

The causal impact of algorithmic trading

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The question

- ▶ Since 2000, escalating use of technology in trading on equities markets.
- ▶ AT now dominates exchanges worldwide. Concerns about liquidity, 'flash crashes', etc.
- ▶ Regulators all over the world are contemplating interventions on AT.
- ▶ In search of finding a market failure that justifies regulatory intervention, numerous researchers have asked: What is the effect of AT on liquidity and volatility?

Existing literature and what it says

Paper	AT/HFT identification
PROXY MEASURES	
Hendershott et al. (2011)	Rate of electronic message traffic
Frino et al. (2013)	Message traffic, Order-to-trade ratio
Hasbrouck and Saar (2013)	Strategic Runs
DIRECT MEASUREMENT	
Brogaard (2012)	NASDAQ HFT dataset
Brogaard et al. (2013)	"
Carrion (2013)	"
Hendershott and Riordan (2013)	AT flag
Chaboud et al. (2013)	AT flag
Jovanovic and Menkveld (2012)	Single HFT firm analysis
Menkveld (2012)	"

Findings: AT generally lowers transactions costs. AT may or may not improve depth. AT may or may not lower volatility.

Four difficulties of the existing literature

1. A lot of the literature uses data from U.S. markets, which have highly fragmented liquidity.
If AT adoption was taking place in different ways in different places, it becomes difficult to pin-point the starting point to measure the impact on the overall market.

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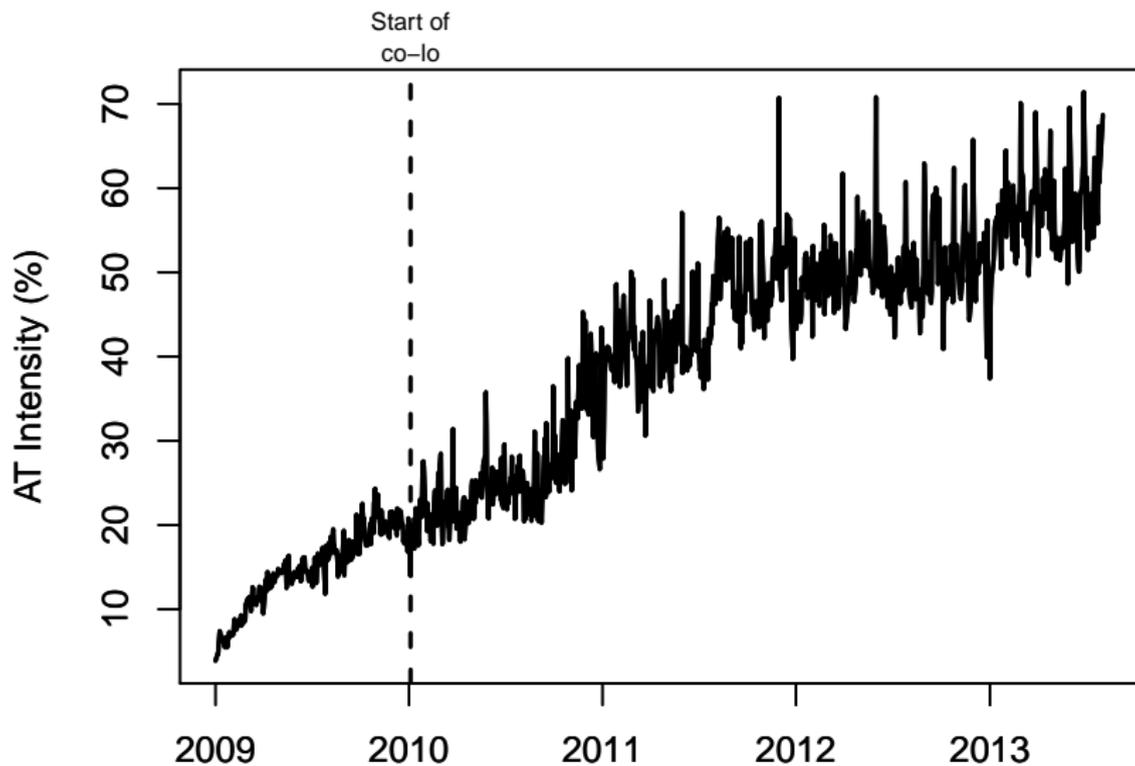
1. A lot of the literature uses data from U.S. markets, which have highly fragmented liquidity.
If AT adoption was taking place in different ways in different places, it becomes difficult to pin-point the starting point to measure the impact on the overall market.
2. Datasets often do not offer clear identification of AT. Without this, the measurement of AT activity is relatively weak.
3. Some papers do use an exogenous change to carry out a before- and after- comparison. But this is not sufficient to establish causality.
4. Two issues that are worrisome:
 - ▶ Endogeneity: If liquidity is a reason for ATs to choose to focus trading on a stock, and liquidity is an outcome to be measured, then which way does the causality flow?
 - ▶ Threats to validity: Was the change in market quality because of AT or other factors, such as macro-economics?

Advantages in this paper

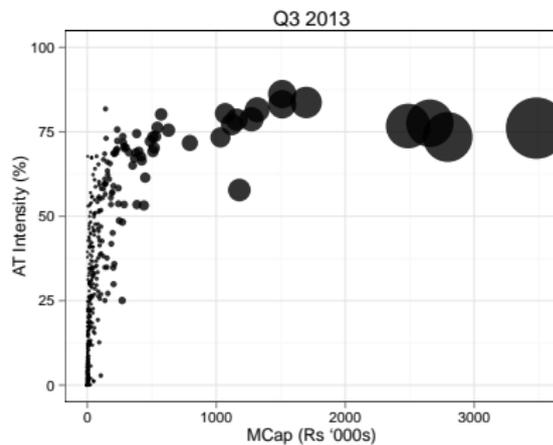
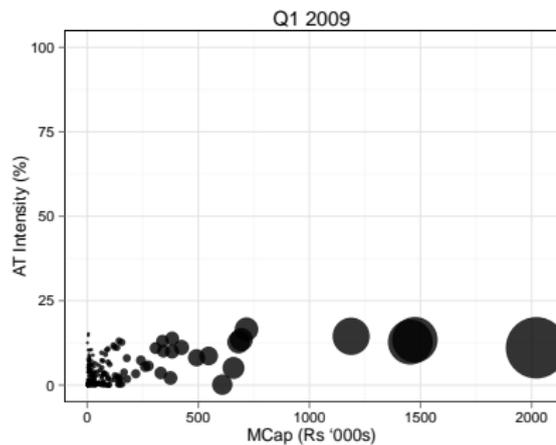
1. *A clean microstructure*: An exchange with 80% market share of all trading, one of the largest exchange in the world by transaction intensity.
2. Uses *an exogenous event*: Introduction of co-location services in Jan 2010, which was followed by an S-curve of adoption.
3. *Data recorded well*: Every order explicitly tagged as “AT” or “non-AT” for every security at the exchange.

With this context, the research design is better able to control for the threats to validity arising from macro-economic factors or endogeneity related to which securities are selected by AT.

AT intensity between 2009-13



Cross-sectional variation in adoption of AT



What we find

Estimation using a Difference-in-Difference regression with matched securities and matched dates.

$$\text{MKT-QUALITY}_{i,t} = \alpha + \beta_1 \text{AT-DUMMY}_i + \beta_2 \text{CO-LO-DUMMY}_t + \beta_3 (\text{AT-DUMMY}_i \times \text{CO-LO-DUMMY}_t) + \epsilon_{i,t}$$

	β_3	Expected sign
QSPREAD	-0.35 ⁺	-
IC	-0.79 ⁺	-
OIB	-13.87 ⁺	-
DEPTH	0.33 ^{**}	
TOP1DEPTH	0.16	+
TOP5DEPTH	0.33 [*]	+
VR-1	-0.03 ⁺	-
KURTOSIS	2.76	-
RVOL	-2.65 ⁺	-
RANGE	-16.90 ⁺	-
LRISK	-0.02 ⁺	-

What we find, contd.

- ▶ We analyse intra-day price movements by asking how frequently:
 1. Traded prices move by 2%, 5% or 10%
 2. In a period of 5 minutesbefore co-lo and after co-lo.
- ▶ What we find:

	Pre co-lo		Post co-lo	
	High-AT	Not	High-AT	Not
TWO-EXCESS	33.35	33.46	29.36	36.84
FIVE-EXCESS	5.21	5.65	5.30	7.85
TEN-EXCESS	1.01	0.91	1.42	1.29

Conclusions

- ▶ The world has shifted from manual to computer-supported trading in an extremely short time.
- ▶ A major new phenomenon that requires analysis.
- ▶ All the regulators of the world are interested.
- ▶ Rapidly growing literature.
- ▶ Four identified flaws: (a) Fragmented microstructure (b) No clear identification in data infrastructure (c) Lack of exogenous change in AT and (d) Problems of causal identification.
- ▶ Our research design addresses these four problems.
- ▶ Main result: AT is good for market quality, but a) no significant impact on the depth though, b) no evidence in support of increase in flash crashes.

Thank you

Comments / Questions?

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