High Frequency Trading: Overview and Issues

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What is high frequency trading?

- "The term ['high frequency trader'] is relatively new and is not yet clearly defined. It typically is used to refer to professional traders acting in a proprietary capacity that engage in strategies that generate a large number of trades on a daily basis."

(SEC Release No. 34-61358)

What is high frequency trading?

- High frequency trading (HFT) is a type of investment strategy where profits are driven by rapidly buying and selling stocks without human trade-by-trade interaction, potentially executing a large number of transactions in a blink of an eye, and often with holding periods of the order of seconds or even less.

- HFT is relatively recent first coming into public eye through a New York Times article in July 2009.

- However, it has qualitatively changed the nature of trading, and the roles of intermediaries

Distinguishing Features of HFT

❑Highly quantitative with computerized algorithms;

❑Investment position is held very briefly - even just seconds – with rapid trades into and out of those positions, sometimes tens of thousands of times a day;

❑No net investment position at the end of a trading day;

❑Mostly employed by proprietary firms or on proprietary trading desks in larger, diversified firms;

❑Very sensitive to the processing speed of markets and of their own access to the market.

Algorithmic Trading

- Algorithmic Trading (AT) is defined as "the use of computer algorithms to automatically make trading decisions, submit, orders, and manage those orders after submission" (Hendershott and Riordan, 2009)

- AT and HFT are similar in that they both use automatic computer generated decision making technology.

- But AT may have holding periods that are minutes, days, or longer.

- On the other hand, HFT hold position for a very short horizon and try to close the trading day in a neutral position.

- What is the difference in functional terms?

Algorithmic Trading

- Hasbrouck and Saar (2011) explain the functional difference.

- Algorithms = Agency algorithms + Proprietary algorithms

- Agency algorithms are "employed to minimize trading costs of buy-side managers"

  - For example, splitting large orders

- Proprietary algorithmic traders are HFTs.

- They trade their own capital, turnover positions quickly, have technology and infrastructure to trade at very high speed (milliseconds) and do not hold inventory overnight.

- All HFT is AT, but not all AT is HFT!

HFT Presence

- Figures on HFT are not conclusive since identification of HFTs is not clear-cut.

- HFT is estimated to represent 70% of U.S equity volume and 77% of UK volume, but done by only 2% of traders

- Zhang (2010) estimates that high-frequency trading accounted for 78% of trading volume in the U.S. in 2009, up from just over 0% in 1995.

- Biggest traders: Goldman Sachs, Credit Suisse, GETCO, Renaissance Technologies, Citadel. Yearly profits in U.S. are fuzzily estimated to $21 billion.

HFT Presence

High frequency players now drive majority of market volume . . .

US equities trade volume (shares bn)
Figure at top of bar is high frequency % of total market

Legend: High frequency volume / Total volume

2005: 30%
2006: 35%
2007: 47%
2008: 59%
2009 est: 73%
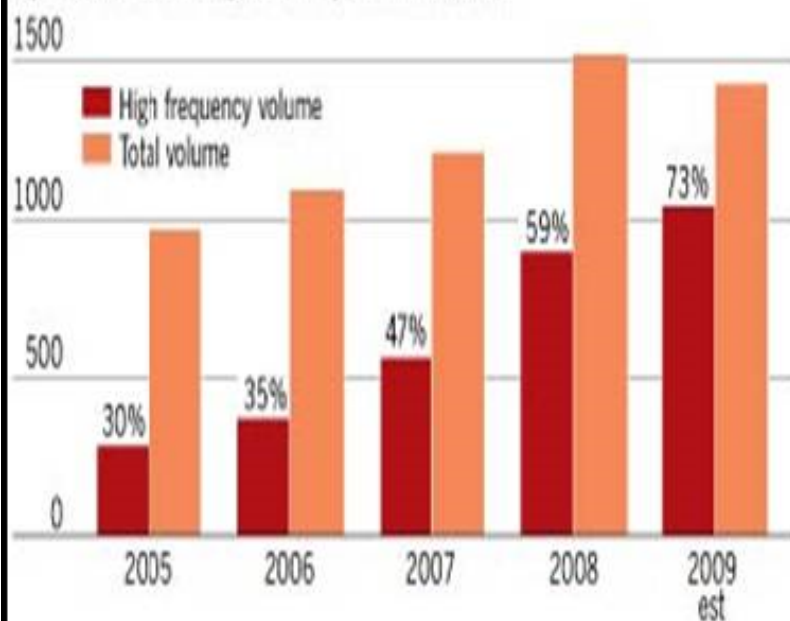
. . . in spite of their relatively small numbers

US trading firms by type (%)
(100% = 20,000 firms)

High frequency: 2
Broker dealers: 23
Hedge funds: 42
Asset managers: 33

Photo: Alamy   Source: TABB Group estimate

HFT Regulatory and Political Concerns

Senator Charles Schumer, in a letter to the SEC writes:

"I have come to believe that HFT provide less of the benefits to our markets than its adherents claim, and does so at a greater cost to long term investors…. The SEC should identify market participants who frequently engage in these practices, and require exchanges and other trading venues to slow down those market participants [in times of stress] …. The Commission should consider imposing a minimum quote duration, so that orders could not be sent and cancelled within a fraction of a second".

HFT Regulatory and Political Concerns

Senator Ted Kaufman,

"Whenever you have a lot of money, a lot of change, and no regulation, bad things happen"

(Kardos and Patterson, January 18, 2010).

HFT Regulatory and Political Concerns

On the other hand, the Joint SEC-CFTC Advisory Committee recommends:

"the Commission should consider encouraging, through incentives or regulation, persons who regularly implement market maker strategies to maintain best buy and sell quotes which are 'reasonably related to the market'…. We recognize that many HFTs are not even broker-dealers and therefore their compliance with quoting requirements would have to be addressed primarily through pricing incentives."

HFT and Flash Crash in May 2010

- A July, 2011 report by the International Organization of Securities Commissions (IOSCO), an international body of securities regulators, concluded that while "*algorithms and HFT technology have been used by market participants to manage their trading and risk, their usage was also clearly a contributing factor in the flash crash event of May 6, 2010.*"

- However, conversely, Kirilenko (Chief Economist CFTC), Kyle and others conduct an academic study (presented at WFA) and find no evidence to link the flash crash to HFTs. However, they find that HFTs exacerbated volatility

HFTs and Flash Crash on May 6, 2010

- Joint SEC and CFTC (September 30, 2010) official report.

HFTs initially provided liquidity to the large sell order that was identified as the cause of the crash. But after fundamental buyers withdrew from the market, HFTs, and all liquidity providers, also stopped trading and providing competitive quotes.

HFT Regulatory Scrutiny

- There has been a proposal (House Resolution 1068) to impose a per-trade tax of .25%.

- Some have suggested implementing fees when the number of canceled orders by a market participant exceeds a certain level, or limit the number of canceled orders.

- While others have recommended requiring quotes to have a minimum life before they can be canceled or revised.

HFT Regulatory Scrutiny

- The European Commission's final draft proposals for the revised Markets in Financial Instruments Directive (MiFID II) along with a related regulation (MiFIR) were published 20 October 2011. Most important proposals relating to AT/HFT:

  AT/HFTs are required to *"be in continuous operation during the trading hours of the trading venue to which it sends orders or through the systems of which it executes transactions. The trading parameters or limits of an algorithmic trading strategy shall ensure that the strategy posts firm quotes at competitive prices with the result of providing liquidity on a regular and ongoing basis to these trading venues at all times, regardless of prevailing market conditions."*

HFT Regulatory Scrutiny

- The European Commission has also proposed to introduce a financial trading tax to constrain AT/HFT.

- The European Union financial transaction tax (EU FTT) is a proposal made by the European Commission to introduce a financial transaction tax (FTT) within the 27 member states of the European Union by 2014. The tax, if implemented, would impact financial transactions between financial institutions charging 0.1% against the exchange of shares and bonds and 0.01% across derivative contracts.

Fuzziness about HFTs

- Differences in the approach towards HFTs stems from fuzziness about the true nature of their strategies, and also the mixed roles they play.

- A common view is that they are the new market-makers.

  – Competition in liquidity provision should be good for the markets even in the absence of the affirmative obligations that bound traditional market-makers (Naik and Yadav, 2003).

- Another role is that of high frequency arbitrageurs.

  – Not just textbook arbitrage but also "value arbitrage"

  – Again this means they should make prices more efficient.

Fuzziness about HFTs: Alternative Perspectives

- Is the liquidity they provide really reliable?

  - The evidence is that they demand and supply liquidity roughly equally.

- What about the other "dirty tricks" they bring to the table.

  - Exploratory trading and order spoofing

  - Herding

  - Overloading the system with excessive traffic and messages.

- Essentially, they are voluntary traders making money anyway they can with their HFT competitive advantage: that is almost certainly "good" in normal times, but is that true in times of extreme behavior and stress?

HFTs: Theoretical Perspectives

- Information Asymmetry: the speed advantage of HFTs should allow them to react more quickly to public news relative to slower traders.

  - This reduces HFTs adverse selection costs when they supply liquidity, but increases adverse selection costs of slower traders, and makes their limit orders more uncompetitive (Jovanovic and Menkveld, 2011).

  - There are also informational asymmetries generated not just between fast and slow traders, but also large and small traders (Biais, Foucault, and Moinas, 2011).

HFTs: Theoretical Perspectives

- Inventory adjustment related effects are also likely to be more relevant since HFTs tend to go home flat, and keep their overall exposure relatively low at all times by demanding liquidity much more often than traditional market makers.

- Order Processing Costs of HFTs should be lower because of high volumes: fixed costs per dollar reduce and there are greater liquidity related rebates.

- Herding (Jarrow and Protter, 2011)

- Potential for disruptive effects (Cvitanic and Kirilenko, 2010)

HFT Empirical Studies

- These focus on three aspects of market quality: Liquidity, Price discovery, and Volatility.

  - Positive Views

  - Hendershott, Jones, Menkveld (2011)

  - Hendershott and Riordan (2011)

  - Hasbrouk and Saar (2011)

  - Brogaard (2010)

  - Hirschey (2011)

  - Carrion (2011)

  - Negative Views

  - Zhang (2010)

Hendershott, Jones, and Menkveld (JF, 2011)

- The New York Stock Exchange automated quote dissemination in 2003, and use this change in market structure that increases Automated trading (AT) as an exogenous instrument to measure the causal effect of AT on liquidity.

- For large stocks in particular, AT narrows spreads, reduces adverse selection, and reduces trade-related price discovery.

- The findings indicate that AT improves liquidity and enhances the informativeness of quotes.

Hasbrouk and Saar (2011)

- Low-latency activity improves traditional market quality measures such as short-term volatility, spreads, and displayed depth in the limit order book.

  - Using 2007-08 order-level NASDAQ data

  - Define low-latency activity as strategies that respond to market events in the millisecond environment.

  - The millisecond environment consists of activity by some traders who respond to market events (like changes in the limit order book) within roughly 2-3 ms, and others who seem to cycle in wall-clock time (e.g. access the market every second).

Brogaard (2010)

- Based on NASDAQ data: 26 firms that participate in 74% trades!

  - Engage in a price-reversal strategy driven by order imbalances.

  - Do not withdraw from markets in bad times.

  - Do not engage in abnormal front-running of non-HFTs.

  - Demand and supply liquidity equally.

  - Provide inside quotes half the time, but only 25% of book depth.

  - Significantly reduce price impact of large trades.

  - HFT trades and quotes contribute more to price discovery than do non-HFT activity.

  - HFT does not increase and may even reduce volatility.

Hendershott and Riordan (2011)

- Overall HFTs play a positive role in price efficiency through their marketable orders

  - Trading in the direction of permanent price changes

  - Trading in a direction opposite to that indicated by transitory pricing errors.

  - HFTs marketable orders' informational advantage is sufficient to overcome the bid-ask spread and trading fees to generate positive trading revenues.

- In contrast, HFTs passive non-marketable orders have adverse selection costs. But still generate overall positive revenues from bid-ask spreads and liquidity rebates.

- HFT predicts price changes over short horizons measured in the tens of seconds.

Hirschey (2011)

- Uses NASDAQ data to test if HFTs anticipate information about future order flow.

- HFTs aggressive buying (selling) predict future aggressive buying (selling) by non-HFTs.

  - Robust to news announcements, so it is not driven by HFTs reacting faster to news announcements.

  - Persistent differences among HFTs.

  - Implications for information adjustment into prices and price impact of traditional asset manager trades.

Carrion (2011) – NASDAQ Data

- Spreads are wider for trades where HFTs supply liquidity and slightly tighter when they take liquidity.

  – HFTs provide liquidity when it is scarce and consume liquidity when it is plentiful.

- Prices incorporate information from order flows and returns more efficiently on days when HFTs' participation is higher.

  – Driven by HFTs demand side participation, indicating that HFTs improve price efficiency when they demand liquidity.

- Successful market-timers but not successful cross-sectional return predictors.

Zhang (2010)

- HFT is positively correlated with volatility after controlling for firm fundamental volatility and other exogenous determinants of volatility. The positive correlation is stronger among stocks with high institutional holdings and during periods of high market uncertainty.

- HFT hinders the market's ability to incorporate information about firm fundamentals into asset prices by causing stock prices to overreact to fundamental news.

- Once the share of high-frequency trading exceeds 50%, traders generate a "hot potato" volume effect as they rapidly pass the same positions back and forth - largely trading with each other, and not providing any liquidity to the market.

- However, the proxy for HFT used here is questionable.

Summary

- There is substantial fuzziness about the nature of HFTs, and the strategies used by them.

- The overwhelming academic evidence indicates that HFT improves efficiency and liquidity overall, but there are question marks in periods of stress.

- Perhaps, we should see HFT as a technology development rather than a strategy, a natural evolution in the market place, accept it as a reality, and consider appropriate regulatory safeguards for extreme market situations.