

High-Frequency Trading: Risks and Benefits

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Microwaves & Lasers in Financial Trading



- ▶ Transatlantic fibre-optic cables
US - Europe - Asia
- ▶ Microwaves Chicago - NY & London -
Frankfurt
- ▶ Laser network NYSE - NASDAQ



Current microwave data latencies:

- ▶ London - New York: 31 ms
- ▶ London - Frankfurt: 2 ms
- ▶ Chicago - New York: 4 ms

(Source: <http://www.quincy-data.com/>)

Sources:

<https://sniperinmahwah.wordpress.com>

Anova Technologies

What is High-Frequency Trading?

Automated trading that employs

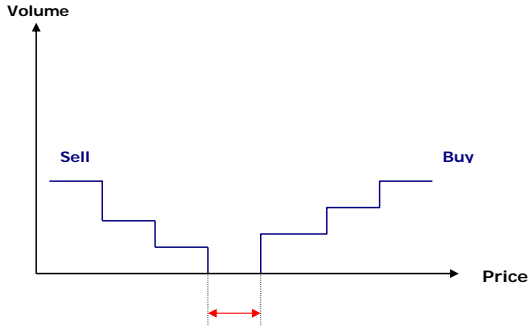
- ▶ algorithms for order execution and routing
- ▶ low-latency technology & co-location services
- ▶ high message rates

Carried out by (i) proprietary firms, (ii) broker-dealer proprietary desks, (iii) hedge funds.

Features:

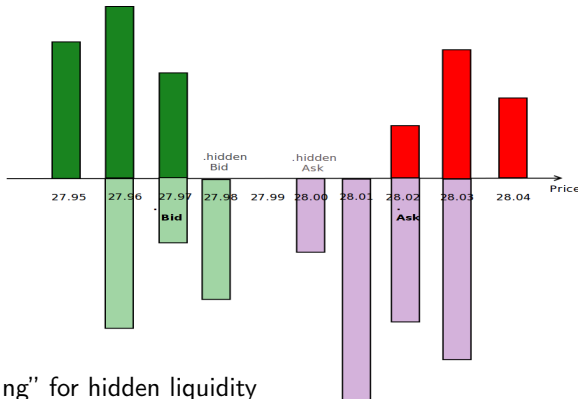
- ▶ Very short holding periods
- ▶ No significant over-night positions
- ▶ Very low margins per trade
- ▶ Focus on highly liquid instruments

HFT Strategy Liquidity Provision / Market Making



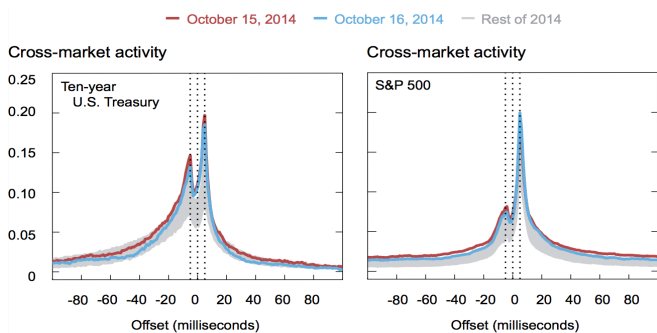
- ▶ Earning the Bid-Ask Spread
- ▶ Liquidity rebate trading

HFT Strategy Order Detection



- ▶ "Pinging" for hidden liquidity
- ▶ Order anticipation in dark pools

HFT Strategy Statistical Arbitrage



Reproduced from Dobrev/Schaumburg, "High-Frequency Cross-Market Trading and Market Volatility," Federal Reserve Bank of New York Liberty Street Economics blog, February 17, 2016.

- ▶ Market neutral arbitrage
- ▶ Cross-market strategies
- ▶ ETF arbitrage

Other HFT Strategies

- ▶ Latency arbitrage
- ▶ "Sniffing out" (routed) order flow / front running
- ▶ Momentum ignition
- ▶ Spoofing (illegal)
- ▶ ...

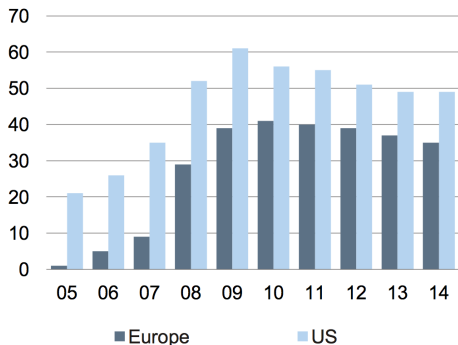
Spoofing or Quote Stuffing?

| Time | # Quotes |
|----------|----------|
| 14:08:24 | 2 |
| 14:08:25 | 3'064 |
| 14:08:26 | 6'180 |
| 14:08:27 | 8'383 |
| 14:08:28 | 11'941 |
| 14:08:29 | 13'557 |
| 14:08:30 | 12'454 |
| 14:08:31 | 8'306 |
| 14:08:32 | 3 |
| 14:08:33 | 6'121 |
| 14:08:34 | 1'151 |
| 14:08:35 | 8'946 |
| 14:08:36 | 6'693 |
| 14:08:37 | 1 |
| 14:08:38 | 0 |
| 14:08:39 | 11'463 |
| 14:08:40 | 10'760 |
| 14:08:41 | 2'398 |
| 14:08:42 | 2 |

- ▶ AMD - NASDAQ Trading - 29 Sept 2011 - 14:08:25
- ▶ Total of $\sim 110'000$ quotes submitted within 18 sec. ($\sim 53\%$ of entire day)
- ▶ Only 20 executions, rest canceled
- ▶ Average duration between submissions 1/10 ms
- ▶ Submission pattern not random. Algorithm draws pattern into posted volume

Extent of HFT

Share of HFT in equity trading (in %)



- ▶ Similar developments in U.S. futures trading
- ▶ Approx. 40% in Bund futures trading in 2014/15
- ▶ Approx. 40% HFT in spot FX trading as at 2014

Arguments on HFT

- ▶ Michael Lewis ("Flash Boys"): Speed traders prey on retail investors
- ▶ Joe Stiglitz (on Fed's 2014 Financial Markets Conference):
 - ▶ HFT steals information rents
 - ▶ Markets are too active and too volatile
 - ▶ No social value & degrades market function \Rightarrow Negative-sum game
- ▶ Paul Krugman (NYT, 2014)
 - ▶ "It's the whole financial industry, not just that piece [HFT], that's undermining our economy and our society".
 - ▶ No return for investment into speed.
- ▶ Burton Malkiel (FT, 2009):
 - ▶ High-frequency trading is a natural part of market evolution
 - ▶ Technology has dramatically improved the efficiency of markets.

History of HFT

- ▶ Introduction of ECNs in the 1990s
 - ▶ 1998: SEC passed Reg. ATS \Rightarrow Increase of market fragmentation
 - ▶ 2001: Quoting prices in decimals \Rightarrow reducing spreads
 - ▶ 2005: SEC passed Reg. NMS; orders posted nationally (NBBA, NBBO); "trade-through rule"
 - ▶ In Europe, MiFID introduces principles-based best execution \Rightarrow Smart Order Routing (SOR)
 - ▶ 2007: Direkt market access (DMA); flexible fee structures
 - ▶ Co-location and proximity services
- \Rightarrow Regulation established level playing field for HFT!

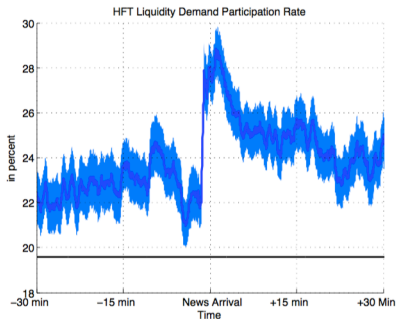
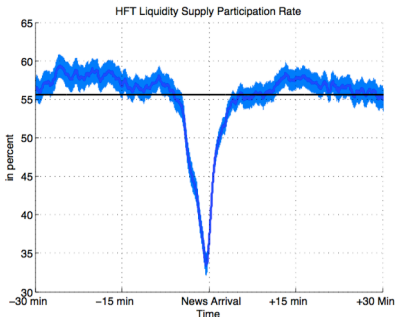
Some Evidence from Recent Research

- ▶ Hendershott et al (2011): AT improves liquidity and enhances the informativeness of quotes.
- ▶ Hasbrouck & Saar (2013): Increased low-latency activity decreases spreads, increases displayed depth and lowers short-term volatility.
- ▶ Brogaard (2010): HFT improves liquidity, efficiency, and volatility.
- ▶ Menkveld (2013): HFTs serve as high-frequency market makers.
- ▶ Brogaard et al (2016): HFTs facilitate price efficiency.
- ▶ Kirilenko et al (2017): Evidence for "stale quote snipping" and latency arbitrage. No "classical" market making.
- ▶ Budish et al (2015): HF arms race symptom of flawed market design.

Evidence: HFT in EUREX Bund Futures Trading

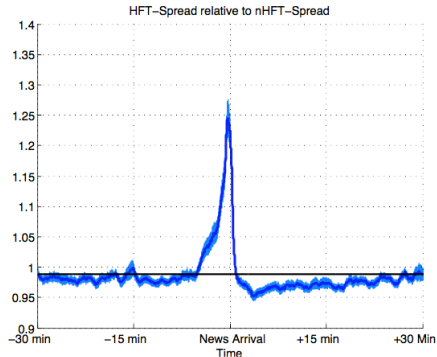
- ▶ Hautsch, Noé, Zhang (2017)
- ▶ Proprietary order-level message data with member ID and trader ID
⇒ Institutional HFT identification
- ▶ Time stamps 1/10 microsecond.
- ▶ Statistical HFT Identification:
 - ▶ > 1,000 order submissions per day
 - ▶ End-of-day position less than 5% of daily traded contracts
 - ▶ Minimal order life times and time between order submissions
- ▶ 120-min periods around scheduled news announcements; 2014-2015

HFT Liquidity Supply & Demand Participation Rates



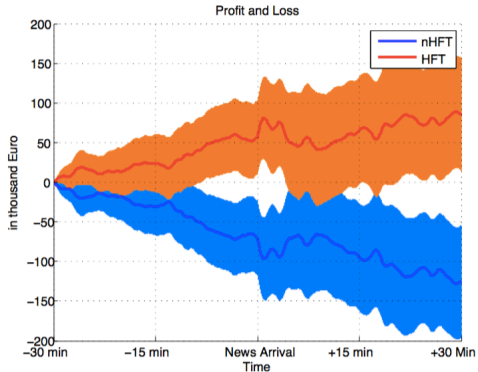
- ▶ Generally: liquidity provision $> 50\%$; liquidity demand $< 25\%$
- ▶ BUT: Before news release, HFT liquidity supply drops by **60%**!

Ratio of HFT-Spread to nHFT-spread



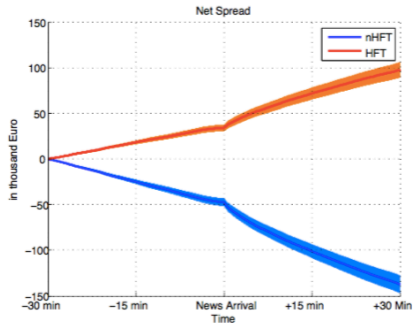
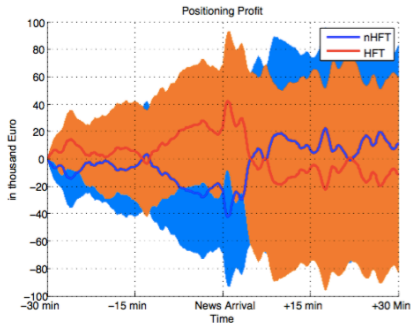
- ▶ Generally, HFTs post more narrow spreads than non-HFTs
- ▶ BUT: Shortly before news release, HFT spreads increase by 25%!

(Gross) Profit & Loss Analysis



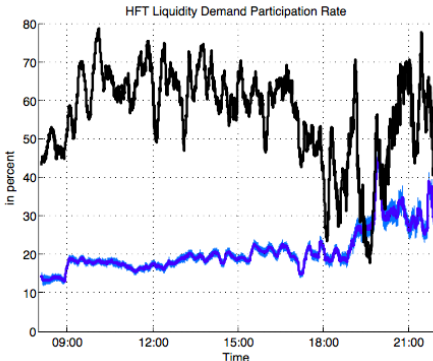
- On average, HFTs earn ca. 100k Euro per hour around news arrivals

Positioning Profits & Net Spreads



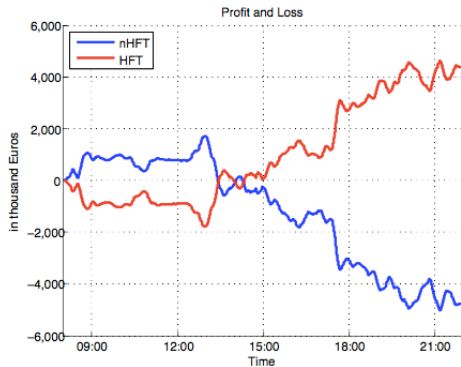
- ▶ HFTs make profits by market making.
- ▶ On average, no profits through directional trading!

HFT Liquidity Demand at Day after Brexit (24/6/16)



- ▶ High order aggressiveness: HFTs initiate more than 60% of all trades

HFT P&L after Brexit (24/6/16)



- ▶ HFTs earn approx. **4 Mio Euro** through directional trading
- ▶ No "classical" market making!

Good or Bad?

- ▶ Passive HFT strategies are beneficial for markets.
- ▶ But: HFTs are no designated market makers. Change strategies according to situation. Run mixed strategies.

Unclear:

- ▶ Effect on volatility and market stability in extreme situations?
- ▶ Higher risk of tail events?
- ▶ Higher frequency of "(mini) flash crashes"? ⇒ Research needed!

Most difficult:

- ▶ **Social benefit** of HFT (liquidity supply)? Can we ever answer this ..?

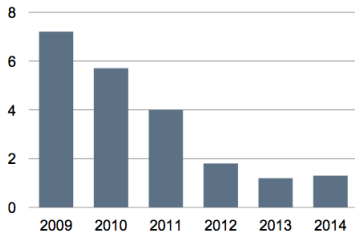
Future of HFT

- ▶ Extent of HFT will decline
 - ▶ Increasing costs of infrastructure
 - ▶ Increasing competition
 - ▶ Alternative trading systems (dark pools, "speed bumps")
 - ▶ Stronger regulation

But:

- ▶ HFT will remain integral part of electronic trading!
- ▶ HFT will change its form depending on (uncertain) regulation

HFT Revenues US (in USD bn)



Sources: TABB Group, Deutsche Bank Research

Regulatory Uncertainty

Regulatory Initiatives US

- ▶ 2010: SEC introduced trading pause regulation
- ▶ 2010: Dodd-Frank restricts so-called proprietary trading of banks
- ▶ 2010: SEC bans "naked" (unfiltered) market access
- ▶ 2015: SEC forces certain HFT broker-dealers to register with FINRA
- ▶ 2015: CFTC proposals for Regulation Automated Trading (Reg AT)
- ▶ 2015: SEC approves batch-auction platform in Chicago

MiFID II in Europe (as at 2018)

- ▶ Obligations on disclosure of information, recording, and monitoring
- ▶ Obligations for trading venues on monitoring, capacity, control mechanisms and transparency
- ▶ Obligations for firms pursuing market making strategies

Potential Regulatory Pitfalls

- ▶ (Too?) much focus on monitoring, registration and (massive) data collection
 - ▶ Details on risk control & testing of algorithms (e.g., MiFID II) vague. Not clear how to implement.
 - ▶ Regulation too rigid for HFT market making (e.g., MiFID II)
 - ▶ No attempts to limit market fragmentation in the U.S.
- ⇒ **Need more attempts to mitigate risks while preserving benefits!**

Two Negative Scenarios

Too rigid and misguided regulation:

- ▶ HFT will be reduced
- ▶ Market quality will suffer: lower liquidity; higher transaction costs; increase of volatility
- ▶ Liquidity flees into non-regulated markets
- ▶ Still high regulation costs

Insufficient regulation:

- ▶ Extent of HFT will increase
- ▶ Higher risk of flash crashes; lower market stability and quality
- ▶ High costs for monitoring and investigating market manipulation

A (More) Positive Scenario

Technological innovation hand in hand with smart regulation

- ▶ Stopping arms race for speed & predatory trading
 - ▶ Limiting latency differences (e.g. as on IEX; ICAP's EBS)
 - ▶ HF batch auctions ⇒ Implications for liquidity supply unclear
- ▶ More incentives for high-frequency market making
- ▶ More incentives for smarter but not faster algorithms
- ▶ Well-balanced use of "circuit breakers" and general safeguards

⇒ HFT will settle down to a moderate level and will predominantly perform **market making**