Toulouse School of Economics

Does preopening matter in fragmented markets?

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The Microstructure Exchange

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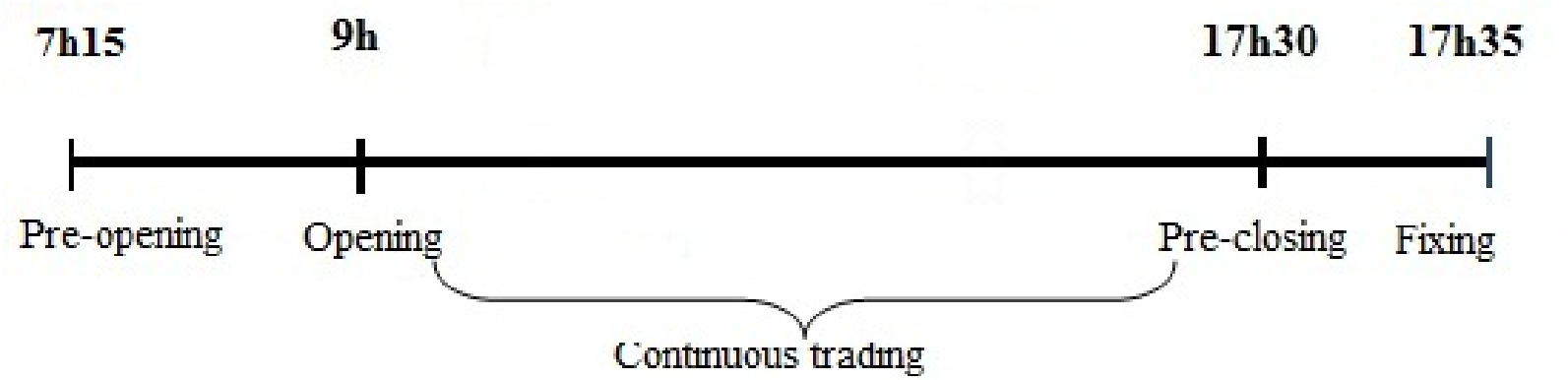
Organization of financial markets

Many stock exchanges open (and close) daily trading with an auction

Example: Euronext (Paris: GMT+1)



Before the opening auction, "Preopening period" during which

- messages (quotes, orders) are submitted to the system
- without triggering any trade: messages are non-binding and can be updated

Preopening period

Various characteristics depending on the trading platform

- Length (10 mn to 1h45), transparency rules, fixed or random end...
- e.g. on Euronext: lasts 1h45, members observe the limit order book, and an "indicative price" is displayed continuously

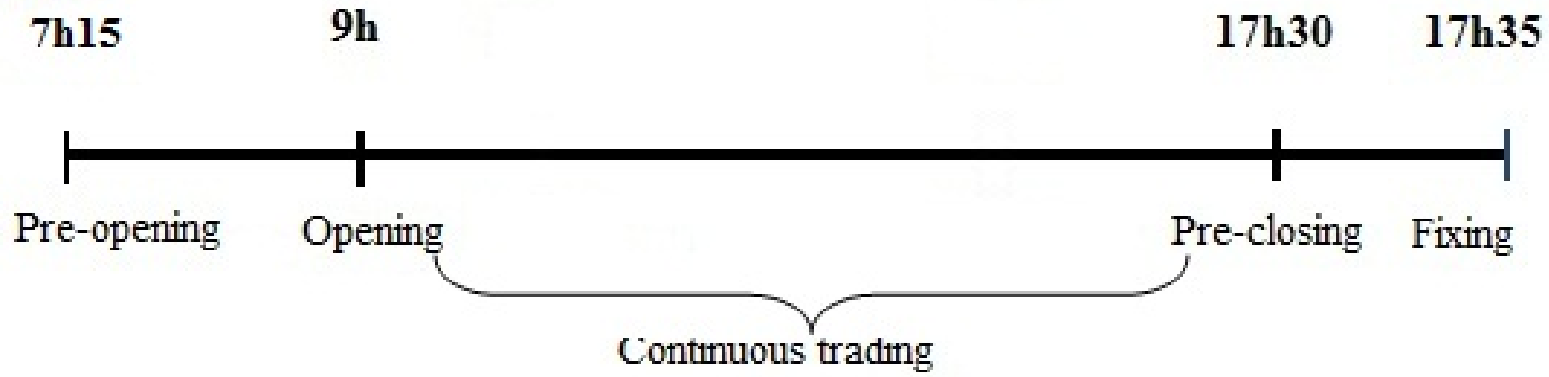
Main objective: To reduce price uncertainty & absorb price pressure after the market has been temporarily closed

- Biais, Hillion and Spatt (1999) or Cao, Ghysels, and Hatheway (2000): late prices contain information

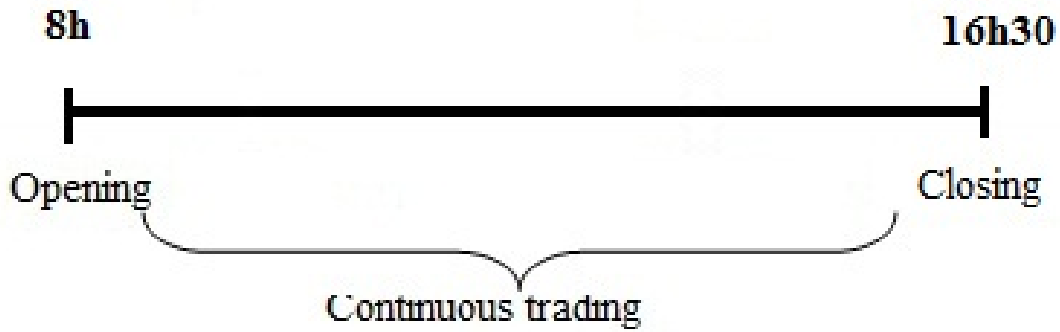
What is new? Today's markets are *fragmented*

Trading of French stocks in SBF120, in 2012-2013

Euronext (Paris: GMT+1) has a preopening period, displays LOB & indicative price



But not Chi-X (London: GMT)



⇒ **In this fragmented environment where the opening volume is down from 10% in the 1990s to 1.5%, is a pre-open still useful?**

Outline

1. Does a pre-open still contribute to price discovery?

2. Does Euronext preopening period facilitate price discovery on Chi-X around the open?

3. Who participates and contributes to price discovery, ... and why?

Literature

On preopening and price discovery: Biais, Hillion, and Spatt (1999) and Cao, Ghysels, and Hatheway (2000) + ...

Two papers use the same dataset to analyze the role of HFTs during the preopening: Bellia et al. (2017) investigate the reasons why HFTs participate & Anagnostidisa et al. (2017) design a test for detecting informed HFTs

On price discovery without trading: Brogaard, Hendershott and Riordan (2018)

Hypotheses Development: Preopening and price discovery

H1. Preopening and opening prices contribute to price discovery on Euronext.

- By concentrating buying and selling interests, the opening call auction aims at easing price discovery after a period of no trade (e.g. Vives [1995]).

H2. Euronext's preopening facilitates price discovery on Chi-X.

- If markets are not segmented and if preopening prices have some informational content, the preopening period should also facilitate price discovery on Chi-X.

H3. The indicative price's contribution to price discovery steadily increases.

Hypothesis Development: Who participates?

$\Rightarrow$ Traders requiring immediacy

H4. The preopening activity on Euronext eases quantity discovery.

- Literature on "sunshine trading" but here: anonymity
- In an anonymous environment, Chakraborty et al. 2012. show that early non-binding orders indeed may serve as a communication device to reach the efficient equilibrium (consistent with Biais et al., 2013)

H5. Some members may submit orders early during the preopening period without updating them to gain time priority.

- Trade-off gain in time priority – risk of (fundamental or non fundamental) inf. leakage
- Benefit – cost increasing over time
- Curuana and Einav (2008)'s model show that with increasing "switching costs" agents can endogenously commit to an action

Data and sample: Eurofidai-Bedofih High Freq dataset

Our sample

- Sample period: May 2, 2012 to December 31, 2013
- Sample stocks: 32 CAC40 stocks + 65 other mid and small caps (from the SBF120 index)

$\rightarrow$ 411 trading days, 40,138 stock-day obs

Data: Eurofidai-Bedofih High Freq dataset
(`https://www.eurofidai.org/en/high-frequency-data-bedofih`)

- Time-stamped messages (submissions, updates and cancellations) and trades,
- & 15-mn snapshots of best quotes (including in the preopening period),

for Euronext Paris and Chi-X (now CBOE-CXE); and in addition for Euronext

1. Account: Client – Prop. – Liquidity Supplier – Related Party - Retail
2. Speed (AMF's HFT flag): HFT – MIXED – NON-HFT

Main take-away from Summary statistics

- Opening volume represents only 1.5% of Euronext daily volume
- Continuous trading: Euronext $\pm$ 75% volume, Chi-X $\pm$ 25%
- Euronext more active and liquid than Chi-X, larger trade size
- CAC40/non-CAC40: Chi-X has a larger market share for CAC stocks

Questions?

1. Does a pre-open still contribute to price discovery?

We follow Biais et al, 1999 or Barclays and Hendershott, 2003

- Compute the indicative opening price (IP) at 7:30, 7:45, 8:00, 8:15, 8:30 and 8:45am using order book data (for 9:00am = opening price)
- Run unbiasedness regressions (in the cross-section, for each day t)

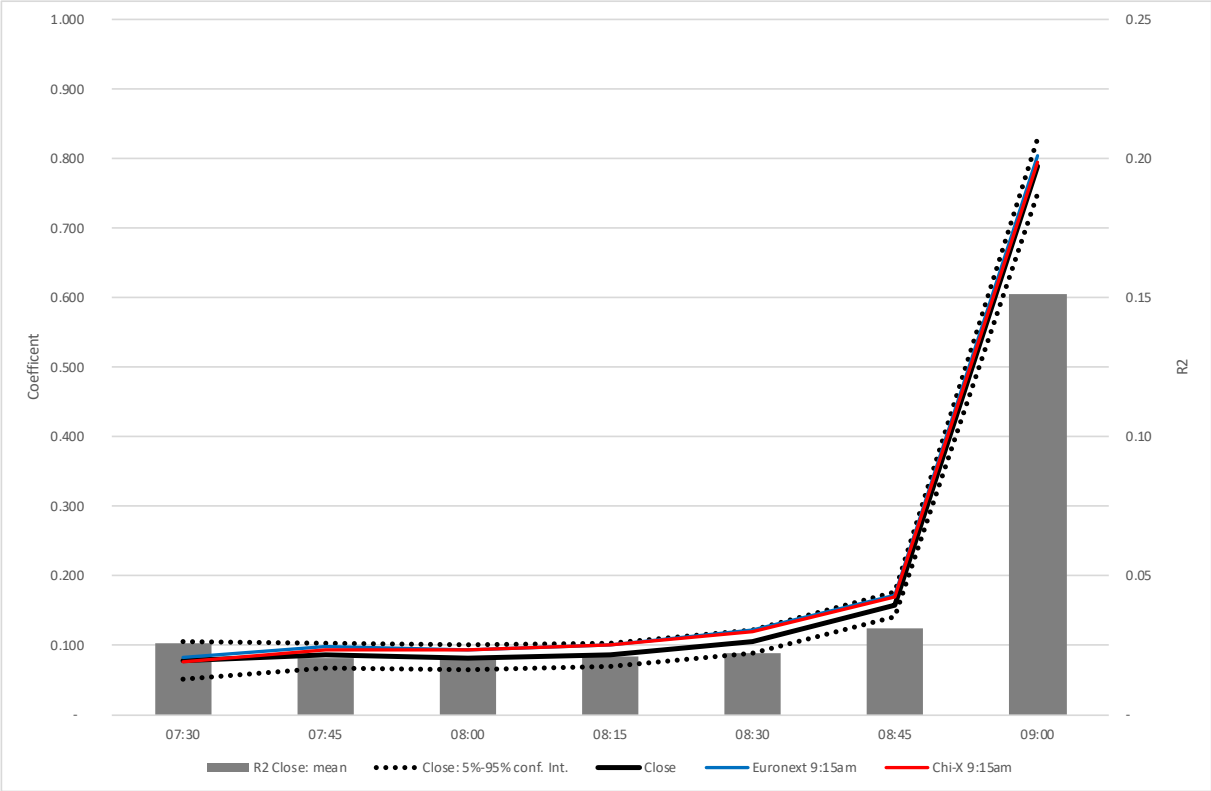
$$r^{CC} = \alpha_{t,\tau} + \beta_{t,\tau} r^{C,IP_\tau} + \varepsilon,$$

  where the close is Euronext's previous day closing price (reference price)
- Compute averages and confidence intervals using time series of coefficients (and R^2)
- Run same regressions replacing r^{CC} with $r^{C,MQ9:15^m}$ for m = Euronext & Chi-X

What do we expect? $\beta_{t,\tau}$ is the noise-to-signal ratio

- If $\beta_{t,\tau} = 0$: rejects H1: no price discovery, IP_τs only contain noise
- If $\beta_{t,\tau} < 1$: rejects BHS "learning" hypothesis, IP_τs are biased estimates of assets' conditional expected values

1. Does a pre-open still contribute to price discovery? **YES**



$\Rightarrow 0 < \beta_{t,\tau} < 1$: imperfect learning, yet one cannot reject H1, preopening prices have informational content

- Even early
- Coefficients increase in time, jump at the open (9:00am) (in line with H3)
- Larger coefficients for non-CAC40 stocks

Price discovery around the open and preopening activity

Our main measure of price discovery (by stock, daily, for Euronext & Chi-X):

$$D\_IC_t^m = \mathbb{1}_{r_t^{CO^m} \times r_t^{O^m, O+15^m} \geq 0}.$$

$\rightarrow$ captures price continuation around the open (first trade), based on price covariance (see Stoll and Whaley, 1990; Madhavan, 2001).

		Euronext		Chi-X		Difference	
	N	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**t-stat**	
Time 1st trade	97	09:00:01am	6s	09:08:52am	15mn 15s	10.67	***
D_IC	97	40.7%	7.2%	48.1%	3.4%	3.99	***
WPC	97	16.1%	4.0%	19.1%	3.9%	8.44	***

- Euronext opening prices have informational content: consistent with previous findings
- But so do Chi-X's first prices (and even more than Euronext!); partly due to Euronext preopening and opening mechanims?

Price discovery around the open and preopening activity

(Baseline) conditional logistic regression:

Dependent variable:	D_IC^E (1)	D_IC^E (2)	D_IC^C (3)	D_IC^C (4)
ln(# Euronext opening trades)	0.0741***		0.0644***	
	(3.20)		(3.56)	
ln(# preop. orders)		0.142***		0.0702*
		(4.35)		(1.88)
Monitoring ratio		0.171		-0.0454
		(0.93)		(-0.26)
Prop. hidden volume		0.269		1.082**
		(0.53)		(2.98)
Prop. aggressive orders		0.155		0.204
		(0.71)		(1.21)
Earnings' announcement	0.354***	0.379***	0.204**	0.228**
	(4.05)	(3.76)	(1.98)	(2.17)
N	40,041	40,041	40,036	40,036
Stock FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Standard errors	bootstrapping	bootstrapping	bootstrapping	bootstrapping
Pseudo R^2	0.0018	0.0020	0.0004	0.0004

- Price continuation on Chi-X is significantly & positively related to Euronext opening & preopening ⇒ **Suggestive** that preopening period and opening call on Euronext may be useful for price discovery on Chi-X

2. Does Euronext preopening period facilitate price discovery on Chi-X?

Objective: to test the *causal* impact of Euronext's pre-open on price discovery on Chi-X

On June 6, 2013, a glitch in the Euronext's system prevented customers from submitting orders to the market at the regular preopening starting time (7:15am).

- Preopening order submission resumed at 9:21:00 and opening auction was rescueduled at 10:00:00 : 1 hour later than usual.

How does this exogenous technology-related delay affect price discovery across the two platforms?

Zoom on the week of the glitch: June 6 vs. June 3, 4, 5 an 7 (normal days)

Univariate tests around the glitch

	N	Normal days	June 6th	*t-stat* Diff	
Time first trade on Chi-X	97	09:09:16am	9:50:15am	8.50	***
# Stocks with first trade on Chi-X bef. Euronext	97	0	35		
D_IC^E	97	44.8%	32.0%	2.33	**
D_IC^C	93	50.0%	28.0%	4.05	***
t-stat of the test $D\_IC^E = D\_IC^C$: bef. 9:21am	30	*-1.14*	*3.73 ****		
t-stat of the test $D\_IC^E = D\_IC^C$: aft. 9:21am	67	*-0.62*	*-1.72*		
# Euronext op. trades	97	51	44	-1.05	
# ORD – Euronext	97	488	417	-1.13	
MON_RATIO^E	97	16.1%	14.7%	-0.97	
PROP_HID_VOL – Euronext	97	4.0%	4.6%	0.89	
AGG_RATIO – Euronext	97	10.1%	12.2%	1.73	
# ORD on Chi-X before 1st trade	97	135	197	1.20	
# trades in 1mn after 1st trade - Chi-X	97	5.23	4.05	-1.44	
MON_RATIO^C	97	40.4%	57.1%	7.17	***
# ORD on Chi-X before 9:21am	97	3,150	192	-7.92	***
# ORD on Chi-X before 10:00am	97	8,252	781	-7.55	***

Little impact on preopening activity or opening volume for Euronext

But a huge impact on Chi-X: first trades delayed (even to after 10am for majority of non-CAC40 stocks), decrease in # of orders, increase in monitoring ... and drop in price discovery

Price discovery around the glitch: multivariate analysis

Baseline regression with dummy June 6

Dependent variable:	D_IC^E (1)	D_IC^C (2)
Dummy June 6, 2013	-0.973^{***} (-2.90)	-0.613^{**} (-2.05)
Dummy stock before 9:21am on Chi-X × Dummy June 6, 2013	1.216^{**} (2.40)	-2.050^{**} (-2.49)
Dummy stock before 9:21am on Chi-X	-0.703^{**} (-2.32)	0.456 (1.47)
N	481	461
Stock FE	no	
Controls	yes	
Standard errors	clustering	

Price discovery decreased both on Euronext and on Chi-X

Stronger effect on Chi-X for 30 stocks traded before Euronext's preopening → **YES**, preopening facilitates price discovery in other platforms

Questions?

3. Who participates? – Overview: Members' market shares

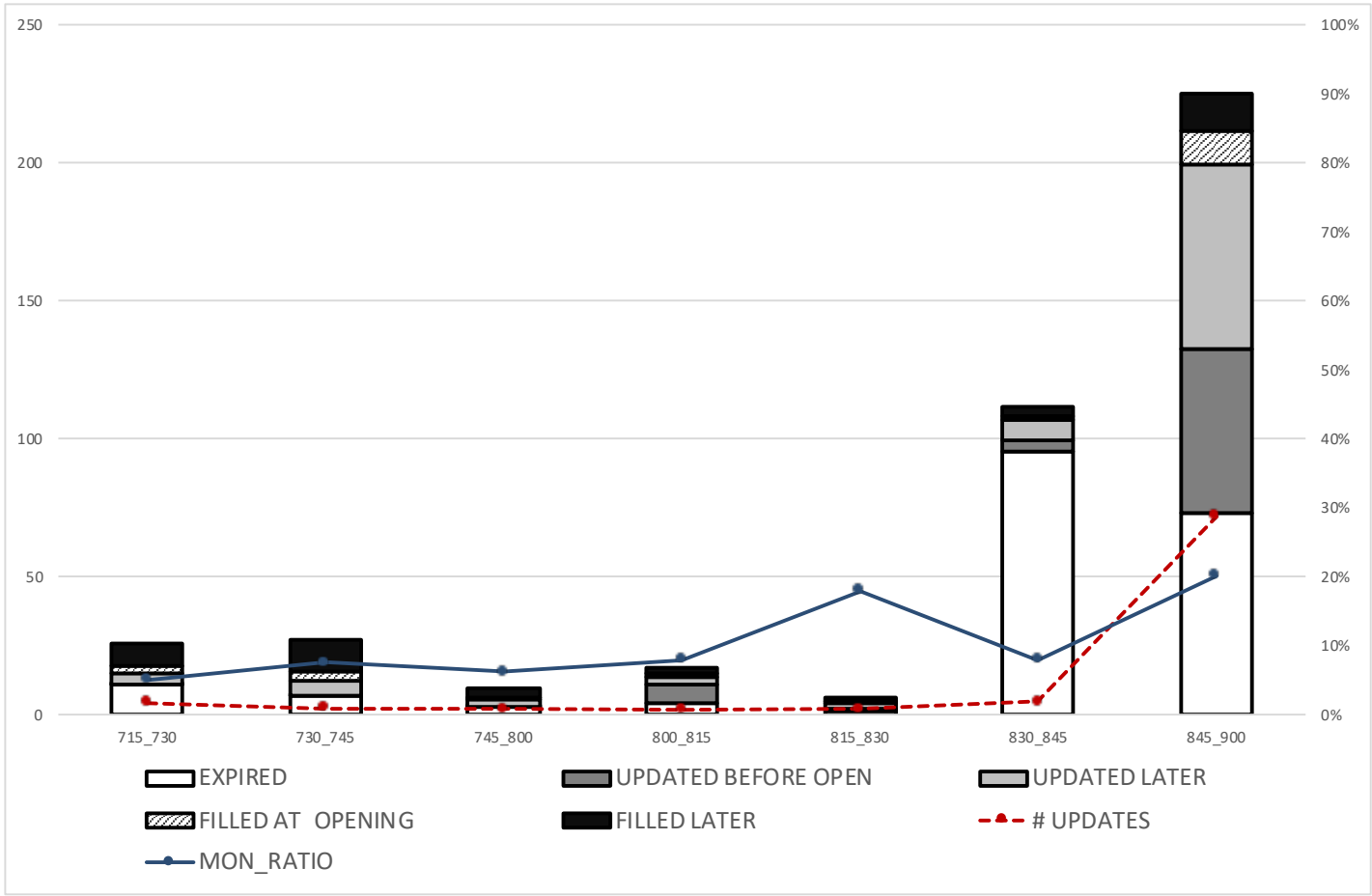
Six main categories of members participate to the pre-open and opening call auction

	Market shares of main categories of participants				#ORD
	Opening auction		Continuous trading session		Preopen
	CAC	NON-CAC	CAC	NON-CAC	
1. HFT prop traders	5%	6%	2%	11%	173
2. Mixed prop traders	37%	30%	34%	36%	69
3. NON-HFT prop traders	8%	6%	6%	5%	31
4. NON-HFT clients	27%	43%	12%	26%	93
5. Mixed clients	14%	11%	9%	10%	32
6. NON-HFT LP	0%	3%	0%	2%	15
(HFT LP)	(0%)	(0%)	(24%)	(6%)	
(Mixed LP)	(3%)	(0%)	(9%)	(2%)	

From anecdotical evidence

- HFT: some former NYSE specialists (IMC, Nyenburgh-Virtu), hedge funds (Optiver)
- Mixed prop: mainly commercial banks (BNP Paribas, Citigroup, Barclays)
- NON-HFT clients: BCG Paris, Louis Capital, Tullett Prebon and other smaller brokers
  - NON-HFT brokers' clients: Large and small asset managers (AMUNDI, AXA AM, Carmignac), private bankers
- NON-HFT LP: corporate brokers on smaller caps, often with a "liquidity contract"

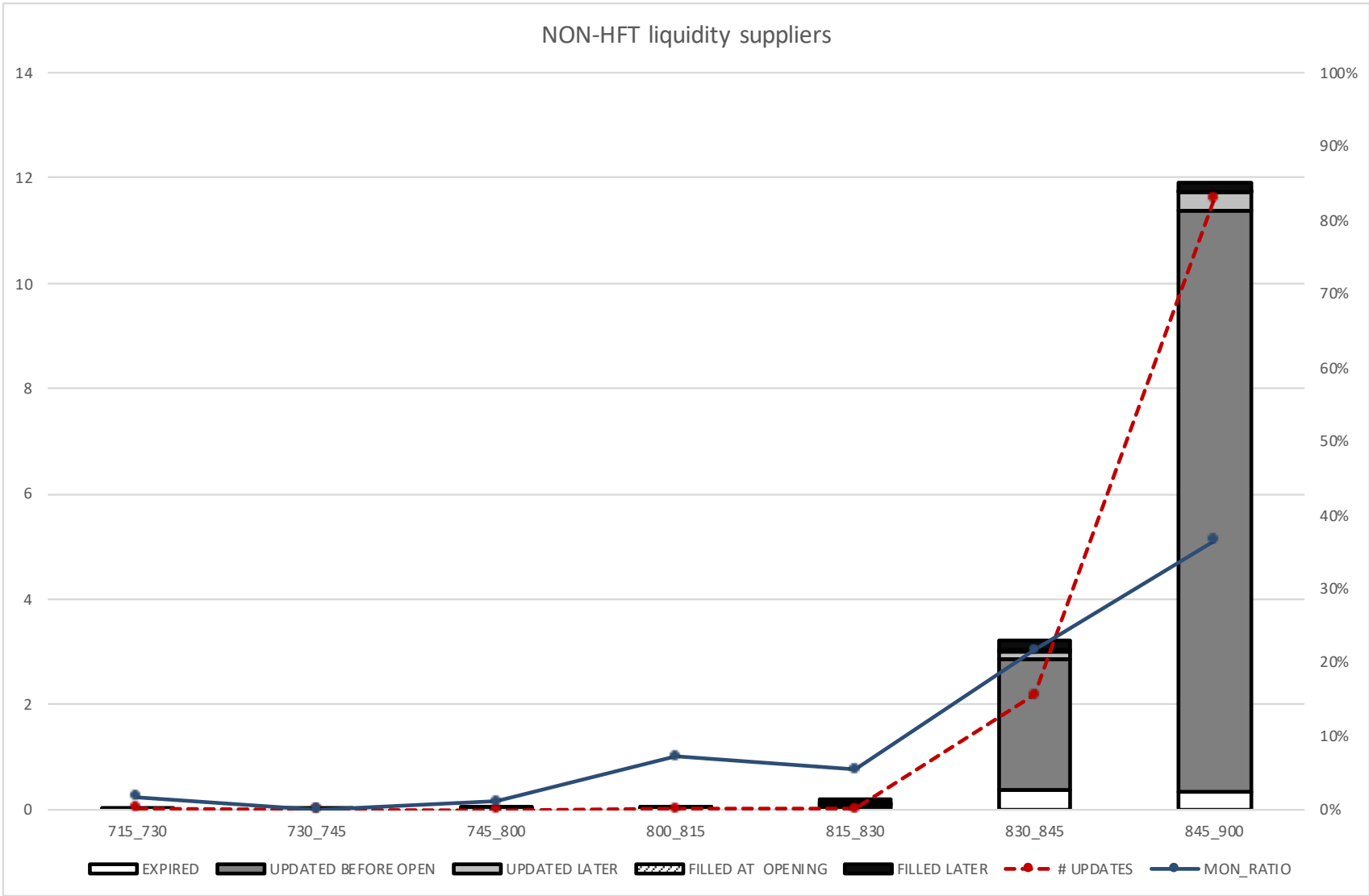
Dynamics of preopening orders and updates



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

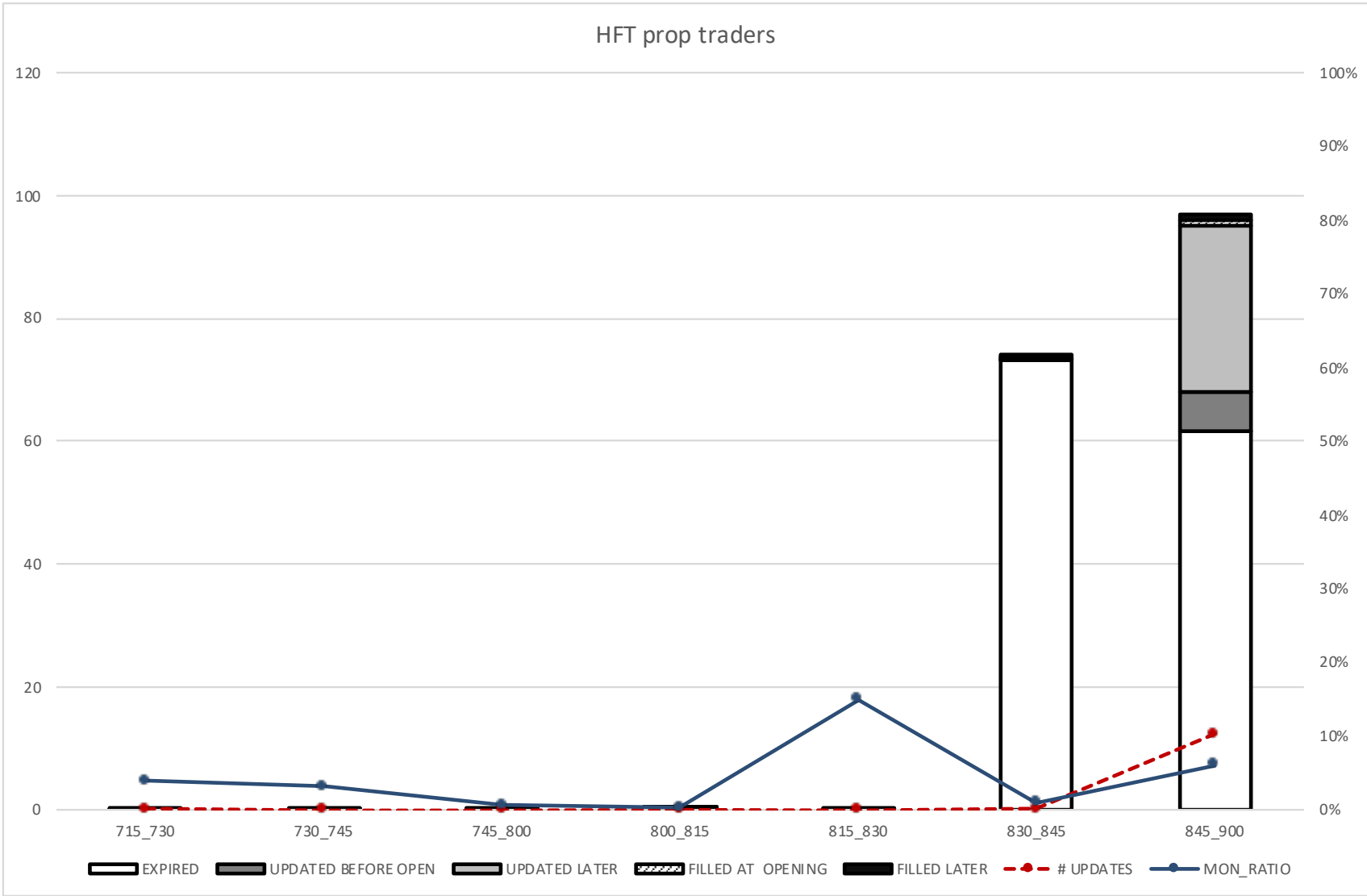
Heterogeneity across members' categories $\rightarrow$ some illustrations follow ($\neq$ scale!)

Dynamics of preopening orders and updates: NON-HFT liquidity providers



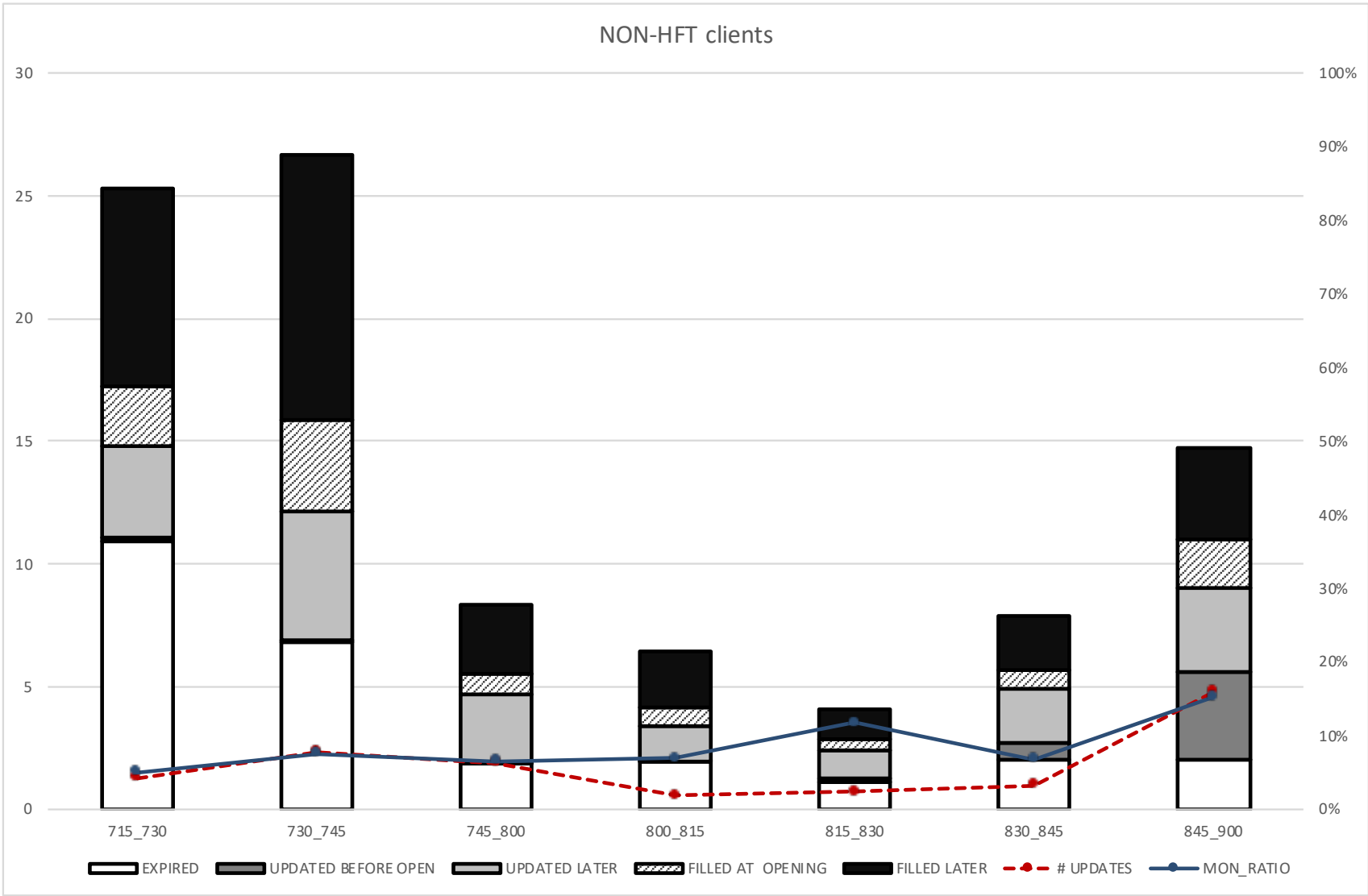
Most members enter in the last 30 mns, e.g. NON-HFT LP, who update most of their quotes before the auction (only non-CAC40 stocks)

Dynamics of preopening orders and updates: HFT prop



HFT prop submit price schedules (many orders away from the best quotes that remain in the book, do not update much)

Dynamics of preopening orders and updates: NON-HFT clients



NON-HFT clients have a U-shape activity, fill rate $\pm$ 50%

Members' participation during the glitch (opening volume)

	Normal days	June 6th		*t-stat* Diff	
# preopening orders					
HFT prop	187	142	-24%	-1.65	
Mixed prop	66	50	-24%	-1.62	
NON-HFT prop	44	82	+86%	1.78	
NON-HFT clients	120	104	-13%	-0.82	
Mixed clients	38	32	-16%	-1.00	
NON-HFT LP	21	3		-3.14	(**)
%Op.vol.					
HFT prop	5.2%	0.8%		-6.49	(***)
Mixed prop	31.1%	19.1%		-5.73	(***)
NON-HFT prop	6.4%	6.6%		0.20	
NON-HFT clients	35.1%	49.4%		5.03	(***)
Mixed clients	14.8%	18.4%		2.12	(**)
NON-HFT LP	2.3%	2.8%		0.48	

Clients' market share is higher // migration of HFTs and Mixed prop traders

Switching costs higher for clients, captive order flow?

Why do (some) members participate early?

Hypothesis

- Quantity discovery (H4)? $\Rightarrow$ expected liquidity shocks
- Time priority (H5)? $\Rightarrow$ should matter more when tick size is high

Panel regression, "Early orders" = submitted before 7:45am included

$$\begin{aligned} PROP\_early_{s,t} &= a_0 + a_1 tick\_size_{s,t} + a_2 D\_div_{s,t} + a_3 D\_Witch_t + a_4 D\_Quarter \\ &+ a_5 D\_earnings + X_{s,t} + \varepsilon_{s,t}. \end{aligned}$$

	PROP_early
Tick Size	1.155***
	(6.40)
D_div	0.397***
	(36.70)
D_witch	0.069***
	(23.62)
D_quarter	0.104***
	(23.51)
Earnings' announcement	-0.00156
	(-0.46)
N	40,043
Controls	Yes
Stock FE	Yes
Standard errors	clustering
Overall R^2	0.0695

Who contributes most to price discovery?

$$D\_IC^m_{s,t} = a^m_0 + \sum_j a^{m,j}_1 ord^j_{s,t} + \underbrace{a^m_2 MON\_RATIO_{s,t} + a^m_3 PROP\_HID\_VOL_{s,t} + a^m_4 AGG\_RATIO_{s,t} + X_{s,t}}_{\text{as in baseline}} + \varepsilon_{s,t}$$

Dependent variable:	D_IC^E		D_IC^C	
	(1)	(2)	(3)	(4)
ln(#*ORD*) HFT prop	0.0188	0.0183	0.0244	0.0241
	(1.31)	(1.27)	(1.68)	(1.77)
ln(#*ORD*) Mixed prop	0.140***	0.140***	-0.0354	-0.0346
	(4.78)	(4.87)	(-1.24)	(-1.63)
ln(#*ORD*) NON-HFT prop	0.0220	0.0217	0.0406***	0.0403***
	(1.48)	(1.51)	(3.85)	(3.91)
ln(#*ORD*) NON-HFT clients	0.0322		0.0589***	
	(1.36)		(3.27)	
ln(#*ORD*) NON-HFT clients bef. 7:45am		-0.00584		-0.000536
		(-0.40)		(-0.03)
ln(#*ORD*) NON-HFT clients aft. 7:45am		0.0423*		0.0621***
		(1.95)		(3.62)
ln(#*ORD*) Mixed clients	-0.0118	-0.0104	-0.0275	-0.0252
	(-0.43)	(-0.42)	(-1.53)	(-1.11)
ln(#*ORD*) NON-HFT LP	0.0929***	0.0968***	0.0551**	0.0603**
	(4.23)	(4.79)	(2.54)	(2.34)
ln(#*ORD*) Others	-0.0218	-0.0210	0.00128	0.00248
	(-1.06)	(-1.03)	(0.08)	(0.13)
N	40,041	40,041	40,036	40,036
Control variables	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes
Pseudo R^2	0.0027	0.0027	0.0010	0.0010

Conclusion: key findings

Even with low trading volumes, preopening still matters for price discovery.

Pre-open in Euronext impacts price discovery in Chi-X, as shown in case of opening delay.

Request for immediacy (time priority, quantity discovery) seems to induce early submission of "captive" order flow from slow brokers.

Mixed Prop traders are leading the price discovery process on Euronext, but NON-HFT clients (slow brokers) and LP (corporate brokers) facilitate price discovery across platforms.