High-frequency trading
Better than its reputation?

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Key questions

- What is high-frequency trading (HFT)?

- What is the economic contribution of HFT?

- Is HFT responsible for violations of market integrity and/or for systemic risks?

- Is there a need for regulatory intervention?
Agenda

1. Hierarchy and definitions of terms
2. Algorithmic trading and High-frequency trading in detail
3. Economic assessment: Impact of HFT on market quality
4. Review of regulatory initiatives
AT and HFT are frequently mixed up in the public debate

Algorithmic trading

High-frequency trading

- Ultra-HFT
- Flash trading

The use of computer algorithms to automatically make certain trading decisions, submit orders, and manage those orders after submission. (Hendershott and Riordan, 2009)

Subset of algorithmic trading where a large number of small-in-size orders are sent into the market at high speed, with round-trip execution times usually measured in milliseconds. (Brogaard, 2010)

Subset of high-frequency trading where a select group of trading firms, whom the exchanges allow to see orders a split second before the rest of the market, gain a significant advantage over other market participants.
HFT vs. AT and traditional long-term investing

High-frequency trading

Algorithmic or electronic trading (execution)

Traditional long-term investing

Execution latency

High

Low

Position holding period

Short

Long

Source: Aldridge 2010
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## Algorithmic trading strategies

<table>
<thead>
<tr>
<th>Name</th>
<th>Description of strategy</th>
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<tbody>
<tr>
<td><strong>Trade execution algorithms</strong></td>
<td>Designed to minimise the price impact of <strong>executing trades of large volumes</strong> by ‘shredding’ orders into smaller parcels and slowly releasing these into the market.</td>
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<tr>
<td><strong>Strategy implementation algorithms</strong></td>
<td>Designed to read real-time market data and <strong>formulate trading signals</strong> to be executed by trade execution algorithms. This may involve automatically <strong>rebalancing portfolios</strong> when certain pre-specified tolerance levels are exceeded, <strong>searching for arbitrage opportunities</strong>, automatic quoting and hedging in a <strong>market maker-type role</strong>, and producing trading signals from technical analysis.</td>
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<tr>
<td><strong>Stealth/gaming algorithms</strong></td>
<td>Designed to take advantage of the price movement caused when large trades are filled, and also to <strong>detect and outperform other algorithmic strategies</strong>.</td>
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Source: ASIC 2010
# High-frequency trading strategies

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<td><strong>Electronic market making</strong></td>
<td><strong>Liquidity-providing strategies</strong> that mimic the traditional role market makers once played. These strategies involve making a two-sided market aiming at <strong>profiting by earning the bid-ask spread</strong>. This has evolved into what is known as Passive Rebate Arbitrage.</td>
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<tr>
<td><strong>Statistical arbitrage</strong></td>
<td>Traders look to correlate prices between securities in some way and trade off of the <strong>imbalances in those correlations</strong>.</td>
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<tr>
<td><strong>Liquidity detection</strong></td>
<td>Traders look to <strong>decipher whether there are large orders</strong> existing in a matching engine by sending out small orders (“pinging”) to look for where large orders might be resting. When a small order is filled quickly, there is likely to be a large order behind it.</td>
</tr>
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Source: Aldridge 2010

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Who are the players and how do they earn money?
Large-scale turnover of numerous positions with a small return on each turnover

- HFTs are mainly proprietary traders (own-account); HFT is usually not conducted on an agency basis (for-client).

- Segmentation of professional HFT firms: proprietary trading firms (ca. 48%), proprietary trading desk of a multi-service broker-dealer (ca. 46%), or hedge funds (ca. 6%).

- All asset classes involved, extending from equities and derivatives into currencies and fixed income.

- Volume of HFT: No consistent figures on the size of HFT available (Estimations: 60-70% of US trading volume, ca. 40% in Europe).

- Prominent players: Proprietary trading firms Getco, Optiver or Tradebot, hedge funds Citadel or Renaissance Technologies, and trading desks within multi-service market participants, e.g. at Goldman Sachs or Citigroup.
Characteristics often attributed to proprietary HFT firms
The need for speed is paramount

- High-speed and sophisticated quantitative and algorithmic computer programs for generating, routing, and executing orders.

- Real-time data analysis.

- Very short time-frames for establishing and liquidating positions.

- Very large number of trades generated on a daily basis, of which often >80% are cancelled shortly after submission.

- Ending the trading day flat ("delta-neutral"), i.e. without carrying significant, unhedged positions over-night.

→ Speed matters in the absolute sense of achieving very small latencies, but even more so in the relative sense of being faster than competitors, even if only by a microsecond.

→ Usage of co-location / proximity services to minimise latency.
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Impact of HFT on liquidity
Provision of liquidity and linkage of fragmented markets

- Often read argument: *HFTs provide no real liquidity because they are constantly attempting to flatten their position.*

- Empirical evidence, however, suggests that...
  - HFTs reduce spreads.
  - HFTs add substantial liquidity to the market.
  - HFTs alleviate effects of market fragmentation.

- From the academic side, there is **no proof for a negative liquidity impact**, but some issues still remain...
  - No market making obligation: HFTs are not obliged to provide liquidity.
  - Size of quotes: HFTs do not contribute to market depth.
  - Accessibility: HFT quotes may be added and cancelled in milliseconds.
Impact of HFT on the price discovery process
HFT is widely seen as beneficial

- HFTs tend to follow a price reversal strategy, driven by order imbalances, and so tend to stabilise prices.
- HFTs provide the best bid and offer quotes for a significant portion of the trading day (but only around a quarter of the book depth).
- Algorithmic traders’ quotes play a larger role in the price formation process than human quotes.

→ No proof for a negative impact on the price discovery process:
  - On the one hand, price discovery benefits from market participants who quickly detect anomalies in market prices and correct them.
  - On the other hand, HFT may also be distorting price formation if it creates an incentive for natural liquidity to shift into dark pools as a way of avoiding transacting with ever-decreasing order sizes. But: no documented empirical evidence so far to support the possibility of this distortion.
The investor perspective
Issues of fairness and investor protection

- Electronification of trading originally led to a democratisation of exchange trading: retail investors benefitted from equally quick access to markets as professionals.

- However, special arrangements to cater for the needs of HFT (i.e. proximity and co-location services to reduce latency, special trade data feeds) give preference to those traders → possibly harms long-term investors and market quality.

- (Sub-penny) Arbitrage, where ATs and HFTs buy and sell stock purely to collect rebates, is often criticised as bringing no value to the retail / long-term investor. But: This provides liquidity (“artificial volume creation”) that would otherwise not be available, easing the pressure of supply and demand.

- Spreads that have been narrowed (and are kept narrow) by HFTs benefit both retail and institutional investors.
The investor perspective
Issues of fairness and investor protection

Bid-Ask Spread Reduction
USD

Source: Georgetown University, 2011
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Regulators’ concerns
Risks for market integrity / confidence and systemic stability

- Market integrity could be endangered when technological advantage is misused for abusive tactics (e.g., by manipulating the price discovery process through excessive order entries and/or cancellations).

- Financial markets could become exposed to systemic risks as a result of technical vulnerability (malfunctioning algorithms), self-reinforcing strategies, and/or overload of technical systems.

- Numerous regulatory investigations and initiatives are under way:
  - SEC/CFTC: (Interim) “Market Event Report”.
  - European Commission: Consultation to MiFID-Review.
  - ESMA: Consultation announced (summer 2011).
  - Working Groups at IOSCO, FSB, BIS, ...
How to guarantee integrity and maintain stability?
Effectiveness of proposals put forward so far is unclear

- Some proposals are conducive to the regulators’ objectives:
  - Risk controls (circuit breakers) to be adopted by trading venues provided they are properly calibrated in cooperation with market participants and consistent across venues.
  - Adoption of minimum tick sizes, calibrated by reference to price and levels of liquidity.
  - Co-location facilities to be made available on a non-discriminatory basis.

- Others are unrealistic and/or will be difficult to put into practice:
  - Artificially limiting execution speed on trading venues.
  - Imposing affirmative obligations (enforced market maker role).
  - Minimum life-time for quotes before they can be cancelled or modified.

- Regulations should not impair HFT’s liquidity provision nor push HFT to other jurisdictions or OTC.