Who Trades at the Close? Implications for Price Discovery and Liquidity

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7th Workshop NES & CBR
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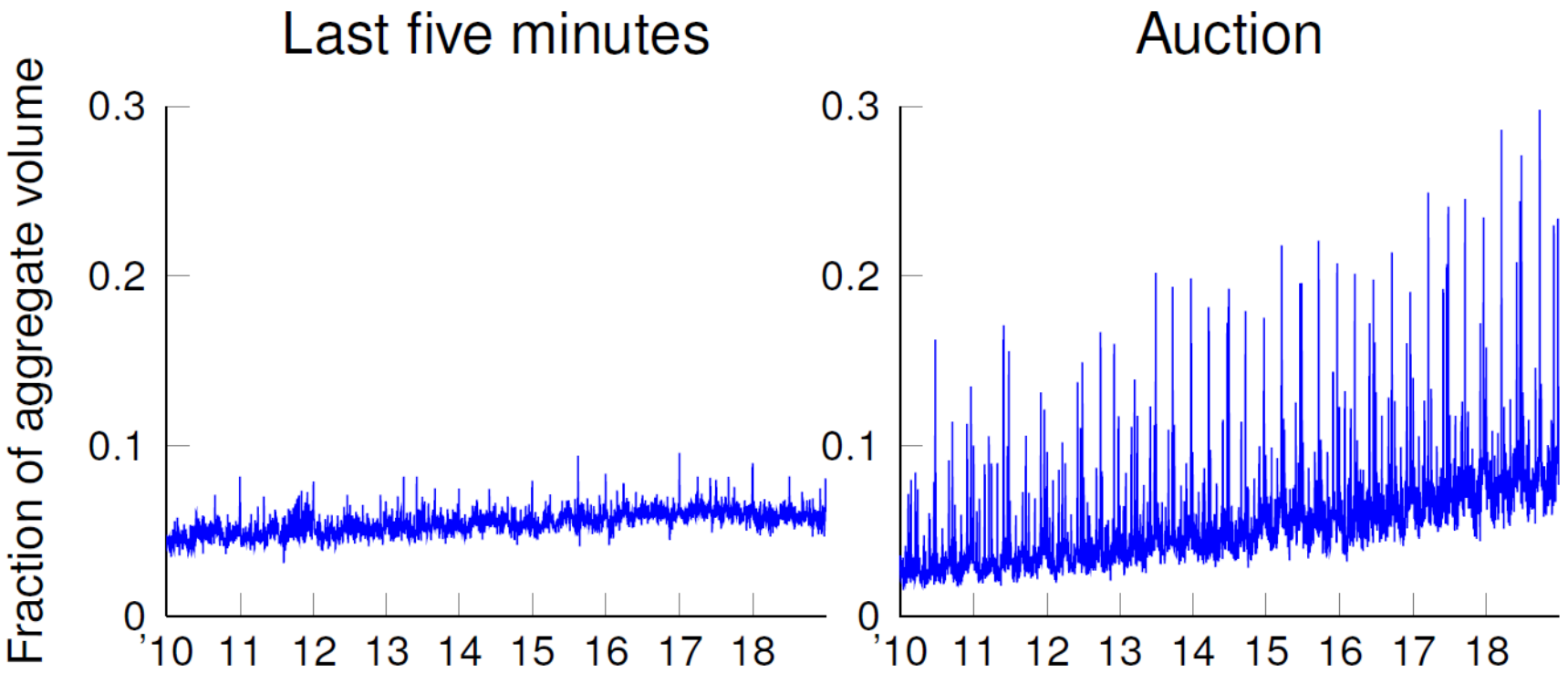
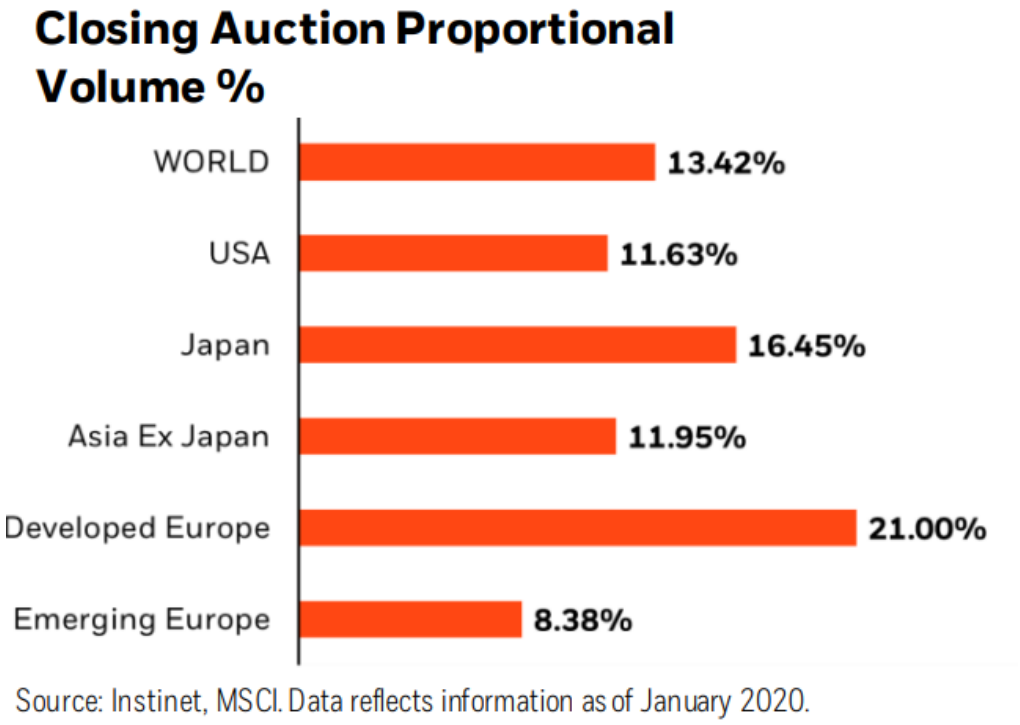
End-of-day volume (U.S. stocks)



Closing auction volume (World)



Source: Instinet, MSCI. Data reflects information as of January 2020.

Closing auction in the news

MARKETS THE WALL STREET JOURNAL.

Late-Day Trading Activity Continues to Increase

Trading near market close becomes prevalent as ETFs and other vehicles look to match index moves

By Michael Wursthorn and Christopher Whittall

Oct. 11, 2018 6:39 pm ET

FT Trading Room FINANCIAL TIMES

The 30 minutes that have an outsized role in US stock trading

An increasing concentration of volumes from 3.30pm to 4pm is causing concern

Robin Wigglesworth, US markets editor APRIL 24 2018

MARKETS THE WALL STREET JOURNAL.

SEC Decision on 4 p.m. Closing Trades Deals Blow to NYSE, Nasdaq

Regulator approves Cboe end-of-day auction proposal despite opposition from two largest exchanges

By Alexander Osipovich

Updated Jan. 21, 2020 8:41 pm ET

MARKETS | ETFS THE WALL STREET JOURNAL.

NYSE Arca Suffers Glitch During Closing Auction

At least $150 billion of exchange-traded funds said to be affected, including world's largest gold ETF

By Asjylyn Loder

Updated March 20, 2017 10:49 pm ET

Growing concerns about the auction

AMF | AUTORITÉ DES MARCHÉS FINANCIERS

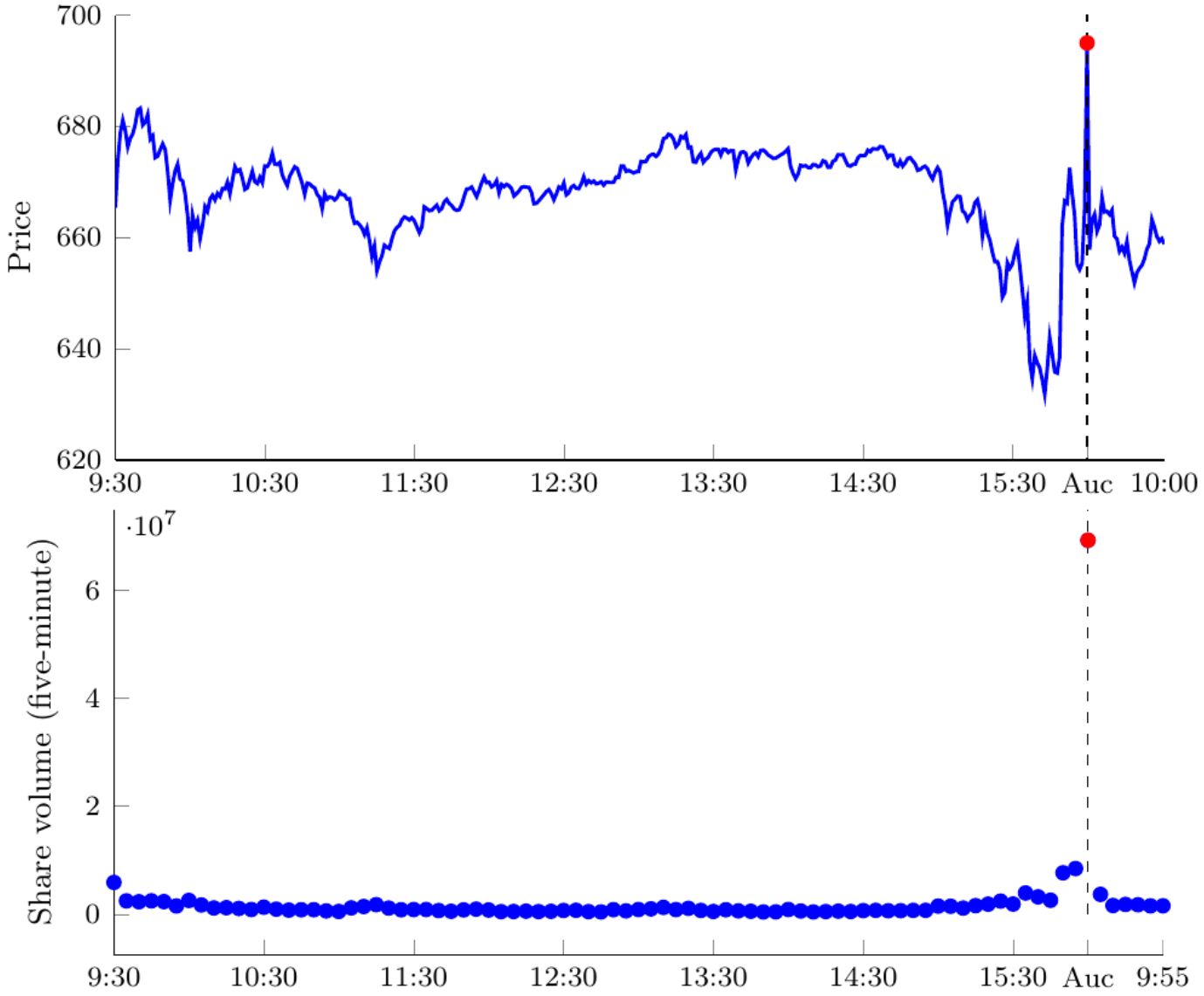
"Concentration of transactions in the closing auction on Euronext is a new market risk."

esma European Securities and Markets Authority

ESMA raised a question on whether it should "take actions to influence this market trend."

- "If the primary listing exchange can't run the closing auction, all hell breaks loose," said Greg Tusar, WSJ 3/15/2018
- "A lot of trading is concentrated in a very narrow period of time," said Marco Pirondini "I would love regulators to start to think about this before there's a problem, rather than after one." FT 4/24/2018

The day Tesla joined the S&P 500



12/20/2020

Main results

1. Who trades and why at the close?
   - Closing auction volume is strongly associated with ETF and passive mutual fund ownership and institutional rebalancing but not active mutual fund ownership
   - Increase in passive ownership cannot fully account for the trend
2. Do prices deviate around the close?
   - Closing price almost always deviate from 4pm midquote but deviations are small on average (half spread)
   - Deviations reverse quickly and almost completely
   - Large price deviations do not appear abnormal relative to the volume traded
3. This resiliency is consistent with “liquidity begets liquidity”
   - Auction matches large volume a low cost
   - Trend coincides with a decrease in liquidity at the open

Related literature

- Auctions: Stoll and Whaley (1990); Amihud and Mendelson (1990); Madhavan and Panchapagesan (2000); Bacidore and Lipson (2001); Pagano and Schwartz (2003); Comerton-Forde, Lau, and MacInish (2007); Barclay, Hendershott, and Jones (2008); Chelley-Steeley (2008); Kandel, Rindi, and Bosetti (2012); Pagano, Peng, and Schwartz (2013);
- Hu and Murphy (2020), Jegadeesh and Wu (2021)
  - We study the “new regime” with record-high auction volume

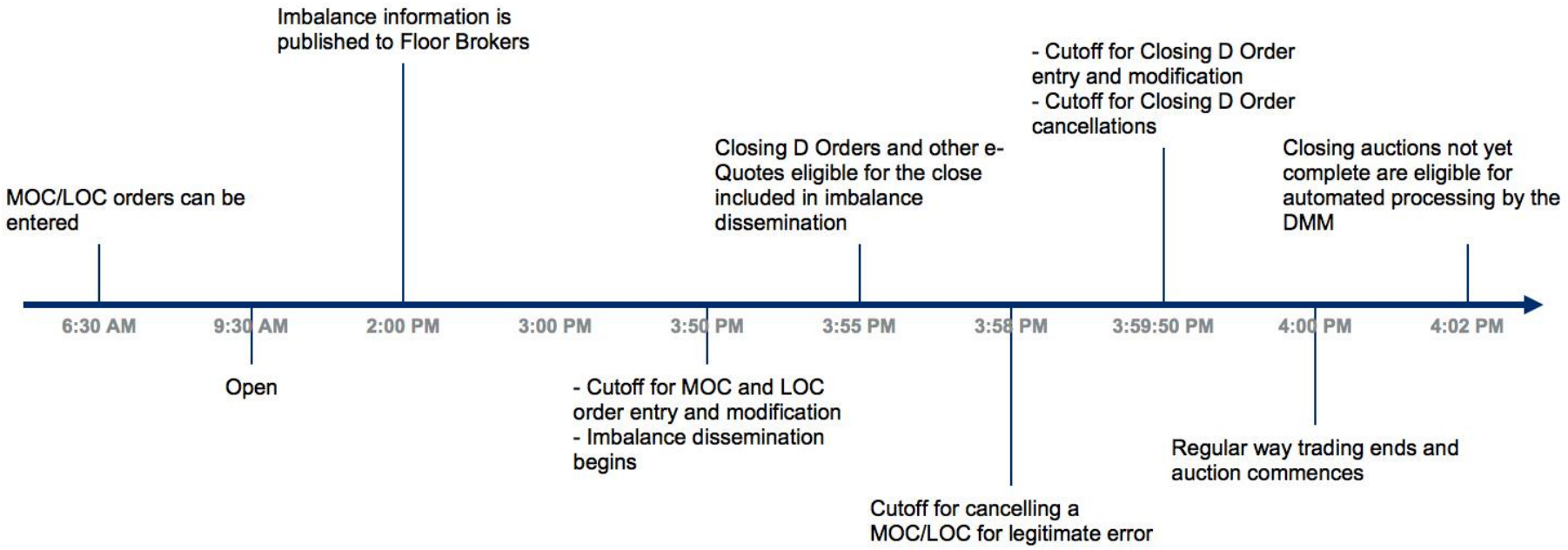
- Institutions and asset prices: Cushing and Madhavan (2000); Greenwood and Thesmar (2011); Ben-David, Franzoni, and Moussawi (2018); Baltussen, van Bekkum, and Da (2020)

Sample

- NYSE and Nasdaq-listed common stocks over 1/2010-12/2018
  - Price > $5 and market cap. > 100 million
- Closing volume and price from TAQ:
  - Auction price = daily CRSP price in 99% of observations (99.99% from 2014)
  - We use the CRSP price and midquote
- Intraday volume and prices from TAQ
- ETF and institutional ownership data from CRSP, TR, and ETF Global

How are closing prices determined for U.S. stocks?

NYSE auction timeline:



Source: NYSE

Moscow exchange example

- MICEX introduces closing auction in August 2013
- The auction is held between 18:40 and 18:50

Цена Аукциона закрытия определяется с применением критерия, минимизирующего дисбаланс:

Покупка			Продажа			
Агр. покупка	Покупка	Цена	Продажа	Агр. продажа	Объем исполнения	Дисбаланс
		МО	20000			
5000	5000	90,22	10000	45000	5000	40000S
10000	5000	90,21	5000	35000	10000	25000S
25000	15000	90,20	5000	30000	25000	5000S
35000	10000	90,19	5000	25000	25000	10000B

МОСКОВСКАЯ БИРЖА

Применив критерий, получаем цену закрытия = 90.20

Volume statistics

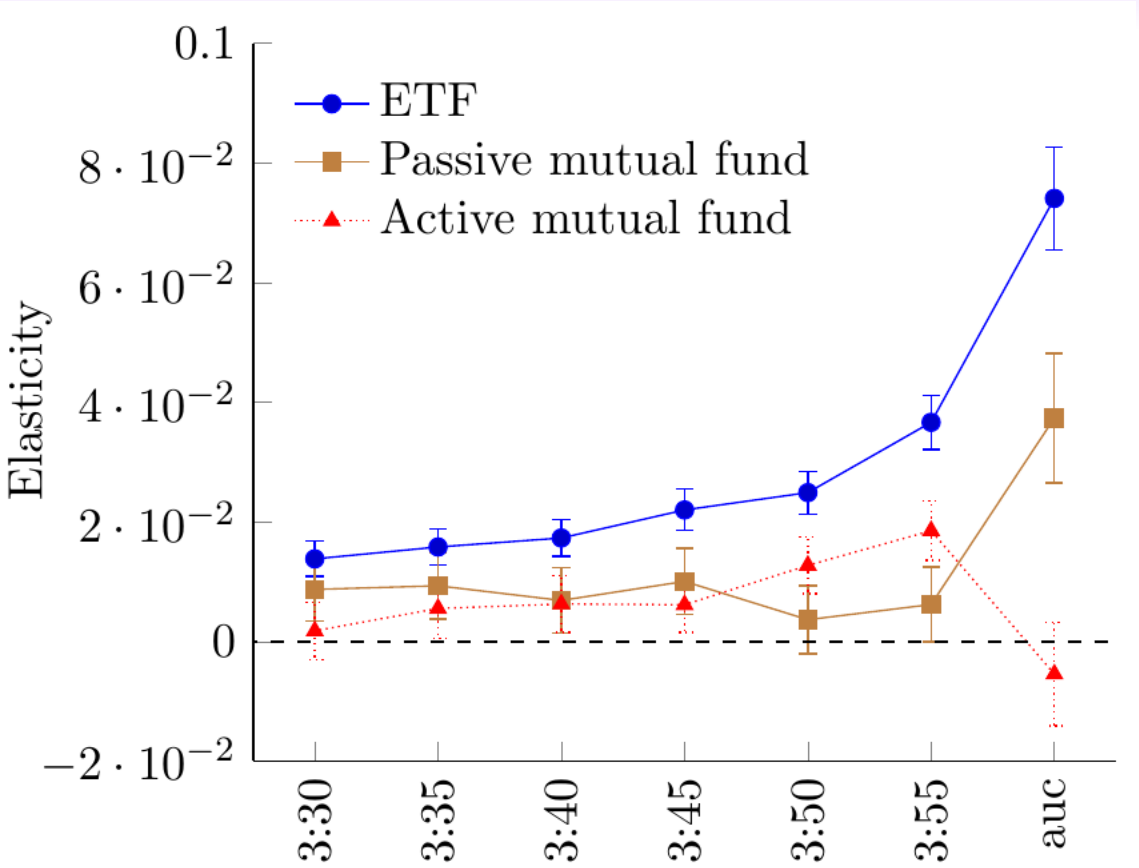
Time series	Full			2010			2018		
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.
Auction volume	5.69	4.38	4.48	4.13	2.79	3.75	7.27	6.18	4.53
Volume 3:55-4:00	6.96	6.06	4.46	5.79	4.88	4.15	7.28	6.5	4.12
Volume 3:30-3:55	10.9	10.21	5.76	11.6	10.86	5.87	10.04	9.42	5.35

- Auction volume, as % of daily volume, increases over time, but the last half-hour volume (3:30-to-3:55) does not change

Cross-section	Low			Mid			High		
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.
Auction volume	6.06	4.22	5.87	5.69	4.53	3.8	5.67	4.56	3.4
Volume 3:55-4:00	7.23	5.65	6.85	7.35	6.63	3.75	5.83	5.4	2.37
Volume 3:30-3:55	9.84	8.12	8.71	11.42	10.72	4.84	10.7	10.23	3.37

- Auction volume is similar across size quintiles

ETF or institutional ownership?

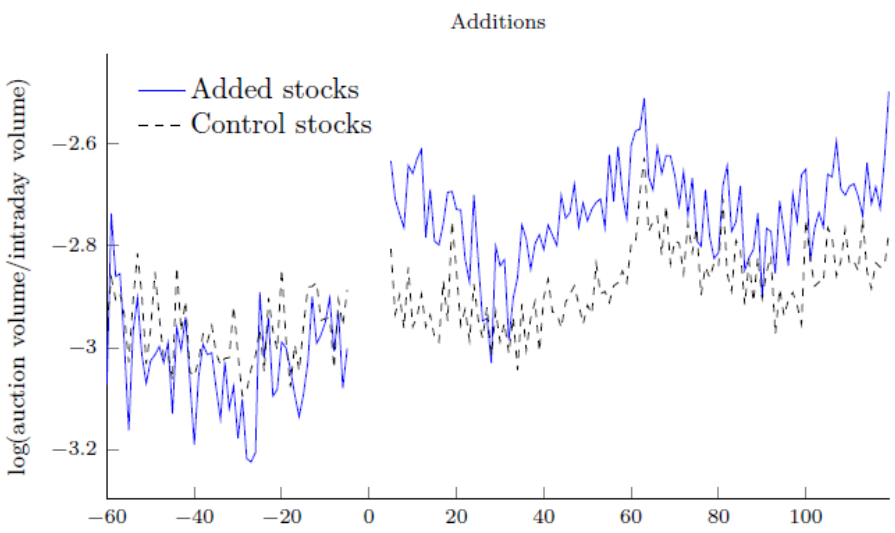


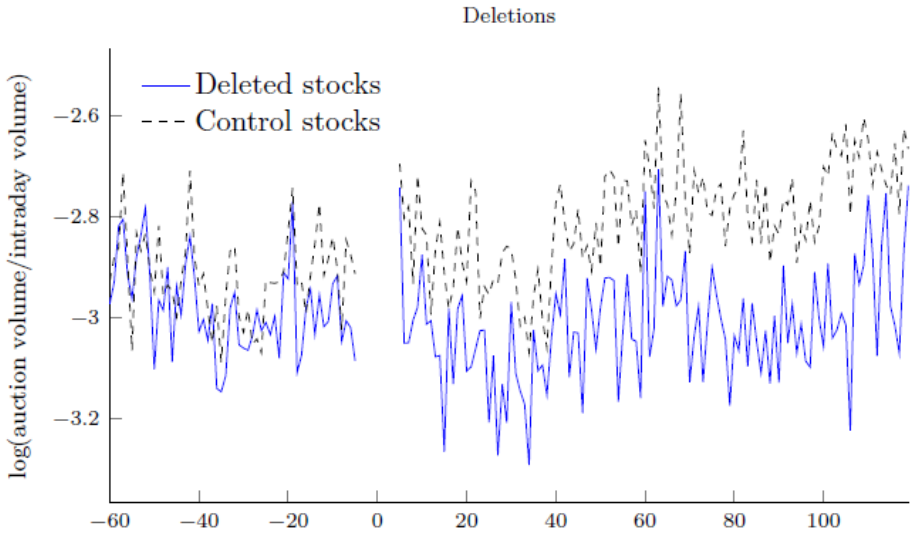
- Elasticity of turnover to ETF and institutional ownerships for each 5-minute interval between 3:30pm and the auction
- ETF ownership elasticity strongly increases at the close

Who trades at the close and why?

	Auction turnover		Last 5min turnover		Intraday turnover	
log ETF own.	0.074***	(0.004)	0.037***	(0.002)	0.037***	(0.003)
log MFund own. (active)	-0.005	(0.004)	0.019***	(0.002)	0.020***	(0.004)
log MFund own. (passive)	0.037***	(0.005)	0.006**	(0.003)	0.010*	(0.006)
Russell rebal. day	2.307***	(0.096)	0.784***	(0.062)	0.078	(0.054)
3rd Friday	0.639***	(0.078)	0.125***	(0.020)	0.210***	(0.021)
First of month	0.195***	(0.030)	0.079***	(0.015)	0.133***	(0.012)
Last of month	0.869***	(0.049)	0.322***	(0.020)	0.008	(0.015)
End of quarter	-0.024	(0.065)	0.055*	(0.030)	-0.092***	(0.027)
EAD-1	0.016*	(0.009)	0.227***	(0.005)	0.224***	(0.005)
EAD	-0.016*	(0.009)	0.083***	(0.005)	0.966***	(0.009)
EAD+1	-0.025***	(0.009)	0.019***	(0.004)	0.494***	(0.006)
log Avg$\|Ret\|$	0.087***	(0.006)	0.075***	(0.003)	0.244***	(0.005)
Ret_{t-1}	-0.400**	(0.174)	-0.364***	(0.092)	-0.318***	(0.103)
log Market cap.	0.037***	(0.009)	0.020***	(0.006)	0.158***	(0.013)
Trend	0.054***	(0.013)	0.061***	(0.006)	-0.063***	(0.007)
Trend^2	0.005***	(0.001)	-0.000	(0.001)	0.006***	(0.001)
log Turnover(9:30-3:30)	0.323***	(0.005)	0.562***	(0.004)		
Calendar month FE	Yes		Yes		Yes	
Day of week FE	Yes		Yes		Yes	
Stock FE	Yes		Yes		Yes	
R^2(%)	30.70%		36.35%		8.97%	
Num. obs.	5,399,673		5,447,479		5,501,841	

S&P additions/deletions





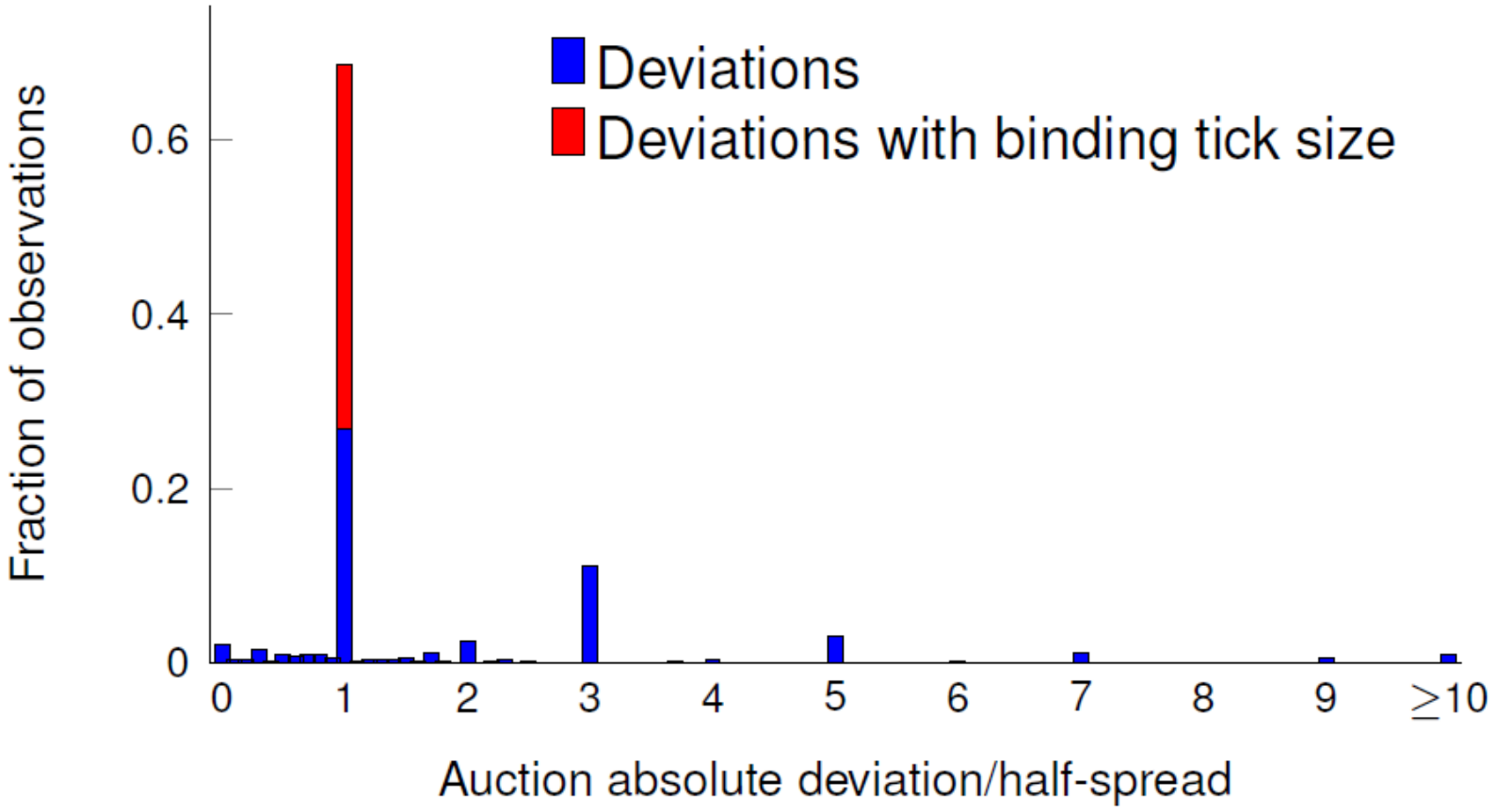
About 20% (15%) permanent increase (decrease) in closing auction volume relative to intraday volume for added (deleted) stocks, relative to control stocks

Price deviations at the close

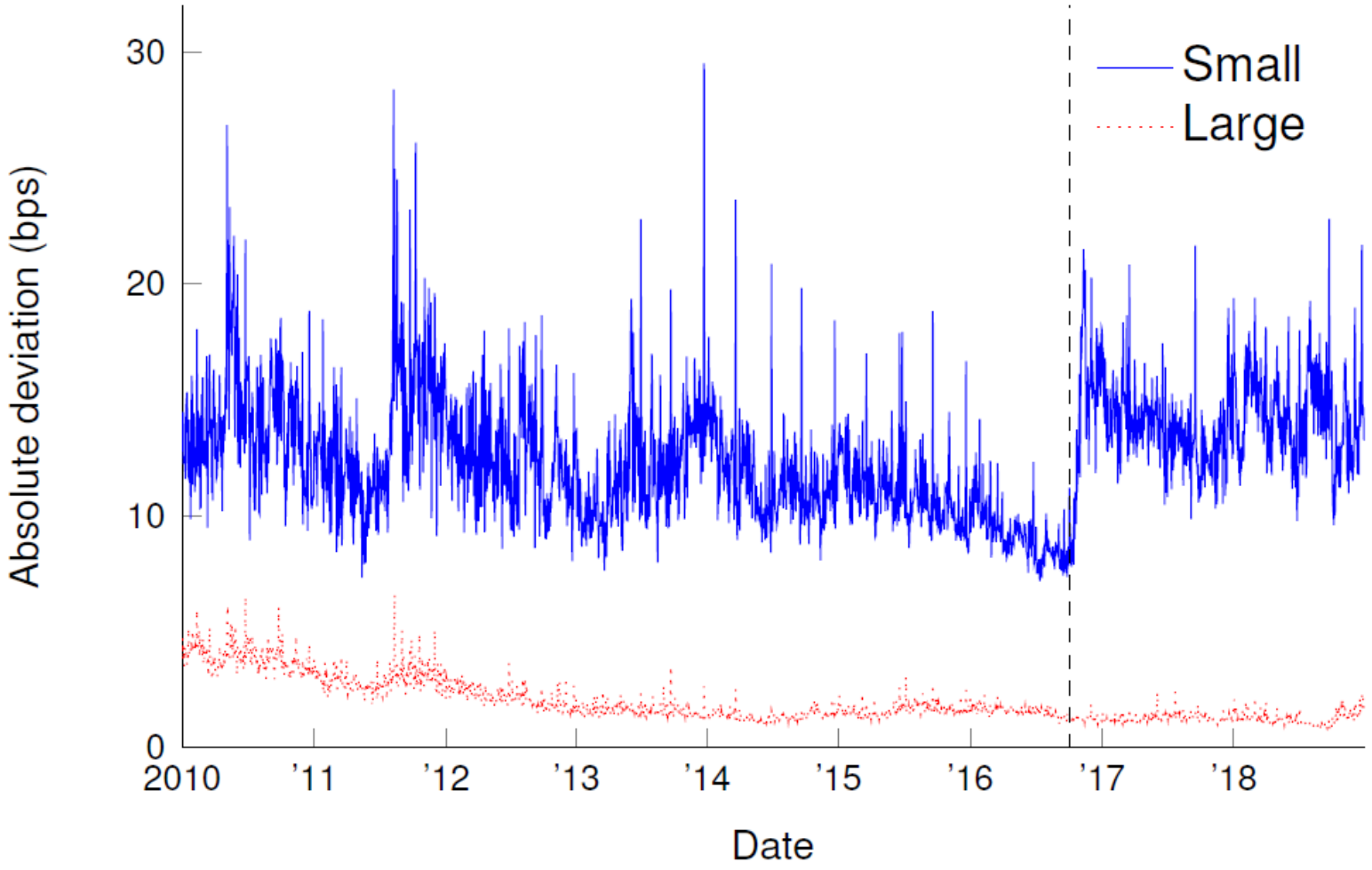
	All	Low	2	3	4	High
Mean	8.1	20.6	9.0	5.5	4.0	2.7
Std.Dev.	15.9	30.3	11.4	6.2	4.7	3.6
90%	17.4	42.1	17.8	11.0	8.3	5.7
95%	26.8	60.9	24.2	14.8	11.1	7.7
99%	63.1	141.2	46.0	25.4	20.0	13.4
99.90%	195.2	356.5	124.8	56.7	43.8	31.4

- Price deviation $= |\log(Closing\ Price/Midquote\ 4pm)|$
- Average price deviation is only 8.1 bps
- In 5% (1%) of cases the closing price deviates by >26.8 (63.1) bps
- |deviation| = half-spread + price impact
  - 8.1 bps = 7.55 bps + 0.55 bps
  - Despite massive volume, closing prices match or improve on the pre-closing bid or ask prices in 76% of cases

Auction absolute dollar deviation/half spread



Auction price deviation over time



Price deviations completely reverse

- $Ret_{Auc}^{9:45am} = \alpha_i + b * Ret_{4:00pm}^{Auc} + \epsilon_{i,t}$

	Ret_{auc}^{945}	$RetAdj_{auc}^{945}$	Ret_{400}^{945}	Ret_{auc}^{945}	$RetAdj_{auc}^{945}$	$RetAdj_{auc}^{945}$ (top 1%)
Ret_{400}^{auc}	-0.845***			-0.872***		
	(0.028)			(0.028)		
$RetAdj_{400}^{auc}$		-0.910***			-0.949***	-0.6604***
		(0.036)			(0.037)	(0.0483)
Ret_{355}^{400}			-0.186***	-0.176***	-0.185***	-0.2574***
			(0.038)	(0.038)	(0.038)	(0.0439)
Stock FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.61%	0.19%	0.11%	0.20%	0.30%	1.52%
Obs.	5,363,155	5,363,155	5,363,155	5,363,155	5,363,155	46,658

- Price deviations almost completely reverse overnight
- Reversal is stronger if we control for bid-ask bounce and include controls
- In contrast, little reversal for the last 5-minute deviation

Price deviations reverse quickly

- $Ret_{Auc}^{4:20pm} = \alpha_i + b_1 * Ret_{4:00pm}^{Auc} + b_2 * Ret_{3:55pm}^{4:00pm} + \epsilon_{i,t}$

	Ret_{auc}^{945}	$Ret_{auc}^{4:20}$	$Ret_{auc}^{4:30}$
Ret_{400}^{auc}	-0.985***	-0.458***	-0.378***
	(0.110)	(0.079)	(0.068)
Ret_{355}^{400}	-0.175*	-0.061***	-0.063***
	(0.104)	(0.015)	(0.015)
Stock FE	Yes	Yes	Yes
Adj. R^2	0.12%	0.11%	0.08%
Num. obs.	1,147,683	346,667	500,768

- For the sample with available after-hours trades, price deviations:
  - reverse completely overnight (as for the full sample)
  - reverse by half in the first twenty minutes after the close

Implications: Liquidity begets liquidity

- How to reconcile the increase in closing volume, the positive volume-deviation relation, and the flat/declining absolute deviation?
  - Other traders shift their trades towards the close (“liquidity begets liquidity”)
- Explains why the rise of passive investing cannot fully account for the trend in closing volume
- Implies that liquidity worsens intraday
  - Informed traders may move as well -> lower volume, higher spread, and lower volatility intraday (Admati and Pfleiderer (1988))
  - Or may not be able to delay their trades -> lower volume, higher spread, and unchanged/higher volatility intraday (Foster and Viswanathan (1990))

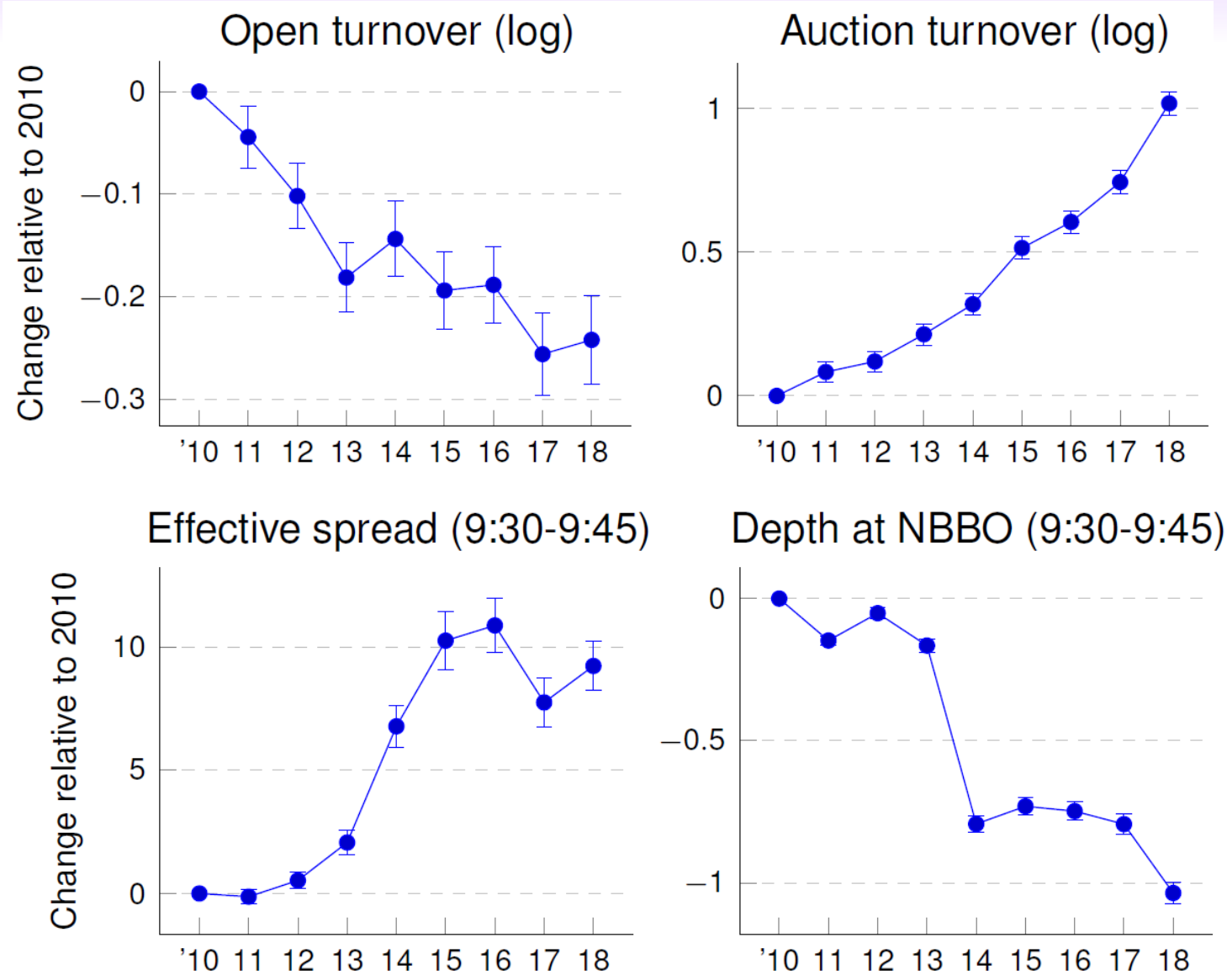
Intraday liquidity: setup

- We focus on the first 15 minutes of trading
  - Qualitatively similar results with first 30 minutes
- We focus on large stocks that are traded over the whole sample period (333 stocks)
  - 92% of observations belong to S&P 500 stocks
  - Estimate panel regressions with stock fixed effects and year indicators:

$$V_{i,t} = \alpha_i + \alpha_Y + controls + \epsilon_{i,t}$$

- where controls can include day/month FE, price, market capitalization, volatility, and volume

Intraday liquidity: results



Conclusion

- Closing auction is likely to become even more important with the expansion of passive investing
  - One way that passive investing affects asset prices
- We study closing volume and its effect on closing prices:
  - Closing volume is fueled by ETF and passive ownerships
  - Closing auction matches large volume cheaply and efficiently but it can become even more efficient if not for the binding tick size