in Europe:**

1. Ende and Lutat (2010): trade-through rate: 12% (sample: stocks of the Euro Stoxx 50 index; 2007-2008).

2. Storkenmaier and Wagener (2010): trade-through rate: 5 to 9% (sample: LSE stocks).

3. From 2010 to 2014: No studies to my knowledge. Would be interesting to have indicators to track the evolution of trade-throughs over time.

Why do trade-throughs happen?

- **Trading in multiple markets is costly:**

  1. Require consolidating quotes in fragmented markets in real time.
  2. Require smart order routing technologies to take advantage of good quotes before they vanish.
  3. Differences in clearing and settlement systems/fees across platforms.

- **Agency issues:** Brokers bear the cost of searching for best prices but cannot necessarily monetize the gain.
- **Best execution has several dimensions: investors are willing to sacrifice good execution prices for faster execution, especially if liquidity is fast moving.**
- **Trading fees (make and take fees) make optimal routing decisions more difficult.**

Why are trade-throughs a risk for liquidity?

- Trade-throughs hinder competition among liquidity providers:
  - Liquidity providers have less incentive to compete in prices if best prices do not attract orders.

- ⇒ Protection against trade-throughs is important: «*Price protection encourages the display of limit orders by increasing the lilkelihood that they will receive an execution in a timely manner and helping preserve investors' expectations that their orders will be executed when they represent the best displayed quotation*» (SEC, RegNMS, 2005).

Trade-Throughs and Liquidity

Cross-sectional regression analysis:

	Spread Ratio (Spread Incumbent/Spread Entrant)	Depth Ratio (Quoted Depth Entrant/(Consolidated quoted depth)
Explanatory Variables		
Inverse of Trade-Through Rate	**0.393****	**0.093**
Volume	0.001**	0.000
Annualized Volatility	-0.004	-0.004
R^2	0.77	0.34

*/**: significant at a 90% / 95% significance level. (Source: Foucault and Menkveld (2008))

Growth of OTC trading

- **«Lit fragmented markets» are less attractive for slow investors (e.g., institutional investors):**
  - Fleeting liquidity.
  - Adverse selection risk.
  - Navigation between various liquidity pools is difficult and costly.
- **⇒ Move of slow investor to OTC markets/dark pools etc. ⇒ Markets become even more fragmented and dark… More informed trading remains on lit markets ⇒ Lit market liquidity declines.**
- **Degryse et al. (2011) do find a negative effect of OTC trading on measures of lit market liquidity.**

Final Thoughts

- **The design of inter-market linkages is very important.**
  - ***The U.S. approach is based on two pillars:***
    - The Order Protection Rule («no trade through rule»)
    - A Consolidated Tape (disseminate best bid and offers across markets for instance.
  - ***The European Approach:***
    - No Order Protection Rule but best execution duties → Brokers and arbitrageurs must integrate markets. Do they? Monthly statistics on trade-through rates and crossed markets rates would be useful.
    - No consolidated tape (yet) → Cost duplication + Differential access to quote information
  - **The «no trade through rule» has its own problems** (e.g., can distort platforms' pricing policies and might be to narrowly focus on best prices).
  - **Yet, market integration without automated linkages and consolidated quote information might not arise spontaneously.**

Final Thoughts

- Alleviate asymmetries in speed of access to market data:
  - Batch auctions. Problem: big change in entire market architecture.
  - Batched market orders with randomized execution (as, for instance, in EBS). Easier to do.
  - Develop «lit» (not dark) slow markets coexisting with fast markets and let traders choose.

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