
HIGH FREQUENCY TRADING

Position Paper

Author(s): Thierry Rijper
Willem Sprenkeler
Stefan Kip

Table of content

Executive Summary	3
1 Introduction	4
2 What is high frequency trading?	5
2.1 What is HFT?.....	5
2.1.1 Market making.....	5
2.1.2 Statistical Arbitrage	5
2.1.3 Other trading strategies.....	5
2.2 Trying to define HFT	6
3 How does HFT impact the markets?	7
3.1 Increasing liquidity	7
3.2 Reducing spreads.....	7
3.3 Reducing tick sizes.....	7
3.4 Lowering transaction costs	8
3.5 Reducing volatility.....	8
3.6 Improving market quality	8
4 What are the main misconceptions on HFT?	9
4.1 HFT firms stop providing liquidity in volatile markets	9
4.2 HFT firms benefit from flash orders	9
4.3 HFT increases volatility	9
4.4 HFT's algorithms are going berserk	10
4.5 HFT often involves front running	10
4.6 HFT provides phantom liquidity	10
4.7 HFT firms profit from slowing down trading by quote stuffing strategies	11
4.8 HFT has an unfair competitive advantage by using sponsored access	11
4.9 HFT has an unfair competitive advantage by using co-location.....	11
4.10 HFT firms benefit from fee structures	12
5 What will be the effects of additional regulation?	13
5.1 Introducing a financial transaction tax	13
5.2 Imposing quoting obligations	15
5.3 Imposing minimum quote durations	15
5.4 Increasing minimum tick sizes.....	16
5.5 Imposing speed limits	16
5.6 Introducing circuit breakers	16
6 Conclusion	17
References	18

Executive Summary

Over the decades technological advancement has had a profound impact on the way financial instruments are traded. These technological advancements have enabled investment firms to do hundreds of trades on several different markets faster than the blink of an eye. This evolution in the marketplace is often categorised under the umbrella of high frequency trading (HFT) and has become a topic of fierce discussion in recent years. The overall negative perception of the industry however, Optiver believes is undeserved. HFT is nothing more or less than an evolution of a system that has been in operation for decades.

Despite all the attention a common definition of HFT is yet to be found. HFT can be part of different financial activities and is used by hedgefunds, proprietary traders, investment banks and brokers with respect to their order execution activities. A proper definition could be “*the execution of trading strategies based on computer programmes or algorithms to capture opportunities that may be small or exist for a very short period of time*”. Some common characteristics of HFT are (1) a high volume of trades with low level of profits per trade; (2) extreme short stock holding period; (3) submitting numerous orders; and (4) no significant open positions overnight.

Often HFT is used by market makers. In strict price-time priority markets, a market makers' success depends on it being among the first to post the best available prices. Furthermore speed is important from a risk management point of view, because it allows them to quickly update their quotes when market circumstances change. HFT is also typically used by firms that employ statistical arbitrage strategies. Just as in market making activities the profit per trade is usually very small, so these strategies are usually implemented in automated fashion using HFT. Optiver believes both strategies are legitimate trading strategies that add true value to the quality of the markets.

When HFT is used however to violate price-time priority and firms are able to step in front of the queue or when brokers use HFT technology to profit from expected price changes resulting from large client orders these strategies are not necessarily beneficial and could actually be detrimental to the market quality.

Recent scientific research has shown that, when used for market making activities or employed in statistical arbitrage, HFT generally increases liquidity to the markets and reduces the volatility. Furthermore it reduces the spreads, leads to lower tick sizes and thus improves the overall market quality. These effects of HFT benefit all market participants, from small retail investors to large brokers and institutional investors.

Despite scientific research showing that HFT is generally beneficial to the market, there are many misconceptions. HFT is for example accused of withdrawing liquidity when markets are volatile, although the facts show that this is not the case. Examples of other misconceptions are HFT firms are sometimes accused of front running, that they benefit from quote stuffing strategies or that they have an unfair advantage over other market participant by using sponsored access or co-location.

Based on such misconceptions some regulators and politicians have recently proposed introduce additional regulations to limit the effect of HFT. Of all these proposals introducing a financial transaction tax will have the most dramatic impact on the quality of the market. Trading volumes would reduce significantly and liquidity and price discovery will be seriously impacted, thus harming not just HFT but all market participants. Other measures, such as imposing quoting obligations or minimum quote durations and reducing the speed with which HFT firms can trade will either result in wider spreads or reduced liquidity. One proposal that Optiver believes will truly work and will not harm the quality of the market is the introduction of circuit breakers, which have already been implemented by several exchanges.

With this position Optiver hopes to contribute to an open discussion about HFT, based on rational arguments and supported by facts. Renewed focus will hopefully help to achieve this and centralise the discussion around the theme that should be at the forefront of any discussion: how can we fortify the market structure and prevent another financial crisis from happening again?

1 Introduction

In the past decades technological advancement has had a profound impact on the way financial instruments are traded. These technological advancements have enabled investment firms to do hundreds of trades on several different markets faster than the blink of an eye. This has made it possible, and therefore necessary, for participants to program their decisions in advance. So instead of making a decision on the spot one has to program its algorithms to do x when y happens.

This evolution in the marketplace falls commonly under the umbrella of high frequency trading (HFT), and has become a topic for fierce discussions in recent years in the wake of controversies such as flash orders and the rise of algorithmic trading strategies coinciding with the worst post-war financial crisis, blaming the practice for causing market volatility, withdrawing liquidity in times of crashes, not adding any benefits to the markets and pocketing enormous profits to the expense of 'ordinary investors'.

These circumstances have caused an overall negative perception of the industry which Optiver believes to be undeserved. We think HFT is nothing more or less than an evolution of a system that has been in operation for decades, and was formerly known as open outcry. The fact however that this is a rather new phenomenon in combination with recent market developments sometimes raises fear or suspicion.

Optiver does not regard itself solely as a high frequency trader. We are a first and foremost a global market maker. We do however use sophisticated technology and advanced trading algorithms to execute our trading activities. Hence, we are often associated with HFT.

As a market maker with headquarters in the Netherlands we are licensed as an investment firm by the Netherlands Authority for the Financial Markets (AFM). In a recent report that the AFM published on HFT the AFM called upon high frequency traders "*to explain their behaviour to their environment and demonstrate that they make a positive contribution to the market as a whole*".¹ With position paper Optiver hopes to satisfy this need for explanation.

In this paper we explain what HFT is and why it is actually beneficial to the market and investors. We will also try to refute often heard accusations of HFT harming the market quality or having unfair competitive advantages over other investors. Finally we will discuss a number of proposed regulatory initiatives that are recently voiced to limit the impact of HFT and analyse the impact of these proposed measures on the financial markets.

¹ The Netherlands Authority for the Financial Markets, "*High frequency trading: The application of advanced trading technology in the European marketplace*", Amsterdam, November 2010, to be found on <http://www.afm.nl/en/professionals/afm-actueel/rapporten/2010/hft-rapport.aspx>.

2 What is high frequency trading?

2.1 What is HFT?

Despite the attention HFT has received since the outbreak of the financial crisis, e.g. from politicians, regulators and media, a common definition of HFT is yet to be found. This is not surprising since HFT can be part of different financial activities and involve completely different trading strategies. It is not only proprietary trading firms or hedge funds that use HFT, but also banks or brokers can use HFT for example with respect to their order execution strategies. In general however HFT is usually part of one or more of the following activities.

2.1.1 Market making

A core function of a market maker is continuous quoting and therewith the provision of a two-sided market to ensure liquidity and execution certainty for investors. Technological evolution in consonance with sophistication of pricing has driven the development towards more and more automated trading practices. The employment of automated, high speed trading applications enables market makers to trade in higher volumes, with higher speed and tighter spreads and therewith assure liquidity and increase the possibility for market participants to transfer their risks. HFT is also facilitating the processing of market data, the timely reaction to changing market conditions and therewith better enables market makers to manage risks.

Market makers earn money by generating very tiny profits on a large number of trades. In strict price-time priority markets a market makers' success depends on it being among the first to post the best available prices. Furthermore speed is important from a risk management perspective. Whenever a market maker provides a quote, he is exposed to the risk that the market moves against him. When latency is low however, a market maker can quickly and continuously update his quotes to reflect the new market situation, which will eventually enable him to quote a narrow spread. Thus the use of sophisticated and fast trading applications is a prerequisite for a market maker to be successful.

2.1.2 Statistical Arbitrage

Statistical arbitrage involves a trading strategy that identifies and tries to capitalise on inefficient pricing of financial instruments, often characterised by temporary aberrations in the relationship between two financial instruments. Examples one can think of are differences between the price of a share and a related depository receipt (e.g. an ADR) and the price of the DAX-index in relation to the EuroStoxx. Usually it involves building up a long position in the undervalued instrument and a short position in the overvalued instrument. More advanced statistical arbitrage can consider not just a pair of stocks, but actually tens or hundreds of stock, in which some are bought and some are sold. Just as in market making activities the profit per trade is usually very small, therefore these strategies are usually implemented in automated fashion using HFT. By arbitraging out such tiny price differences these firms contribute to the efficiency of the market.

2.1.3 Other trading strategies

Optiver believes both market making and statistical arbitrage are legitimate trading activities that add true value to the quality of the markets. Of course there can be other trading strategies that use HFT which do not fall in to either category. Optiver agrees that some of these strategies are not necessarily beneficial and can actually be damaging to the market quality. An example one can think of is the situation where a broker is buying index futures contracts while at the same time holding a large customer order in an ETF on that same index (to profit from the expected price impact of that customer order). In this case arbitrageurs will quickly shift the price impact of the brokers' futures order to the ETF where it will increase the costs of filling the clients order. This strategy can of course only be implemented by firms with access to client orders. Optiver does not have any clients and strongly opposes strategies like these.

2.2 Trying to define HFT

A good attempt to *define* HFT we think was recently done by Martin Wheatley, chief executive officer of the Securities and Futures Commission in Hong Kong and former deputy chief executive of the London Stock Exchange. In an article in the Financial Times Wheatley defined HFT as:

*“the execution of trading strategies based on computer programmes or algorithms to capture opportunities that may be small or exist for a very short period of time”.*²

Wheatley also identified three important characteristics of HFT: (1) high volume of trades on a daily basis with low level of profits per trade; (2) extreme short stock holding period; (3) submitting numerous orders; and (4) no significant open position overnight.

HFT is often confused with algorithmic trading (AT). But actually they are not the same. HFT and AT are similar in that they both use automated computer generated decision making technology. However, they differ in that AT may have holding periods that can be days, weeks or longer, whereas HFT by definition hold their position for a very short horizon and try to close the trading day in a neutral position.³ For instance institutional investors nowadays often use algorithms instead of manual buy orders to accumulate a stock position. HFT is really a subset of AT, but not all AT is not at all HFT.

² Martin Wheatley, “*We need rules to limit the risk of superfast trades*”, The Financial Times, September 20, 2010

³ Jonathan A. Brogaard, “*High Frequency Trading and its Impact on the Market Quality*”, Kellogg School of Management, September 2010, p.3.

3 How does HFT impact the markets?

Optiver strongly believes that HFT, when used for market making activities or employed in a statistical arbitrage strategy, is not detrimental to the market. On the contrary, often the activities of these trading firms contribute to the quality of the financial markets. Some of the benefits that can be identified are:

3.1 Increasing liquidity

By posting two-way, continuous quotes market makers provide liquidity to the markets. Thus investors are always able to buy or sell a financial instrument. Even in the depths of the market turmoil since 2008 most market makers have constantly provided two way quotes.

By using computer programs and trading algorithms HFT firms can now trade more markets and different financial instruments at the same time, thereby adding volume to the screen. All investors benefit from this as they can trade bigger sizes.

In the past five years the daily volume on the New York Stock Exchange has shot up from 2bn to 5bn shares, mostly because of high-frequency traders. This greater volume means that large institutional can more easily move large blocks of shares without running too much risk of prices moving against them. *“We have moved from a market in which humans manually traded to one in which computers execute the bulk of trades without human intervention. Volume is higher. Trade size has become smaller as it is now cheaper for institutions to divide orders up into smaller slices to reduce market impact.”*⁴

3.2 Reducing spreads

The use of fast computers and software has enabled trading firms to price more accurately and update prices much quicker. For market makers this means that they can quote with tighter spreads, as the risk of outdated quotes or incorrect pricing of a financial instrument reduced significantly. The subsequent reductions in latency on exchanges have continued this trend. Thus HFTs establish the true balance of supply and demand in financial instruments. A recent NYSE Euronext study of quoted spreads shows that spreads have declined markedly in the era of HFT dominance - even when volatility was very high – and that HFT activity is likely to have been a positive factor in this trend.⁵ This is confirmed by Brogaard, who showed in a recent study on the impact of HFT on market quality of the US markets that HFT firms provide the best bid and offer quotes for a significant portion of the trading day.⁶ So rather than harming for example long-term investors it can be argued that HFT is actually beneficial to investors as it reduces the spreads and improves price discovery.

3.3 Reducing tick sizes

The rise of HFT activity has led to a dramatic tightening of the spread (see above). This development, along with an increased message capacity of the exchanges, has driven a significant reduction in tick sizes. The lower tick sizes have enabled the increased capability of the marketplace to facilitate tighter spreads to be transmitted to the observed spreads. If the tick sizes had remained unchanged (as has happened in a few markets) the benefits in terms of spread and liquidity would have been far less significant, in other words the lowering of the tick sizes has removed an important barrier for competitive pricing and its benefits.⁷

⁴ James A. Angel, Lawrence E. Harris and Chester S. Spatt, *“Equity Trading in the 21st Century”*, research paper, February 23, 2010, p.53.

⁵ NYSE Euronext, *“High Frequency Trading Helps Narrow Quoted Spreads”*, August 19, 2009, (<http://exchanges.nyse.com/archives/2009/08/hft.php>)

⁶ Jonathan A. Brogaard, *“High Frequency Trading and its Impact on the Market Quality”*, Kellogg School of Management, September 2010, p.40.

⁷ Critics of lower tick sizes sometimes argue that very low tick sizes negate time priority, that is that an active participant can very cheaply jump in front of a limit order, and this would dissuade participants to post liquidity. There is definitely merit to this argument in the case that the typical spread in an underlying is many ticks wide. However that does not make the current lower tick size undesirable in general as the average spread has tightened a lot as well, so the relative tick size has not been going down much at all.

3.4 Lowering transaction costs

By adding liquidity and reducing spreads between bid and ask prices HFT firms contribute to a decrease in the cost of trading. Their willingness to devote capital to buy when others desire to sell and vice versa smoothes out the price effects of order imbalances and further reduces transaction costs for end investors.⁸ Due to HFT, transaction costs on an average trade have decreased significantly in the last decade. For example a retail investor could pay over 1% for an average retail transaction ten years ago, while that same investor can now enter into transactions for 25 basis points or even less. For institutional investors the reduction in transaction costs has been dramatic as well. Thus HFT cuts costs significantly for everyone. Research recently done by Hendershott, Jones, and Menkveld also suggest that algorithmic trading lowers the costs of trading and increases the informativeness of quotes.⁹

3.5 Reducing volatility

Market makers reduce volatility by restoring the markets to order since they are required to quote. They create order and increase liquidity and make the market a fairer place to do business. But it is not only market making which reduces volatility. In one of the few empirical studies of the impact of HFT on the quality of the market Jonathan Brogaard showed that HFT in general does dampen volatility. *“During the largest price increase HFT’s buy and demand less liquidity than normal. The same relationship is true during price declines: during the largest price declines HFTs decrease their liquidity demand and increase the liquidity they provide.”*¹⁰ These findings are confirmed in a study done by Woodbine Associates, who evaluated trading in the 40 most liquid stocks in the US equity markets in 2008 and 2009. According to a recent report in *Advanced Trading* they conclude “that HFT in general has improved execution quality and reduced volatility”.¹¹

3.6 Improving market quality

Through increased liquidity from electronic market making, reducing spreads and transaction costs and dampening volatility, HFT contribute the overall quality of the market. Thus both private and institutional investors benefit from the presence of HFT in the market. As Burton Malkiel (Professor of Economics at Princeton University) and George Sauter (Chief Investment Officer of the Vanguard Group) recently wrote in an article in the *Financial Times* *“individual investors are the ultimate beneficiaries when their pension funds and mutual funds can transact large volumes of trades anonymously with great speed and at lower cost”*.¹² A similar conclusion is drawn by Brogaard in his research paper. He concluded that *“Overall the results in this paper suggest that HFT’s activities are not detrimental to non-HFTs and that HFT tends to improve market quality.”*¹³

⁸ James A. Angel, Lawrence E. Harris and Chester S. Spatt, *“Equity Trading in the 21st Century”*, research paper, February 23, 2010, p.52.

⁹ Terence Hendershott, Charles M. Jones, and Albert J. Menkveld, *“Does Algorithmic Trading Improve Liquidity”*, (August 30, 2010). *Journal of Finance*, Forthcoming; WFA 2008 Paper. Available at SSRN: <http://ssrn.com/abstract=1100635>

¹⁰ Jonathan A. Brogaard, *“High Frequency Trading and its Impact on the Market Quality”*, Kellogg School of Management, September 2010, p.25.

¹¹ Cristina McEachern Gibbs, *“Study: HFT Benefits Traditional Trader”*, *Advance Trader*, April 28, 2010.

¹² Burton Malkiel, *“High-frequency trading is natural part of evolution”*, *The Financial Times*, December 4, 2009.

¹³ Jonathan A. Brogaard, *“High Frequency Trading and its Impact on the Market Quality”*, Kellogg School of Management, September 2010, p.39.

4 What are the main misconceptions on HFT?

4.1 HFT firms stop providing liquidity in volatile markets

Critics of HFT sometimes claim that HFT firms do indeed add liquidity to the markets, but only in 'normal' market circumstances. The facts however suggest that this is a big misconception. HFT firms are present in the market both in regular and in volatile market conditions and the levels of their activity do not change very much when market volatility decreases or increases.¹⁴ In fact "HFT's already passed the toughest test they will likely ever face in this subject. It was called the Great Financial Crisis of 2008-2009, and HFT's provided liquidity in the US stock markets without fail through its roughest days."¹⁵

The most prominent instance of HFT leaving the market appeared in the recent past occurred only when regulators around world imposed a short selling ban on certain financial stocks, as measure which may in fact have had the opposite consequence of what was intended. In a study to the effect of these measures Boehmer, Jones and Zhang concluded that "Stocks subject to the ban suffered a severe degradation in market quality, as measured by spreads, price impacts, and intraday volatility".¹⁶

4.2 HFT firms benefit from flash orders

It is often claimed that HFT firms benefit from their technological and speed advantage by trading on flash orders and thus have an unfair advantage over other investors. We think it is important to get the facts straight. Flash orders are "an order type whereby when an exchange that was not offering the national best bid or offer (NBBO) received a market order it "flashed" the order to market participants who had registered to receive such flashes, giving them the option to take the other side of the trade before routing the order to the exchange with the NBBO."¹⁷ In the US Flash orders claimed just a shade over 3 percent of all equities volume in the US.¹⁸ According to Rosenblatt securities flash orders accounted for only 2.8% of US equity trading in July 2008.¹⁹ Furthermore the SEC already in 2009 proposed to ban flash orders.²⁰

In Europe flash orders are almost entirely absent from the European trading landscape. The nearest equivalent in Europe is a system called Blink, operated by Nasdaq OMX Europe; the difference is that, with Blink, orders sit on its book for 25 milliseconds and are seen by everyone. The vast majority of HFT activity occurs in markets that display firm quotes and, unlike flash orders, help investors transact at the best possible price.

Optiver is not and has never been involved in trading flash orders. We support any move to ban flash orders from the market as we strongly believe in transparency and a level playing field. However, we agree with former SEC Chairman Arthur Levitt, who said "While I support the move to ban flash orders because they have the potential to undermine the goals of market competition, that does not mean we should demonize or regulate out of existence all high-frequency trading".²¹

4.3 HFT increases volatility

HFTs are often considered to be speculators who move markets to extremes. In fact, the vast majority of HFT involves looking for very small arbitrage opportunities, as between futures and cash markets or between the prices of exchange traded funds and their net asset values. These actions do not create volatile markets - they close gaps across markets and increase market efficiency. As Brogaard conclude his study on the impact of HFT on the quality of the (US) markets "HFT firms do not seem to increase volatility and may in

¹⁴ Jonathan A. Brogaard, "High Frequency Trading and its Impact on the Market Quality", Kellogg School of Management, September 2010, p.24.

¹⁵ Rosenblatt Securities, "An In-Depth Look at High Frequency Trading", Trading Talk, September 30, 2009.

¹⁶ Ekkehart Boehmer, Charles M. Jones and Xiaoyang Zhang, "Shackling Short Sellers: the 2008 Shorting Ban", Texas A&M University, Columbia Business School and Cornell University, January 31, 2009.

¹⁷ Jonathan A. Brogaard, "High Frequency Trading and its Impact on the Market Quality", Kellogg School of Management, September 2010, p.67.

¹⁸ Nina Mehta, "2009 Review: The Past and Future of Flash Orders", Traders Magazine, December 2009.

¹⁹ Rosenblatt Securities, September 30, 2009, page 30

²⁰ SEC Press Release "SEC proposes Flash Order Ban", September 17, 2009

²¹ Arthur Levitt Jr., "Don't Set Speed Limits on Trading", Wall Street Journal Online, August 17, 2009

fact reduce it".²² In addition, market makers in particular were the ones still quoting prices in the regulated markets during the 2008 turmoil, adding to the ease with which investors could buy and sell.

4.4 HFT's algorithms are going berserk

Some worry that an algorithm may lose control and overwhelm the markets with a flood of erroneous orders, and maybe even crash the system. Optiver thinks algorithm/order madness is a threat which should not be taken lightly. Algorithmic trading is not restricted to HFT, many position taking firms also engage in it. We believe all firms using algorithmic trading should have the right risk processes in place. This should include things like appropriate IT governance, testing procedures, security access arrangements and change management procedures as well as regular risk monitoring.

It's essential to keep in mind however that most proprietary trading firms are very aware of the risk to their own firm because it's their own money that is at risk. Many HFTs have a number of safeguards in place, both technological and process-based, to address the operational risks from runaway algorithms. Beyond that, there are many safeguards at the exchange level (as well as the clearinghouse level), to avoid these situations becoming a catastrophic situation. Optiver is closely cooperating with exchanges for further improvement of such safeguards.

4.5 HFT often involves front running

It's often alleged that HFT is a form of front running, in that people are using technology to detect what other people are doing and get in front of their orders. Front running is acting on non-public information and on customer orders that have not yet been made public to the marketplace. However the majority of HFT firms do not have customers, so there's no possible way that they could be engaged in front running their client orders. Effectively what happens is that HFTs perceive an imbalance in the order flow and bids up the price of that asset to reflect the fact that there seems to be, at that moment in time, more buyers than sellers. HFT firms are just reacting to changes in the order book more quickly than some traditional investors.

Optiver believes executing a large order (for a client or on own account) without moving the market is a utopia. A healthy market is supposed to reflect all known information about a stock, including supply and demand. The fact that an investor is buying a large amount of shares obviously impacts demand and should, in an efficient market, trigger a rise in the stock price.²³ Since there are more mechanics, front running is actually less likely thanks to HFT since the buy side is less dependent on a broker who has to show the order to several desks before getting an acceptable offer.²⁴

4.6 HFT provides phantom liquidity

The substantial increase in the order to trade ratios (the fraction of submitted orders resulting in a trade) has led to the allegation that HFT firms provide phantom liquidity. The increase in unfilled order is used as proof that many orders are submitted for reasons other than trading. As shown below the reduction in tick sizes offer a more satisfying explanation for the observed rise in order to trade ratios than the darker motives suggested.

The connection between the tick size (see par 3.3) and the order-to-trade ratio is not commonly appreciated. However it is a necessary consequence of more competitive pricing that prices need to be updated more often. For instance if Royal Dutch Shell were to have a €0.25 euro tick size a market maker might only need to update his €23.25-€23.50 a few times a single day, however in today's markets with a €0.005 far more frequent updates become necessary. This is obvious as a change of the underlying value of a cent will always trigger a price update in the current situation, while only necessitating it very occasionally with a

²² Jonathan A. Brogaard, "High Frequency Trading and its Impact on the Market Quality", Kellogg School of Management, September 2010, p.45.

²³ Cameron Smith, "Commentary: How High Frequency Trading Benefits All Investors", Traders Magazine Online News, March 17, 2010.

²⁴ Will Acworth, "Making Markets: A Conversation with Five High-Frequency Trading Firms", Futures Industry Magazine. Retrieved on February 10, 2010.

quarter euro tick size. Even if one factors in the higher velocity caused by the resulting tighter spreads the result is still a much higher order to trader ratio.

4.7 HFT firms profit from slowing down trading by quote stuffing strategies

It has been supposed, by Nanex among others, that some trading firms deliberately generate a large number of quotes or orders that competitors have to process but that the firm can ignore since they would have generated them, thereby gaining valuable processing time which will allow the firm to profit from quotes of competitors which would become delayed by the order generation. This has become known as quote stuffing. As a consequence of the quote stuffing the exchange's matching engine would also slow down and eventually shut down the entire market because of the excessive amount of messages. Nanex has even claimed quote stuffing to be one of the reasons for the flash crash. Extreme market conditions naturally pose the risk of exchange systems overloading as these situations generate a lot of legitimate traffic to the exchanges. In the flash crash report the CFTC and SEC point towards a combination of a large sell order and SI's only sending sell orders while trading against the buy orders themselves as factors in causing the flash crash, without mentioning quote stuffing.

Because an overload in messages slows down or even shut down the exchanges matching engines, exchanges have a big interest in and are vigilant in preventing such overloads. Market makers do have restrictions on the amount of orders they put in and if there seems to be an excessive amount of orders exchanges typically contact the trading firm responsible, or take more severe steps when appropriate. The fact that exchanges have stated that they see no evidence for the practice therefore makes the quote stuffing claim incredible.

4.8 HFT has an unfair competitive advantage by using sponsored access

For the clients of sponsoring firms the benefits are faster access to the markets, or low latency and administrative and infrastructural work is effectively outsourced to the sponsoring firms. These clients of sponsoring firms add more liquidity to trading platforms which benefits all other participants of that platform. However, at the moment clients of sponsoring firms are able to benefit from low latency execution whilst avoiding the responsibility of guaranteeing trades. They are not direct subject to risk and compliance controls. Although our view is not supported by statistical data and widespread survey, we experience a lack of risk and regulatory controls. Such lightly controlled access to markets undermines regulatory requirements and therewith might cause systemic risks for the orderly functioning of organised trading platforms. Furthermore Optiver believes that all exchanges should be open to remote membership so that firms can access the markets in their own names. This way sponsored access would become less relevant and respective risks could be mitigated.

4.9 HFT has an unfair competitive advantage by using co-location

Co-location commonly involves installing trading hard- and software in the close proximity of the trading engine of an exchange. That way trading firms reduce the total latency of trade messages as result of which they are able to trade faster. Co-location is generally available at most important exchanges. It allows firms to trade stocks and sometimes options in microseconds. HFT have been a driving force for more efficient technologies in all parts of the trading environment and improved exchange latency being one of them.

Co-location does not provide an unfair advantage since co-locations are available for everybody, both directly and indirectly - via commercial vendors. In fact barriers to entry are very low with firms selling low latency trading systems and connectivity. Co-location rather provides a competitive advantage. Any firm that decides to invest in co-location services has the ability to do so. The latter is completely in line with MiFID.

Regulated markets (RMs) and multilateral trading facilities (MTF's) usually facilitate co-locations on a non-discriminatory basis. To ensure that co-location service is offered in a non-discriminatory basis, these services are usually subject to regulatory oversight. If co-location services were only offered by private sector solutions, there is a potential for discriminatory behavior that would be out of the regulatory arm of the exchange or national regulators. Therefore Optiver believes that co-location does merit a close look, to

ensure that providers are not discriminatory in how they price or allocate co-location capacity. Regarding SECs regulation on Nasdaq's Co-location, Noll (Nasdaq executive vice president in charge of transaction services) contended to Traders Magazine that a regulated co-location business is better than no co-location business.²⁵ If the SEC decided to ban exchange operation of co-location facilities, then unregulated "wildcat operators" would step in to offer it. "They would be unregulated and would not ensure fair access," he said. If the practice of co-location were banned, traders will probably seek to locate their servers in the closest piece of real estate to the exchange data centres, with far less oversight than is possible within the exchange data centres.

4.10 HFT firms benefit from fee structures

Traditionally, the European exchanges kept opaque fee structures in place which charged relatively high flat fees per trade. In recent years, exchanges in Europe have been losing market share due to the introduction of MIFID and hence the creation of MTF's. One distinctive instrument that the MTF's use to capture market share was to introduce a simplification of the fee structure and overall lower fees based on the value of the trade, as well as the maker/taker scheme. The response by the incumbent exchanges was to change their fee structures in order to retain liquidity. Most prominent European exchanges have lowered their fees, simplified their fee structures and/or adapted maker/taker schemes themselves, albeit with some modifications.

Lower fees incentivise arbitrage between different trading platforms, intra-continently. Therefore, lower fees promote a more efficient market. Additionally, a maker/taker scheme incentivises liquidity provision, competition among liquidity providers and as a result spreads are narrowing. Therefore, it helps improving liquidity for the trading platforms and increasing the overall market quality. Displayed liquidity benefits markets as it makes supply and demand more transparent, thus it fosters pre-trade transparency

²⁵ Peter Chapman, "SEC to Regulate Nasdaq's Co-Location", Traders Magazine, December 2009.

5 What will be the effects of additional regulation?

5.1 Introducing a financial transaction tax

Of all proposals to limit the effects of HFT imposing a financial transaction tax (FTT) is probably the one with the biggest negative overall effect on market quality. Imposing a FTT (sometimes also referred to as a Tobin tax) – no matter how it is structured – will create market distortions that will reduce the efficiency of the markets for all participants. It would not just harm HFT but all market participants. As a result of any FTT market volumes will reduce, which will have negative impact on liquidity and price discovery. Some specific effects that we see resulting from a FTT are:

▶ *A reduction in volume*

Volumes will reduce because investors will try to avoid the tax by trading other products. If a FTT would be imposed on certain products (e.g. stocks) investors and traders will probably move to other products, such as bonds or contracts for differences (CfD's). If bonds or CfD's would be taxed too, the financial engineers of large financial institution will develop new products which will imitate the pay off of these bonds or stocks.

And a transaction tax could not even drive trading volume to other products, but as well to other markets (where such a tax does not exist). A transaction tax was in the past revived by Sweden but cancelled after a few years after it turned out that it drove financial businesses out of the country.

Any effect on the volume is important to take into account, as transaction volume is considered to have an informational content. Thus a migration of volume (e.g. to jurisdiction without a FTT) would result in lower informational efficiency of instruments and markets from which it migrated. If transaction taxes are the cause of volume migration, then they can inhibit the informational efficiency of markets. The Chinese government increased the securities transaction tax from 0.3% to 0,5% in 1997. Research on the effects of this increase done by Li Zhang showed that as a result volumes decreased considerably.²⁶

▶ *A reduction in liquidity*

A FTT will reduce liquidity because market makers will be less willing to provide liquidity to the markets. Every market maker is trying to find small price differences that offer a trading opportunity and as such a market maker earns its money generating very tiny profits on a large number of trades. Even a small FTT would seriously reduce liquidity because the margins on which electronic traders operate are so small.²⁷

▶ *An increase in spreads*

Intermediaries that continue to provide quotes will only do so if they can price the tax into the spread. This will result in wider spreads which would hurt all investors, both retail and professional.

▶ *Reducing relative market efficiency*

As said many HFT firms engage in statistical arbitrage. By arbitraging out very tiny price differences these firms contribute to the efficiency of the market. But like in market making activities the profit per trade is usually very small. Imposing a FTT would probably eliminate the profit entirely as a result of which these price inefficiencies would continue to exist. The said price differences develop because of temporary supply and demand imbalances. The counterparty to the arbitrageurs would be harmed by the fact that the arbitrageurs will be impeded in their activity and this will adversely affect the price they will fetch or pay for their shares, as the arbitrageur by investing his capital would raise the price of the temporarily undervalued asset or lower that of an overvalued one.

²⁶ Li Zhang, "The Impact of Transaction Tax on Stock Markets: Evidence from an emerging market", M.S. Research Paper, Department of Economics, East Carolina University.

²⁷ James A. Angel, Lawrence E. Harris and Chester S. Spatt, "Equity Trading in the 21st Century", research paper, February 23, 2010, p.52.

► *An increase in volatility*

Proponents of a FTT believe that a FTT could act as fundamental function to reduce excess stock return volatility. However, as Li Zhang showed in his research paper on the increased transaction tax in China in 1997, volatility increased significantly on the Shanghai and Shenzhen stock exchanges after the increase of a FTT.²⁸

Price volatility can be explained by the variability of four components: public information, private information, transaction costs, and other market frictions. Other things being equal, higher transaction costs increase volatility. Consequently, the introduction of FTTs can increase the volatility of transaction prices.²⁹

► *Weaken market structure*

The whole discussion about the FTT seems to originate from the plan to tax the banking industry for the role they played in the financial crises. In order to judge this effect it is good to know that parties providing liquidity in the financial markets are normally non-bank participants with banks at the opposite side. Proposing a FTT for the industry will therefore achieve exactly the opposite of what it is meant for. It will effectively increase the grip banks hold on the financial market structure due to the fact that the majority of the burden will fall on the non-bank participants. The analysis for this reasoning can be derived from the impact this FTT could logically be expected to have, namely;

- low margin business such as market making will be heavily impacted leading to substantially lower volume on exchange;
- the wider spreads resulting from this will allow internalisers to internalise even more transaction flow which will cause an even greater adverse selection in the trades available for others, consequently weakening them;
- it will strengthen the OTC market relatively to the open market while it is unclear whether or not an OTC trade can be classified as a financial transaction. This will open the door for regulatory arbitrage by having lower or no taxes on the (near) equivalent OTC trades.

Financial markets and financial stability in particular, need a competitive environment which promotes specialisation and a diverse array of participants all committing capital executing their specialism, so that a weakness in one area is less likely to contaminate others. The above shows that a FTT will achieve exactly the opposite.³⁰

Furthermore the proposed tax will – if it also applies to derivatives - discourage hedging activities, resulting in fewer investments in risky assets. It will also discourage arbitrage activities that align prices across various markets and make them more efficient.³¹

As Habermeier and Kirilenko conclude, a FTT can have a substantial effect on the transformation of investor demands into transactions. A FTT “*can obstruct price discovery and price stabilization, increase volatility, reduce market liquidity, and inhibit the informational efficiency of financial markets.*”³²

²⁸ Li Zhang, “*The Impact of Transaction Tax on Stock Markets: Evidence from an emerging market*”, M.S. Research Paper, Department of Economics, East Carolina University.

²⁹ Karl Habermeier and Andrei Kirilenko, “*Securities Transaction Taxes and Financial Markets*”, IMF Working Paper WP/0/51, May 2001.

³⁰ A good example of the unwelcome consequences of a weak market structure where a few very large participants hold the roles of producers, financiers and market makers is the CDO market. In this market the “happy few” were massively overextended in size of their inventory (as producers they had unfinished goods). As a consequence the liquidity in the said issues dried up completely when these markets crashed, as the few market makers all already had a massive inventory. But this circumstance is not unique to the CDO episode. In other situations and other lines of business it has been shown as well that weak market structures have little stress tolerance.

³¹ Menachem Brenner, “*Tax Proposal is as bad as it ever was*”, US Banker, March 2010.

³² Karl Habermeier and Andrei Kirilenko, “*Securities Transaction Taxes and Financial Markets*”, IMF Working Paper WP/0/51, May 2001.

5.2 Imposing quoting obligations

Some regulators have recently suggested reintroducing quoting obligations. This would mean that market makers, in exchange for the privilege of engaging in high frequency trading, are obliged to provide liquidity in all market circumstances – even in times of market crashes. Others propose for example to require market makers to quote with a maximum spread. Proponents of imposing such requirements assume that measures like these will prevent markets from crashing.

Although imposing an obligation to be present in the market might appear to make sense, the problem is that it will not work when markets are crashing. Quoting obligations are not new to markets makers. Market makers (or specialists on the NYSE) with certain quoting obligations have been in the markets for a very long time, but still the markets crashed in 1987, 1998 and 2007. Remaining in the market would simply have meant that they would be out of business within hours. And the same holds true for narrow band obligations – complying with obligations like these in times of markets stress will probably mean liquidating your company the morning after.³³ No company can simply be asked to commit suicide voluntarily.

The proposals in that direction fail to appreciate why there have been market making requirements in the first place. While most stocks do no longer have designated market makers it is still a very common practice in the option markets. Market making schemes, which do include quoting obligations, originate from the appreciation of exchanges of the importance of displayed quotes when attracting interested participants. This makes sense as a casual observer can continuously track the price development and consequently won't be more concerned than necessary of getting a wrong price - the transparency reduces both the monitoring costs as well as adverse selection. Furthermore continuous quoting instils the confidence of market participants in their ability to get out of positions at a reasonable spread, which in turn will encourage them to engage in the initial trade.

None of the quoting requirements in market making schemes have a 100% requirement in the time market makers have to fulfil the stated obligations, the reason for that is that the requirements were never introduced for the purpose of backstopping a panic. Introducing this obligation for those opting to provide displayed liquidity runs counter to the original rational for them in discouraging rather than promoting displayed liquidity and will therefore be detrimental to the market.

5.3 Imposing minimum quote durations

This idea has been inspired by the notion that the high order cancellation rates are damaging investors, as they claim the quotes are not shown with the intention to trade. As explained in 3.3 under the reduced tick size heading, higher quote refresh frequencies are a natural consequence of tighter markets with similar volatilities, as a smaller change in underlying value will be enough to trigger a change.

As a remedy for the supposedly damaging high order cancellation rates it has been proposed to have a minimum duration for which a quote remains valid. But if you are required to keep your quotes in the market for certain period of time the likelihood that your quotes become stale will increase significantly. This would provide other firms (e.g. arbitrageurs) to trade on your outdated quotes and thus pocket an easy profit. Effectively as a market maker you would be short a strangle every time you post a two sided market.³⁴ As explained in the section above displayed liquidity is essential for the quality of a market, this proposal runs counter to that notion.³⁵

³³ Stephen J. Nelson, "Two Decades and Four Crashed – What have we learned?", Traders Magazine Online, October 19, 2010.

³⁴ A strangle is an option strategy where the investor holds a position in both a call and put option with different strike prices but with the same maturity and underlying asset.

³⁵ Actually some platforms have the policy to give market makers the right to cancel trades within a short time period after the transaction in order to promote good prices, examples are certain exchange's structured product segments as well as electronic currency platforms. While we do not support this policy as it runs counter to the notion of what a quote is, it does show that in promoting market quality doing the opposite is ludicrous.

5.4 Increasing minimum tick sizes

Increasing the minimum tick size is also often mentioned as a way to limit the influence of HFT activity. However, increasing the tick size would have a negative effect on the overall quality of the market. A large tick size prevents transactions between willing buyers and willing sellers inside the tick. Furthermore market makers cannot show their best prices anymore, which will prevent competition between these market makers who cannot longer compete on quality.

Several studies have showed that as result of a decrease in tick sizes the bid-ask spreads have reduced, volumes have increased and market quality has improved. In a study into the market quality of a large set of stocks that are subject to different tick sizes on the Hong Kong Stock Exchange Chan and Hwang conclude that, when tick sizes decrease, bid-ask spreads become tighter and the market depth improves for almost all of the tick size and price ranges. Furthermore the volume increases with the reduction of the tick size as well.³⁶ Naturally reversing this trend and increasing tick sizes again will have the opposite effect on the market quality.

5.5 Imposing speed limits

Proposals to introduce speed limits are usually done with an intention to make high frequency trading less attractive. However, just as with limiting co-location possibilities, reducing speed with which firms are able to trade will increase the risk of trading. Extreme low latency access to exchanges reduces the period of time in which there is uncertainty about the execution of a market maker. This translates in lower risk for a market maker and consequently allows for tighter bid-ask spreads – which benefit all investors. We agree with former SEC Chairman Arthur Levitt, who said: *“We should not set a speed limit to slow everyone down to the pace set by those unwilling or unable to compete at the highest levels of market activity. Investors large and small have always been served well by those looking to build the deepest possible pool of potential buyers and sellers, make trades at a better price, and all as quickly as possible”*.³⁷

5.6 Introducing circuit breakers

Another proposal, which is actually already been implemented, are circuit breakers. This has been proposed specifically with the flash crash in mind and does indeed tackle the essence of the problem. The problem is that, now as well as in for instance 1987, the market place cannot at all times deal with large size, immediate and indiscriminate buy or sell orders such as an avalanche of stop loss orders, limit free large buy or sell algorithms (which are essentially repackaged market orders) or a trading algorithm going berserk. Circuit breakers, which use has often been described as “calming the market place” are useful not so much to provide the said calm, but to remove the immediate and the indiscriminate part of the equation, allowing implicit demand to be made explicit and participants with stop loss orders to reconsider their orders. Optiver supports the principle of circuit breakers, because they help limit the adverse consequences of such a temporary breakdown. Regulators should review, and in fact are reviewing, how circuit breakers can be configured so that it is most effectively. It should be noted that the aim of circuit breakers is not to limit price move, not even big ones per se, but to halt a market breakdown.

³⁶ K.C. Chan and Chuan-Yang Hwang, *“The Impact of Tick Sizes on Market Quality: An Empirical Investigation of the Stock Exchange of Hong Kong”*, Department of Finance, Hong Kong University of Science & Technology, Hong Kong, October 1998.

³⁷ Arthur Levitt Jr., *“Don’t Set Speed Limits on Trading”*, Wall Street Journal Online, August 17, 2009.

6 Conclusion

HFT is essentially a continuation of pre-existing functions within financial markets that have evolved continuously over the past years, partly as a result of technological innovation. This evolution has benefitted the overall market structure while it helped to increase liquidity, reduce spreads, lower tick sizes, lower transaction costs and reduce volatility. HFT is a subset of algorithmic trading (AT), but not all AT is HFT.

Recently it has been proven that HFT added value during the financial crises when it managed to keep on providing liquidity while the OTC market nearly collapsed. As a result of this non-functioning of the OTC markets and the profound impact it had on the overall market we are now facing a situation where everything that has to do with trading in financial instruments is under intense scrutiny. We believe that this scrutiny is justifiable, but it should not result in measures that have the effect of a deteriorating of the marketplace. If the end result is reduced liquidity in the lit markets, internalisers gaining additional market share and the OTC market to increase in size, then the result of any new measures will be exactly the opposite of what they were originally intended for.

We believe that any situation that is detrimental to the market place should be ruled out of existence. Circuit breakers, a ban on flash orders and forcing OTC trading to transparent, CCP cleared exchanges are examples of measures that will help to fortify the current market structure leading to benefits for society in general. All measures aiming to achieve this will always receive our full support. Renewed focus will hopefully help to achieve this and centralise the discussion around the theme that should be at the forefront of any discussion: how can we fortify the market structure and prevent another financial crisis from happening again?

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