Algorithmic trading in India: What do the data tell us?

Nidhi Aggarwal Chirag Anand Susan Thomas
IGIDR Finance Research Group

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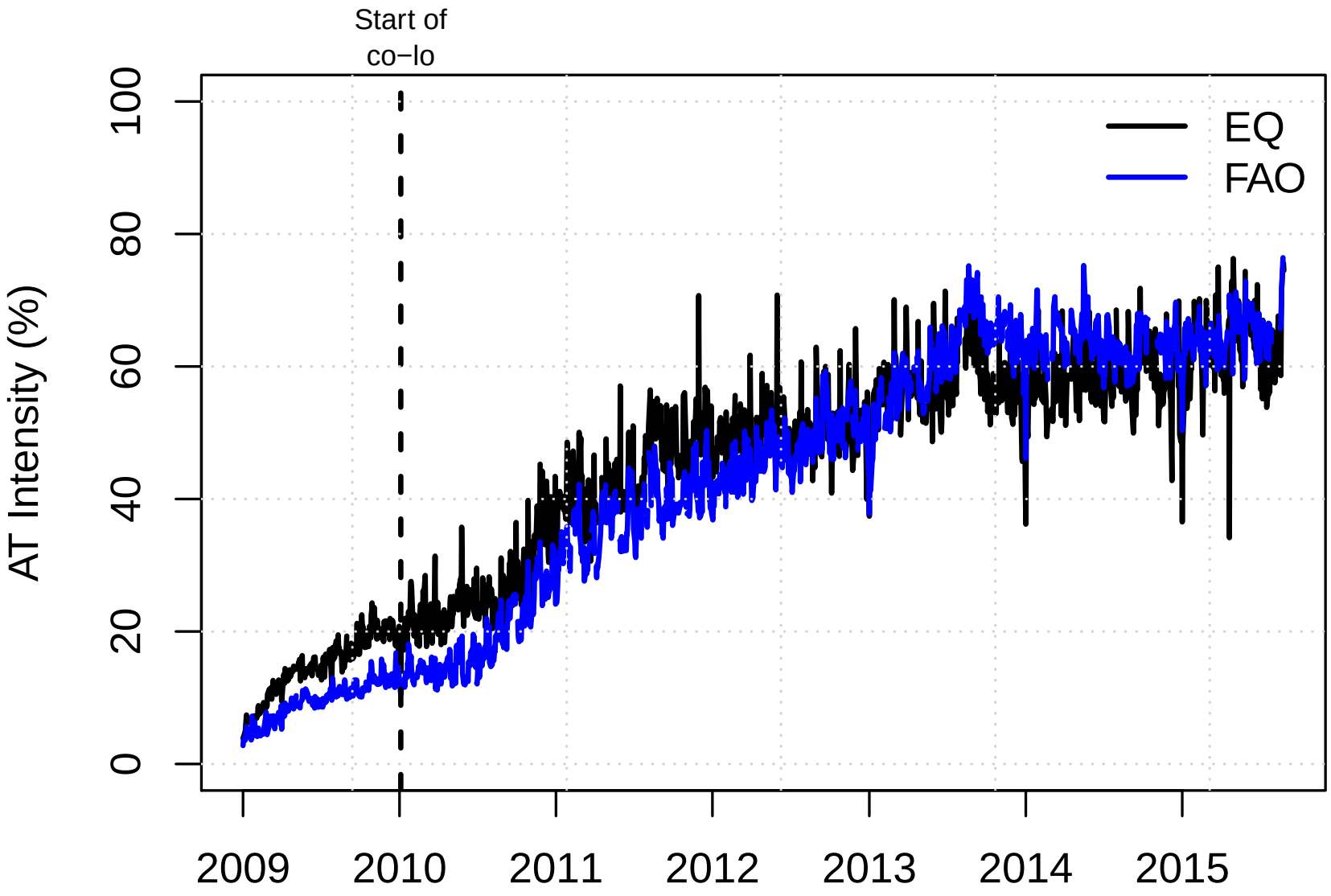
Background

- Advances in technology have altered the microstructure of the markets.
- Algorithmic trading (AT, or its close kin, HFT) dominates trading activity worldwide.
- Similar is the case in India as well.

Algorithmic trading on NSE equity markets (as % of TTV)



With the rise in AT,

- Benefits indisputable, but concerns regarding the negative externalities imposed by these traders.
- AT/HFT has been a subject of intense focus amongst the regulators. Pressure on the regulators to 'do something'.
- Consequence: Several policy proposals being contemplated to curb AT/HFT activity (MiFID II, HFT Act etc).
- SEBI similarly contemplating various measures to regulate AT so as to minimise the possibility of AT hurting the markets.

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- Much of the empirical evidence suggests that AT has indeed improved market quality.
- Several concerns are based on what has been seen in the the US.
- But the structure of the US markets is *very different* from that of the Indian markets (or even markets elsewhere).
- Yes, ability to trade faster has *changed* the structure of the markets!
- But important to understand *how* it has changed in order to know the implications.

Thus, the need for data analysis.

Thus, we resort to the *data*, and examine

1. How has the market structure changed in terms of trading behavior and liquidity provisioning?
   - Segment: NSE equity spot & derivatives.
   - Period: Nov-Dec 2009 (prior co-location) and Nov-Dec 2013 (post co-location).

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And how we accomplish this: Data details

1. Tick by tick orders and trades data from NSE, timestamped in jiffies.
2. Each order and trade marked by the exchange as AT or non AT.

Q 1: How has the market structure changed due to higher AT?

Potential impact

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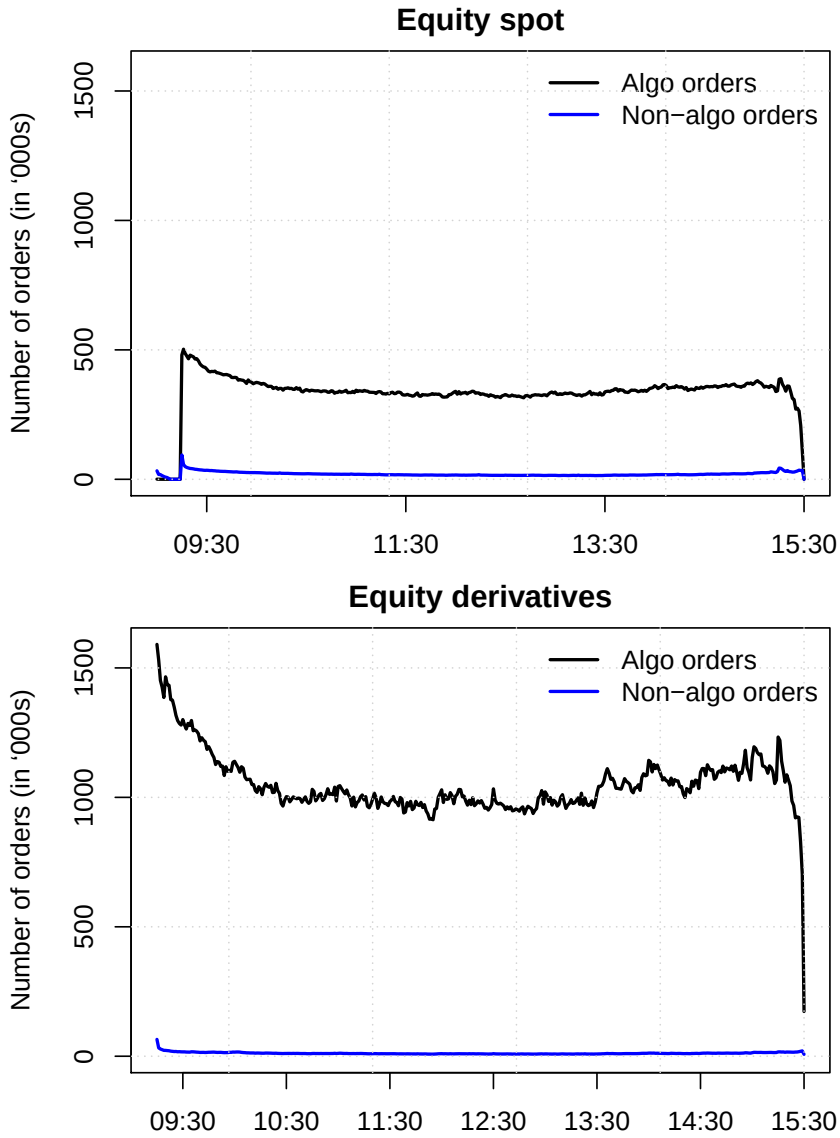
Q 1c: Instead of performing a market maker's function, AT's trade on the quotes of slow traders, and thus increase adverse selection.

Q 1d: Fast access has caused AT to send orders and then cancel them immediately, before any trader could act upon that order.

Q 1a: Do algorithmic traders flood the markets by large number of orders?

Per minute order arrival



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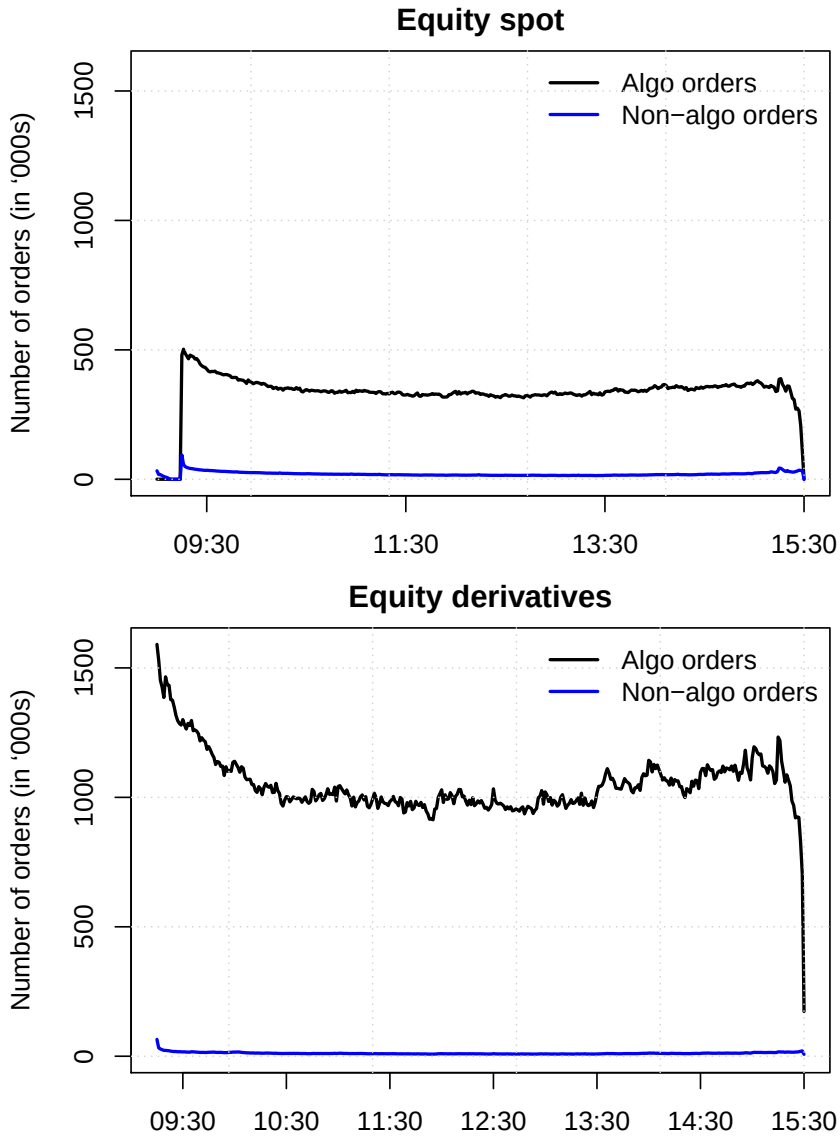
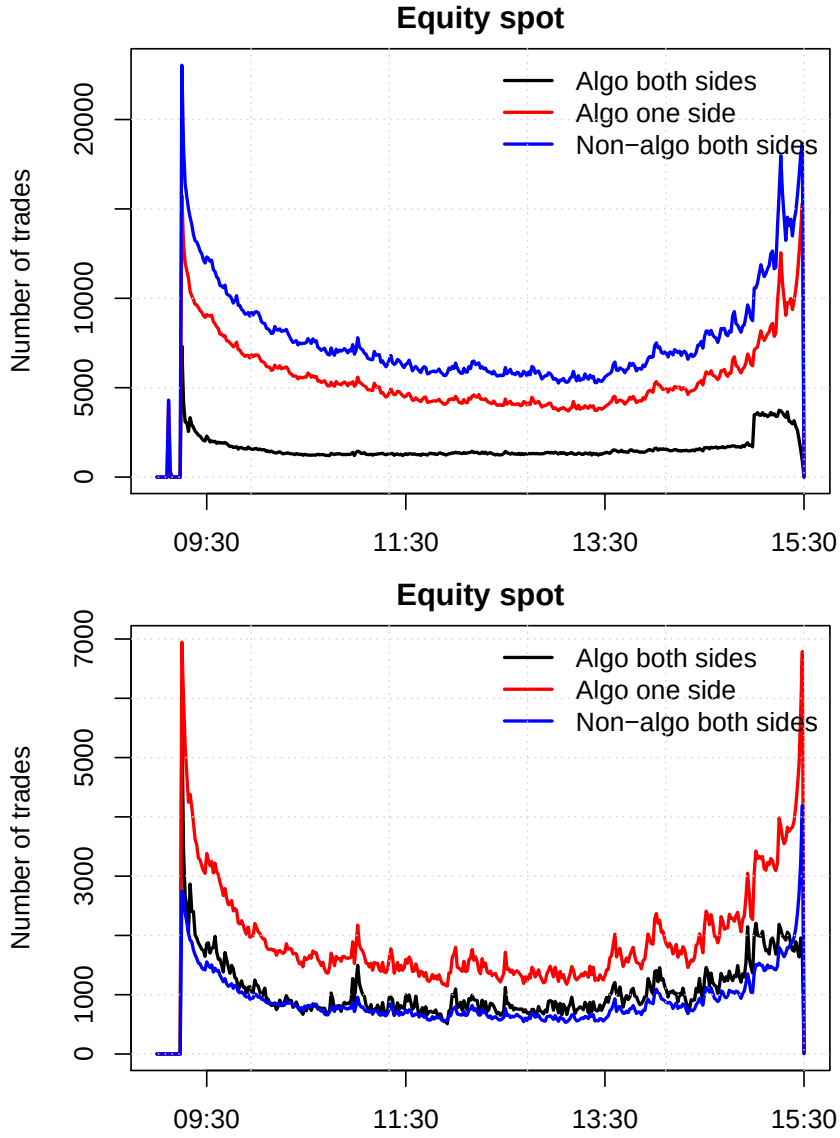


More than 90% of the orders sent by algorithmic traders.

Q 1b: Are slow traders being crowded out?

Per minute trades



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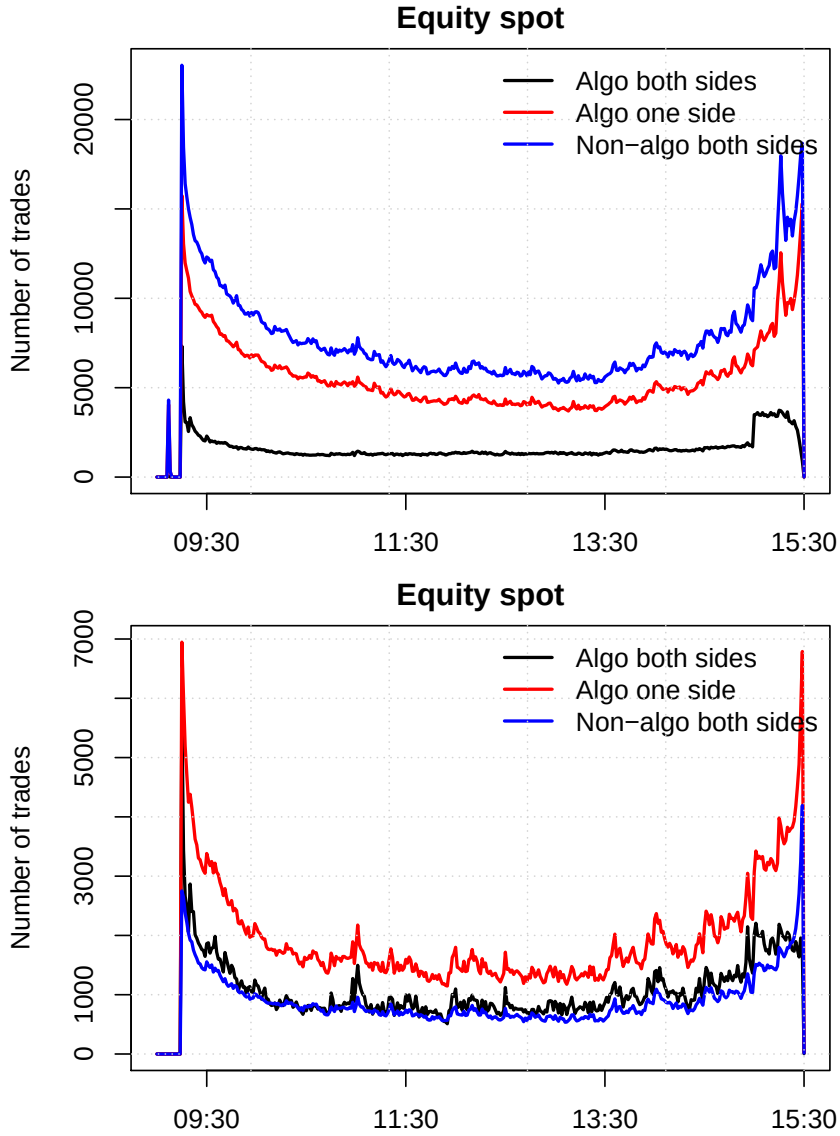
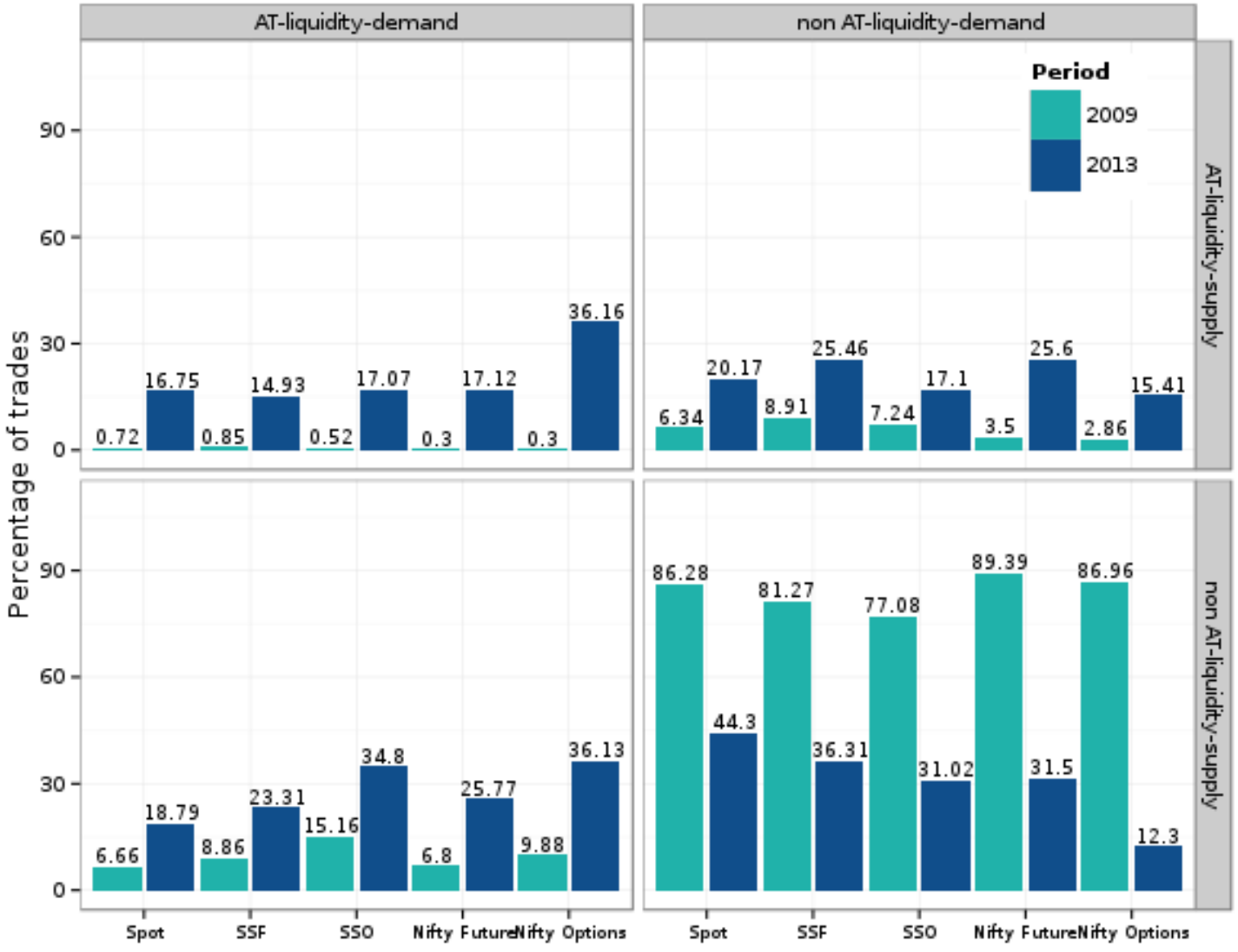


Non-algorithmic have equal and high share in number of trades, indicating that algorithmic traders do not crowd out non algorithmic traders.

Q 1c: Do AT's take away liquidity from slow traders?

Do AT supply liquidity or demand liquidity?



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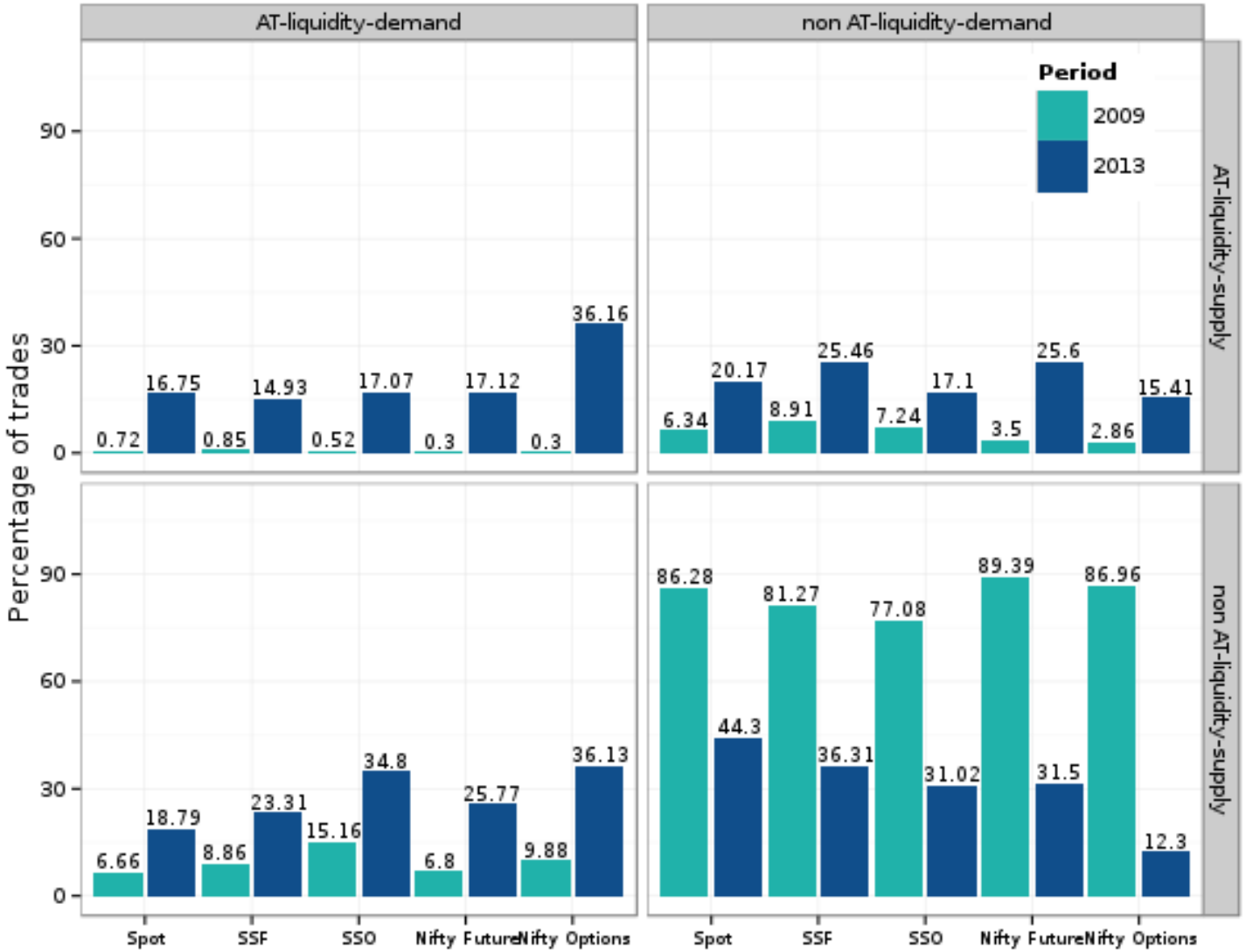

Except for the Nifty options market, the share of algorithmic traders in liquidity demand matches with their share in liquidity supply.

Q 1d: Are AT's cancelling orders before any trader can react on it?

Findings

- Significant increase in the percentage of orders that are cancelled.
- Of the total unique orders that came to NSE, the percentage of orders that got cancelled increased from
  1. 30.06% in 2009 to 56.97% in 2013 on the spot segment,
  2. 82.40% to 94.11% on the SSF
  3. 47.66% to 81.58% on Nifty futures, and
  4. 63.37% to 87.51% on Nifty options.
- Percentage of orders that got traded, declined, on the other hand.
- Large percentage of cancellations, is a feature of limit order markets, and can have legitimate reasons.
- Important to examine if these cancellations are happening at too fast a pace.

Findings

- We examine the lifespan of cancelled orders and compare it with the lifespan of traded orders.
- If the speed of quote cancellation is much quicker than the speed at which those quotes can be accessed, then the markets might be too fast. (Greg Bermann, SEC, April 2014)

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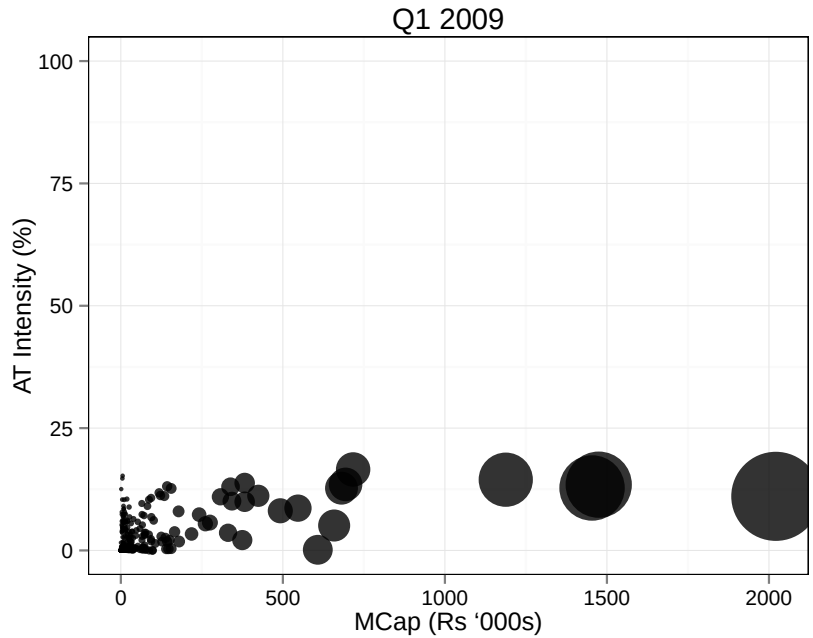
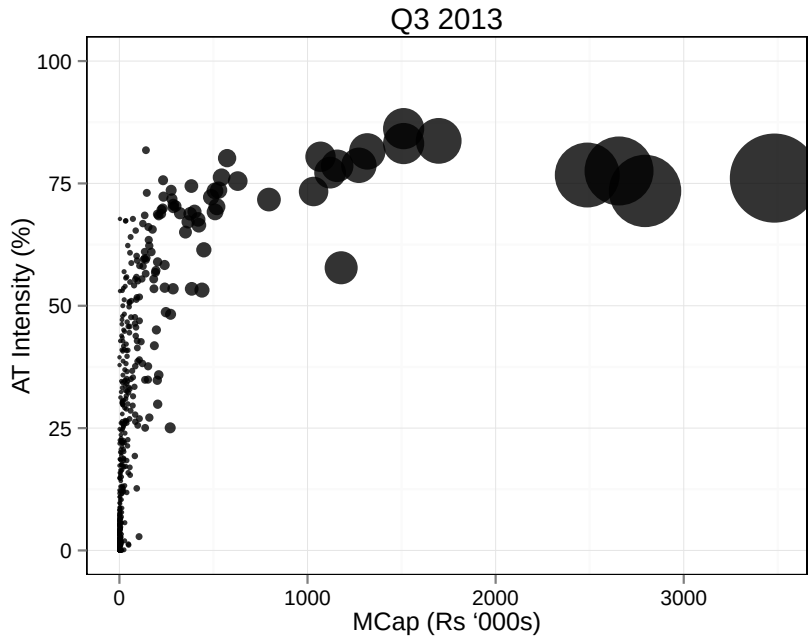
- If the speed of quote cancellation is much quicker than the speed at which those quotes can be accessed, then the markets might be too fast. (Greg Bermann, SEC, April 2014)
- The speed of order execution is higher than the speed of order cancellations on Nifty options. This is however not true of the SSF segment of the NSE.

Q2: How has AT affected market quality?

Examining the impact: Cross-sectional variation in AT





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    1. Traded prices move by 2%, 5% or 10% in a period of 5 minutes.

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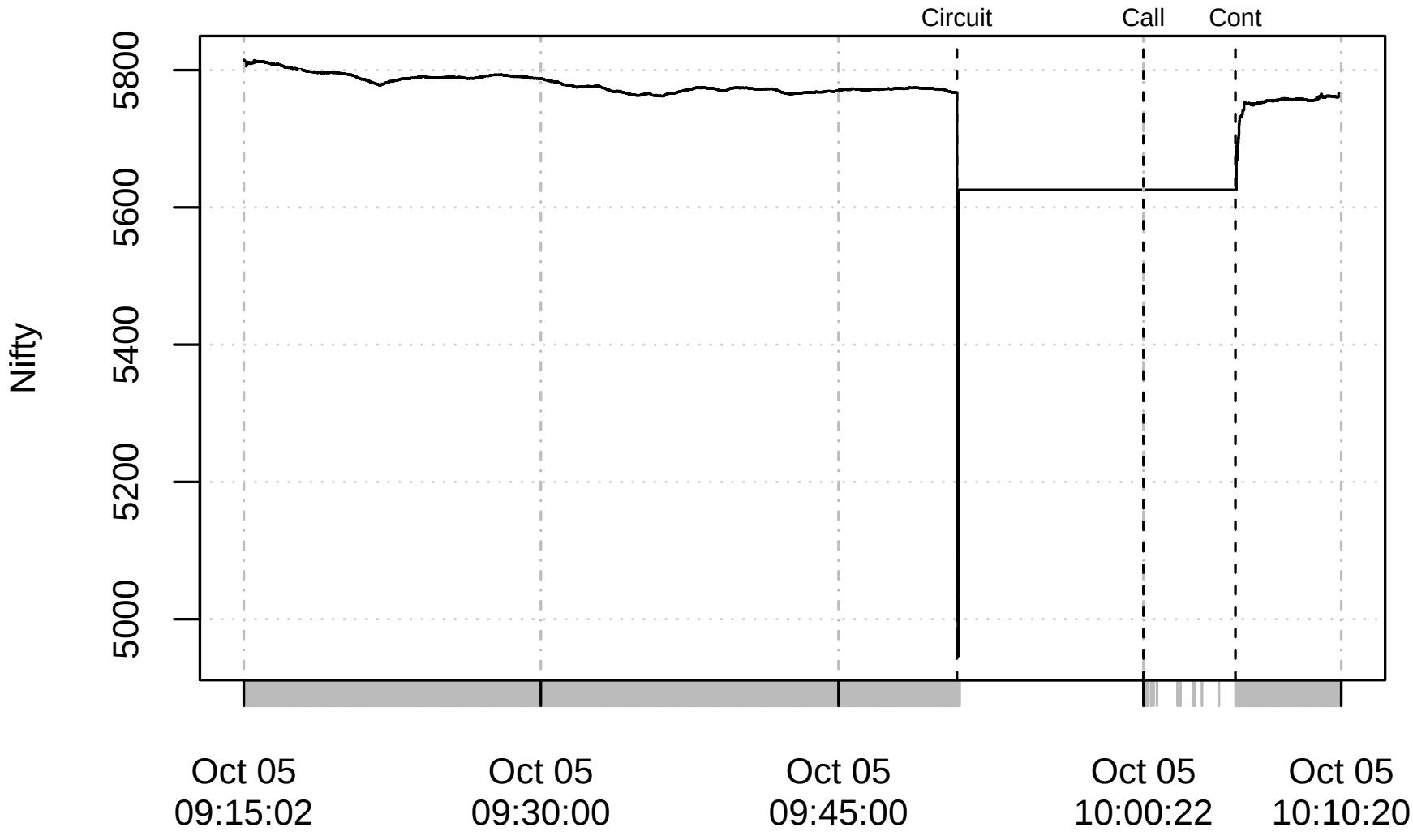
The evidence indicates that AT improves market quality and does not increase the incidence of extreme price movements.

Q3: Do AT's flee the markets during stress periods?

The crash


Circuit
Call
Cont
Nifty
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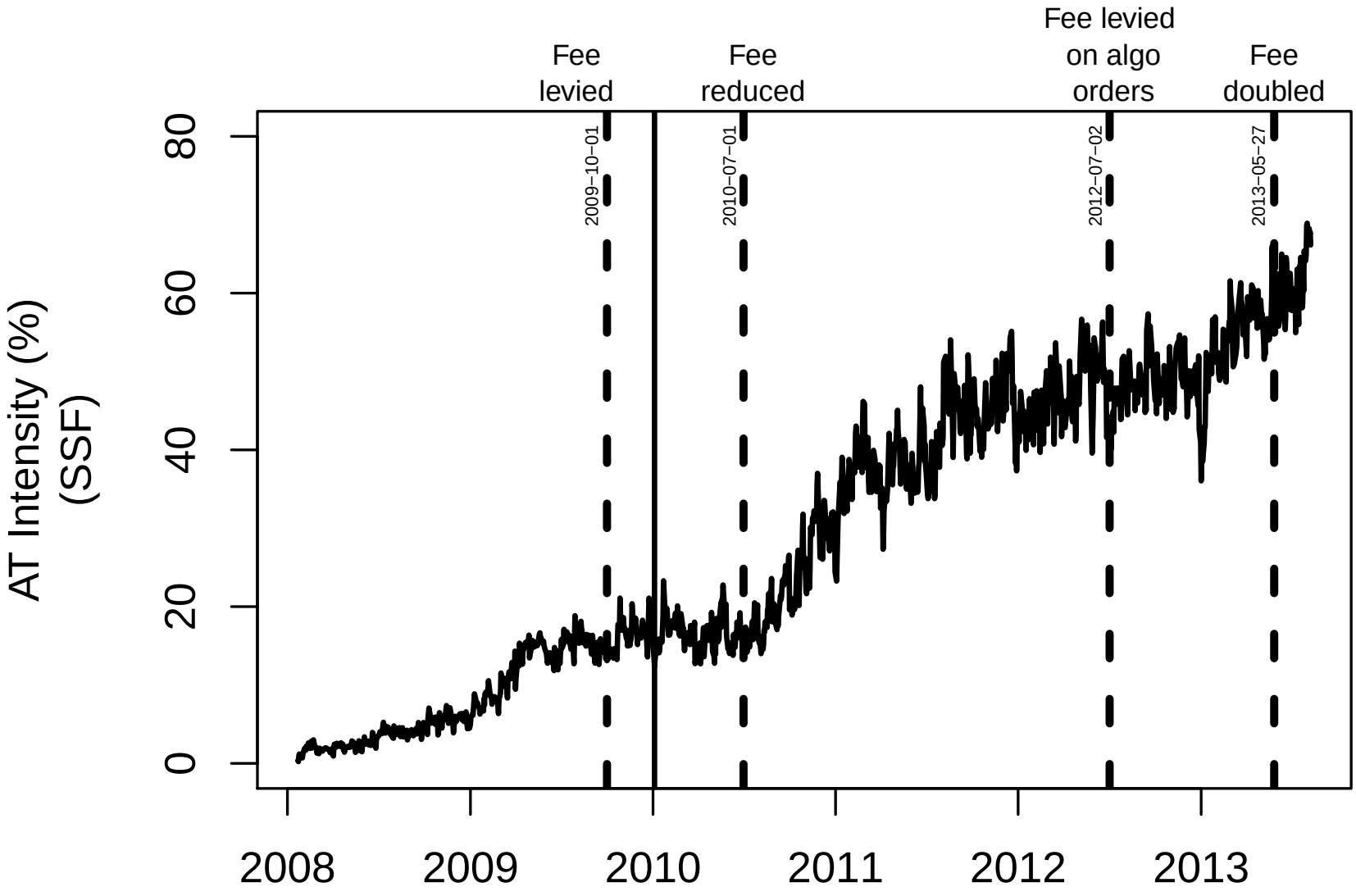
10:00:22
Oct 05
10:10:20

What we find

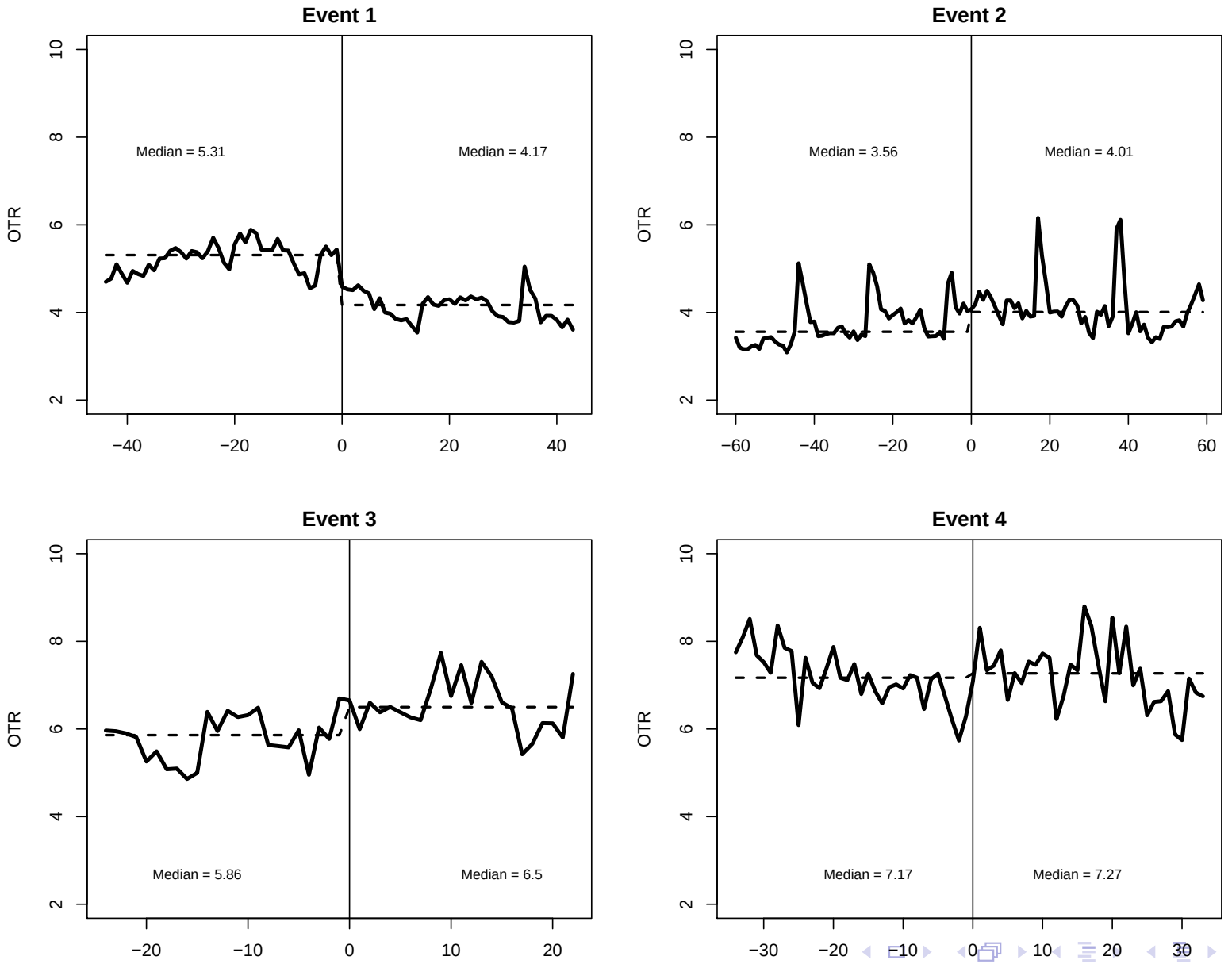
1. Did quote cancellations increase around the Emkay crash period?
   Ans. No, we do not find a sudden increase in order cancellations around the period of the crash.
2. Did AT's increase the stress by taking away the liquidity from the markets?
   Ans. We *do not* find any increase in AT's liquidity demand from non AT's, neither on the spot market nor on the futures market. We, however, find that non AT's liquidity demand from AT's *increased* on the futures market around the period of crash.

Existing regulation on algorithmic traders: OTR fee

Timeline of the events around OTR fee



Behavior of average orders-to-trades ratio after each implementation



The 1% LTP limit: % of orders that breached the limit

Event 4:

	Pre	Post	p-value
Average	2.67	2.11	0.00
Median	2.95	2.39	0.00

Question: If on an average, the % of orders that breached the price limit on a stock in a day was less than 2%, was that the intended target?

Conclusion

- To summarise, the analysis does not indicate that higher AT is adversely affecting the markets.
- It needs to be find out whether AT's are involved in spoofing.
- Good regulation making should indeed be based on scientific evidence.
- Given the data-access, it is important to find evidence of current market flaws, and then design an approach to correct them.

References

1. The causal impact of algorithmic trading on market quality, *Aggarwal and Thomas*, 2014. IGIDR Working Paper.
2. The changing landscape of equity markets, *Aggarwal and Anand*, Jul 10, 2015, Ajay Shah's blog.

Thank you

Comments / Questions?

http://www.ifrogs.org/