The role of pre-opening mechanisms in fragmented markets

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Thesis : Competition among stock exchanges

1. Competition among stock exchanges and reputational concerns, 2017, Finance 38 (2017), 7-44.

2. Stock exchange demutualization, market performance & market quality.

3. The role of pre-opening mechanisms in fragmented markets.

What is a pre-market period ?

Period preceding the opening of a market, characterized by :

- orders accumulate in the limit order book (or quotes are displayed)
- Absence of trade execution in the corresponding platform
  Non binding orders : orders can be updated or canceled any time, and never trigger execution before the opening

Various characteristics

- Length (from 10 minutes to 1h45)
- Transparency rules
- Fixed or random end

What do we know about pre-opening periods ?

Objective : To reduce price uncertainty & absorb price pressure after the market has been temporarily closed.

$\Rightarrow$ A valuable source of fundamental information

- A kind of *tatonnement* process during which opening prices are discovered on the Paris Bourse (Biais, Hillion, and Spatt, 1999).

$\Rightarrow$ May also reveal non-fundamental information

- From the buy side : Inf. on liquidity needs (Dia and Pouget, 2011)
- From the sell side : Inf. on inventory risks (Lescourret, 2016)

What has changed ?

- Decreasing volume at the open (down from 10% back in 1995 (see BHS, 1999), to less than 2% of the daily volume in our sample)
- Market fragmentation : some platforms have pre-opening periods (historically, stock exchanges) but not always competing venues.
- Arrival of High Frequency Traders.

Issues

- Does a pre-open still contribute to price discovery in fragmented markets ?

- From fast/slow traders, which group does contribute to price discovery ?

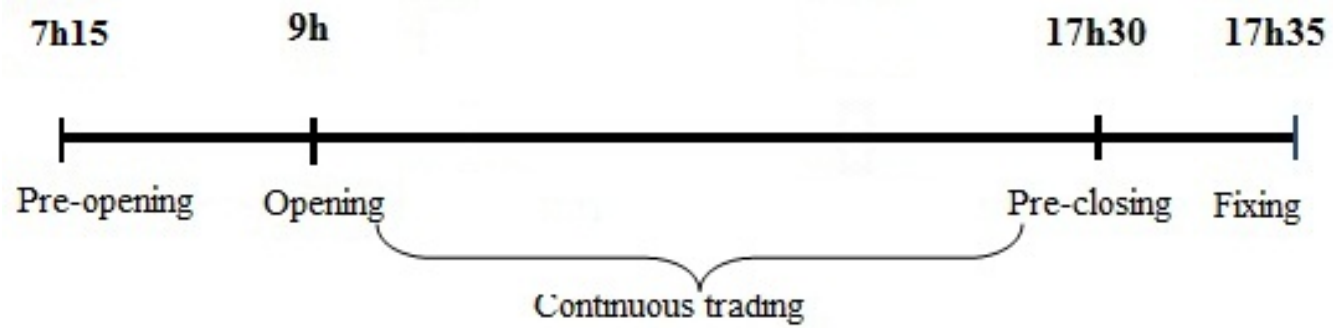
Literature review

- Preopening and price discovery : Biais et al (1999) for the Paris Bourse, Cao, Ghysels and Hatheway (2000) for the Nasdaq in the early 90's, Davies (2003) for TSX, Barclay and Hendershott (2003).
- Preopening and HFT : Bellia et al (2016), Bellia et al (2017), and Anagnostidis et al (2018).
- Price discovery without trading : Brogaard, Hendershott and Riordan (2018)

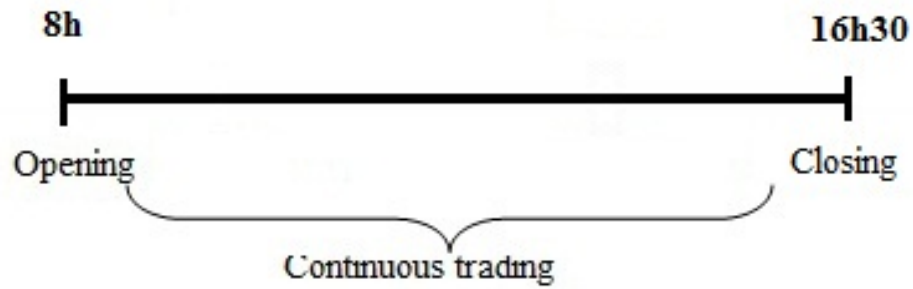
Periodic call auction vs endogenous discriminatory order matching ?

During the time period of our study,

- In Europe, Euronext has a pre-opening period (Paris, Brussels, Amsterdam GMT+1, Lisbon GMT) :



- But not in Bats Chi-X Europe (now Cboe-Europe) (London : GMT) :



Data : Eurofidai-Bedofih High Frequency datasets

BATS (now, CBOE-BXE) & Chi-X (now, CBOE-CXE)

- Anonymized trades, messages and snapshots of best quotes (from 9 :00 am to 5 :30 pm - Paris time)

Euronext Paris

- Snapshots of best quotes every 15 min (from 7 :15am to 5 :30pm)
- Messages (from 7 :15am to 5 :35pm), trades (from 9 :00am to 5 :35pm) flagged by trader's type
  - by speed : HFT-non HFT-Mixed (flag provided by the AMF),
  - by account : prop trader, broker, LP, other

Sample selection

Sample : all the underlying constituents of the SBF120 index

- continuously cross-traded in Euronext Paris, BATS & Chi-X
- spanning 20 months from May 2, 2012 to December 31, 2013

Final sample : 97 stocks (from SBF120 index), 421 trading days and 40 138 stock-day observations.

Summary statistics : sample of stocks

	Euronext		BATS		CHI-X	
Panel A : CAC40 stocks	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
# trades per day	6,948	4,118	975	781	4,779	3,139
Daily Volume (mio €)	61.65	52.61	3.98	4.03	20.92	17.61
Market share	71.2%	6.2%	4.4%	2%	24.4%	5.4%
Trade size (€)	8,330	3,046	1,897	626	2,139	612
Relative Spread (in bp)	5.8	1.9	14.4	9.6	6,2	2.6
N	13,209		13,209		13,209	
Panel B : NON-CAC stocks						
# trades per day	1,411	1,334	134	163	690	684
Daily Volume (mio €)	6.09	7.50	0.31	0.44	1.75	2.13
Market share	76.7%	9.5%	3.7%	2.9%	19.7%	8.4%
Trade size (€)	3,837	1,759	1,146	666	1,218	482
Relative Spread (in bp)	15.2	9.4	61.1	78.2	31	46.8
N	26,929		26,929		26,929	

- Euronext more active and liquid than Chi-X and BATS.
- Fiercer competition for largest stocks.

Outline

1. The opening call auction
2. Preopening messages submission activity by category
3. Price discovery during the preopening period
4. Relation between price discovery and preopening activity
5. Evidence of the impact of the Euronext preopen on competitors

Opening volume, breakdown by type and account

Type	HFT	MIXED	NON HFT	SUM
Panel Index : CAC40 stocks				
Clients	0.19%	14.17%	27.14%	41.50%
Prop traders	4.84%	36.83%	7.73%	49.40%
Liquidity providers	0.07%	2.87%	0%	2.94%
Retail traders	0%	0%	0.06%	0.06%
Others	0%	5.87%	0.23%	6.10%
SUM	5.10%	59.74%	35.16%	100
Panel Non Index : Non CAC40 stocks				
Clients	0.11%	11.12%	42.70%	53.93%
Prop traders	5.88%	30.28%	6.46%	42.62%
Liquidity providers	0.01%	0.47%	2.70%	3.18%
Retail traders	0%	0%	0.07%	0.07%
Others	0.00%	0.09%	0.11%	0.20%
SUM	6.00%	41.96%	52.04%	100%

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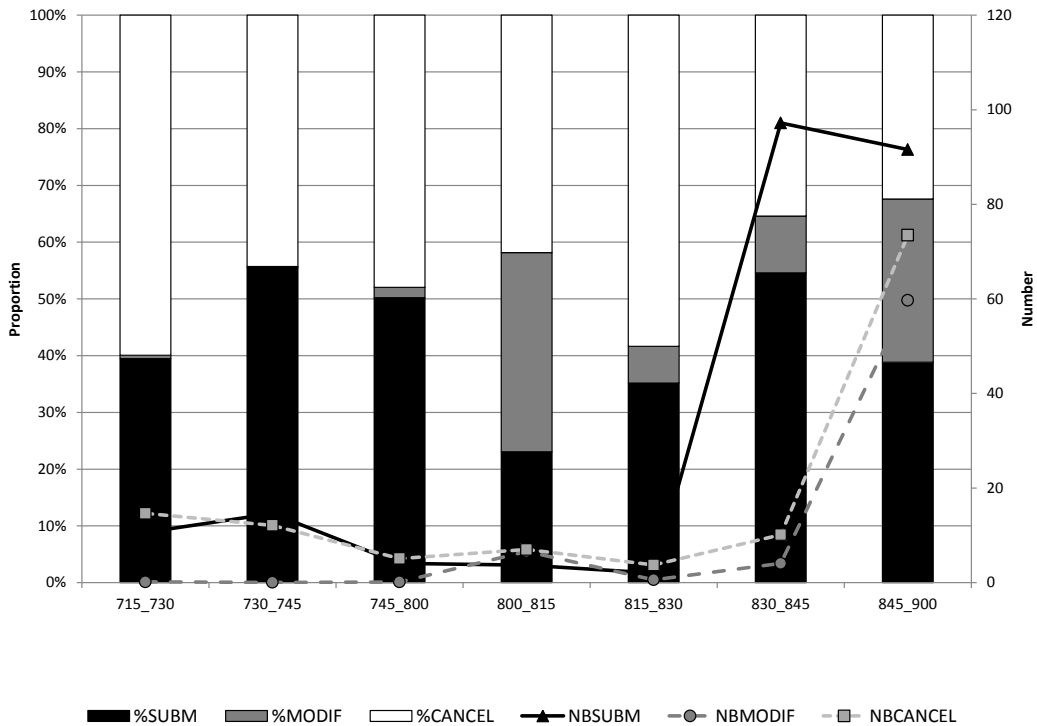
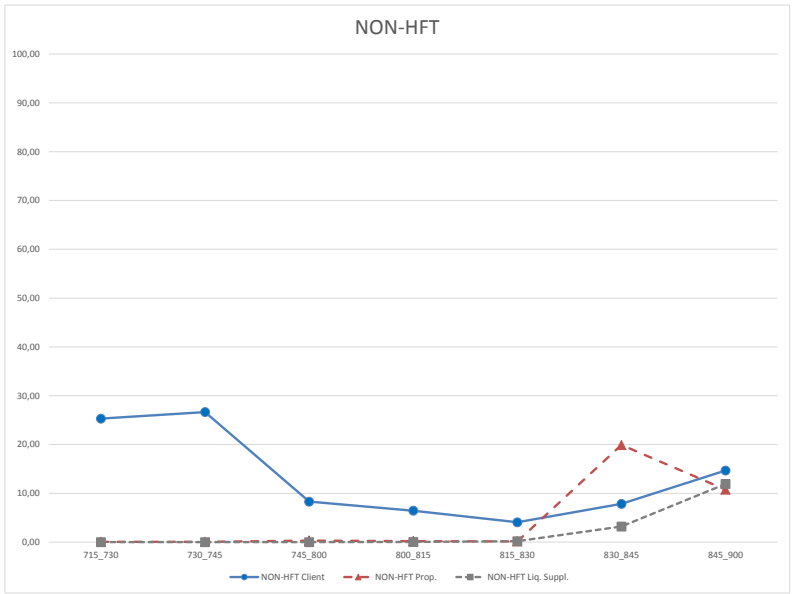
Preopening messages submission for each 15-min interval

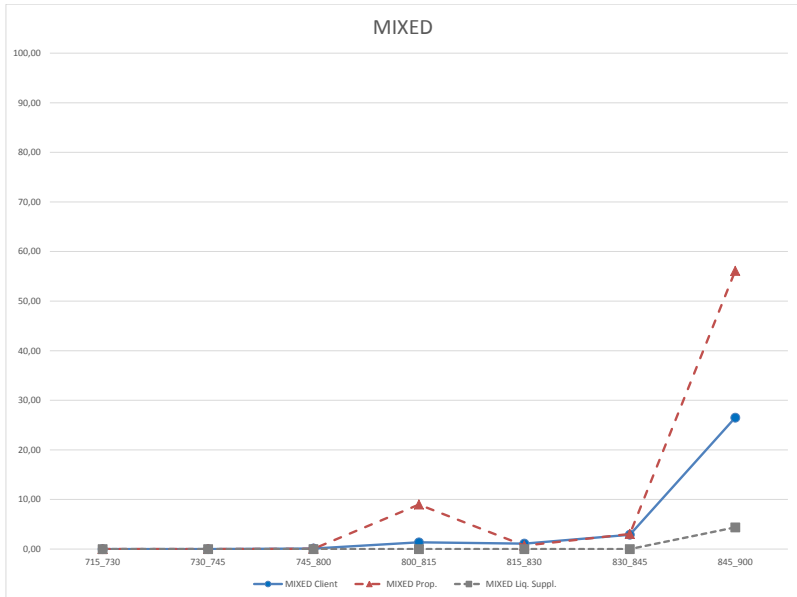


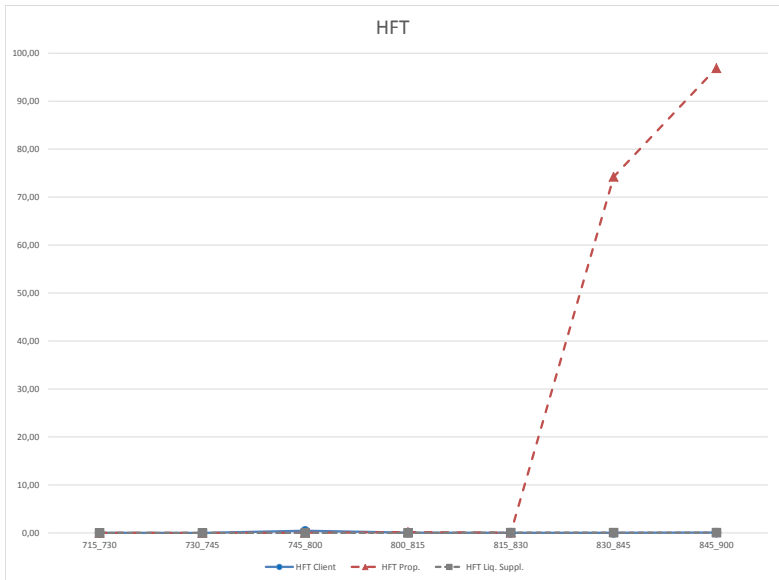
J-shaped activity, with a peak in the last half-hour but also early in the session

$\Rightarrow$ What are the underlying driving members' activity ?

Preopening messages submission activity by category

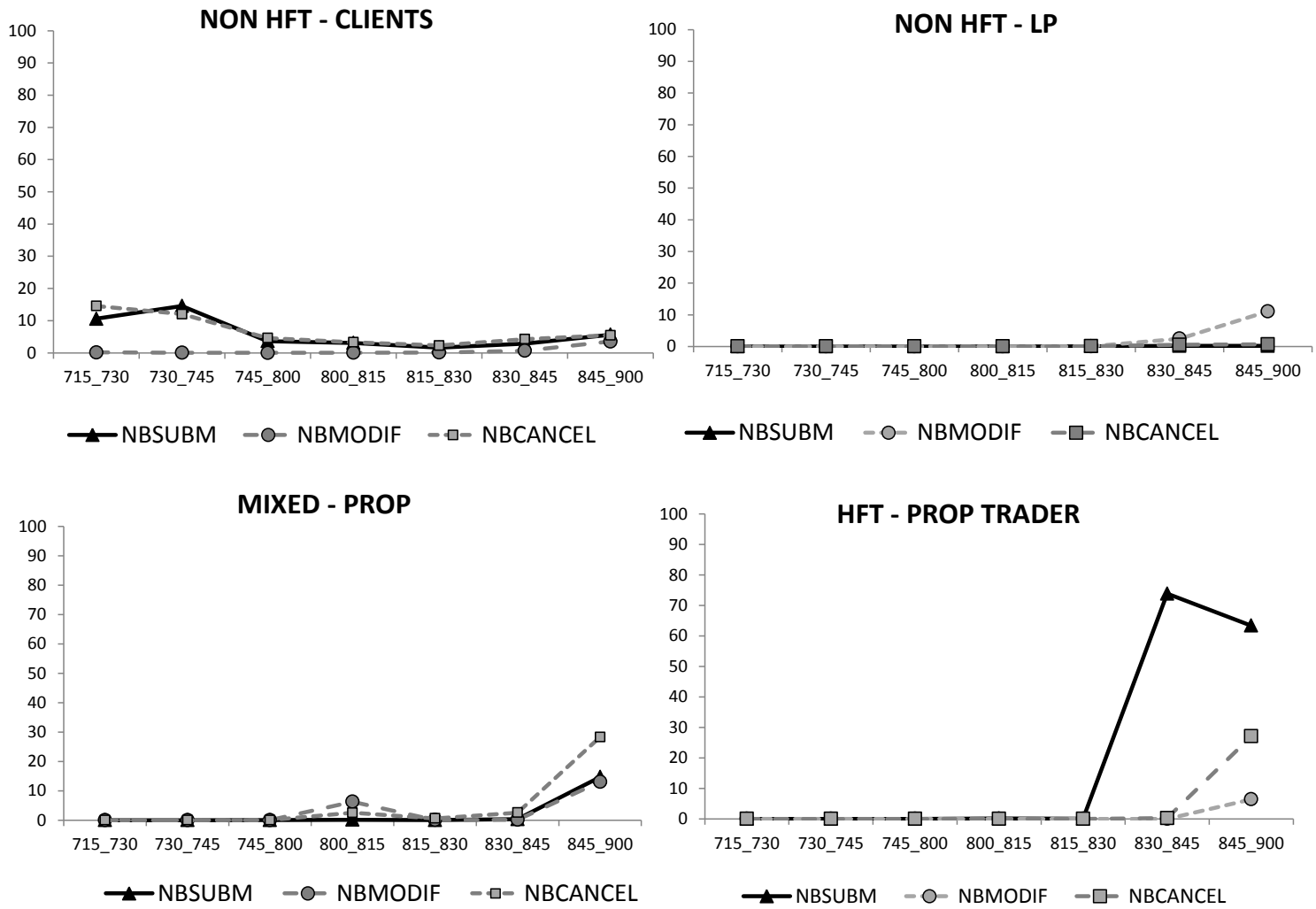






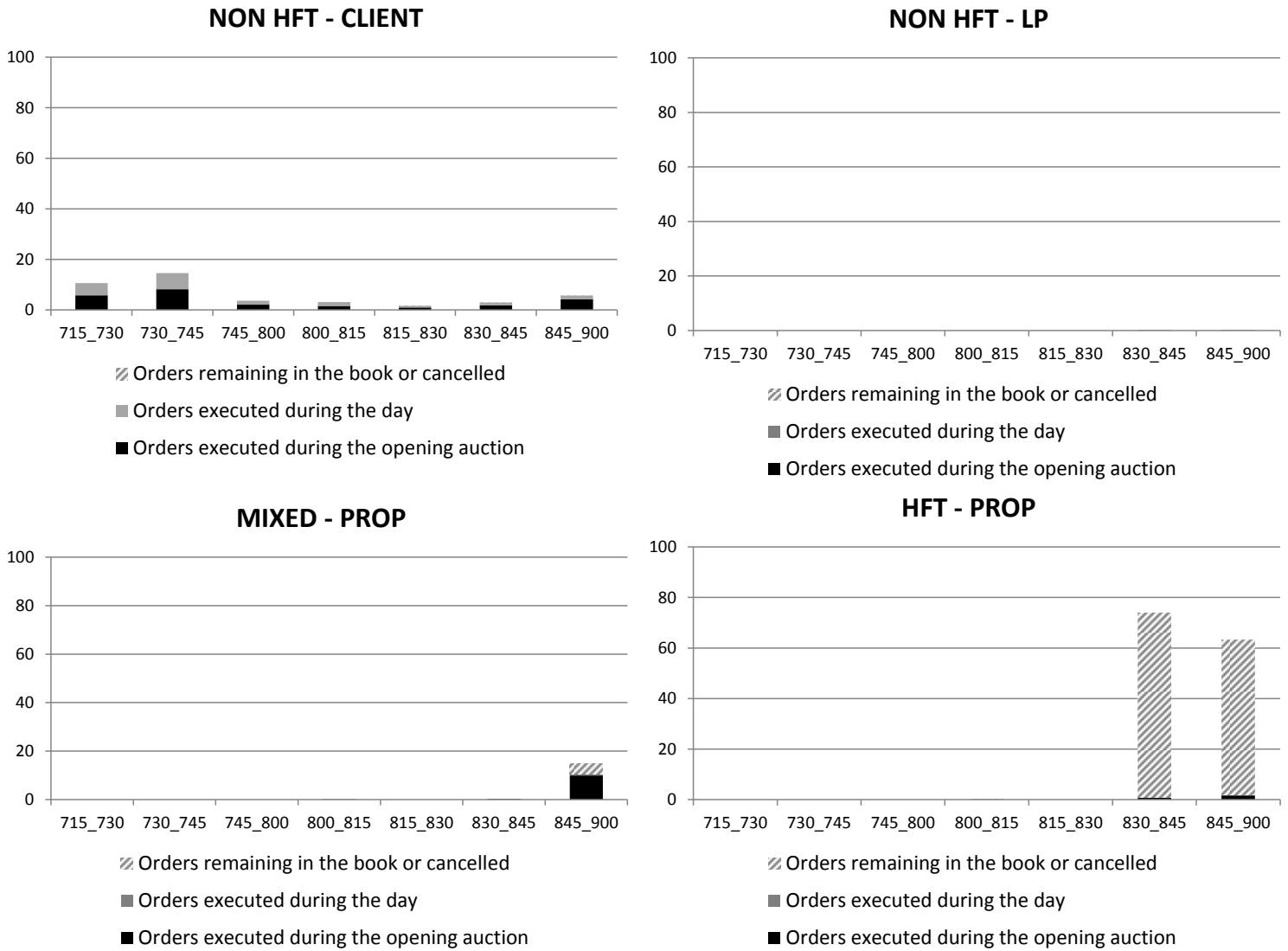
Six main categories : HFT prop, Mixed prop, Mixed client, NON-HFT prop, NON-HFT client, NON-HFT LP (other minor categories are termed as OTHERS).

Messages by 15-min interval : Zoom on specific categories



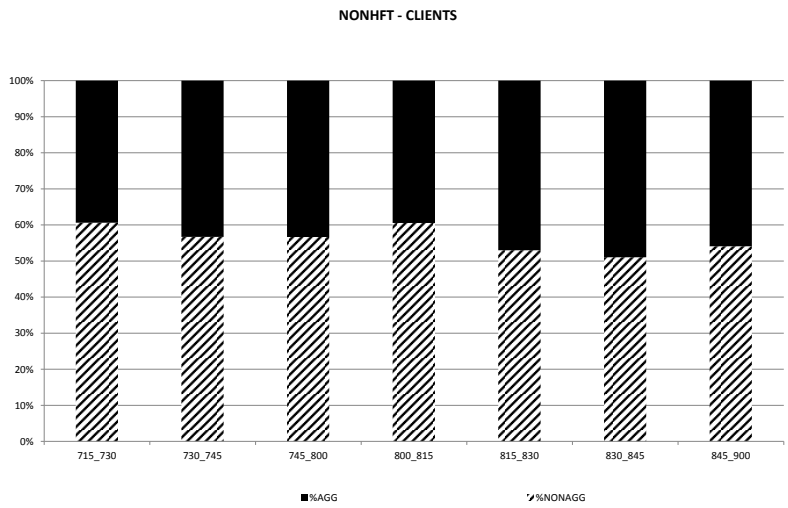
- NON HFT : mainly brokers (active early and late in the pre-opening) and LP (modify their orders in the last half-hour).
- Mixed prop traders are mainly active in the last 15 minutes.
- Fast prop traders mainly submit new order between 8 :30 and 8 :45.

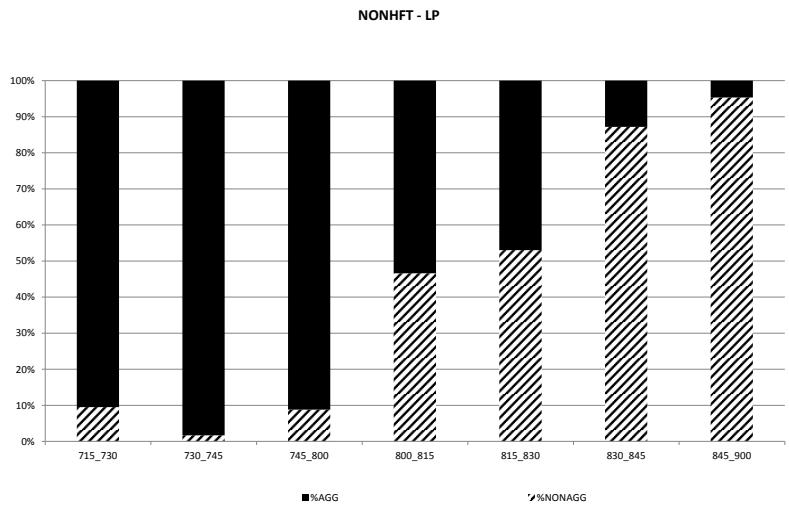
Execution of orders by 15-min interval : Zoom on specific categories

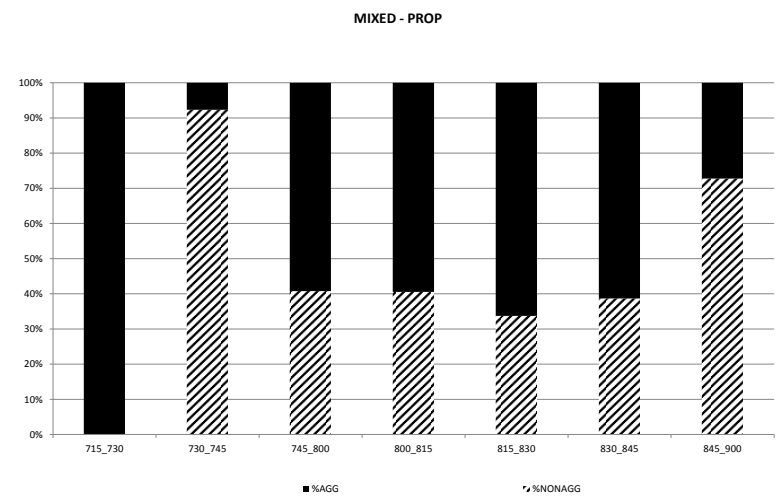


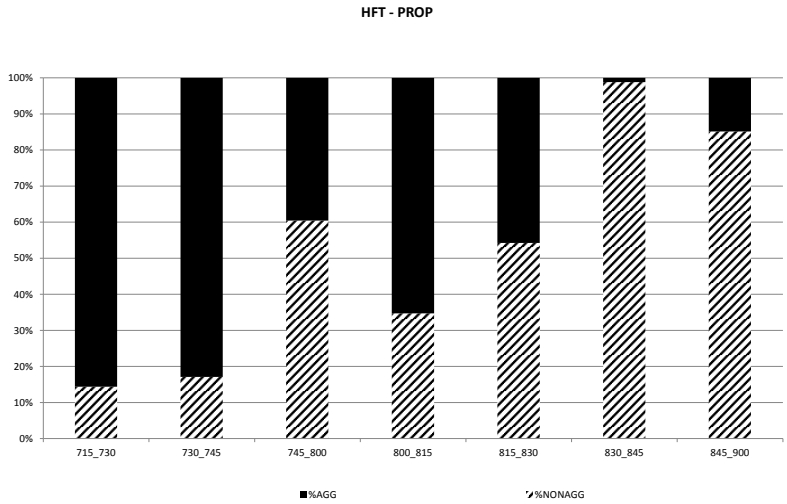
Early messages indeed executed at the open or during the day

Order aggressiveness









Mixed prop traders more tempted to submit aggressive orders.
Much lower aggressiveness of HFT prop traders and NON HFT liquidity providers

Summary

- Slow brokers are active very early : cancel stale orders, submit new orders, half of which are executed at the open or during the day. Consistent with a large participation to the opening volume (27% for CAC40 stocks, 43% for Non CAC40 stocks)

- HFT enter on their own account & in the last half hour. Submit many new orders, represent most of the messages sent during this period. Yet orders are not executed at the open and their market share in the opening call is close to 5%.

- Fast Liquidity Suppliers do not participate (yet 24% of market share for CAC40 stocks during the day !).
  Slow Liquidity Suppliers enter only in the last 30 minutes

Outline

Price discovery during the preopening period

1. **Weighted price discovery** (Barclay and Warner, 1993 ; Cao et al, 2000) :

$$WPC = \sum_j \left(\frac{|r_j^{CC}|}{\sum_j |r_j^{CC}]}\right) x \left(\frac{r_j^{CO}}{r_j^{CC}}\right)$$

   WPC of the preopening/opening session : 19.4% (mean) for CAC40 stocks, 14.63% for NON CAC40 stocks.

2. **Unbiasedness regressions** (Biais et al, 1999) : for each stock, and each 15 min, $r^{CC} = \alpha_{0,\tau} + \alpha_{1,\tau}.r^{CP_\tau} + \varepsilon$ where τ=7 :30, 7 :45, ..., 9 :00.

Computation of tentative opening prices

All pending orders that would contribute to the formation of the opening price using Euronext algorithm are displayed to Euronext members by direction and price level.

Using snapshots of this LOB every 15 min during this period :

- We compute demand and supply curves
- If they cross : Tentative Opening Price (TOP)
- If not : Tentative Midquote (TMQ)

We run unbiasedness regressions on TOP and TMQ.

Price discovery during the preopening period

	7 :30	7 :45	8 :00	8 :15	8 :30	8 :45	9 :00
# crosses with TOP	26,973	34,482	35,273	36,118	36,691	37,627	40,138
Average $\alpha_{1,\tau}^{TOP}$	0.078	0.086	0.083	0.087	0.105	0.159	0.789
5% CI	0.052	0.067	0.065	0.070	0.089	0.141	0.749
95% CI	0.105	0.105	0.101	0.104	0.121	0.177	0.829
# no cross with TMQ	13,148	5,641	4,847	4,009	3,437	2,503	
Average $\alpha_{1,\tau}^{TMQ}$	0.073	0.240	0.092	−0.131	−0.100	0.230	
5% CI	0.003	−0.092	−0.145	−0.377	−0.613	−0.152	
95% CI	0.142	0.572	0.330	0.115	0.413	0.612	

- More crossing between demand and supply closer to call auction.
- When there is a cross, positive and significant coefficients.
- Yet, the average coefficient is significantly different from one.
- Early orders have informational content.

Outline

Relation between price discovery and preopening activity

Methodology

- Left-hand side variables
  - Daily measures of price discovery :
    A price continuation measure : DIC a dummy that takes value 1 if $r^{C,O}$ and $r^{O,O+15} > 0$.
- Right-hand variables
  - (Log) nb of messages (NBMSG) submitted to platform S by category, (log) nb of trades executed at the open by category (S = E ;B ; and C)
- Control variables
  - Daily (lagged) volatility (HILO), daily preopening activity ((log) Total # msg)

Relation between price discovery and preopening activity

A price continuation measure : DIC a dummy that takes value 1 if $r^{C,O}$ and $r^{O,O+15} > 0$.

	D_IC		
Ln(# pre-opening msg)	Euronext	BATS	CHI-X
HFT, Prop traders	0.018	0.026*	-0.02
	(1.25)	(1.82)	(-1.29)
MIXED, Clients	-0.035*	0	-0.04*
	(-1.71)	(0.02)	(-1.94)
MIXED, Prop traders	0.106***	0	-0.01
	(3.61)	(0.01)	(-0.48)
NON-HFT, Clients	0.042*	0.057**	-0.02
	(1.74)	(2.37)	(-0.76)
NON-HFT, Prop traders	0.018	0.021*	-0
	(1.42)	(1.65)	(-0.31)
NON-HFT, Liquidity Providers	0.094***	0.029	-0.01
	(3.90)	(1.28)	(-0.45)
Others	-0.035*	0	0.014
	(-1.75)	(-0.02)	(0.73)
ln(lagHILO)	0.777**	-0.297	0.242
	(2.31)	(-0.89)	(0.72)
Total # msg	0.038	-0.086	0.063
	(0.65)	(-1.49)	(1.09)
Obs.	39852	39852	39852
Stock FE	Yes	Yes	Yes
R^2	0.01	0.01	0.01

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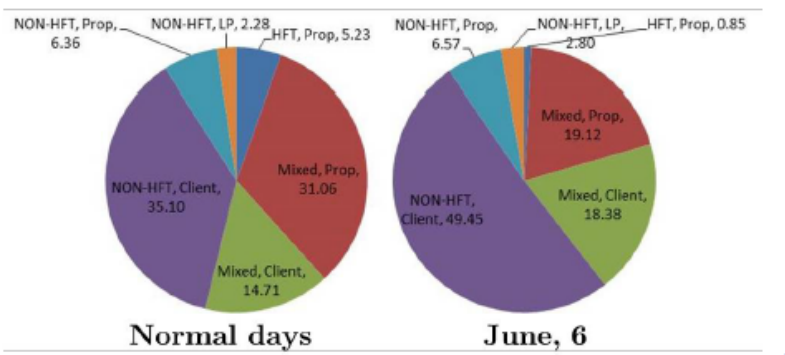
Euronext delayed opening

- What is the impact of the Euronext preopening on the other competing platforms ?
- On June 6, 2013, a glitch in the Euronext's system prevented customers from submitting orders at the regular pre-opening starting time (7 :15am).
  - Preopening order submission resumed at 9 :21 :00 and opening auction occured at 10 :00 :00 : 1 hour later than usual.
  - How does this exogenous technology-related delay affect price discovery and liquidity across the three platforms ?
- Zoom on the week of the glitch : June 3, 4, 5 an 7 (normal days) vs. June 6.

Univariate analysis around the glitch

	Normal days Mean	June 6th Mean	Difference	*p-value*
RBAS (open + 15 min) - EURONEXT	0.17	0.16	0.012	0.4085
RBAS (first trade + 15 min) - BATS	0.55	0.43	0.12	0.1668
RBAS (first trade + 15 min) - Chi-X	0.42	3.13	-2.71	0.0000***
D_IC - EURONEXT	0.48	0.33	-0.15	0.0061***
D_IC - BATS	0.47	0.43	-0.03	0.5247
D_IC - Chi-X	0.49	0.53	0.04	0.4968
# op. trades -Euronext	50.22	43.50	-6.71	0.2788
LOB activity - BATS	287.02	1588.64	-1301.62	0.0004***
LOB activity - Chi-X	142.41	200.08	-57.67	0.0992*
timediff_BATS	34 min 5s	16 min 43s	- 18 min 8s	0.0248**
timediff_Chi-X	9 min 15s	-9 min 48s	-19 min 36s	0.0000***
N	388	97		

- Chi-X opened earlier than Euronext. BATS started only to trade after Euronext open.
- Significant changes in the composition of the opening volume.

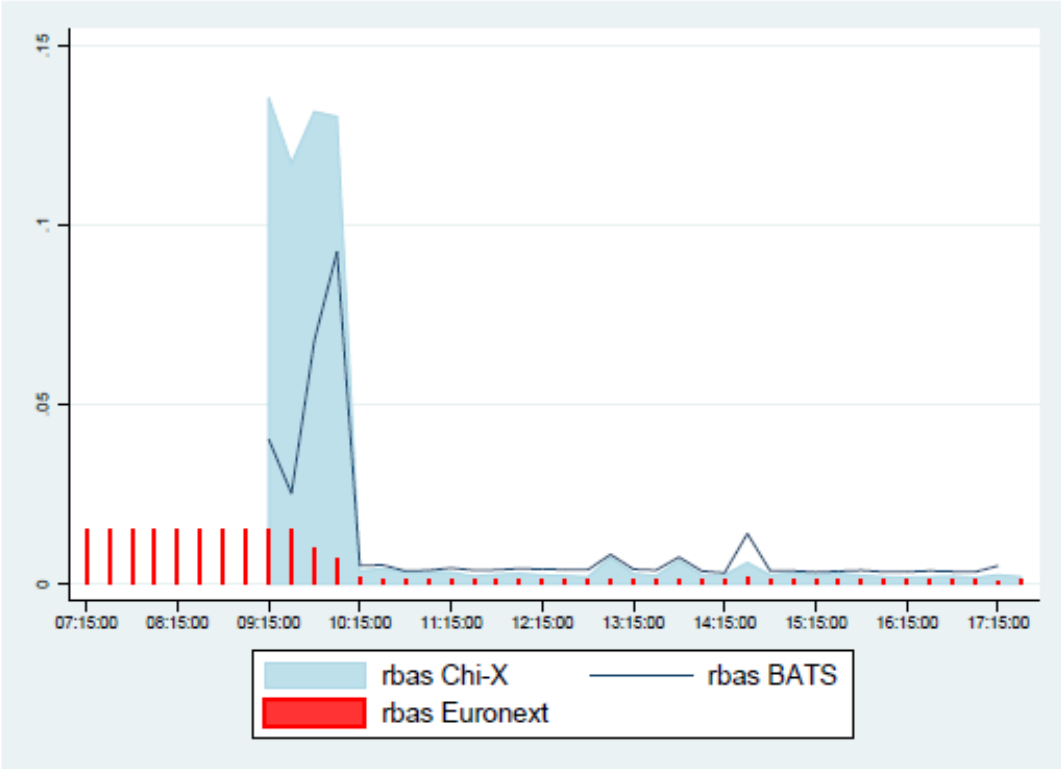


Price efficiency around the glitch

A price continuation measure : DIC a dummy that takes value 1 if $r^{C,O}$ and $r^{O,O+15} > 0$.

	D_IC		
Ln(# pre-opening msg)	Euronext	BATS	CHI-X
d_6june	-2.775**	-0.716	0.59
	(-2.24)	(-0.80)	(0.65)
d_6June X HFT, Prop	-0.359	0.246	0.133
	(-0.64)	(0.52)	(0.27)
d_6June X Mixed, Prop	-0.001	0.546	0.197
	(-0.00)	(1.37)	(0.51)
d_6June X Mixed, Client	-0.569	-0.299	-0.105
	(-1.28)	(-0.83)	(-0.30)
d_6June X NON-HFT, Client	1.091**	0.149	-0.088
	(2.37)	(0.43)	(-0.25)
d_6June X NON-HFT, Prop	-0.138	-0.54**	-0.401
	(-0.48)	(-2.03)	(-1.50)
d_6June X NON-HFT, LS	-2.391*	-0.608	-0.422
	(-1.79)	(-1.09)	(-0.83)
d_6June X OTHERS	-0.174	-0.018	-0.107
	(-0.46)	(-0.06)	(-0.32)
LOB activity - Chi-X	-0.221**	0.03	0.072
	(-2.08)	(0.55)	(0.78)
LOB activity - BATS	0.112	0 .196	-0.066
	(1.22)	(0.95)	(-0.85)
N	430	460	460
Stock FE	Yes	Yes	Yes

Liquidity around the glitch



- No significant liquidity changes for Euronext
- Strong illiquidity on Chi-X, opened earlier.

Conclusion

- Work in progress : Information share / trade dynamics on June 6.
- Preopening still matters, both in terms of liquidity and price discovery.
- Mixed Prop members are leading the price discovery process. HFT prop help to discover price mainly for CAC40 stocks.
- NON-HFT brokers placing orders very early contribute significantly to price efficiency.