



UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

High Frequency Trading

- A study of the issues identified by actors on the Swedish financial market

Bachelor thesis in Business Administration
Industrial and Financial Management

School of Business, Economic and Law,
University of Gothenburg
Fall semester 2011

Supervisor: Taylan Mavruk

Authors:
Annika Bengtsson
Simon Strandberg

Date of birth:
860826-
880523

Abstract

Title	High Frequency Trading – A study of the issues identified by actors on the Swedish financial market
Authors	Annika Bengtsson and Simon Strandberg
Department	Industrial and Financial Management
Supervisor	Taylan Mavruk
Keywords	High frequency trading, Algorithmic trading, Market efficiency, Volatility, Liquidity, Bid-ask Spread, Nasdaq OMX, MiFID

This bachelor thesis adds to the research regarding high frequency trading (HFT) as it studies the issues identified by actors on the Swedish financial market. Using the efficient market theory and including the basic market functions of volatility, liquidity and bid-ask spread, as a framework, in-depth interviews have been performed with actors from different positions on the Swedish financial market. Empirical findings lead to the conclusion of HFT being perceived by market participants to have a negative impact on market quality in some aspects.

Higher volatility is unanimously seen as result of macroeconomic news and not as a result of an increase in HFT, yet it may intensify volatility. HFT is also perceived to increase intraday volatility, which however does not have an impact on long-term investments. According to some market participants HFT provide liquidity. Larger actors however experience the liquidity to be thin. This leads to the emergence of so called dark pools where actors turn outside the public market, which undermines transparency and reduces liquidity in regular stock markets. A correlation between the increase of HFT and reduced spreads is perceived to exist. Smaller participants experience this as a reduced cost of trading. The correlation might however be explained by the changes in tick sizes made by Nasdaq OMX. These adjustments have been required to be able to compete with new market places. A fragmentation of markets has followed the implementation of the MiFID directive initiated by the European Union. At last we present our final thoughts on the issues behind the study with some suggestions on continuous research.

Acknowledgements

First of all we would like to thank the people who agreed to be interviewed for this study. It has been very interesting and rewarding and this thesis could not have been written without their engagement.

We would also like to thank our supervisor Taylan Mavruk for his guidance, input and patience.

Last but not least, a special thanks to all friends and teachers who have set time apart to discuss this subject with us and come with thoughtful opinions.

Gothenburg 2012-01-07

Annika Bengtsson and Simon Strandberg

Table of Contents

ABSTRACT	2
ACKNOWLEDGEMENTS	3
1. INTRODUCTION.....	6
1.1. BACKGROUND	6
1.1.1 <i>Algorithmic Trading</i>	6
1.1.2 <i>Nasdaq OMX</i>	7
1.1.3 <i>MiFID – Markets in Financial Instruments Directive</i>	7
1.1.4 <i>Debate regarding HFT</i>	8
1.2. PROBLEM STATEMENT.....	9
1.3. PURPOSE AND RESEARCH QUESTION	10
1.4. DISTINCTIONS.....	11
1.5. CONTRIBUTION.....	11
2. THEORETICAL FRAMEWORK.....	12
2.1. HIGH FREQUENCY TRADING IN RELATION TO ALGORITHMIC TRADING.....	12
2.2. THE EFFICIENT MARKET HYPOTHESIS.....	13
2.3. ARBITRAGE AND THE LAW OF ONE PRICE	13
2.4. VOLATILITY	14
2.5. LIQUIDITY	15
2.6. BID-ASK SPREAD.....	16
3. METHOD	18
3.1. INTERVIEWS.....	18
3.2. DESIGN OF THE INTERVIEW GUIDE	19
3.3. SELECTION OF INTERVIEWEES	20
3.4. VALIDITY AND RELIABILITY.....	21
4. EMPIRICAL RESULTS	23
4.1 DIFFERENCE BETWEEN AT AND HFT.....	23
4.2. VOLATILITY	24
4.3. LIQUIDITY	25
4.3.1 <i>Dark pools</i>	27
4.4. BID-ASK SPREAD	28
4.5 OTHER CONCERNS	30
4.5.1 <i>MiFID</i>	30
4.5.2 <i>Structural Change</i>	30
4.5.3 <i>Risks</i>	31
4.5.4 <i>Co-location</i>	32
4.5.5 <i>Regulations</i>	33
4.6. SUMMARISED OPINIONS.....	34
5. ANALYSIS.....	36
5.1. HFT VERSUS AT	36
5.2. VOLATILITY	36
5.3. LIQUIDITY	38
5.3.1 <i>Dark pools</i>	39
5.3.2 <i>Increased cost and reduced profitability</i>	40
5.3.3 <i>Co-location</i>	41
5.4. BID-ASK SPREAD	41

5.4.1. <i>MiFID and Market Fragmentation</i>	42
5.4.2. <i>Regulations</i>	42
6. CONCLUSIONS	44
6.1. SUGGESTED FURTHER RESEARCH	45
7. REFERENCES	46
7.1. PRINTED REFERENCES.....	46
7.2 SCIENTIFIC PAPERS.....	46
7.3. REPORTS AND BACHELOR THESIS	48
7.4. ELECTRONIC SOURCES	48
APPENDIX 1 – INTERVIEW GUIDE	50

1. Introduction

The financial market is nowadays completely electronic and algorithmic trading has been used for some years to automatically execute orders at the stock market. Speed has become a crucial aspect when trading and certain market participants have discovered and taken advantage of the ability to make arbitrary winnings with the help of speed – the high frequency traders. Using an information advantage to make arbitrary profits is illegal. Using a speed advantage to process information faster is however still acceptable even though causing major discussions.

The high frequency trading has increased significantly during 2011, followed by a hot debate claiming it has a negative affect on market quality. Scientific research has nevertheless been unable to prove it harmful, on the contrary high frequency trading improves market quality in some aspects. Focusing on the effects on volatility, liquidity and bid-ask spread, this thesis aims to identify the roots of this discrepancy by addressing the issue from a different approach.

1.1. Background

The Stockholm stock exchange opened in 1778 in the old town of Stockholm. In the 70's Stockholm stock exchange initiated an electronic system and left the old manual system of using chalkboards. In 1993 the monopoly was abolished when the Stockholm stock exchange was converted into a limited company (Laliberte and Lumme Kinnunen 2009). The era of trading securities electronically originated 40 years ago when a computer-assisted market system was introduced in the U.S. The system then evolved to what we today know as NASDAQ. (Black 1971a; Black 1971b) The first computer-assisted system in Europe was introduced in the 80's but it was not until in the 90's that securities could be traded in fully automated ways (Gomber et al. 2011). Today the technology has finally lead us to the phenomenon of computers trading with algorithms and in thousands of a second initiating and making trades in financial markets.

1.1.1 Algorithmic Trading

As technology moves forward the scene of trading have moved from the floor on Wall Street into a technological world and out on the electronic markets (Gomber et al. 2011). Algorithmic trading (hereafter AT) is one of the more recent technology advancements.

Computer algorithms are programmed with the purpose to replicate the work of a floor trader because of cost benefits. The algorithms have the ability to process information and automatically make trading decision and are therefore widely used by market participants today (Hendershott et al. 2011).

Since the start of the new millennium there has been a development of AT, called high frequency trading (hereafter HFT). These algorithms are run by computers who collect maximum amount of information and after processing that take their decisions on how and what to invest in, all in the time of milliseconds. But to be able to play the game and be involved in HFT there is a vast fixed cost that every actor needs to deal with. An actor must acquire hardware and ultra-rapid connections to the exchanges (often by placing a computer server just next to the market venue), but also hire highly qualified personnel to develop and maintain algorithms (Biais et al. 2010).

Within the U.S., HFT was estimated to be responsible for 73% of the trading volume in 2009. (Biais et al. 2010) At the Stockholm Stock Exchange AT have since 2007 gone from being responsible for 7% of the turnover to 54 % in August 2011, where HFT firms are responsible of 15-20%. The HFT had its breakthrough in Sweden in August 2011 when it conducted 16 million trades compared to the 7million recorded in august 2010 (Ring 2011). However the raise of the algorithms have not come out of nowhere, important changes have been made to the financial market for algorithmic trading to work properly and being possible. Starting with the acquisition of the Stockholm Stock Exchange.

1.1.2. Nasdaq OMX

In 2007 the privately owned and US based company Nasdaq acquired the Stockholm Stock Exchange. Nasdaq is today the worlds largest exchange company and besides owning the American and Nordic market they also have businesses in the Baltic countries and special market trading commodities (Nasdaq OMX 2011).

One of the vital changes Nasdaq made since their entrance on the Swedish market is the implementation of decreased tick size in some stocks, meaning minimum allowed change in bid-ask stock price (Börjesson and Högbom 2011).

1.1.3. MiFID – Markets in Financial Instruments Directive

Another change affecting the emergence of algorithmic trading is the European Union

directive MiFID. The new directive, which was implemented 1st of November 2007, aims to harmonize the legislation of financial instruments within the EEA (European Economic Area) to facilitate trading over the borders. The main objectives of the directive are to proclaim free competition and consumer protection within the financial markets (Government Proposition 2006).

In practice MiFID will promote competition and aim to open up markets within the EU. One of the more vital changes that comes with MiFID will be the focus on promoting both pre- and post-transparency for firms through something called best execution. Best execution means a firm must seek to achieve the best possible execution of an order for their clients in terms of price, speed and likelihood of execution (MiFID 2011). This has in Sweden led to a fragmentation of market venues. The original Stockholm Stock Exchange, now Nasdaq OMX is still the largest venue but MiFID has given rise to a number of so called Multilateral Trading Facilities such as Burgundy, Nordic MTF and Aktietorget. This development has brought large cost in terms of system adjustments to the participants on the financial market (Finansinspektionen 2012, Laliberte and Lumme Kinnunen 2009).

With these changes being made the emergence of algorithms and HFT have been quite quick, however not always successful.

1.1.4. Debate regarding HFT

The first really abnormal event highlighted in media as well as in public was the “flash-crash” at the U.S Dow Jones. May 2010. The Dow Jones index dropped close to 10% and recovered again in the matter of minutes. After the U.S financial department issued inspections in September 2010, SEC chairman Mary Schapiro said, according to Biais and Woolley (2011, p.1), “... high frequency trading firms have a tremendous capacity to affect the stability and integrity of the equity market. Currently, however, high frequency trading firms are subject to very little in the way of obligations either to protect that stability by promoting reasonable price continuity in tough times, or to refrain from exacerbating price volatility”.

A comparable situation occurred in Sweden as late as November 30th 2011 when Nasdaq OMX saw some very unusual stock specific activity. 14 000 trades were made in one single stock in just 10 minutes. Similar activity was also seen in other stocks and the reason was

found to be an incorrect algorithm (Torgander 2011).

The Swedish minister of finance, Anders Borg, expressed his concerns during the fall of 2011 when the financial markets in Sweden had been showing these abnormal events and volatile tendencies. Borg claimed that if research showed that the HFT had impact on the fluctuations in the stock market further regulation might be implemented (Edenholm 2011).

Participants on the Swedish financial market have from the end of summer and during the fall of 2011 started to protest against HFT. Several debate articles in major newspapers, including Dagens Industri, have been published. The main concerns are based on the fear of HFT firm breaking the law by manipulating the market and share prices. They also highlight the risk of HFT undermining the confidence Swedish investors have in the market. Regulations in other European markets are also feared as that could cause other European HFT firms turning to the Swedish market (Börjesson et al. 2011). It has been claimed that investors do not stand a chance to the speed of the pre-programmed computers and there is a fear of incorrect programming and technical problems causing serious breakdowns and misleading prices on the stock market (Lenhammar 2011). According to Hedelius for Svenska Dagbladet, Nasdaq OMX also gives high frequency traders (HFTrs) advantages over other customers. Renting out space for the servers of the high frequency traders constitutes a major source of income which creates a conflict of interest for the Stockholm stock exchange whose task is also to supervise trading (Hedelius 2011).

1.2. Problem Statement

Clearly HFT has the recent months caused major discussions in both Sweden as well as worldwide. As the paragraph above suggests, the phenomenon has been exposed to extensive criticism in media and is claimed to pose several threats to both other market participants and to the financial market as a whole.

The media debate is however seldom based on academic research and because the phenomenon is new and relatively unknown it is easy to criticize and blow out of proportion to create headlines.

A number of scientific studies have been carried out on the subject. The majority of these

focus on whether or not HFT has a positive or negative impact on the financial market regarding volatility, liquidity and bid-ask spread - resulting in an almost unanimous conclusion that HFT is in fact good for the market. This leaves an interesting paradox.

There is a risk connected to an overheated debate. If the media debate does not coincide with reality there is a risk of undermining the trust of the financial market. Investors might be discouraged to act on the stock market due to the existence of HFT even though no scientific research has proved it to be harmful. There is also the possibility of the previous research not yet having examined all vital parts of the issue or not yet approached it from all perspectives.

1.3. Purpose and Research Question

A gap has been identified between the media debate and the scientific research. The purpose of this thesis is therefore to identify issues experienced by actors at the Swedish financial market due to HFT.

The majority of previous scientific studies have a market-oriented view, with the basis in a quantitative approach. A positive stand is taken based upon what is optimal for an efficient market and little consideration is taken to the actors operating on this market. This thesis addresses HFT from a qualitative point of view. The anticipation is to capture the concerns regarding HFT, highlighted by participants with direct insight in the Swedish financial market.

By approaching the matter of HFT from a different perspective than previous research, the ambition is to identify the roots causing the media debate. To still be able to relate the results of this study to preceding ones, volatility, liquidity and bid-ask spreads will be used as tools to evaluate HFT on the basis of the efficient market hypothesis.

The aim of this study is to answer the following question:

From the perspective of actors in the Swedish financial market and within the framework of the efficient market hypothesis, what issues, in relation to volatility, liquidity and bid-ask spread, can be identified as problematic regarding high frequency trading?

1.4. Distinctions

This study solely focuses on the Swedish financial market and therefore only Swedish market participants have been chosen for the conducted interviews. Previous studies have mainly focused on the U.S. financial market where HFT have flourished for a number of years. In Sweden HFT had a breakthrough in 2011, which makes this thesis very up-to-date and one of the first with this distinction. There are several market places in Sweden but since Nasdaq OMX undisputedly is the largest, the focus has naturally been put on this one.

This thesis has been structured around the concepts of volatility, liquidity and bid-ask spread since these are recurring topics in both the earlier research as well as in the media debate. These concepts are also difficult to separate since they are all important characteristics of an efficient market.

1.5. Contribution

This issue is of high relevance to the society because there is a chance of hollowing the trust of the financial market when concerns of human market participants are not highlighted in scientific research.

The majority of previous studies on the subject are of quantitative nature, they analyse the workings of HFT using intraday data from equity and foreign exchange markets. Most of the studies are conducted on the U.S. market, some on the British market and a few on other European markets. This thesis will therefore add to the literature in two major ways; it addresses the subjective opinions and concerns of the people in the industry and it is also one of the first studies conducted on the Swedish equity market.

While this study was conducted another qualitative study was also performed on the Swedish equity market. This was not known by the authors at the time but the results of the studies have later shown to be similar.

HFT is a phenomenon where progress is made extremely fast and opinions changes quickly. Therefore will any recent study be a contribution to the understanding of the current situation.

2. Theoretical Framework

The ambition of this section is to provide a basic overview of the functions of the financial market. The Market Efficiency Hypothesis and The Law of One Price are widely accepted theories and make good starting points for evaluating behaviour in financial markets. Volatility, liquidity and bid-ask spread are also central concepts of the basic market functions and will be used as tools to evaluate HFT.

2.1. High Frequency Trading in relation to Algorithmic Trading

As mentioned above several studies have been made on the subject of algorithmic trading. However not all of them make a point of separating HFT from AT and only a few focus exclusively on HFT. High frequency trading is a subset of algorithmic trading and Gomber et al. (2011) stress the importance of making a difference of the two. Common for both is the automated order submission and pre-designed trading decisions but AT is mainly used to execute client orders whereas HFT-firms trade with their own capital.

This description coincide with the definition of Hendershott et al. (2011, p.1) who define AT as “the use of computer algorithms to automatically make certain trading decisions, submit orders and manage those orders after submission”. They further point out that algorithms are widely used by many different market participants and stands for up to 73 % of the trading volume in the US. AT not only save money for banks and financial institutions but it may also improve the functioning of the markets (Biais and Woolley 2011).

Hendershott and Riordan (2011) states that AT is used both for agency and proprietary trading but however claims proprietary algorithms often are denoted as HFT. In their research they were not able to separate the two from each other but they indicate an alternative study could possibly identify the specific investment and trading strategies of HFTrs.

Brogaard (2011) refers to HFT as a hyperactive algorithmic trading strategy with extremely short holding intervals where a computer based trader moves in and out of stock to attempt to capture a small profit per trade. HFTrs also tend to end the day at a net zero position and generally have no overnight holdings. According to Biais and Woolley (2011) HFTrs most vital concern is their speed. They compete with the most powerful computers, connections

and programs as well as locating themselves as close to the trading venue as possible.

2.2. The Efficient Market Hypothesis

The main purpose of the equity market is to allocate ownership and raise equity. For this to function ideally prices of securities have to “fully reflect” all available information (Fama 1969). The efficient market hypothesis helps understand how information and expectations affect security prices; using all available information an optimal forecast is created which build up expectations for the price of a share (Mishkin and Eakins 2011). For instance, if a company develops a new technique, the price of the shares would be expected to rise immediately. According to the efficient market hypothesis, firms should be able to receive a price for their shares that reflects the value of the company and the amount of risk incorporated. Investors should not be able to make an arbitrary winning on the price adjustment. In reality, different kinds of information have different affects on prices and based on this, three versions of the efficient market hypothesis have been identified in previous literature (Jensen 1978).

A situation where all information, both public and private, is available to anyone is called a strong form of the efficient market hypothesis. According to this theory no individual can expect higher trading profits because of monopolistic access to information (Finnerty 1974). Even though this is somewhat a utopic scenario there is little evidence against this form of the hypothesis (Jensen 1978). The semi-strong form of the efficient market hypothesis implies that prices should reflect all information that is publicly available (Jensen 1978). A weakly efficient market can be described as one where information on past share prices is incorporated. An example of such a strategy is to buy when a share has gone up for a certain number of days, and to sell when it has gone down for a certain number of days. Hillier et al. (2010) claims that trading strategies based on historical data and not information about the firm, are not profitable.

2.3. Arbitrage and the Law of One Price

An arbitrage opportunity can be defined as any situation where it is possible to make a profit without taking any risk or making an investment (Berk and DeMarzo 2007). If such an opportunity appears in a financial market, investors would immediately take advantage of it and prices would quickly respond. In an efficient market no arbitrage opportunities exists due to the Law of One Price. If the price of a security differs in two different competitive markets it would be possible to buy cheap and sell for a profit without taking any risk or

making any investment. However, as soon as other investors discover this they will try to make money in the same way leaving the cheap market with only buy orders and the expensive market with only sell orders. Soon enough prices will equalize (Berk and DeMarzo 2007).

2.4. Volatility

Volatility measures unsystematic risk and expresses how much the price of a share is expected to fluctuate over a certain period of time. Diversification can help eliminating firm specific risk in a portfolio but the market specific risk will always be affected by macroeconomic events such as conjunctures, interest rates and the availability of raw material.

Hillier et al (2010) claim that high volatility is not inconsistent with market efficiency. The price adjusts to new information and new information reaches the market all the time. However in a thin market, with few buyers and sellers, fewer transactions will occur and thus create higher volatility (Pagano 1989).

The financial market has faced higher than average volatility since the financial crisis in 2008. Whether or not the technology and strategies of HFTs have aggravated this volatility has been debated. Several studies have investigated the affect of algorithmic trading at large but relatively little has been written specifically about HFT's effect on volatility. Chaboud et al. (2011) were the first to investigate AT in the foreign exchange market, focusing on the difference in impact between algorithmic and human trades. Analyses of minute-by-minute data in three different currency-pairs showed that AT only has little impact on the market but not in a harmful way and no evidence were found that AT causes excess volatility. Hendershott and Riordan (2011a) find no greater relationship between volatility and AT either. Another study by Hendershott and Riordan (2011b), focusing solely on HFT using an American data set provided by NASDAQ, neither found evidence of HFT contributing to unstable prices. HFT was rather found to decrease volatility as trades were made in the opposite direction of temporary pricing errors.

According to Brogaard (2011) a relationship between HFT and volatility do exist. A statistically significant connection between the two states that they co-move but the conclusion claims that HFT increases as a result of increased volatility and not the opposite.

Intraday volatility was in fact decreased by HFT.

Exacerbated volatility has occasionally occurred, one specific event being the May 6th US Flash Crash in 2010. This incident was proved not to be triggered by HFT, but however HFTs intensified the market volatility on that day (Kirilenko et al. 2010).

Zhang (2010) is one of few to find a positive correlation between stock price volatility and HFT on the U.S. capital market. A stronger correlation during periods of high market uncertainty was found and he further claims HFTs to take advantage of large trades by institutional investors, which explains an even stronger correlation for stocks with high institutional holdings.

2.5. Liquidity

Whether a market is thick or thin is related to liquidity (Fabozzi and Modigliani 2003). When an investor sells a financial asset, liquidity is provided to the market. The term can be defined as how easily an asset is transformed into money or is available for immediate consumption (Lippman and McCall 1986). Cash is the most liquid asset because it can be consumed right away; stocks are less liquid than cash but more liquid than real estate. Liquidity can also be defined as the ability to trade a certain amount. The more shares available to be sold or bought at any given time to a certain price, the easier it is to transform the asset into money. If only a small volume is available, the market participants either have to turn to a different market place or accept volumes with a less favourable price (Castura et al. 2010).

Liquidity is a basic presumption needed for an efficient market place to function and will create a stable market place where spreads and volatility are low. Investors will turn to the marketplace where liquidity is the highest (Gårdängen 2005).

The study of Castura et al. (2010) also shows that HFT has a positive impact on liquidity. The liquidity of both NYSE-listed and NASDAQ-listed stocks reached historically high levels in 2010. They claim it is reasonable to assume the increase in liquidity can be explained by the increase of HFTs as no evidence can prove otherwise.

Biais et al. (2010) agree that HFT seems to be associated with higher trading volumes

according to earlier empirical work. Liquidity can be defined as being able to conduct transaction immediately, which is pointed out as not necessarily being equal to large volumes. He claims it would be a hasty conclusion to say HFT contributes with more liquidity because the volumes could be hollow and not always be available to traders.

Gomber et al. (2011) finds that a common strategy of HFTs is to provide liquidity. They do this to earn the spread between bid and ask limits and by providing the liquidity they get reduced transaction fees or similar compensation for the increased market quality and attractiveness.

Biais et al. (2010) are some of few to address HFT from a different, than above mentioned, approach. In their study they highlighted some of the negative externalities caused by HFT. An increase in HFT enhances liquidity thus it makes it easier to find a trading counterparty, which raises trading volume and gains from trade. On the other hand, because algorithmic traders can process information faster, asymmetries occur and cause adverse selection costs for slow traders. A too high level of HFT will exclude slow traders from the market and ultimately reduce the overall volume and gains from trade. Systematic and operational risk was not considered in this paper but the authors point out that there is a need for further investigation of this.

2.6. Bid-Ask Spread

A liquid market generally results in a narrower spread. The spread of a stock is the difference between the bid and ask price. An investor wanting to sell a stock immediately might agree to the bid price and accept a loss on the spread, therefore spreads are a cost to trading (Castura et al. 2010). Gårdängen (2005) hence claims a small spread is preferred because it means stocks can be sold quickly without the seller losing too much money – it makes the market more liquid.

The spread is also affected by the tick size as smaller tick sizes generally give smaller spreads (Ahn et al. 1995). The price of a share is not completely liquid but moves in small ticks, called tick size. That means if a share has a tick size of 0.50 SEK the price cannot fluctuate with less than 0.50 SEK per tick. Different shares have different tick sizes.

Previous studies made on AT seem to agree on algorithmic traders having major speed advantages over human traders. This means that they can process information about fundamental values faster and thus speed up the price discovery process and reduce spreads. Using data from the Deutsche Boerse, Hendershott and Riordan (2011) came to the conclusion that AT contributes to more efficient pricing. Algorithmic traders monitor the market strategically to discover price differences and have the ability to quickly buy when prices are low and sell when prices are high.

The same results have generally been reached in studies regarding HFT exclusively. Biais and Woolley (2011) claim informational efficiency is improved by HFT. The price discovery process is enhanced as HFTrs can process information faster and better.

Castura et al. (2010) show in their study on the U.S. equity market that HFT have contributed to a more efficient market with tighter spreads and an improved price discovery process. They claim the total cost of trading has decreased due to the reduced spreads, which is beneficial to all investors.

The introduction of MiFID within the EU has promoted competition between different market places and thus created a fragmentation of equity markets. According to Biais et al. (2010) algorithms significantly enhance the efficiency of locating good trading opportunities among the different markets.

3. Method

This section aims to explain and motivate the method used for this thesis. The selection of interviewees and their relevance for this subject will also be discussed as well as the quality of the study.

3.1. Interviews

“An interview designed to obtain descriptions of the interviewee’s life world, in order to interpret and understand the described phenomena.” (Kvale 1997, p. 13)

The new technology of HFT has during the last couple of years grown stronger and is today better known, even though it still is a very unexplored topic. To be able to capture the subjective opinions and beliefs of Swedish actors on the financial market we have chosen to execute a series of interviews. It is found to be the best way to gather the most recent information about a subject where prerequisites and opinions change constantly. Thereby taking a qualitative approach as opposed to a quantitative.

The gains of performing interviews come from the idea of interacting with the interviewees as opposed to conducting a survey where the respondent answers to specific questions limited by options and space. Semi-structured interviews have been chosen for the thesis because it allows the interviewees to express and develop thoughts by his own wishes. Thereby room is given for answers that may not be expected as in a regular survey.

To facilitate the interviews and to be able to steer them in the right direction an interview guide has been used during the interviews (see Appendix 1). All questions in the guide have not necessarily been asked but have rather been used as suggestions to keep the conversation flowing. This guide is built up on the different issues related to in previous research and the interviews have revolved around these. However the guide has only been used to the extent it gives a similar structure to the interviews and we have encouraged respondents to speak freely.

Interviews also allows for an understanding of the problem and not only looking at the frequency of an answer. By performing interviews the source of the difference can be

identified and not only how often the difference might occur (Esaiasson et al. 2007).

Attention has been paid to the fact that respondents are subjective and that their answers may not be taken for facts. Interesting is how the answers in the interviews correlate with already published and known research. Even more interesting is if the interviews were to point out something that the research not yet has.

3.2. Design of the interview guide

As mentioned in the introduction, this thesis focuses on the issues of HFT regarding volatility, liquidity and bid-ask spread. When designing the interview guide these subjects naturally formed the framework. To prepare for any occurring situation during the interviews an additional set of questions was also primed. Important to bring in to the following paragraphs is that the interview guide was only used as a tool to steer the interviews in the right direction, and not as a strict questionnaire. See Appendix 1 for full interview guide.

To gain information about the interviewees and their background, some introductory questions were first posed. This gives the reader an idea of why the respondents are of relevance to the study. Together with previous knowledge, this information is presented in the following section “Selection of the interviewees”.

Furthermore questions about the concept of HFT were asked. Partly because it was found necessary to make sure the interviewees had an understanding of the concept and the difference from AT but also to capture their general knowledge and opinion.

The questions about HFT regarding volatility, liquidity and bid-ask spread has mainly taken its starting point in the theoretical framework and the media debate. Volatility, for example, has been claimed by the media to cause excess volatility whereas previous research mainly claims the opposite. Questions on the perceived effect have therefore been asked. All these subjects naturally led to a number of follow-up questions changing from interview to interview.

To get as broad picture as possible, an additional number of possible concerns were also written down in the interview guide. Several of these have previously been highlighted in the media debate and served as finishing questions to sum up the interviews.

3.3. Selection of Interviewees

To conduct this study, a number of interviewees have been chosen that all have a relation to the Swedish financial market in some major way. What they all have in common is a good insight on the mechanisms of the financial market. Since the aim is to capture as many different opinions of the issues as possible, a broad spectrum of actors have been selected where both small and big actors have been captured as well as actors with different strategies. To give yet another perspective one interview has also been preformed with a person representing the supervisory body Finansinspektionen.

A total of six interviews have been preformed which has been judged sufficient as many different opinions ranging from very positive to very negative have been captured. Neutral actors have also been found. To give yet another perspective one interview has also been preformed with a person representing the supervisory body Finansinspektionen.

Due to anonymity requests from the majority of the respondents they will from now on be referred to as Individual 1, Individual 2, etcetera. To still be able to argue why the respondent are relevant to this study the following descriptions of the interviewees have been made:

Individual 1

Individual 1 has a long experience from trading, both as head of equities and head of trading at major institutions and as founder and associate of a pension fund. Individual 1 also has an academic career within finance.

Individual 2

Individual 2 has been active in the equity business for over 25 years, working as a broker, fund commissioner and analyst. He currently holds a position as CEO at a smaller asset management company.

Individual 3

Individual 3 has a PhD in financial economy and is the founder and CEO of a smaller fund company. Individual 3 has been professionally active since 2009 but has over 20 years of private experience from the equity market.

Individual 4

Individual 4 currently works as chief technology officer at one of the major Swedish banks, which means he is responsible for the production of algorithms. The Stockholm Stock Exchange previously employed him since 1987.

Individual 5

Individual 5 has long experience as a stockbroker but currently works as an asset manager for a relatively large fund management company. The company has an explicit long-term strategy.

Individual 6

Individual 6 currently works for the supervisory body Finansinspektionen (FI) where he is specialized in the investigation of HFT.

3.4. Validity and Reliability

Validity and reliability are important components used to decide the quality of a study. The validity tells how well the chosen method serves its purpose of measuring what it was intended to and reliability tells to what extent the result would be the same if the study were to be repeated by someone else (Esaïasson et al. 2007).

The use of in-depth interviews is undisputedly an appropriate method to outline subjective opinions on high frequency trading. More relevant is rather to discuss the number of interviews, the choice of respondents, how the interviews were conducted and the types of questions.

The initial aim was to perform eight interviews. However, as experiencing saturation in answers after about five interviews it was found unnecessary to continue much further. The limited time perspective was also a factor when deciding to settle with six interviews. The interviews so far had already given plenty of empirics to process. There is a slight chance a few more opinions could have been captured with more interviews, but it was judged unlikely since answers so far covered a full spectrum ranging from very negative to very positive.

The choice of respondents is considered satisfying but it would have been interesting to also capture the other side of this phenomenon. The actors engaging in high frequency trading are very private and difficult to get a hold of. The ones actually responding did not have time to give any interviews. On the other hand would their answers most probably be quite predictable and it is unlikely they would say anything negative about their own businesses. But nevertheless, it would have been good for the study.

To perform interviews over the phone can possibly be argued to decrease reliability because information can be more difficult to interpret. Because of this, personal interviews were conducted to the extent possible. Of course difficult to judge, but limitations were not experienced due to lack of personal contact. Telephone interviews also have some advantages over personal interviews as they limit unconscious impact from the interviewer (Esaiasson et al. 2007). When it comes to Individual 6, neither a personal nor phone interview was possible. Instead questions were sent by email and written answers returned. This definitely lowers reliability since it hindered from following up on interesting points and get exhaustive answers but the alternative was not to include the person in the study at all and it was therefore considered the best option.

As mentioned earlier the reliability of a study is high if it were to be repeated and still generate the same result. The recording of all interviews allowed us to go back and listen again allowing a more correct interpretation of the information. If someone were to listen to the interviews the result would positively be the same. Important to mention is however that due to the uncertainty and fast growth of this phenomenon, opinions might change quickly. This is something we cannot not remedy, only consider.

4. Empirical Results

This section will present all the qualitative information gained from preformed interviews. The empirical result has not been reported interview by interview; instead answers have been divided between into the topics of discussion.

4.1 Difference between AT and HFT

There are different ways to make use of algorithms in the equity market and the interviewees highlight the importance of separating different strategies. The following definitions of AT have been identified:

“Algorithmic trading is trade where orders are generated by an electronic system based on predetermined instructions and parameters” (Individual 6 2011-12-23).

“Trading in which buy or sell orders of a defined quantity are determined by a quantitative model that automatically generates the timing of order and the size of orders based on goals specified by the parameters and constraints of the algorithm” (Individual 4 2011-12-12).

Individual 1 says AT is very common and many participants on the equity market use algorithms for their trading. Individual 2 agrees and says the algorithmic trading is here to stay which cause no problems as long as it is not abused.

High Frequency trading, a sort of algorithmic trading, on the other hand uses advanced hard and software to achieve fastest possible order entry and execution. The purpose is to conduct trading strategies that utilize mispricing or other inefficiencies existing under extremely short periods of time. HFT is characterized by the absence of fundamental analysis and that it generally results in high order intensity (Individual 6). Individual 4 characterize HFT by actors who exploit arbitrage opportunities by using extremely fast systems and co-location services. An important feature is also proprietary trading.

Individual 2 emphasizes that problems occur when these actors are a little bit faster and try to sabotage for others. The HFTs monitor certain actors and tries to recognize patterns,

which allows them to sell before the other actors who instead have to settle for a lower price.

4.2. Volatility

In the discussion of HFT causing excessive volatility the last year, individual 6 says that it all depends on what year we are comparing with. Today's volatility is no worse than under any other financial crisis. From FI's experience of monitoring the market and performing interviews, HFT help decrease volatility under normal market conditions and may increase the volatility during excessive volatility. However, since the research on the Swedish market is limited there is no evidence for this being the truth.

Individual 6 does say that a perceived change in volatility may lead to a change in attitude to risk and hence also a change in the risk premium. However with the background of the fall of 2008 he think such changes are not likely.

Individual 6 also states that the volatility may differ depending on measures of day-to-day or intraday volatility. HFTs does not have any big net positions from day-to-day which makes it hard to see if the volatility is affected based on closing prices. In terms of intraday volatility individual 6 thinks that the volatility would be smaller nowadays (if measured) because of the amount of trades made at very small price differences. The question is though if it does matter, if the traded volumes are very small and too fast for a human trader. So the perceived volatility is certainly higher than earlier.

That the volatility is not much higher today than before is something individual 4 agrees on. As example, the volatility experienced during the crash of Lehman Brothers was in fact a lot higher than the volatility today. In media the volatility we saw in August was said to be extremely high but that is just a myth, compared to the number we saw in 2008. And we still had the HFT firms back then, but at that time they were not as exposed as they are today. Something interesting is however the number of orders placed during August 2011. That number was extreme, as well as the life span of an order. Today an order may be placed and withdrawn in just a couple of milliseconds.

This change of market prerequisites is forcing market participants to make big investments to be able to compete at these levels. The technique needed to control and process all the

information as fast as possible comes with very large investments under many years. Thanks to investments we have made the recent years, we did not experience any problems in august but other actors may have had difficulties (Individual 4).

That today's volatility would come from HFT is nonsense, it is clear that it is macroeconomic factors that make the market volatile and a good example would be the crisis in Greece and within the European Monetary Union (individual 1). Individual 5 agrees and says it is important to acknowledge that the big macroeconomic issues faced today have a major impact. Whether HFT intensifies this volatility is difficult to say. Using long-term investment strategies gives the opportunity to set own terms and not play at the terms of the market. Volatility has little significance to us because we are able to wait until we receive the price we want (Individual 5).

A common critique in terms of volatility and HFT is the possibility of HFT algorithms withdrawing their orders and thereby also the liquidity on the market if excessive volatility is perceived (individual 3). Sometimes there are movements on the market we cannot explain and if the market is volatile it is hard to say it is caused by HFT. In the last couple of months HFT have been taking a lot of the blame for movements in the market that might actually be explained by big actors buying or selling large posts of shares (individual 3).

HFT might not cause volatility itself but the strategies used may intensify price differences. However, since they do not have any net positions over the night, the day-to-day volatility is not much affected (individual 2).

4.3.Liquidity

There are clearly different points of views among the interviewees when it comes to liquidity. Some think HFT promotes liquidity while others think it erodes the liquidity.

Individual 6 states he is convinced HFT provides liquidity to the market due to the way they act as a "maker" and have their special place in a trade. However there is another question of how good the quality of this liquidity really is. As an example many HFT firms are providing liquidity to already liquid stocks and further the liquidity may be perceived as volatile. Many actors on the market have expressed concerns of an "illusion of liquidity" that they never are able to trade on. This is however when they trade with the help of best

execution on many markets, and that is when the liquidity subsides. At other times the speed of today's market is just too fast for trading manually.

Individual 6 has also in his supervisory role talked to a number of the HFT firm in Sweden. They claim to mainly provide liquidity for other computers but not for humans. The part of AT that is not HFT could use their algorithm to take advantage of this volatile liquidity.

Individual 4 experiences that it is today harder to find buyers and sellers in an order book than that it was 2-3 years ago. He says it depends on the liquidity being smaller in the order books than before, but he also underlines the importance of other reasons. Like macroeconomic factors that today are very uncertain and makes a lot of investors unsecure and cautious.

Some of the changes Nasdaq OMX have made with the change of tick size, as well as offering HFT firms DMA (direct market access) are the reasons for increased liquidity (Individual 1).

Individual 5 claims not to have a stake in whether the market offers liquidity or not, due to their strategy of making long-term investments. When looking for an investment for our portfolio, corporations are analysed to the core and how much we are willing to pay for a share is based upon that, says Individual 5. We have the possibility to wait and if the market is more or less liquid we just had to adjust to current market conditions. Neither are we concerned about available volumes, especially as we mostly invest in large-cap stocks where liquidity is always good anyway. In other words, there is a big difference of making long-term investments and trying to make quick money (individual 5).

Even though it is not to our concern, changes in liquidity have been noticed. It is clear that the number of orders have increased, both on the stock market as well as in order books. Our traders experience a lot of orders to be withdrawn from the market but if it is manipulation or added liquidity is very hard to say (individual 5).

Individual 3 experiences the presence of HFT to add liquidity and facilitate the finding of buyers and sellers. 9 out of 10 times it is better to have the computers present. And we want liquidity in the marketplace when we want to invest. The magnitude of the computers

impact is seen when working in the order books. The main criticism of HFT is due to their games of placing and withdrawing orders. It looks like a pinball ball game with the volumes flying up and down and what we see is not really something we can trade on (Individual 3).

Regardless of what proponents say, Individual 2 claims HFT to reduce liquidity. He gives an example of how he tried to buy a stock for the price of 100SEK per share. As soon as he started buying, computers used their advantage of speed to “steal” the order right in front of him. Ultimately he ended up not getting the volume initially asked for. This demonstrates how the liquidity talked about among proponents is in fact just an illusion (Individual 2).

To solve the illusion of liquidity market participants have started to go outside the regular market and in fact go back two decades in time and pick up the phone. By doing so they may avoid the “fake” liquidity and still buy and sell their stock, in dark pools. Even though there is a bigger risk involved, firms have started turning to these dark pools (Individual 2).

4.3.1. Dark pools

Lately there has been an emergence of so-called dark pools where traders directly can turn to find a counter part. This kind of trading grows faster than the HFT today (Individual 1).

Individual 2 says the emergence of dark pools is a negative side effect of HFT because it undermines transparency. Because robots are pushing prices on the stock market it is more profitable to turn to dark pools where it is possible to get a better price.

Individual 4 agrees to some extent and says transparency has been undermined because it is now more difficult to follow trades. Because they are connected to all dark pools it does not pose a problem for them, it does however require quite large investments. The share traded at dark pools is still relatively small, maybe 3-4 % of today's market but it will increase. According to many actors the liquidity is so thin at traditional markets, which makes it easier to trade on dark pools (Individual 4).

According to Individual 3 some volume moves to dark pools because spreads are too big on the stock market, which makes it difficult to get a reasonable price. You have to look outside the stock market to find a counter part to agree with and thereby, in the end, being able to

buy at the desired price. Because we are so small we do not experience this as a problem and I think it is unlikely the HFT would make this grow so much it becomes a problem says Individual 3.

Because trading in dark pools increases I think the brokers will have a new role in the future says Individual 5. The computers can never completely outcompete humans because there will always be large shareholdings that need to be mediated. We do not see the emergence of dark pools as a problem. If it were to be proved that prices were manipulated it would of course not be good for anyone but that is not something we have experienced (Individual 5).

4.4. Bid-ask Spread

Everyone agrees upon that elimination of tick sizes leads to reduced spreads. Further effects and who gains from it can however be discussed. When Nasdaq purchased The Stockholm Stock Exchange they made some fundamental changes. The first alteration made it possible to trade with single shares instead of blocks of shares and the second was the removal of tick sizes.

According to Individual 2, this was a well-conceived plan to make way for the high frequency trading. He claims most actors on the stock market did not realize this would impede the work of the traders but be a prerequisite for the HFTs to make money. This contradicts Individual 1 who says the reason the tick sized has been reduced is because of the liquidity has increased.

Individual 2 further claims Nasdaq has a lot to gain from an increase in HFT. They not only make money per transaction but also on co-location. HFTs stands for a great majority of all orders and if these actors were to disappear the profitability of Nasdaq would decline drastically.

Individual 3 addresses the issue from a different approach. He too claims reduced tick sizes definitely benefits HFTs because it reduces spreads but it is important to remember that it is beneficial to other actors too. "Smaller tick sizes are a great advantage to us because the smaller the tick size, the smaller the spread which means a lower cost for conducting

transactions. Commission is not the main cost for us, it is the spread” (Individual 3 2011-12-12).

Individual 4 who says it is impossible to determine the optimal tick size takes a more neutral stand. A retail client prefers small tick sizes because it reduces spreads but it also reduces the value of the order book, which is bad for bigger investors. Individual 4 says they cannot even decide for themselves what is better because of the conflicts of interests. There are wishes to both maximizing transparency and minimizing the risk of front running and these two are not compatible. Market structure is extremely complex, especially in such a fragmented market. HFTs might prefer smaller tick sizes but who is to decide what is better?

Individual 5 too has a neutral stand and claims the tick size and spread does not matter much to them because they trade on such a long perspective. They mostly trade in liquid companies where spreads are smaller anyway. Individual 6 also lists pros and cons with tick sizes. He agrees with Individual 3 that the removal indirect reduces transaction costs, but only when it comes to the execution of smaller orders. The negative side of the issue is that the value of a smaller spread is very limited due to the much smaller volumes it leads to. This generally means higher transactions costs for executing larger orders, and it takes more time. Another aspect is the constant change in prices with complicates manual trading.

According to Individual 6 many actors request a slightly higher tick size. Individual 2 who say reintroduction of a higher tick sizes would be an easy way to limit HFT confirms this. Individual 1 would not be surprised if this were to happen even if he does not support the suggestion. He claims the institutions have not yet accepted the development in this area.

A common stand all the interviewees take is that the removal of tick sizes that Nasdaq introduced when they bought the Stockholm Stock Exchange has triggered the rise of HFTs. A lower tick size reduces spreads and makes it possible for algorithms to place orders on more ticks and thereby they get the opportunity to make money.

4.5 Other Concerns

In addition to the above mentioned issues regarding volatility, liquidity and spread interviewees have highlighted some other concerns regarding the recent increase in HFT. Among other things HFT is accused to have caused traders to lose their jobs. There has been a discussion whether or not computers are taking over the work of humans.

4.5.1. MiFID

What several of the interviewees also point out is the introduction of MiFID as a reason for the increased usage of algorithms in general.

Individual 1 claims the introduction of MiFID and best execution is the reason the usage of algorithms has accelerated the last 3-4 years. Due to the resulting fragmentation it is now impossible for one single human to keep track of current state of all markets at the same time. Algorithms are a necessity in order to achieve best execution and almost all institutions use them.

The number of transactions has increased significantly, with a culmination in August this year. Ours did, but most systems were not able to follow. I think many actors want an explanation to this, says Individual 4. He says it is important to point out that not only the high frequency trading is behind this but also the introduction of MiFID and the followed fragmentation. About 70 % of the trading of Swedish securities happens at the Stockholm Stock Exchange; the rest is spread out at other market places. In the next step however, the introduction of MiFID has definitely led to an increase in the amount of HFTs.

MiFID was not a bad decision but I don't think the wished for effects have been achieved, Individual 4 continues. The original thought was to encourage competition because the previous stock market monopoly was not preferable. Three to four years ago there were numerous investors, many middle hands but only one market. Today the same amount of investors can operate on several market places but because economies of scale the middle hands will eventually be eliminated. I do not think that was the original intention of MiFID.

4.5.2. Structural Change

The role of the broker or trader was 10 years ago to prepare orders for clients and they were very well paid for it. Today algorithms can preform the same job but much faster and

in many cases better. So of course human traders are outcompeted by computers (Individual 3). Individual 1 agrees and says there is no chance a human can compete with the speed and multitasking of a computer. The hot debate about HFT has definitely arisen because people lost their jobs (Individual 1). We have already seen signs of traditional brokers being excluded from the market, partially due to the macroeconomic conditions but also as a consequence of the increased HFT. Stockbroking and many types of trading will face a hard time to compete in this technically advanced high frequency environment. Margins have moved to HFTrs but also to end customers. As profitability decreases within the traditional trading areas, cuts are also made in other division. HFTrs do not provide services like analyses and liquidity guarantees and therefore the quality of the market is put at risk (Individual 6).

People in the business constantly lose their jobs, says Individual 2. Mainly broker colleges, but Swedbank also got rid of 10 analysts last week. If it were not for HFT, these drastic cuts would not have been necessary. Broker divisions have been closed down, as they no longer are profitable. In the end, only banks will provide this service, which is unfortunate as the diversity goes lost (Individual 2).

The other opinions that were presented was that computers can never completely overtake the role of human traders because there will always be a need to mediate large share holdings. I think the brokers will find themselves in new positions in a near future, says Individual 5. Because the difficulty of trading large volumes at the stock market they will have to turn to dark pools to find trading partners. Functions that has little value, such as placing orders, has already disappeared due to the rise of Internet trading and algorithms (Individual 5).

4.5.3. Risks

When humans to a smaller and smaller extent execute trading orders and the usage of computers algorithms increases, a discussion of new risks naturally came up.

It is important to remember that this is really advanced computers and algorithms we are dealing with, and sometimes things go wrong. A good example is an algorithm owned by Morgan Stanley, that a while back started to buy and sell extremely much by itself and for a while was out of control. The persons that are building these algorithms are extremely

bright people, but after all human and can not predict everything and in combination of today's market being in a constant change a lot can happen in 6 months. And that is something that is really easy forgotten. (Individual 3)

The risk of algorithms failing because of human error is something we have seen before, that itself does not provide especially big risk for non other than the actor itself. However there is a counterpart risk when you do not know whom you are trading with. A risk that we do not take into consideration, but there is no way to know who is behind the order, Swedish or foreign, it is just a black box. Something that is interesting is however the strategies algorithms are using; we have seen day-traders being sentenced for using the same strategies that algorithms are using today (individual 2).

The risk of the so-called flash crashes is not something that we have to be worried about. The computers are mainly trading with themselves anyway. But since there is almost no cost of placing an order this is not so weird. Off course algorithms will place as many orders as necessary to earn money. And this has also lead to a lower spread and better liquidity. The phenomena of dark pools have however occurred and will probably grow a lot in upcoming time; probably more than the HFT itself (individual 1).

What may be seen as a risk and as a problem is the complexity between minimizing the risk of front running and at the same time maximizes the transparency of the market. We cannot put our name on ticks without exposing us for the risk of front running, as goes for other actors as well. The risk we see here is that of a potential regulation might move the trade to another market or another land. We saw an example of that during the 90's when a transaction tax was introduced and most of the trade moved to London. The only regulation we see could work would be from the EU level (individual 4).

4.5.4. Co-location

Speed is one of the fundamental requirements for HFT to function and every millisecond matters in the quest for arbitrage opportunities. Nasdaq allows market participants to put their trading systems in its basement in order to minimize the distance. Individual 2 identifies this as a major problem. According to him, this makes it possible for HFTs to act much faster than other market participants. He says, as far as he knows has no serious, well-

established player paid their way in so far. To have to pay to get access to the stock market seems insane.

Because of the development in the U.S. with the increased volumes, Individual 4 says they predicted the same development in Europe due to the fragmentation. Therefore they co-located and now keep servers in the Nasdaq basement. Individual 5 says they have no opinion on the matter because it does not affect them but adds that actors obviously should be able to compete on equal terms.

Finansinspektionen does not consider co-location as a bad thing. Individual 6 says it is positive as long as it is on equal terms. The entry barriers are low enough to also allow smaller participants to rent space. In countries where co-location is prohibited, financially strong actors buy the land closest to the stock market and thereby gain far more advantages.

4.5.5. Regulations

Whether or not the emergency of HFT requires some kind of regulations or not have also been discussed by the interviewees.

Individual 3 says it is good that the HFTs contribute with liquidity but the fact that these actors completely can withdraw their volumes and change the prerequisites of the market is not good. He says: I have previously been against this myself but now thinks a small cost for placing an order would be suitable. I am only interested in making sharp deals and do not have time to play with robots who constantly pull back orders to find arbitrage opportunities. I want to be able to follow through with the placed orders. Even a very small cost for placing an order would in the long run cut profitability if 19 out of 20 orders were pulled back (Individual 3).

What is important to remember however is that an actor cannot be discriminated just because a computer places the order as long as the intention is to actually see through the deal. Only functions that lead to such extreme market imperfections that they compromise the basic thought of the market should be removed (Individual 3).

Individual 2 believes some kind of regulation will be imposed, probably a turnover tax. What is feared the most is that the tax will be imposed in the rest of EU with Sweden standing outside. That would cause every robot in Europe to turn to the Stockholm Stock Exchange. Individual 4 also points out that if a regulation were to be imposed in Sweden all trade would move abroad and that is not good either.

Individual 5 is neutral when it comes to regulations. She says it is good the market is being supervised by Finansinspektionen but there is no recipe for how they should act. The stock market is supposed to be a place where all should be able to act on equal terms and receive the same information. To supervise and make sure this is the case is important.

Individual 1 thinks that when it comes to regulations the most important part is that the costs caused by HFT due to extra capacity requirements should be born by the HFTrs. Market supervision is of less importance. These are professionals trading with each other and they should accept the game.

4.6. Summarised opinions

The opinions on HFT differ significantly and this sections aims to give a final comment about the interviewees overall opinions.

Individual 1 do not see the HFT as a major problem but says the problem is rather that not all actors have gotten used to the new order. Trading is no longer as profitable and this debate has emerged because smaller margins cause companies to make cutbacks.

Individual 2 is very critical towards the HFTrs who he claims manipulates stock prices and give a false picture of the liquidity. He is also critical towards Nasdaq and how they have, according to him, made way for the HFT. This has caused a drastic decrease in profitability and a lot of people lose theirs jobs because brokerage departments are being shut down.

Individual 3 is a proponent of HFT since it contributes with liquidity but is somewhat sceptical when it comes to the large number of orders that is never seen through. He says the stock market is a place where everybody is out to make as much money as possible and there will always be new ways of doing so even if the regulatory was to change. The debate is not to be taken too seriously; the media is trying to make it bigger than it is. It would be a

shame if people because of this became too afraid to act on the stock market and the nice development we have seen the last 20 years would go lost. The stock market exists because companies need capital therefore fair pricing is the most important thing.

Individual 4 claims to be agnostic regarding HFT. He says he cannot think the phenomenon is good or bad but only adjust to the present situation. He believes HFTs increase liquidity and the competition between the markets but it cannot be prohibited or regulated as long as no facts are determined. He says they have made several large investments to cope with this development and it is understandable if smaller actors are concerned if they cannot keep up with the investment rate. Everyone has to make investments, problems will occur for the ones that have not made any.

Individual 5 has a neutral attitude towards HFT. Because they trade on such long term they have not been affected by the recent development and neither are they concerned about a future increase. If it were to be proven that prices are being manipulated it is of course a problem but as long as that is not the case you can only try to adjust to the situation.

Individual 6 thinks the increase in HFT is a natural development due to the constant wish of always being the fastest. There will of course be consequences where some segments will be outcompeted. It would be good for the industry to clarify exactly what technical and informational benefits can be bought. Low entry barriers are a requirement to ensure fair competition which today might not be the case. There is still room for further evaluation but in many aspects the equity market is fairer now than ever.

5. Analysis

By using the theoretical framework as a starting point this sections aims to analyse the empirical result retrieved from performed interviews. The analysis will form the basis for the final conclusions.

5.1. HFT versus AT

The previous research only to a smaller extent highlights the importance of separating HFT from AT. Results from the interviews however stress the significance of this. Interviewees claim almost all actors on the stock markets make use of algorithms but there are only a few actors using the strategies of HFT. This can be interpreted as a wish not to be connected to HFT even though algorithms are used frequently used by many of the interviewees. The individuals see the development of AT as natural and do not have anything against the usage of them for regular trading purposes.

The empiric result show that the definitions of HFT in relation to AT however is consistent with the definition mentioned in previous research which shows the individuals are well aware of the phenomenon and base their arguments from the same starting point.

5.2. Volatility

HFT has in media been blamed to cause excess volatility in the financial market. The majority of previous research has not been able to prove HFT to have any affect on volatility and some studies have even showed it to have a stabilizing effect. Actors on the Swedish financial market do not in general blame volatility on HFT. It is pointed out that today's volatility is not unusually high for the current economic situation and can be explained perfectly by macroeconomic events. The reasons for high volatility are many: lowered credit ratings, EMU crisis, the financial crisis and its aftershocks of 2008 among the more intense examples.

In August 2011, when HFT was claimed to have its breakthrough in Sweden, the volatility on financial markets was recorded to be higher than normal. This may or may not be a coincidence but important to remember is the many macroeconomic news affecting the financial market at that time. Little evidence indicates a relation between high volatility and the increase in HFT. After a year of poor economic development, it is easy to try to find a

scapegoat and due to the uncertainty of the effects brought by HFT, it is easy to appoint HFT as the villain causing volatility.

What some of the interviewees however underline is that intraday volatility may differ extremely and that this may be a result of HFTrs withdrawing their orders and therefore intensifying the changes in the market and the price. Little of the previous research has taken this into consideration, as it does not cause the volatility to change from day to day. HFTrs do not hold big net position overnight and days usually start and finish at zero.

It cannot be concluded from this study that the claimed increased intraday volatility is a case of stock price manipulation or market abuse. According to the efficient market hypothesis, the price of a share should reflect all available information and the value of the company. It does seem highly unlikely that the value of a company would fluctuate so much over a day and then return to the original position.

Since the day-to-day volatility is not affected by HFT there is no reason for private investors, or an investor with a longer-term perspective, to flee the market. Another important aspect in this matter is the strategy used when trading. The holding intervals of a stock today is for average far shorter than some years ago and that leads us to understand there is more speculation and trading on the market than before. But with a long-term investment strategy there is no need to even care about the HFTrs. Individual 5 repeats the essence of their long-term investment strategies and explains how they do not have to take the HFTrs into account.

Up for discussion have also been events where technical difficulties have caused extreme intraday volatility in the financial market. The May 6th Flash Crash is an example of when HFT has been accused of causing this. Previous research has however been unable to prove HFT to have triggered the Flash Crash. The perception among interviewees is that there is always a possibility for errors and if HFTrs make a mistake it generally only brings costs to themselves.

There is always a human factor, even behind algorithms, and mistakes can always be made. The speed and anonymity of HFT is however problematic in such events. A human probably

discovers an error quicker and can remedy the problem before it goes too far whereas an algorithm, which can make thousands of trades in just a minute, quickly has the ability to cause an avalanche-like reaction. Even if an error only brings costs to the actor itself, such an event can have discouraging effects on other market participants and compromise their trust for the market. If actors start withdrawing from the stock market it reduces liquidity and the efficiency of the market.

5.3. Liquidity

Whether or not HFT contributes with liquidity is disputed, both in previous research and in the empirical result of this study.

Depending on how the concept is defined HFT can be said to provide liquidity to the equity market. Theory says an asset is liquid if there are many sellers and buyers and therefore immediately can be transformed into money. HFT increases both the number of sellers and buyers and the HFTs place tons of orders. However, the empiric claim the liquidity to be thin as only a fraction of the orders are carried out. Many orders are withdrawn as soon as investors start buying and are thereafter only available to a higher price. This makes it difficult to trade larger volumes.

Individual 4, representing a large market participant, witness about this. He says it is more difficult to find buyers and sellers today than it was 3-4 years ago. Individual 3, being a smaller participant do not experience the same problem and claims HFT increases liquidity. Depending on what position an actor holds on the market, HFT's contribution to liquidity is perceived differently. All interviewees have noticed the large number of orders being withdrawn, but not all of them are affected by it.

The increase in order entries and liquidity puts a higher pressure on market systems. To cope with higher flows the capacity has to be expanded thus creates costs for investments. The question is who should bear these costs? The actual increase in liquidity is favourable to everyone but the withdrawn are not. There is a risk the costs for expanded capacity will result in an overall increased cost of trading even though the capacity is only needed because of a small number of HFTs. If costs are increased it might no longer be profitable for smaller investors to trade with stocks. But by particularly looking at the order entries (that later are withdrawn) and the impact that has on the systems, when no actors really

have requested such a change we find it clear that these are the actors that should bear such a cost.

What may be neglected in this development of high frequency technology, that requires large amount capacity, is the focus of safety and transparency on the market. If this is overlooked the market is risking harming its investors.

This can be interpreted as a thin order book rather being an issue for larger participants trading larger volumes. This also rules out HFT being a problem for smaller and private investors regarding liquidity in the short run. In the long run however, this might cause a problem due to the emergence of dark pools.

5.3.1. Dark pools

According to the theory, if only small volumes are available, market participants either have to turn to a different market place or accept a lower price. The empirical result has proved this to happen in terms of dark pools. The interviewees claim the liquidity sometimes is so thin it becomes impossible to trade larger volumes at a reasonable price. Therefore they turn to dark pools to find an alternative trading partner. Again, the company represented by Individual 4 is already connected to all dark pools while the smaller actor, Individual 3, claim to be so small it is not yet necessary.

The emergence of dark pools can be connected to number of problems: Larger actors are the ones turning to dark pools because they cannot trade large volumes at the regular markets. If this were to escalate it would mean a significant loss of liquidity at the regular markets, the sort of liquidity that actually leads to trades not just orders placed and withdrawn. This is a negative consequence to all other market participants. Thinner liquidity means larger spreads, and according to the theory, larger costs.

The interviewees do not express great concerns regarding dark pools but Individual 4 claims it is yet relatively small. According to Individual 1 is the phenomenon growing faster than HFT, which then potentially could pose a threat in the future.

The lack of transparency and the fact that they are not open to the public is also a problem. Neither of the markets will be fully efficient if information is unavailable for some

participants and prices might therefore not be ideal and reflect the actual stock value of the company. Another problem caused by undermined transparency is the inability to prevent market abuse. Regular stock markets work actively to prevent abuse and report any discoveries to Finansinspektionen but there are no such functions in dark pools.

5.3.2. Increased cost and reduced profitability

When liquidity is thin, theory says the alternative to dark pools is to settle for a less favourable price. Because trading at the stock market is a zero-sum game this is how the HFTs make profit, but it also means there is a losing side. The increase of HFT has therefore lead to increased trading costs hence reduced profitability for trading institutions.

According to the empirics, many institutions have been forced to close down trading and stock broking divisions due to decreasing profitability and many traders and brokers have lost their jobs. Whether or not this is a consequence of the increase in HFT can however be discussed.

The increase of algorithms has most likely also had an affect on the employment in the industry. The development of AT has been on-going for several years and the interviewees all seem to agree on its benefits. AT has been a natural progress in the quest for cost efficiency and profit maximization. The Interviewees all agree upon algorithms' ability to preform the work of a human trader much more efficient.

It is easy to forget the volatile macro economy and the hard years experienced since the financial crisis of 2008. Factors as profitability and unemployment are central to the insecurity seen in financial market lately. While people are losing their jobs, their income is affected, hence their ability to consume and invest. This finally comes down to a very insecure market for companies as well as for individuals.

What is clear and gives a good explanation of the closing down of trading divisions is in fact the movement of the margins, just as some of the interviewees point out. Instead of human trader performing their classic work, algorithms today do it for them. Resulting in them no longer being needed. Hench, when banks and financial institutions no longer have any use of their traders and analysts there is a natural choice to let them go. Leaving a lot of unemployed workers. This may also be an explanation to the intensified debate of HFT.

5.3.3. Co-location

The issue of co-location has also been raised in the empirics. Individual 2 points out that Nasdaq OMX rents out space for the servers of HFTs to minimize their distance to the market in order to further speed up transactions. This can be seen as a way for Nasdaq OMX to try to create advantages for HFTs.

Co-location is profitable for Nasdaq in two ways: by rental income and by assuring liquidity on their market. This does however not necessarily have to be a negative aspect for other actors. First of all, co-location is apparently not only for HFTs as Individual 4 claims the company he represents also is co-located. Second of all, it can be seen as a way to give all actors equal opportunities.

We agree with Individual 6 who claims co-location is good as long as entry barriers are low enough for anyone to rent a space. If co-location were illegal, capital strong actors would probably instead buy up land surrounding the stock market, thus creating far more advantages.

For the market to function efficiently it is important that all participants can compete on equal terms. As long as Nasdaq does not raise rental costs, excluding certain actors, co-location is not to be seen as a problem.

5.4. Bid-ask Spread

Previous research states that HFT leads to better price discovery where price equilibrium is reached faster hence narrows spreads. Swedish actors experience spreads to have become smaller but rather point out that certain conditions have made this possible. No one explicitly says HFT has led to narrower spreads and Individual 3 says the emergency of dark pools is a result of larger spreads caused by HFT.

The change in tick sizes introduced by Nasdaq OMX leads according to the theory to reduced spreads. This can be identified as the underlying variable affecting spreads. The interviewees believe this change has led to an increase in HFT as it opens up opportunities for HFTs to make use of arbitrage strategies.

Individual 2 claims Nasdaq introduced this change as part of a plan to open up possibilities for HFT as Nasdaq profits from each trade made. This might very well be true but it is easy to forget that Nasdaq OMX is a privately owned company. Nasdaq is easily seen as an institution controlled by the government and not a company with the ambition to make a profit. Important to consider is also the possibility of this change being a necessity due to the fragmentation of market places.

5.4.1. MiFID and Market Fragmentation

The objective of MiFID was to encourage competition in the financial market and ultimately reduce costs. In Sweden this has resulted in a fragmentation of market places. Nasdaq does today find itself in a highly competitive environment where they have to compete for the volumes. With completely homogenous products the only possibility of differentiation is through price and services.

According to the theory large spreads are a cost of trading. Due to fierce competition is Nasdaq OMX forced to cut transaction costs. Reduction of tick sizes is a way to narrow spreads hence minimizing the cost of trading.

Nasdaq has a competitive advantage in being the “traditional” market where most trades are made. As mentioned, they should also be able to differentiate themselves with services and provide a safe and qualitative market place. Constantly focusing on cost reduction might lead to cuts in areas as supervision and the prevention of market abuse, ultimately leading to undermined trust. If the trust is reduced, actors might choose not to invest in the equity market. The problem with MiFID and “best execution” is the focus on low costs and short investment perspective. Working as an agent, traders are due to “best execution” forced to trade where prices are the lowest. Therefore it is made impossible to provide better services instead of lower costs.

5.4.2. Regulations

Some of the interviewees request regulations to limit the progression of HFT but the issue is problematic. As the interviewees further pointed out, such a regulation cannot be implemented exclusively in one specific country or for one specific market venue. According to the efficient market theory are equal terms for competing market places a prerequisite for fair competition. If a regulation, such as a cost for each placed order were to be imposed it would have to be imposed to all connected markets. If introduced in only one market

place or in one country, the liquidity would immediately move to a more profitable venue. Due to best execution, traders are obliged to trade where prices are the most favourable within the EU. Because European markets are connected since the introduction of MiFID, regulations can only be imposed on European level.

Furthermore, if any regulation or some kind of ban of computer algorithms were to come in place it has to be based on actual research and facts. No discrimination of market participants can be tolerated just because orders are placed by computers and not by human traders.

6. Conclusions

With the ambitions throughout this study, to identify the issues regarding high frequency trading from the perspective of actors at the Swedish financial market, the following have been concluded from the analysis:

HFT is not perceived to have an impact on day-to-day volatility but to some extent on intraday volatility. An efficient market is based on prices fully reflecting all available information - the value of the company. The excessive volatility seen during one day is highly unlikely to represent the true value of the shares and therefore the market quality deteriorates. This has however little impact for market participants with investment perspectives longer than intraday.

It has been shown that high frequency trading provides liquidity to the stock market and facilitates the finding of sellers and buyers. Companies trading with larger volumes however experience the liquidity to be thin. Because orders placed by high frequency traders can be withdrawn within milliseconds it is found difficult to trade large volumes. The cost of trading hence rises. The alternative to increased trading costs is to turn to dark pools.

Actors at the Swedish financial market experience HFT to promote the emergence of trading at dark pools. This is today not seen as a major problem but would if it were to escalate. Because dark pools mainly attract larger participants, an increased dark pool trading would significantly reduce liquidity at the regular market places. Trading in dark pools also raises concerns regarding transparency and the exclusion of private investors.

HFT is further considered to speed up the price discovery process and reduce bid-ask spreads, reducing the cost of trading smaller volumes. The correlation between HFT and reduced spreads is also perceived as a result of reduced tick sizes. The changes introduced by Nasdaq OMX has made way for the HFT firms and can be seen as necessary to be able to compete with other market places. If adjustments had not been made or regulations were to be imposed, volumes would immediately move to other market places and liquidity would decrease drastically.

The implementation of MiFID has triggered the fragmentation of markets and encouraged competition. Because of the European market integration HFT can only be regulated at EU level. If regulation is imposed in one market and not another, volumes would quickly move to the market with less regulation.

Technical innovation is a constant process and the usage of algorithms to execute trading orders is a natural development in the strive for cost efficiency. Algorithmic and high frequency trading are here to stay. The purpose of this study is to highlight the problems brought on by HFT but important is also to overlook the big picture and see good and bad sides in proportion. HFT has evolved to be a prerequisite for competition between market places. To ban HFT from the markets would be a step backwards and away from the free, open and integrated markets the EU stands for.

This study has contributed to the research by identifying areas where market participants are concerned HFT has a negative impact on market efficiency. The study does not claim the concerns to be facts but as long as they are perceived to be, it poses a risk of undermining the trust of the financial market.

We suggest there is an urgent need for further research within the identified problem areas. Regulations can only be imposed upon scientific facts and if these were to be established we suggest they are made on EU level.

6.1. Suggested further research

The topic of high frequency trading is today extremely relevant with its innovative approach to trading and quest for development and thereby also a pleasure to conduct research in. For researchers and other students interested in the area of algorithms and HFT we could from our experience recommend this subject. Because HFT is relatively new and unexplored there is a lot of interesting research to be made. We would like to take this opportunity to highlight the importance of qualitative research, like our own, but also underline the importance of continuing research from a quantitative approach as well. Our study has shown further research is needed in the fields of volatility, liquidity and bid-ask spread. We also recommend looking closer at the results of MiFID and the forthcoming MiFID 2, the effects of dark pool trading and potential regulation.

7. References

7.1. Printed References

Berk, J. and DeMarzo, P. (2007), *“Corporate Finance”*, Pearson Education, Inc.

Esaiasson, P; Gillijam, M; Oscarsson H. and Wängnerud L. (2007) *“Metodpraktikan: Konsten att strudera samhälle, individ och marknad”*. Nordstedts Juridik AB

Fabozzi, F.J. and Modigliani, F. (2003), *“Capital Markets – Institutions and instruments”*, Pearson Education, Inc.

Hillier, D; Ross, S; Westerfield, R; Jaffe, J and Jordan, B (2010), *“Corporate Finance”*, Mc Graw-Hill Education

Kvale, S. (1997), *“Den kvalitativa forskningsintervjun”*. Lund: Studentlitteratur.

Mishkin, F. S. and Eakins, S. G. (2011), *“Financial Markets and Institutions”*, Pearson Education

7.2 Scientific Papers

Ahn, H.J; Cao, C.Q. and Choe, H. (1995), *“Tick Size, Spread, and Volume”*, Journal of Financial Intermediation 5, pp. 2-22, Article no. 0002

Biais, B. and Woolley, P. (2011) *“High Frequency Trading”*, Business, Vol. 8, pp. 54-57

Biais, B; Foucault, T and Moinas, S. (2010) *“Equilibrium Algorithmic Trading”*, Working paper, TSE and HEC

Brogaard, J. A. (2011), *“High Frequency Trading and Volatility”*, Working paper, University of Washington – Department of Finance and Business Economics

Black, F. (1971a), *“Towards a Fully Automated Exchange”*, Part I, Financial Analysts Journal

27, pp. 29–34.

Black, F. (1971b), *“Towards a Fully Automated Exchange”*, Part II, *Financial Analysts Journal* 27, pp. 24–28.

Castura, J; Litzengerger, R; Gorelick, R and Dwivedi, Y (2010), *“Market Efficiency and Microstructure Evolution in U.S. Equity Markets: A High-Frequency Perspective”*. RGM Advisors, LLC

Chaboud, A; Hjalmarsson E; C. Vega and B. Chiquoine (2011), *“Rise of the Machines: Algorithmic Trading in the Foreign Exchange Market”*, Federal Reserve Board International Finance Discussion Paper No. 980

Fama, E. (1969), *“Efficient Capital Markets: A Review of Theory and Empirical Work”*. The Journal of Finance, Vol. 25, No. 2, Papers and Proceedings of the Twenty-Eight Annual Meeting of the American Finance Association New York, N.Y. December, 28-30, 1969 (May, 1970, pp. 383-417)

Finnerty, J. E. (1974), *“Insiders and market efficiency”*, Working paper No. 96, Divisional research, Graduate School of Business Administration, The University of Michigan

Gomber, P; Arndt, B; Lutat, M. and Uhle, T. (2011), *“High-Frequency trading”*, Working paper, University of Frankfurt and Goethe University Frankfurt

Gårdängen, M. (2005). *“Share Liquidity and Corporate Efforts to Enhance it. A study on the Swedish Stock Exchange”*. Lund Business Press, Lund Institute of Economic Research.

Hendershott, T; Jones, C. M. and Menkveld, A. J. (2011), *“Does Algorithmic Trading Improve Liquidity?”*, The Journal of Finance, Vol. 66, No. 1, pp.1-33

Hendershott, T. and Riordan, R. (2011a), *“Algorithmic Trading and Information”*, Working paper, University of California

Hendershott, T. and Riordan, R. (2011b), "High Frequency Trading and Price Discovery", Working paper, UC Berkley

Kirilenko, A; Kyle, A.S; Samadi, M. and Tuzun, T. (2010), "The impact of high-frequency trading on an electronic market", Working paper, University of Maryland.

Jensen, M. C. (1978), "*Some Anomalous Evidence Regarding Market Efficiency*", Journal of financial Economics, Vol. 6, Nos. 2/3, pp. 95-101

Lippman, S.A. and McCall J.J. (1986), "*An operational Measure of Liquidity*". The American Economic Review, Vol. 76, No. 1, Mar 1986

Pagano, M. (1989), "*Endogenous Market Thinness and Stock Price Volatility*". Review of Economic Studies, Vol. 56, pp. 269-288

7.3. Reports and Bachelor Thesis

Laliberte, K. and Lumme Kinnunen, H. (2009), "*Nya handelsplattformar för värdepapper – Fördjupning avseende införandet av Burgundy*", Bachelor thesis, KTH

Government proposition 2006/07:115, "Ny lag om värdepappersmarknaden"
Stockholm, 2007-04-26

7.4. Electronic Sources

Börjesson, P. H. and Högbom C. J. (2011), "*Så kan vi minska börsrobotarna framfart*", Newsmill.se, published 2011-11-21 at <http://www.newsmill.se/artikel/2011/11/20/s-kan-vi-minska-b-rsrobotarnas-framfart> (accessed 2011-12-09)

Börjesson, P. H; Norberg, G. and Thorén, J. (2011), "*Debatt: Robothandel farlig för fondsparar*", Dagens Industri, published 2011-09-15 at http://di.se/Default.aspx?tr=294762&rlt=0&pid=245153_ArticlePageProvider&epslanguage=sv&referrer=http%3A%2F%2Fwww.google.se%2Fsearch%3Fsourceid%3Dnavclient%26hl%3Dsv%26ie%3DUTF-

[8%26rlz%3D1T4HPEB_svSE261NO264%26q%3Drobothandel%2Bdagens%2Bindustri](#)
(Accessed 2011-11-12)

Hedelius, P. (2011), "*Dags att bannlysa den snabba robohandeln*", Svenska Dagbladet Näringsliv, published 2011-09-26 at http://www.svd.se/naringsliv/dags-att-bannlysa-den-snabba-robothandeln_6500370.svd (accessed 2011-11-13)

Lenhammar, U. (2011), "*Robothandel – en riskfri storvint?*", Aktiespararna, published at <http://www.aktiespararna.se/ungaaktiesparare/Nyheter-och-artiklar/Robothandel---en-riskfri-storvinst/> (accessed 2011-11-11)

Ring E. (2011), "*Börschefer kritiserar robohandlarna*", Veckans Affärer, published 2011-09-08 at <http://www.va.se/artiklar/2011/09/08/nasdaq-omxs-vd-kritiserar-robotforetagen/> (accessed 2011-11-23)

Torgander, M (2011) "*Börsen: Misstag bakom extrema volymer i Altas och SSAB*", Affärsvärlden, published 2011-11-30 at <http://www.affarsvarlden.se/hem/nyheter/article3357478.ece> (accessed 2011-12-03)

Edenholm, Y. (2011), "*Datorhandeln oroar Borg*", Affärsvärlden, published 2011-08-22 at <http://www.affarsvarlden.se/hem/politik/article3237075.ece> (accessed 2011-12-02)

MiFID - Markets in Financial Instruments Directive
<http://www.mifidirective.com/> (accessed 2011-12-09)

Nasdaq OMX
http://www.nasdaqomxnordic.com/about_us?languageId=1 (accessed (2011-12-12)

Finansinspektionen
<http://www.fi.se/Marknadsinformation/Borsinformation/> (assessed 2012-01-04)

Appendix 1 – Interview Guide

Our intention is to use this interview as part of our research for our bachelor thesis regarding high frequency trading. Several scientific studies already exist on the subject but a gap has been identified as very few address the subjective opinions of people in the industry.

Introductory questions

- What do you do for a living?
- For how long have you been working in the industry?
- Please describe the company you work for.
- Please describe your tasks.

High frequency trading

- How familiar are you with HFT?
- How would you define HFT as opposed to AT?
- Does your company use algorithms for trading?
 - Why/ why not?
 - What are the benefits?

HFT has in the U.S. been behind the majority of all trades for a couple of years. In Sweden the breakthrough came in August 2011 when over 16 million trades were made in one month, compared to 7 million a month the previous year.

- Has this development been noticeable for your company?
- In what ways?
- What is your general opinion about HFT?

Volatility

The stock market has lately been characterized by high volatility.

- Have you experienced a change during the fall of 2011?
- What would you say is the reason for the increased volatility?
- Can the high volatility be derived to the increase in HFT?

Liquidity

- Has the HFT made it easier or more difficult to locate sellers and buyers?
- Do you feel it is possible to compete with HFTs on equal terms?

Bid-ask Spread

- Has there been a change in bid-ask spreads recent months?
 - In that case, why?
 - Does that have any affect for your company?

Other Concerns

- How do you think AT and HFT will evolve in the future?
 - Is it a natural evolution?
 - Will it keep increasing?
- Does HFT limit the ability for regular traders to act on the stock market?
- Are people in the industry worried that the usage of algorithms will makes humans redundant?
- Can technical difficulties with preprogramed computers cause problems for the whole equity market?
- Is there enough transparency?
- How should the government and Finansinspektionen handle the situation?
- Do you have any other concerns?