“Money & Speed: Inside the Black Box” (thru 2:35)
[YouTube link]

The Professor:

“People did not know why it was happening.
And, there was rumor after rumor after rumor.
And, it kept on getting worse”

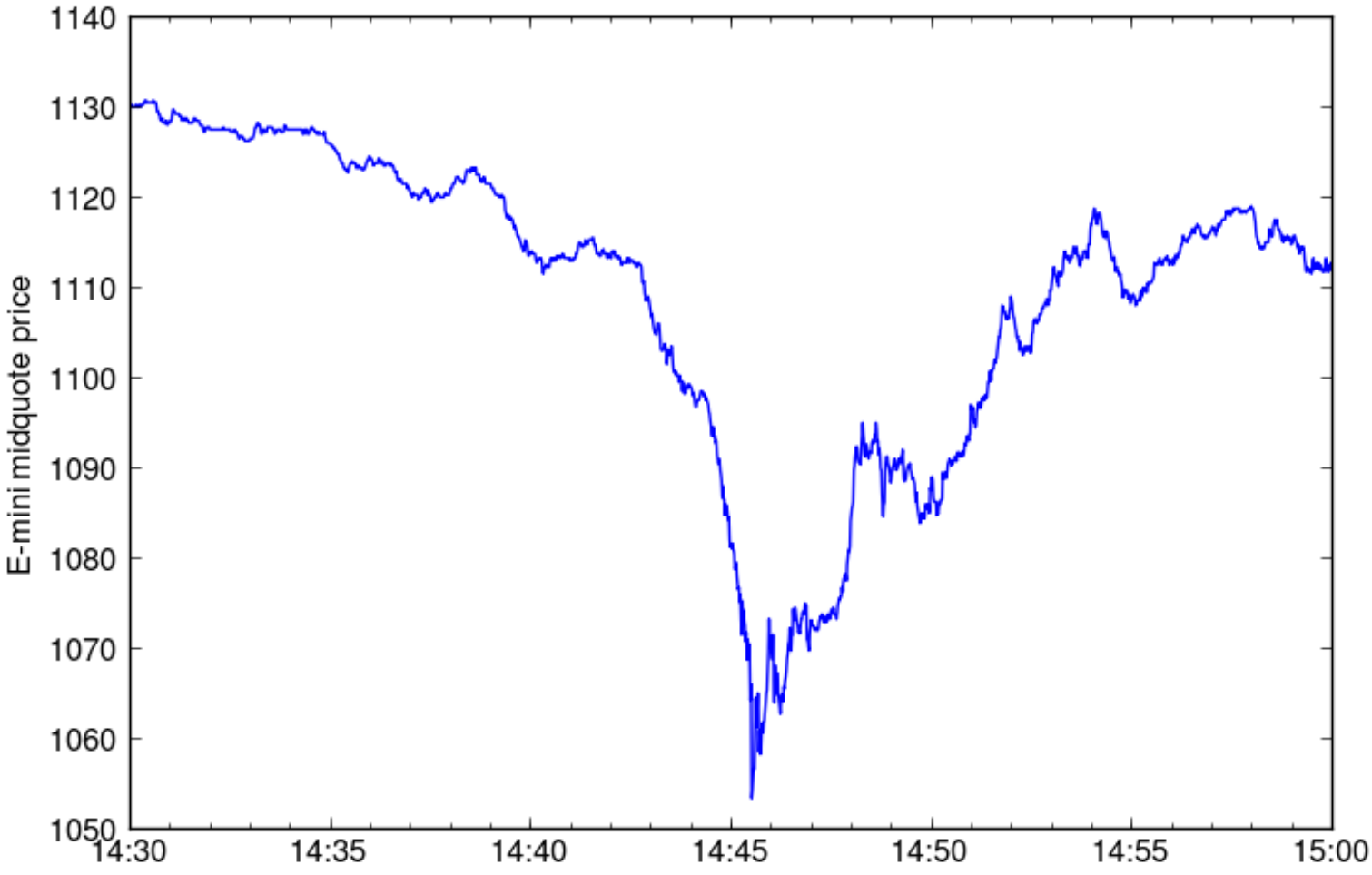
Anatomy of the Flash Crash

Albert J. Menkveld and Bart Z. Yueshen

VU University Amsterdam, Tinbergen Institute, Duisenberg school of finance

April 2013

What happened?



So what?

- CFTC-SEC committee: “challenge to investors’ confidence.”
- Scare off participants, five months of U.S. equity outflows.
- Still lead example for regulators worried about ‘vulnerability’.

What do we know?

- Large seller initiated selling 75,000 E-mini contracts, $4.1 billion. (CFTC and SEC 2010)
- Market grew more 'toxic' by the hour. (Easley, López de Prado, and O'Hara 2012)
- High-frequency traders very active in the minute of price collapse. (Kirilenko, Kyle, Samadi, and Tuzun 2011)
- Collapse triggered price declines first in ETFs then in index constituents. (Ben-David, Franzoni, and Moussawi 2012)
- ETFs collapsed due to extreme liquidity deterioration. (Borkovec, Domowitz, Serbin, and Yegerman 2010)
- Most affected were ETFs trading in fragmented markets. (Madhavan 2011)

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Data available

1. All large seller trades (time, price, quantity). (new)
2. Best bid and ask price, their depth, and all trades for
   - E-mini.
   - SPY.

Time stamp granularity is 25 milliseconds (ms).

What more do we like to know?

1. Did the large seller cause the Flash Crash?
2. How did her trading affect price (co-)integration across securities?
3. Did the large seller pay a reasonable price for 'immediacy'?
4. Was the large seller's strategy 'irrational'?

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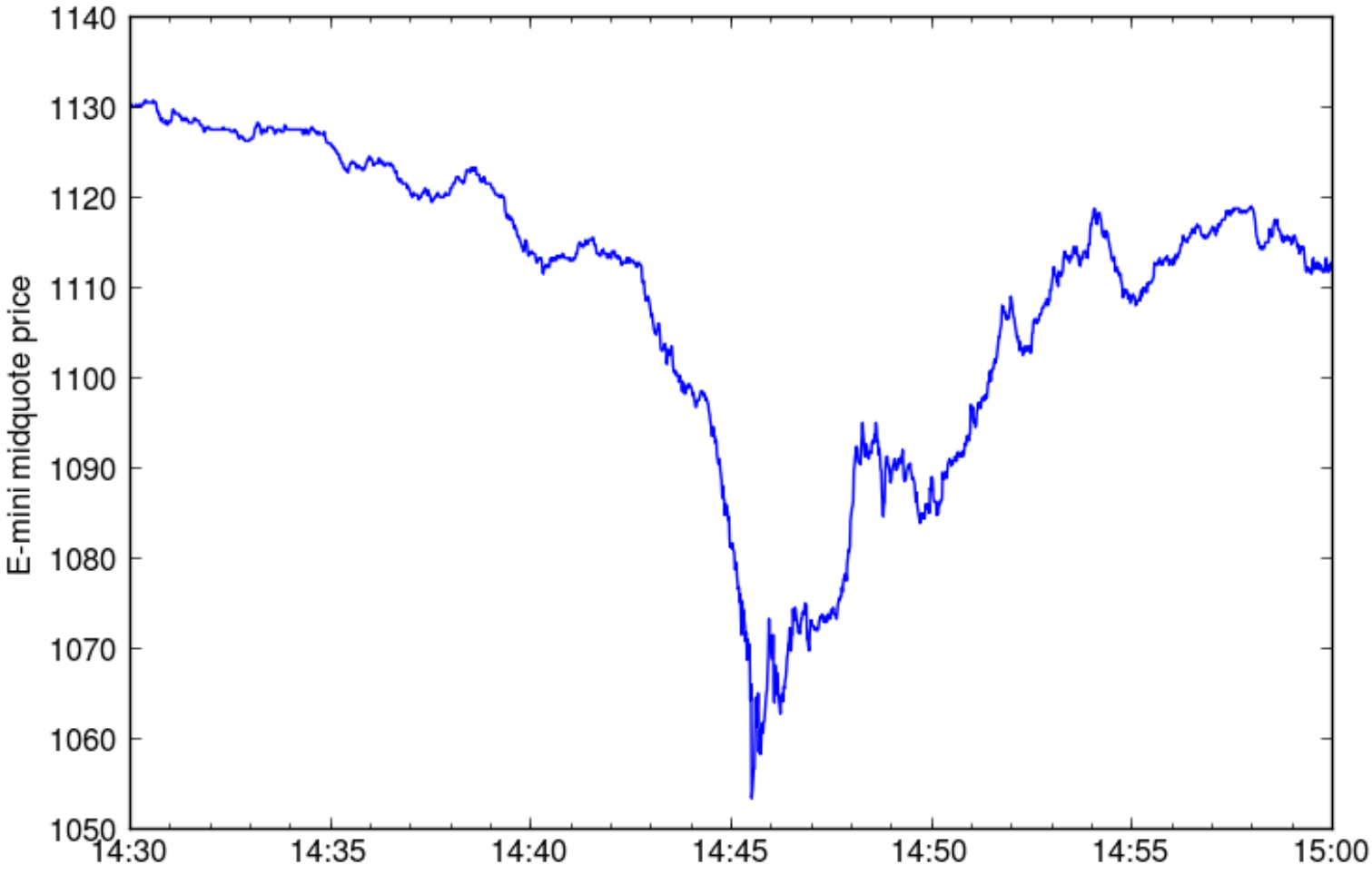
Large seller's trades



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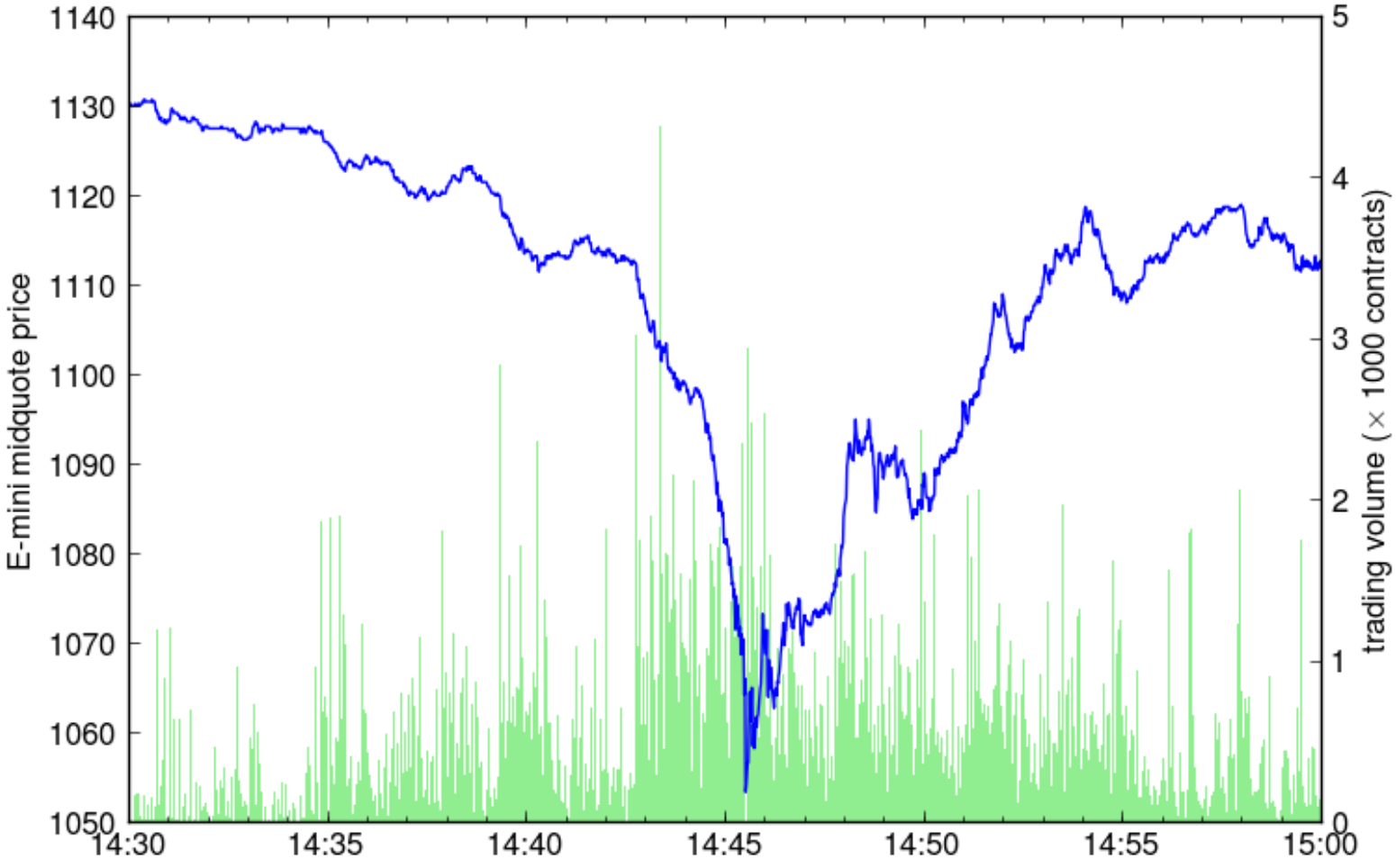

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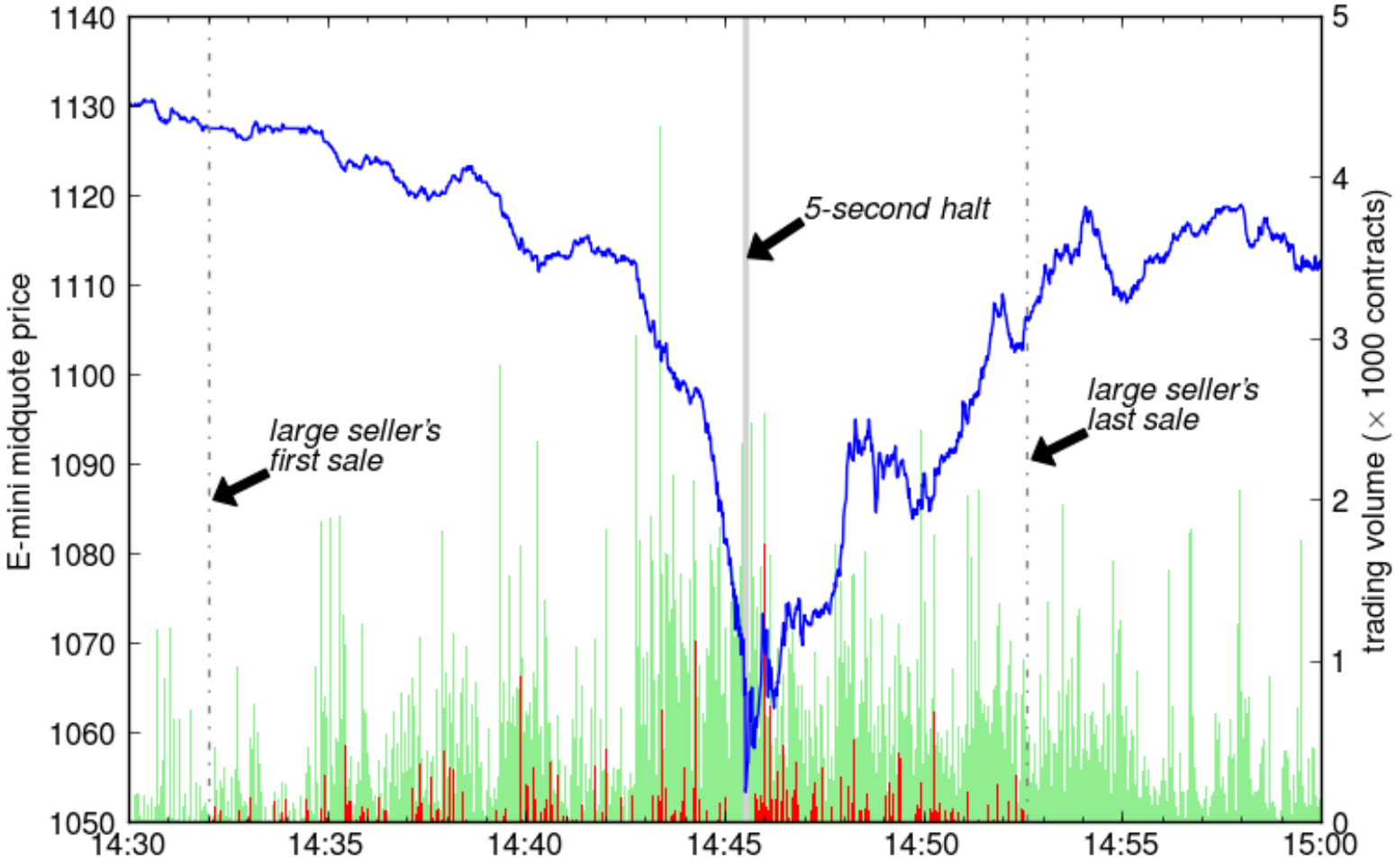

Response to large seller's net flow

In the one-minute crash period, large seller net flow

- did not move the price instantaneously.
- was followed by strong selling by others after 300 ms.
- was followed by disproportionate price response after 300 ms.

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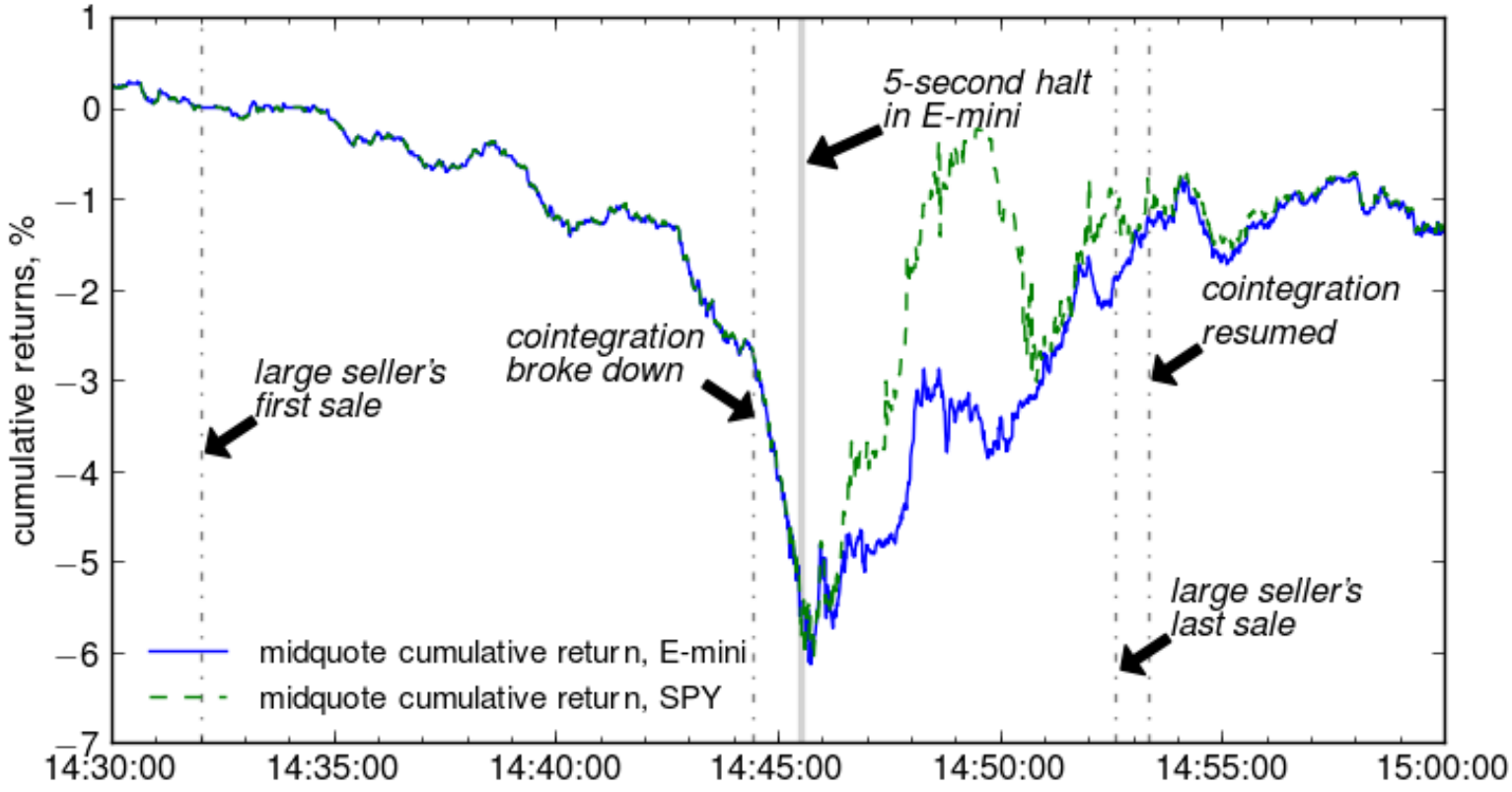
E-Mini vs. SPY

Price integration temporarily broken.



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   Price (co-)integration broke. Large, long-lived arbitrage opps?
3. Did the large seller pay a reasonable price for 'immediacy'?

4. Was the large seller's strategy 'irrational'?

Price paid for immediacy reasonable?

Large seller paid \$56.4-\$117.3 million for immediacy (one to two times her Q1 operating income that year).

A Grossman-Miller (1988) calibration suggests the intermediation sector would need to have

1. very low capital (just enough to buy the \$4.1 billion).
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   She paid a disproportionately large price
4. Was the large seller's strategy 'irrational'?

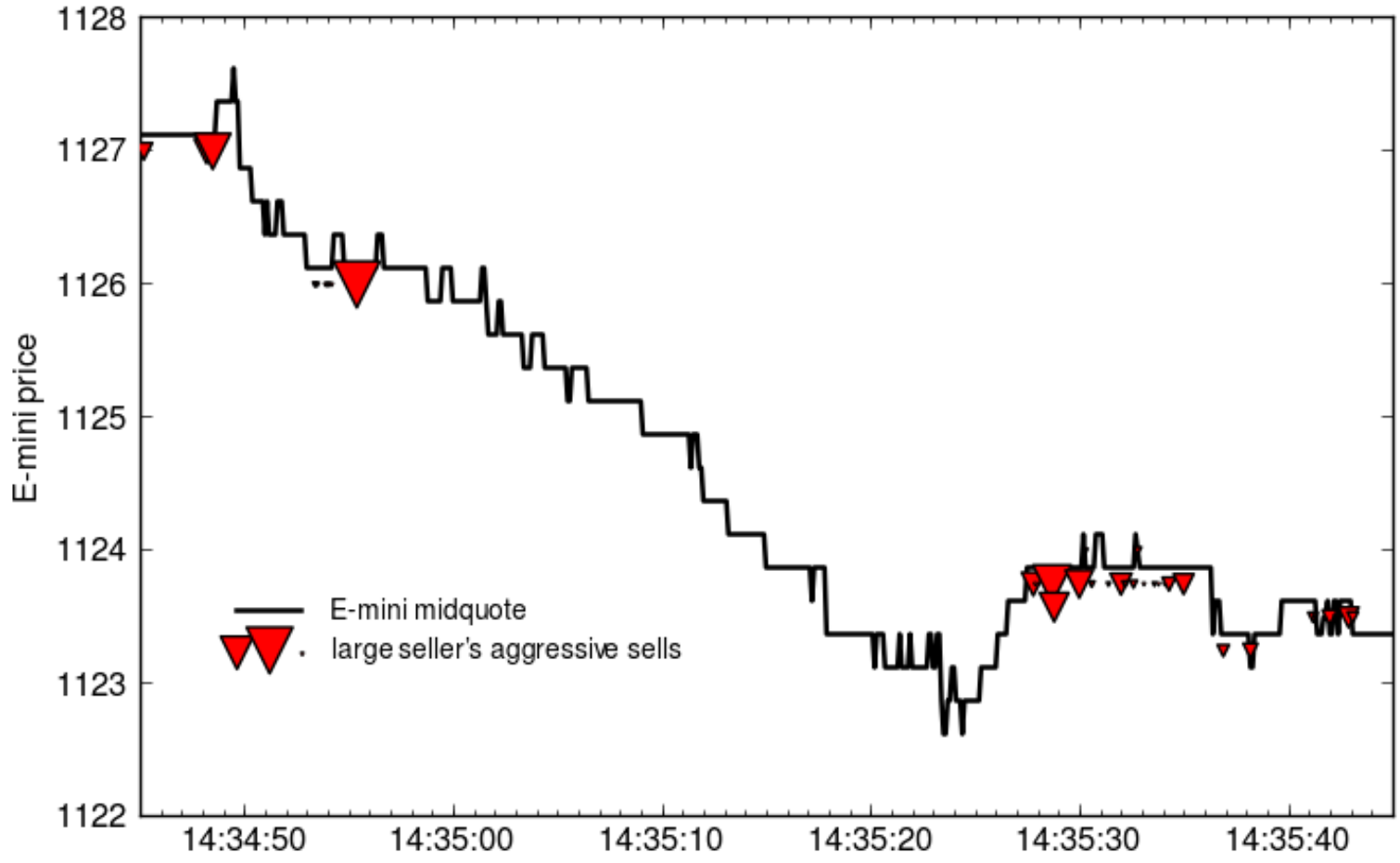
Large seller ulgorithm

CFTC-SEC (2010) report (p.2):

> *"This large fundamental trader chose to execute. . . via an automated execution algorithm. . . to target an execution rate set to 9% of the trading volume calculated over the previous minute, but without regard to price or time."*

Large seller algorithm

More aggressive only on more bid depth or after price uptick.



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3. Did the large seller pay a reasonable price for 'immediacy'?
   She paid a disproportionately large price
4. Was the large seller's strategy 'irrational'?
   Followed a 9% volume target, but implemented it cautiously

Conclusion

- Flash Crash result of agent interaction, not attributable to single agent (type).
- Unfortunate consequence is that large seller seems to have overpaid for immediacy.
- This could lead investors to demand higher required returns or to shy away from the market altogether.
- Regulatory action depends on what friction drove this destructive interaction. Left for (future) theoretical work. (Brunnermeier and Pedersen, (2005), and Menkveld and Yueshen, (2012))

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