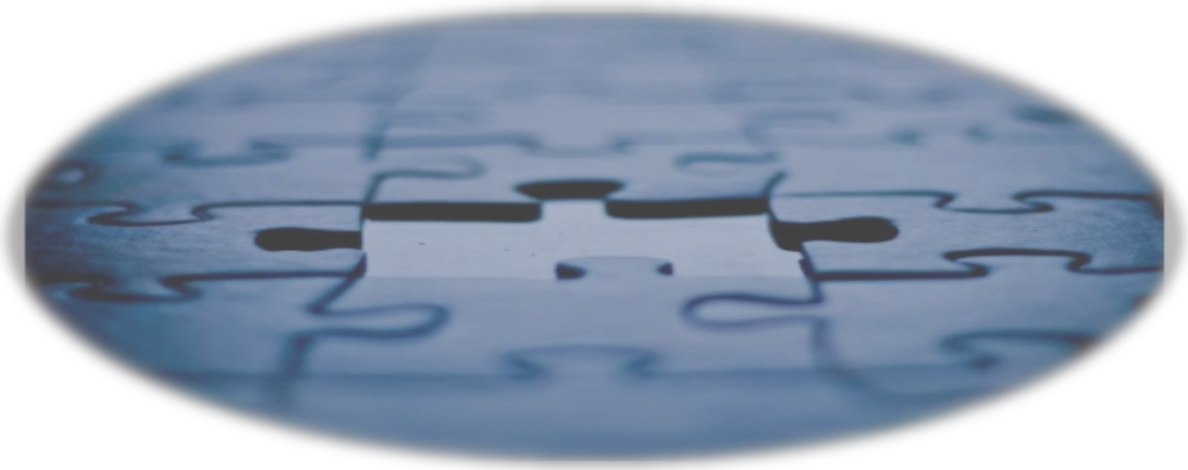
# High Frequency Trading:
# The Technological Puzzle



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"*We have developed speed, but we have shut ourselves in, machinery that gives abundance has left us in want, our knowledge has made us cynical, our cleverness hard and unkind. We think too much, and feel too little.*" Charlie Chaplin

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## Glossary

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| AFM | The Netherland Authority for the Financial Market; |
| AMLA | Swiss Anti-Money Laundering Act, RS 955.0; |
| AMF | Autorité française des Marchés Financies; |
| art. | article(s); |
| ASIC | Australian Securities & Investments Commission; |
| AT | algorithmic trading; |
| ATS | alternative trading system; |
| BA | Banking Act, RS 952; |
| BGBl | Gesetz zur Vermeidung von Gefahren und Missbräuchen im Hochfrequenzhandel vom 7.5.2013 ; |
| CC | Swiss Federal Civil code, RS 210; |
| CEO | Chief Executive Officer; |
| cf. | see; |
| CFTC | Commodity Futures Trading Commission; |
| CH | Confoederatio Helvetica; |
| CHF | Swiss francs; |
| CJEU | Court of Justice of the European Union; |
| CMCRC | Capital Markets Cooperative Research Centre; |
| CO | Swiss federal Obligation code, RS 220; |
| CRD IV | Capital requirement directive 2006/49/EC; |
| CRS | U.S. Congressional Research Service; |
| CS | Credit Suisse SA; |
| CSIS | Center for strategic and international studies; |
| Cst. | Swiss federal Constitution, RS 101; |

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| D-FMIA | Draft of the Financial Market Infrastructure Act, (available here: http://www.news.admin.ch/NSBSubscriber/message/attachments/33160.pdf ); |
| DEA | Direct Electronic Access; |
| DMA | Direct Market Access; |
| e.g. | for example; |
| ed. | editor(s); |
| edit. | edition; |
| EMIR | European Market Infrastructure Regulation, UE n°648/2012; |
| ESMA | European Securities and Market Authorities; |
| et. al. | and all the others; |
| ETF | Exchange Traded Fund; |
| EU | European Union; |
| evt. | eventually; |
| EY | Ernst&Young; |
| f. | and following page; |
| FC | Swiss Federal Counsel; |
| FDF | Swiss Federal Department of Finance; |
| FED | U.S. Federal reserve; |
| FESE | Federation of European Securities Exchange; |
| FF | Swiss Federal leaf; |
| ff. | and following pages; |
| FIA | Futures and Options Association; |
| FINMA | Swiss Financial Market surveillance Authority (Finanzmarktaufsicht); |

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|---|---|
| FINMASA | Financial Market Supervision Act, RS 956.1; |
| FINRA | Financial Industry Regulatory Authority; |
| FMIA | Financial Market Infrastructure Act, FF 2015 4485; |
| G.J. | Mr. Gabriel Jaccard; |
| GesKR | Gesellschaft und Kapitalmarktrecht review; |
| Go-Science | Government Office for Science of London; |
| GS | Goldman Sachs; |
| HFT | High frequency trading; |
| HFTr | High frequency trader(s); |
| HOT | High Order-to-Trade; |
| Idem | same citation as precedent; |
| infra | see below; |
| IOSCO | International Organization of Securities Commissions; |
| IPO | Initial Public Offering; |
| Let. | Letter; |
| LT | Swiss federal law on Stamp Duty, RS 641.10; |
| M&A | Merger and Acquisitions; |
| MAD I | Market Abuse Directive, 2003/6/CE; |
| MAD II | Market Abuse Directive II, 2014/57/EU; |
| MAR | Market Abuse Regulation (EU) n°596/2014; |
| MIDAS | Market Information Data Analytics System; |
| MiFID II | Markets in Financial Instruments Directive 2014/65/EU; |
| MiFIR | Markets in Financial Instruments Regulation (EU) N° 600/2014; |
| mio | million(s); |

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|---|---|
| MS | Member State of the EU; |
| ms. | millisecond(s); |
| MTF | Multilateral trading facilities; |
| n.b. | nota bene; |
| not. | notably; |
| NASDAQ | National Association of Securities Dealers Automated Quotations; |
| NBA | Federal Act on the Swiss National Bank, RS 951.11; |
| n$^{o}$ | number(s); |
| not. | notably; |
| NY | New York city (U.S.A); |
| NYSE | New York Stock Exchange; |
| OFR | Ordonnance sur les fonds propres et la répartition des risques des banques et des négociants en valeurs mobilières, RS 952.03; |
| OMIA | Ordinance on the Market Infrastructure; |
| OMIA-FINMA | Ordinance of the FINMA on the Financial Market Infrastructure; |
| OTC | Over-the-counter; |
| OTF | Organized trading facilities; |
| OTR | Order to trade ratio; |
| p. | page(s); |
| P&G | Procter&Gamble; |
| par. | Paragraph; |
| PWC | Price&Waterhouse&Coopers; |
| RS | Swiss systematic compilation; |

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|---|---|
| RSS | Really Simple Syndication; |
| SA | Société Anonyme; |
| SCC | Swiss Federal Criminal Code, RS 311.0; |
| SEC | U.S. Securities and Exchange Commission; |
| SESTA | Federal Act on Stock Exchanges and Securities Trading, RS 954.1; |
| SESTO-FINMA | Ordinance of the FINMA on Stock Exchanges and Securities Trading, RS 954.193; |
| SOR | Smart Order Routing; |
| supra | see above; |
| SWX | SIX Stock Exchange SA ; |
| TTF | Financial Transaction Tax; |
| UEE | Ultrafast extreme events; |
| U.S. | United States of America; |
| U.S.A | United States of America; |
| UBS | Union de Banque Suisse SA; |
| UK | United Kingdoms; |
| vol. | volume; |
| vs. | versus. |

## Introduction

High frequency trading is comparable to **a complex puzzle**. The several aspects, of which it is composed, require considerable thought and precision before, piece-by-piece, a completed picture appears.

Since 1980[1], new **trading technologies** have amplified the speed at which trading may occur and have resulted in the present day standardization of automated trading. The hesitations that arise from this automation require us to look at a complex interaction among economical, juridical, political and philosophical judgments. Before the financial crisis struck in 2008[2], worldwide regulators felt concerned about the security of automated trading and increased legislation over financial markets. This regulation came alongside a growing fear, and sometimes anger, of public opinion[3]. In recent history, financial events, such as the bailout of important banks, have shown how complex, misunderstood, and fragile the financial world was.

In the middle of those developments, **HFT in particular** represents an interesting feature of what is happening in the markets. The topic is a challenge in itself to understand fully, which is reflected by the diverging opinions among specialists: balancing between encouraging and hostile. Furthermore, it constitutes an example combining human intelligence with machine, hence creating an augmented intelligence in the trading environment[4]. This results in a dual set of consequences. On one hand this new trading environment results in the problem of disconnection and mistrust over the financial tools[5] and, on the other hand, it highlights the ability of humans to continuously advance technologies to fulfill roles and needs in today's markets.

The **present work aims** to enable us define what HFT is and analyze the development of its regulation. Furthermore, this work will assess the critiques and risks resulting from this

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[1] CONTRATTO, p.145 f.
[2] A recent opinion of GS analyst explained why we where living the third wave of the crisis notably in China: http://bit.ly/1QmOlqM.
[3] E.g. French President François Hollande stating: *« my enemy is the financial world »* http://bit.ly/1OSCJLG
[4] GOURLEY *Big Data*. 2012.
[5] FINMA, *Annual report 2014*, p.2: and also the phenomena of the "*finance casino*".

phenomenon. Finally, we aim to provide sufficient "*pieces of the puzzle*" in order for the reader to arrange them in such a way as to forge an opinion regarding HFT.

The **structure of this work** begins by describing HFT and all of its relevant elements (*infra* n°1). Then, we will observe several effects of HFT on the markets (*infra* n°2). After this overview, we will study the new regulations of HFT in Switzerland and Europe (*infra* n°3). Then, we will view specifics of the relationship between market manipulations and HFT (*infra* n°4). At the end of this work, we will redact a conclusion regarding HFT (*infra* Conclusion).

# 1 What is High-frequency-trading?

In this first part, we focus on the definition and understanding of HFT. We will first define HFT (*infra* n°1.1) and its components (*infra* n°1.2). Then, we will study the characteristics of HFT definitions such as: the latency (*infra* n°1.3), the frequency, the short holding period, the cancelation of orders and the intraday perspective (*infra* n°1.4), the main strategies used and the algorithms (*infra* n°1.5). Finally, we will provide an overview of the volume and presence of HFT in today's markets (*infra* n°1.6).

## 1.1 High frequency trading

There exists **no clear or homogeneous definition** of HFT. However, a precise and uniform definition would not be fruitful[6] or satisfactory and would result in it challenging and circumvention[7]. This lack of uniformity at the definition stage leads to circumspection whenever we wish to assess the impact of HFT and *a fortiori* the concurrent juridical measures. Recently, some local definitions have emerged in the law, as under MIFID II (art.4 (1) 40)[8], but such a definition does not exist in Switzerland.

The second point to highlight is **the data problematic**[9]. The heterogeneity of worldwide approaches and the few datasets available in literature, of which most consider specific data and fragmented markets[10], complicates allegations and creates uncertainty and imprecision[11]. Few datasets exist in Europe, as most of them concern the U.S. market[12], and are often easily outdated and criticized, notably because HFT is difficult to separate from the general trading flow[13]. Lastly, HFT is a highly secret activity[14] and public data are not sufficient to assess it[15].

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[6] http://bit.ly/1ONCJwJ
[7] ESMA, *HFT report 2014*, p.4 ; Appendix1 Question 1.
[8] See *infra* n°3.2.
[9] ZIMMERMANN, p.101 f.
[10] (problematic notably considering the cross border nature of HFT)
[11] ESMA, *HFT report 2014*, p.5.
[12] ESMA, *HFT report 2014*, p.19.
[13] IOSCO, *Regulatory issues report 2011*, p.22.
[14] See *infra* n°1.2.
[15] SEC, *HFT literature review*, 2014, p.8 f.

In general, the total trading activities are divided in two categories: algorithmic trading (AT) (1) and non-algorithmic trading (2)[16]. Algorithmic trading encompasses: "*The use of mathematical models, computers, and telecommunications networks to automate the buying and selling of financial securities*"[17] and was recently defined under art.4 (1) 39 MIFID II[18]. HFT is unanimously recognized as ***"a subset of algorithmic trading"***[19]. The distinction between HFT and AT appears difficult in practice[20]. The prominent differentiating elements are that HFT operates at a higher speed of execution[21] and has an intraday perspective[22]. Besides, HFT must be further distinguished from others types of automated trading[23], like systematic trading[24] (e.g. with SOR system that only convey orders[25]).

Even though, we can rely on the literature to define it under an **informal definition**. The doctrine agrees that HFT is a "*catch-all notion*"[26]. Moreover, the financial dictionary defines it as: "*A program trading platform that uses powerful computers to transact a large number of orders at very fast speeds (...) HFT uses complex algorithms to analyze multiple markets and execute orders based on market conditions*"[27]. Finally, the European commission

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[16] ESMA, *HFT report 2014*, p.5.
[17] ESMA, *HFT report 2014*,p.5.
[18] Under art.4(39) MIFID II the definition is the following: "*trading in financial instruments where a computer algorithm automatically determines individual parameters of orders such as whether to initiate the order, the timing, price or quantity of the order or how to manage the order after its submission, with limited or no human intervention, and does not include any system that is only used for the purpose of routing orders to one or more trading venues or for the processing of orders involving no determination of any trading parameters or for the confirmation of orders or the post-trade processing of executed transactions*".
[19] SHORTER / MILLER, p.5.
[20] For the whole list of differentiation and similarity see: Appendix 8: Difference between HFT and AT and MACINTOSH, p.4 f.
[21] IOSCO, *Regulatory issues report 2011*, p.22.
[22] E.g. the use of an algorithmic trading technique over a week in order to slice the selling of a big block of stocks and avoid the fall of the price.
[23] SEC, *HFT literature review 2014*, p.5.
[24] ADIL, p.1.
[25] SEC, *HFT literature review 2014*, p.5 ; see Appendix 20: Smart Order Router. MÜLLER, p.387.
[26] SHORTER / MILLER , p.5 ;. IOSCO, *Regulatory issues report 2011*, p.21.
[27] http://bit.ly/1jLXGLt

simplified its definition as the "*use of very sophisticated technology to implement traditional strategies*"[28].

The doctrine agrees on the following **main characteristics** defining HFT, of which we choose to rely on wider leadings reports and doctrines:

- Proprietary trading[29] (*infra* n°1.2);
- Latency sensitive[30] (*infra* n°1.3);
- Frequent orders, cancellation or modification[31] (*infra* n°1.4);
- Short holding period[32] (*infra* n°1.4);
- Intraday perspective[33] (*infra* n°1.4);
- Used of algorithm[34] (*infra* n°1.5).

## 1.2 High frequency traders

As stated above (*supra* n°1.1), the heterogeneous nature of its definitions leads to **difficulties in recognizing HFTr**. However, in general, HFT is either used by a proprietary firm[35]or by large banks[36]. Traders can then organize as Hedge funds[37], proprietary firms, or proprietary desks of a multi-service broker dealer. Furthermore, HFTr often permits their clients to trade through their access[38], which amplifies complexity. In the U.S. (no longer in EU[39]), it is even possible for HFTr to not be registered as broker-dealer in a trading association (e.g.

[28] MACINTOSH, p.3 and references.
[29] ESMA, *HFT report 2014*, p.5 ; IOSCO, *Regulatory issues report 2011*, p.21 ; SEC, *HFT literature review 2014*, p.4.
[30] *Idem*.
[31] *Idem*.
[32] ESMA, *HFT report 2014*, p.5 ; SEC, *HFT literature review 2014*, p.4.
[33] ESMA, *HFT report 2014*, p.5 ; IOSCO, *Regulatory issues report 2011*, p.21 ; SEC, *HFT literature review 2014*, p.4.
[34] IOSCO, *Regulatory issues report 2011*, p.21.
[35] (using pure/mix HFT strategies)
[36] (where HFT is one of the panel of activities)
[37] MACINTOSH, p.3.
[38] (E.g. DEA)
[39] In the EU, the use of HFT will now require a license, see *infra* n°3.1.2.

FINRA)[40]. Finally, the issue of a single man being able to perform HFT on his own proves risky, notably considering the knowledge and material this activity requires. However, the recent allegation of the SEC against Mr. Navinder Sarao shed light on this question, but further obscures the definition of HFT[41]. Geographically, HFT is centralized into the core financial cities (e.g. London, New York, Singapore, Zürich)[42].

There are several methods used worldwide to spot HFT and HFTr [43]. In this work, we explain the **ESMA's method**[44] (EU) because it is relatively current, contains a supranational dataset, and holds importance for Switzerland. The ESMA, retains three approaches to assess HFT activities: the direct (1), the indirect (2) and the mix (3)[45]. None of them are used with preponderancy among EU member states[46] and according to ESMA itself none can fully identify HFTr[47].

Firstly, the **direct approach** analyses the primary business of the participant and the use of services that minimize latency (e.g. colocation [48]). It spots HFTr according to what is displayed on HFTr's Internet site or its statute among a trading association[49]. This approach is criticized for its vagueness. Indeed, HFTr are not necessarily registered[50] and furthermore they are often reluctant to display publicly their activities [51]. This approach has no half measure: once a source is identified as HFT all trades that the source effectuates are considered HFT. Finally, HFT cannot be reduced to speed or latency it since non-HFT firms can also be faster than HFT[52], as stated in the same ESMA's report.

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[40] SEC, *HFT literature review 2014*, p.4.
[41] http://bv.ms/1Fcovjh
[42] MACINTOSH, p.3.
[43] ESMA, *HFT report 2014*.
[44] Note, the*"*ESMA, *HFT report 2014"* is the first part of a study conducted by ESMA. The second is not yet published.
[45] ESMA, *HFT report 2014*, p.6 f.
[46] ESMA, *HFT report 2014*, p.21.
[47] ESMA, *HFT report 2014*, p.8.
[48] (See *infra* n°1.3).
[49] ESMA, *HFT report 2014*, p.8 and 10.
[50] SEC, *HFT literature review 2014*, p.4.
[51] E.g. you do not want to be consider as HFT in order not to fall under a regulation.
[52] ESMA, *HFT report 2014*, p.7.

Secondly, the **indirect approach** focus on the trading and quoting patterns of the market participant such as: intraday inventory management, lifetime orders, message traffic, and strategies recognition methods[53]. Those elements permit to identify different types of strategies used by HFTr. This approach is criticized since there is no uniform method permitting to identify the lifetime of orders or message traffic as in the German HFT Act (BGBI). The ESMA report states that "*no rules*" of threshold characterizes HFT[54]. Moreover, the use of a limit rule can appear backwards regarding technology[55].

Finally, the **mix approach** is a combination of both aforementioned approaches[56]. The critiques made can then be reiterated. In addition, this approach refers to the NASDAQ data set and only identifies certain profiles of HFTr (not. independent HFT firms)[57].

We can consider that **others approaches** at the international level exist. Without being too specific, we mention Australia's use of OTR and mix indicators[58] to identify HFTr and Canada's use of OTR as proxy for HFT (disagreeing with ESMA's)[59].

In conclusion, regarding HFTr as human being, or the so-called "**Flash boys**"[60], the official name of the position is quantitative analyst ("*Quants*") and consists of elaborating algorithms and strategies. On average, such Quants are highly paid (average $290K/year)[61], they are often bound by a strict silence policy, and hold a degree in physics, informatics or mathematics. They build the crème de la crème of the "*financial aristocracy*"[62]. For instance, we can name the followings firms as performing HFT: Tradeworx, Citadel, Getco, Goldman Sachs (U.S.), UBS, CS (CH)[63]. Theses firms generate billions in revenue per year thanks to HFT[64].

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[53] ESMA, *HFT report 2014*, p.6. (see *infra* n°1.4 and 1.5).
[54] ESMA, *HFT report 2014*, p.9.
[55] BIAIS / WOOLLEY, p.17
[56] ESMA, *HFT report 2014*, p.21 and p.23.
[57] ESMA, *HFT report 2014*, p.23.
[58] ESMA, *HFT report 2014*, p.8.
[59] *Idem*.
[60] LEWIS.
[61] http://bit.ly/1PO2Rr7
[62] CHESNEY, p.15 ff.
[63] SHORTER / MILLER, p.13 ; see also, RIOULT, p.78
[64] BROGAARD / HAGSTRÖMER / NORDÉN / RIORDAN, p.30.

## 1.3 Latency

This point is the centrepiece of HFT but it cannot be abbreviated to this aspect alone, notably because success also relies considerably on regulation (e.g. of the exchange) and the given trading environment[65]. The term **latency sensitive** signifies to reduce "*the time that elapses from the moment a signal is sent to its receipt*", and consists in the reduction of the time of these three phases: the reception (input), the processing, and the response (output)[66]. The advantages of speed allows for the gaining of prior data and thus prior reactions, which is crucial for instance concerning arbitrage opportunities. It furthermore allows for quick shifts in risk, hence reducing the time of exposure, which is highly valuable[67]. This quest for speed created a "*war for speed*" among participants as developed below[68]. In reaction to this quest for speed, and to guarantee unrigged[69] markets, "low latency" platforms were created (e.g. IEX trading[70] or Plato[71]). In the followings paragraphs we will now study several means to be latency efficient.

Firstly, we shall briefly mention that HFTr aims at reducing the **processing** time of information. For this reason, HFTr invest large sums of money in order to create superfast computers (hardware, software…).

A second mean is the use of private telecommunication fibres, so-called **dark fibres,** which connect exchanges[72]. The lines are conceived in such a way as to be time efficient. The main advantage is that HFTr thus has independent access[73]. The problems of the fibre are that it requires to be dug in the soil and the directions it can take are often non-linear. Those constructions require then legal authorisation and hence an organisation with local authority, it also has to be efficiently protected. Furthermore, the cost of installation is enormous (e.g.

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[65] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015.
[66] http://bit.ly/1nljwVf
[67] BIAIS / WOOLLEY, p.9 f. This aspects is interesting notably in the context of the "*illusionnal liquidity*" treated afterwards *infra* n°2.1.
[68] *Infra* n°2.3.
[69] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015.
[70] http://bit.ly/1WecFyT
[71] http://bit.ly/1P1kEto
[72] Appendix 7: New York / Chicago fibre
[73] http://bit.ly/1LxCBgP

300 mio in LEWIS[74]) and depends on natural elements or the ground (e.g. mountain, buildings rivers). However, the use of fibre is globalized, (e.g. underwater fibre[75]). Recently, a project called the "*transatlantic*"[76], passing through both the Atlantic and Pacific Oceans (3'701 miles) was decided for the cost of $1.5 billion. This project will enable a gain of 60 ms between the exchanges of London and Tokyo[77].

On the European continent, a similar mean to the above mentioned is the use of **antenna** transmitting airwaves signals. This method has several advantages. First, in the air the signal can go faster and follow a linear trajectory. However, the European law forbids building antennas for uniquely financial market purposes. In response, the price of several buildings skyrocket such as in Belgium where a simple tower (called "*Houtem*") was sold for 5 mio euros[78].

A fourth element, very often related to HFT is the use of **colocation**[79]. Colocation consists in "*locat(ing) computers of a trader in the same premises where an exchange's computer servers are housed"*[80] for a fee. The traders are linked to the central server by an equidistant cable[81]. Originally it was created to halt the "*war for speed*", which created housing crises around markets[82]. According to the FINRA and the new Swiss and European regulations, colocation services can be offered within the respect of the principles of fair, transparent and equal access to all the market participants (art.18 FMIA; art.48 (8) MIFID II)[83]. Today, colocation is not reserved to HFTr but is open to any traders[84]. For example, SWX offers colocation at the speed is of 35 ms[85] to around 30 traders[86] for a fee of a few thousands CHF

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[74] LEWIS, p.12.
[75] For a map cf. Appendix 2: map of European fibre in water ; See http://bit.ly/1Uruqty
[76] There are others like the « *project express* » of Hibernia lining the Europe and the USA at the speed of 56.5 ms, 6 ms better than the actual liaison. MULHOLLAND / CHAPERON, p.141.
[77] http://bit.ly/1e3KQgl
[78] http://bit.ly/1KBjazM
[79] MACINTOSH, p.22.
[80] http://bit.ly/1nljwVf
[81] FINRA, *Annual report 2015*, p.21 ; ESMA, *DP*, p.279 ; LEWIS, p.64.
[82] LEWIS, p.64.
[83] For the whole lists of requirement ESMA, *RTS / DTS annexe 1*, p.297 ff.
[84] MACINTOSH, p.22: Hedge fund are sometimes collocated.
[85] Appendix 1 Question 3.
[86] *Idem*.

per month[87]. In Europe, many exchanges (Paris, Brussels, Amsterdam, Lisbon, and Luxembourg) have been relocated in Basildon (UK), in a missile proof building, notably to attract HFTr[88].

In theory, colocation creates an informational advantage[89] because HFTr receive and emit faster. However, fragmentation of markets and places as dark pools, where an asymmetry of information exists, can relativize the gain of speed[90]. In practice, exchanges promote colocation. The first reason is that they help involving traders on market by reducing distances, hence creating liquidity. This gain of liquidity is beneficial to them because liquidity is the sign of a healthy market[91], which is demanded by many investors[92]. Additionally, exchanges are paid on the numbers of transactions made on their exchange and hence are willing to have this creation of liquidity[93]. Finally, exchanges can be "*forced*" to offer colocation, especially because they do not want to give their biggest client a further reason to outsource their stocks.

Last but not least, we mention some of the many **others means** that can be use. For instance, SOR, which creates sequential cost-effective route for orders. Further, HFTr often use DMA, DEA or sponsored access[94].

### 1.4 Frequency, holding period, cancelation, modification and intraday

In today's trading environment, the **holding period** has drastically decreased and frequencies of orders have inversely increased especially in the context of HFT. The holding time of a stock by HFTr depends on the strategy, it is often less than one minute[95], but it can also be

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[87] *Idem*.
[88] CASH INVESTIGATION, La finance folle: l'attaque des robots traders, 2015.
[89] BROGAARD / HAGSTRÖMER / NORDÉN / RIORDAN, p.1 ; see also infra n°4.3 concerning the issues of insider dealing. We note that an informational advantage is not necessarily illegal.
[90] Note that the new EU regulation will probably reduce this asymmetry of information. DAY TRADE TO WIN, *How High Frequency Trading Works, Trading Speed, and the Flash Crash*, 2013.
[91] Appendix 1 Question 7.
[92] BIAIS / WOOLLEY, p.6.
[93] BROGAARD / HAGSTRÖMER / NORDÉN / RIORDAN, p.7 ; CHESNEY, p.54.
[94] MÜLLER, p.386.
[95] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015.

100 ms, or several hours[96]. Those numbers can be in contradiction with others found in other markets (e.g. Australia)[97]. Another example is given by the AMF where, in one day, one single stock was traded 114'600 times by a firm[98] (see other examples[99]). This phenomenon of intensive, "*hot potato*" trading, allows for, as previously mentioned, to shift risk rapidly[100] and gain thick margins over very frequent trades[101].

Another element very characteristic of HFT (compare to AT[102]) is the numerous **cancelations and modifications** of orders. Cancelling signifies that an order is sent to the market but cancelled before being fulfilled. This action repeated creates "*noise*" for participants and a lot of critics denounce those actions as being a "*poker liar*"[103], or as blurring the "*true vision*" of the markets, especially when more than one HFTr is present[104]. We note that the cancelation or modification of orders is only problematic concerning *non bona fide* orders[105]**.** However, the barrier can be thin between market manipulations, especially when it ends up misleading participants or saturating the network (e.g. quote stuffing[106]). Statistically, very few orders of HFTr are effectively executed. The cancelation and modification aspects are often part of the "*sniffing*" strategy, to spot liquidity on a trading venue[107].

We will finally focus on the **intraday perspective**. HFTr has a day–to-day perspective: "*everyday start fresh*". The HFTr either liquidate all of their stocks at the end of the trading

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[96] SHORTER / MILLER, p.10.
[97] ASIC, *Sheet*, p.7: « *Our analysis also showed that only 1.2% of high-frequency traders held positions for an average of two minutes or less, 18% for less than 10 minutes, and 51% for less than 30 minutes*. ». But we note that Australia has another definition of HFT based on HOT.
[98] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015.
[99] UBS trades 2587.5 stocks per seconds: See, *UBS Shares ATS montly volume* ; BARKER / POMERANETS , p.48. Tradeworx trades 60-80 mio/day shares: URSTADT, p.44.
[100] *Infra* n°1.3.
[101] MACINTOSH, p.6.
[102] MACINTOSH, p.5.
[103] CHESNEY, p.53 ; cf. LEWIS (« *poker liar* ») ; http://bloom.bg/1NwGSBR
[104] LEWIS, p.69 ; If one HFTr creates noise, it can have itself a fair view. However, from the moment, there are two of them, each can try to mislead the other and no one have the full view over the market anymore.
[105] CORNERSTONE RESEARCH, p.2.
[106] See *infra* n°4 ; MACINTOSH, p.10. We note also that quote stuffing is defined under art.4 let.c MAD II but not under Swiss law.
[107] MACINTOSH, p.8 ; see *infra* n°1.5.

day or finds "*flat positions*". In fact, HFTr do not want to bear overnight risks, which are less controllable. This behaviour affects liquidity depending on the time of day. Historically, HFT seems to supply more liquidity at midday[108].

## 1.5 Strategies and algorithms

Generally, strategies are divided in two categories: **passive and actives strategies**[109]. Passive strategies consist in "*providing limit orders and injecting liquidity into the markets*" (e.g. market-making). Active strategies consist in "*the provision of market orders or marketable limit orders"* [110] (e.g. arbitrage). HFT is sometimes considered as a strategy in and of itself, however as the EU commission states[111], it is but a new way to implement traditional strategies[112].

Between those two categories, HFTr uses and creates a **multitude of strategies**[113]. Those can be used alone or in combination[114], and every new use or detail added in the coding of an algorithm can potentially create a new strategy[115]. We give, in the followings paragraphs, several examples.

First, **market-making** strategies. It consists in making a profit on the bid/ask spread or on the rebate made by the exchanges[116], thus creating liquidity. A second, well-known strategy is the **arbitrage**. It exploits price discrepancies between the two exchanges[117]. This strategy relies on the fragmentation of the market and the speed of the HFTr[118]. Among all others, we can also notably mention **directional** strategies, which aim at taking advantage of a direction taken by a stock (up or down); and structural strategies, which exploits structural vulnerabilities. Another interesting strategy is the liquidity detection strategy (e.g. order

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[108] ASIC, *report*, p.86.
[109] SHORTER / MILLER, p.10.
[110] SHORTER / MILLER, p.10.
[111] MACINTOSH, p.3.
[112] SEC, HFT literature review 2014, p.8.
[113] Appendix 6: Strategies table
[114] SHORTER / MILLER, p.10.
[115] Appendix 1 Question 6.
[116] Notably mentioned as allowed under Circular FINMA 2013/8, n°32 ; BARKER / POMERANETS , p.48 ; IOSCO, *Regulatory issues report 2011*, p.23.
[117] SEC, HFT literature review 2014, p.8.
[118] BIAIS / WOOLLEY, p.7 ; ZIMMERMANN, p.100 ff.

anticipation)[119], which aims to spot (thanks to "*sniffer*") hidden liquidity (or "*Iceberg*"[120]), for instance inside dark pools[121], in order to trade ahead of it[122].

A special mention is made here for the so-called **dark strategies**. Those strategies are used to manipulate the markets. Among them we can mention: *quote stuffing* (Numerous orders send to create congestion and making loose milliseconds to others)[123], *spoofing* (Placing orders with no intention of executing it, in order to take advantage of the depreciation or increase)[124], *layering* (Creation of an artificial bid and cancellation before being carried out)[125], *momentum ignition* (Attempt to trigger a number of other participants to trade quickly and cause a rapid price move)[126], *marking the close* (Trading activity before or during the close of trading on market which impacts settlement price)[127].

The goal of every strategy is to generate **profits**. Most are market neutral[128] and are created to attain global success of at least 51%[129]. Most of the profit is realised by active strategies (90% return against 20%)[130]. HFTr seek short-term profit and aim to earn pennies[131].

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[119] CORNERSTONE RESEARCH, p.2 ; ASIC, *Report*, p.91.
[120] E.g. liquidity hidden by large orders, not. concerning Hedge fund. http://bit.ly/1kVVLnZ
[121] See Latour's case (US): http://www.sec.gov/news/pressrelease/2015-221.html. This can be put in relation with the recent will of the NYSE to force actors with significant strength on the market to disclose their order publicly: http://bloom.bg/1KoBk7V
[122] SHORTER / MILLER, p.12 ; e.g. Price is 20, limit is 20.3, HFT can use a predatory algorithm to identify that limit by "*pinging*" the market with sell orders that are issued in fractions of a second and cancelled just as fast URSTADT, p.48.
[123] We note also that quote stuffing is defined under art.4 let.c MAD II but not under Swiss law.
[124] BIAIS / WOOLLEY, p.8 f.
[125] *Idem*. This strategy is similar with spoofing.
[126] http://bit.ly/1jUlg8S ; ASIC, *Report*, p.91 f. ; MÜLLER, p.386.
[127] http://bit.ly/1RxVUrC ; Circular FINMA 2013/8, nº26.
[128] URSTADT, p.45: either direction goes the market HFTr make money.
[129] SHORTER / MILLER, p.10.
[130] SHORTER / MILLER, p.10.
[131] MACINTOSH, p.6. ; FINMA, *Annual report 2014*, p.32.: FINMA talks of a "*corporate culture of misconduct*" relying often on short term profit and putting the interest of the client in second place.

According to data, HFTr earn very well[132], so well that their actions are perceived as being an invisible tax on the slow(er) traders[133] and is this unethical[134].

All HFT strategies are built with the coding and the creation of **algorithms**. An algorithm is a "*set of rules for accomplishing a task in a certain number of steps"*[135]. HFTr use two kinds: trading algorithms (1), which identify opportunities; and execution algorithms (2), which execute orders and set modalities[136]. Quants create many of them (e.g. Guerrilla, Sumo Ninja)[137] to implement strategies, and improve them perpetually[138]. Furthermore, algorithms are able to adapt to do more complex tasks such as: learning from their mistakes (e.g. loss, imitation of gain)[139], reading news by keywords (e.g. fake tweet of the White house[140]), and decoding RSS feed[141]. However, they do not take into consideration all data (e.g. who the CEO is)[142] notably because processing is costly in time. Nevertheless, algorithms are often solely coded by the principle "*buy low sell high*" and, in the end, are "*dumb*" and "*do not think*"[143]. For instance, they are totally detached from the real economy[144] (e.g. of cases: BATS IPO[145], Dark knight capital, Bloomberg or Facebook[146]) and social welfare or morality[147]. Algorithms therefore have great value and can even, in the wrong hands, pose a

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[132] URSTADT, p.48: worst years Tradeworx (U.S.A) made 15% return.
[133] CHESNEY, p.53: calls it an « *hidden tax* ».
[134] CHESNEY, p.3 f. We can also mention the comment of Navinder Sarao,…. Stating at his process that he's only guilty of being "*good at his job*" http://bloom.bg/1MDSvFW
[135] http://bit.ly/1MfbsMV
[136] MÜLLER, p.387.
[137] http://reut.rs/1MPnbST
[138] http://bit.ly/1q9VrPl
[139] GO-SCIENCE, p.36.
[140] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015.
[141] http://bloom.bg/1wahl7n
[142] CBS, Wall Street: *The Speed Traders*, 2010.
[143] See Appendix 5: Human versus algorithms ecosystem and Appendix 11: Advertising.
[144] CHESNEY, p.79.
[145] http://bit.ly/1OSFkoN
[146] GOURLEY, *HFT*, 2012.
[147] See in relation with this question the proposition of « *compliant algorithms* » proposed in the new CH and EU regulations: *infra* n°3.1.2. Note that human are sometimes not better than algorithms e.g. case of life savings pills raised by a trader from 13.50$ to 700$ for profit: http://nyti.ms/1Jjf8LR

threat[148]. Note that above 2 messages/second over a day period, ESMA considers orders as being process by an algorithm[149]

## 1.6 Market and size

The presence of **HFT on the markets** can only be roughly estimated because datasets diverge on HFT definition and cannot take into account all of the relevant data, such as those on cross-borders trading or non-transparent platform[150]. In the USA, HFT represents 50% of the total volume traded in listed equities[151] (low estimation[152]) and 60% of the total futures exchanges[153] by 2% of the number of the market participants[154]. According to specialists, this volume is stagnating maybe even decreasing[155]. In Canada, the presence is estimated at 18% (HOT methods)[156]. Lastly, there are very few in South-America, but the activities are being developed[157]. In Europe, the UK estimated HFT for 50% of the equities in 2012[158] (low estimation)[159]. The ESMA, in its last report, estimated HFT's presence in Europe between 24-40% of the volume traded[160]. In Switzerland, it represents around 25%. In Asia, the phenomenon is present with much disparity. For instance, Japan has 50%, Australia 30%, yet most others are at or close to 0%[161]. The development of HFT in Asia is notably hampered by factors such as the heavy regulations of markets (e.g. taxes[162]), the cultural vision of the

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[148] http://bloom.bg/1RxW2Ym ; SORNETTE / VON DER BECKE, p.13.
[149] ESMA, *CP*, p.231.
[150] (e.g. dark pool)
[151] MACINTOSH, p.1 ; SEC, *HFT literature review* 2014, p.4.
[152] 70 % according to MULHOLLAND / CHAPERON, p.141.
[153] SHORTER / MILLER, p.37 ; see also ADIL and references advancing the number of 40%.
[154] SORNETTE / VON DER BECKE, p.7.
[155] PWC, p.4.
[156] MACINTOSH, p.2.
[157] http://bloom.bg/1MfaMqV UBS just bought a HFT company (2014).
[158] MACINTOSH, p.1
[159] 77% according to SORNETTE / VON DER BECKE, p.3.
[160] ESMA, *HFT report 2014*, p.15.
[161] (e.g. China)
[162] Not. Stamp duties in Hong-Kong of 0.1%.

market[163]. Even with a low presence, HFT is however a concern for Asia (e.g. China had recently spoofing issues[164] and India is willing to regulate it[165]).

Secondly, HFT stands in different proportions according to the **types of markets** concerned. The traditional playground of HFT is the stock (equities) market[166]. However, it is also present on foreign exchange[167], options, derivatives (e.g. equity ETFs[168]), commodities, or futures markets[169]. Most of the time, HFTr are active on markets that are already highly liquids (e.g. blue chips[170]).

[163] E.g. china and India are not very welcoming foreign investors. REUTERS, Bold ambition meets harsh reality as HFT targets Asia, 2011 ; CMCRC, *HFT in the Asia-Pacific region,* 9 April 2014.
[164] http://bloom.bg/1PQf4ut
[165] http://bit.ly/1NwKS5h
[166] BIAIS / WOOLLEY, p.4.
[167] BANK OF ENGLAND, p.290 f. ; N.B. we note that foreign exchange occurs mainly in OTC Markets.
[168] SORNETTE / VON DER BECKE, p.11 f.
[169] SHORTER / MILLER, p.13.
[170] ESMA, *HFT report 2014*, p.15 ; ESMA, *DP*, p.272.

## 2 What main effects and risks do HFT have?

In this section, we will study some of the effects and risks of HFT. We will focus on the most prominent elements of the doctrines[171]. First, we will talk about the liquidity (*infra* n°2.1) followed by the volatility (*infra* n°2.2). Thirdly, we will assess the effects on others market participants (*infra* n°2.3), Finally we will study some of the risks HFT poses (*infra* n° 2.4).

### 2.1 Liquidity

Liquidity signifies that "*there is a bid/offer on the other side when I need it, for the amount I need it (market depth) at a reasonable level (market breath)*" [172]. It is mainly used as a signal of health for markets and it is interpreted as confidence by the investors, which can easily resell their stocks[173]. However, studied have shown that an excess of liquidity can reduce the real value of stocks and increase the effects of crashes[174]. If liquidity is hidden to some market participants (e.g. in dark pool), it is then called "*dark liquidity*"[175]. In relation with HFT, their impact on liquidity depends on the strategies used[176]. The HFTr are crucial in the creation liquidity[177] (e.g. Market-making) [178], but they can also be liquidity drying (e.g. when markets forecast a market-taker rebate)[179].

The effects of HFT over liquidity are under an on-going debate without clear answer[180]. The accusation bears on the idea that the liquidity created by HFTr is **illusory or fragile**[181]. Their judgement relies in the short holding period[182] and the certainty that HFTr will not conserve

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[171] For the whole lists of studies and themes up to now (march 2015) see LEUCHTKAFER.
[172] SORNETTE / VON DER BECKE, p.5.
[173] http://bit.ly/1P1liHo
[174] SORNETTE / VON DER BECKE, p.5 ff.
[175] http://bit.ly/1MJBts8 ; ASIC, *sheet*, p.1. Australians have dedicated a whole report on these questions.
[176] Cf. *supra* 1.5.
[177] GO-SCIENCE, p.39: stating that enhance liquidity and price efficiency ; BIAIS / DECLERCK / MOINAS.
[178] Appendix 1 Question 6: Special data of the Taux-plancher at SWX highlighted this importance of HFT for the liquidity.
[179] BARKER / POMERANETS , p.48 ; SORNETTE / VON DER BECKE, p.5.
[180] CONTRATTO, p.148.
[181] RIOULT, p.80 f.
[182] See *infra* n°1.4.

the stock (information based trade[183]). It results in the hypothesis that HFTr do not absorb any risks[184]. In the same vein, a further another accusation against HFT is to withdraw during crashes, when liquidity is the most necessary ("*resilient liquidity*")[185]. This accusation is debated between those believing the supply is continuous[186] and those who doubt it (not. recently the Chief of the FED)[187]. The MIFID II and FMIA address these issues, notably by making mandatory contracts with market makers to force them to provide continuous liquidity and by imposing a minimum tick size[188].

## 2.2 Volatility

**Volatility** means the "*measure of the dispersion of returns*"[189]; it interprets the degree of risks and fluctuation of a given instrument. A lower volatility is beneficial because it enhances market confidence[190]. As stated above for liquidity, here again, the effect depends on the strategies used by HFT[191]. For instance, aggressive strategies are known to create volatility and bubble, followed by strong corrections[192]. It appears that HFT gains to create this volatility because the amount of gains is linked to the spikes created[193]. Usually, those spikes are prevented by markets, which put in place technical safeguards (e.g. circuit breakers[194] see *infra* nº3.1.2). Nevertheless, the numbers show that volatility on markets has decreased[195].

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[183] BARKER / POMERANETS, p.50.
[184] SORNETTE / VON DER BECKE, p.7 ;http://read.bi/1R9IUsr ; CONTRATTO, p.151 ; Appendix 13: Volume feedback loop.
[185] SEC, *HFT literature review* 2014, p.33 ff.
[186] BIAIS / DECLERCK / MOINAS, p.1: HFT provided liquidity during the flash crash and during the Greek crisis.
[187] http://1.usa.gov/1N2YSFF
[188] See *infra* nº3.1.1 and f.
[189] http://bit.ly/1H51f4r
[190] SORNETTE / VON DER BECKE, p.6.
[191] SEC, *HFT literature review 2014*.
[192] URSTADT, p.49 ; SORNETTE / VON DER BECKE, p.17.
[193] SORNETTE / VON DER BECKE, p.18. ; Chesney, p.26 ; BARKER / POMERANETS, p.50.
[194] Appendix 1 Question 8 and 9.
[195] Appendix 1 Question 4 and 5 ; BARKER / POMERANETS, p.49.

Since the **Flash Crash** of 6 May 2010, where in 10 minutes the market lost 1 trillion dollars, HFTr are ostracized and accused of causing crashes[196]. In the detail of those allegations we, once again, lack certainty. Indeed, many reasons for the triggering of flash crash have been advanced among: "*fat finger syndrome*"[197], "*defect algo of Waddell & Reed*"[198], single trader "*Navinder Sarao*"[199]). But the puzzling result of those investigations was resumed last august by J.Powell, Governor of the FED: "*We do not know*"[200]. Such events are disastrous but quite exceptional. Yet new regulations in the EU and Switzerland aim to prevent them by requiring the use of testing environments and technical safeguards[201]. Crashes are very important because they are the vision the public opinion has of the financial world, its link being with the regulators.

On a more regular basis, we note the recurrent appearance of **mini flash crashes** (spiking up or down) on many markets[202]. There is no definition of mini crash[203] (or UEE)[204] and it is currently difficult to link those to HFT activities[205]. However, HFTr are accused of causing them[206], which would be plausible.

## 2.3 Market participants

HFT has had a significant impact on the markets, firstly for **traders** themselves. Indeed, HFT began a "*race to the bottom*"[207] or a "*war for speed*", as related by LEWIS[208], between participants, which created imperfect competition between traders who had the money to be

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[196] http://bit.ly/1NwInjr
[197] URSTADT, p.47: A trader wanted to send an order for 4 millions $ and added some zero by mistakes to make $4 billions.
[198] SEC, *Findings of may 6th*.
[199] http://bv.ms/1Fcovjh
[200] Jerome Powell, Governor of the FED (August 3, 2015): http://bit.ly/1H51f4r
[201] See *infra* nº3.1.1 and f.
[202] SHORTER / MILLER, p.30 ff.
[203] Is a sudden fall of 1% a mini crash? Appendix 1 Question 8 and 9
[204] CONTRATTO, p.150.
[205] SORNETTE / VON DER BECKE, p.12.
[206] http://bit.ly/1NwInjr
[207] See notably RIOULT, p.80 about it.
[208] The use of a speed superiority is very old, and the financial milieu have understand very fast that a good information or « *insights* » before anyone could lead to extreme wealth. See for instance the system of dispatch rider of the Rothschild's' family in the 19th century.

properly equipped and those who had not[209]. This situation is particularly relevant in the context of market-making, which is now overwhelmed by HFTr[210] due to the necessary gear for it[211]. The resulting effect is that traders, including HFTr performing not well enough, withdraw from markets[212]. Further, another consequence is that the entrance for new market participants has become much more arduous[213]. More generally, all traders that used to make money on wide spreads had to review their tactics.

On the **investors'** side, HFT affects differently long term investors whether it be in regards to retails or institutional[214]. Today, we should consider shifting the image of investors we have. Indeed, most are professional traders or HFT and no longer resonate with a traditional vision of long-term investors[215]. Overall, HFT was beneficial to investors because it helped price discovery[216] and efficiency [217], in addition to the aforementioned comments on volatility and liquidity[218]. Furthermore, the spreads have generally tightened[219] and the automation saved cost[220]. However, HFTr's predatory strategies tend to raise cost for institutional investors[221]. Especially, the question of the price discovery and to know what the "*right price*" is at any given time and place can be difficult[222].

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[209] BIAIS / WOOLLEY, p.11.
[210] CONTRATTO, p.149. Speaks about an « *oligopoly* ».
[211] BARKER / POMERANETS, p.50.
[212] BIAIS / WOOLLEY, p.15 ; SHORTER / MILLER, p.14: As a number of HFT firms went out of business in 2012.
[213] RIOULT, p 80
[214] http://bit.ly/1WelbZA
[215] ASIC, *sheet*, p.8 ; http://nyti.ms/1Nxba4X
[216] BIAIS / WOOLLEY, p.6 f. ; ZIMMERMANN p.101: "*Eine optimale Börsenstruktur muss in erster Linie den Preisfindungsprozess (price discovery) unterstützen, was nach Schwartz (2009) eine räumliche und zeitliche Konsolidierung des Autragsflusses erfordert* ». Notably via arbitrage strategies.
[217] BARKER / POMERANETS, p.49. ; CONTRATTO, p.147.
[218] See *supra* n°2.1 and n°2.2.
[219] MACINTOSH, p.1 ; BARKER / POMERANETS, p.48 f.
[220] SHORTER / MILLER, p.13.
[221] BIAIS / WOOLLEY, p.6.
[222] See ZIMMERMANN, p.110 f.: « *Der Preisfindungsprozess ist damit aufs Engste mit dem Findungsprozess des «optimalen» Systems verbunden, welches niemand kennt, sondern nur im Wettbewerb unterschiedlicher Systeme gefunden werden kann* ». Appendix 1Question 4 and 5 and also http://nyti.ms/1Jjf8LR e.g. see the case of drugs increase over night.

## 2.4 Other risks

### 2.4.1 **Systemic risks**

It is generally agreed that HFT can create **systemic risk**. This allegation was reaffirmed in a report from 2014 by the IOSCO, which showed that 59% of participants believed HFT was a risk for security markets[223]. This fear is also emphasized by the informational asymmetry resulting from the reaction time of humans vs. computers[224]. In the following paragraphs, we will consider examples of the sources of those risks.

Firstly, few HFTr[225] often handle high **volumes of transaction**[226]. In case of failure, the risk of default of HFTr and the effect resulting from the interconnection of the markets would be important[227]. Indeed, the HFTr are often relatively lightly capitalized[228] (e.g. 1.5 mio art.22 SESTO[229]; CRD in EU[230]) and we note that there is no special risks model (e.g. stress test by inside of banks doing HFT[231]) applying. This dilemma notably concerns the "*funding liquidity*"[232], which is one of the reforms of the MIFID II[233] regarding HFT[234], which appears highly sensitive to credit risk[235]

Second, the fragmentation[236] and the current non-transparency[237] often hide the **interconnection and interdependence**[238] of the markets at large[239]. HFTr in particular are

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[223] IOSCO, *Market risk trends 2014*, p.15. ; see also Appendix 14: Risk categories.
[224] GO-SCIENCE, p.85 ; Appendix 10: time reaction of the market.
[225] SORNETTE / VON DER BECKE, p.7. ; ASIC, *report* p.73.
[226] http://bit.ly/1kIAzlh ; ASIC, *report* p.72, see notably the graphic presented.
[227] CHESNEY, p.56 and p.63.
[228] BIAIS / WOOLLEY, p.15.
[229] Art, 15 MIFID II refering to the legislation of MS.
[230] KERN ALEXANDER / SCHMIDT, p.48. See Reference. With the difference that the capital does not need to be fully liberated, it can be contracted for more than 1.45 million euros with an insurance, CRD 2006/49/EC.
[231] CHESNEY, p.69.
[232] Definition: "*The ability to pay the stock owner in case of default*".
[233] Notably clearing party. We note that new technology, e.g. Block chain, could revolutionize this domain.
[234] See Appendix 18: Eurex chain risks.
[235] BARKER / POMERANETS, p.50 f.
[236] CONTRATTO, p.153.
[237] ZIMMERMANN, p.100 f.
[238] CONTRATTO, p.153.

very active on wide markets and cross-border. The last crisis should have taught us that the systemic relevant issues are often not clear[240]. We will address some of the transparency issues later on.

Lastly, the **behavior of HFTr** reveals that they are highly correlated[241] and rely on very similar strategies[242]. Further, algorithms are able to provoke a contagious effect[243] ("*hot potato effect*"), as during the Flash Crash. In addition, HFTr are incentivized to behave aggressively[244] in order to stay the best. This short-term view can result in a "*normalization of deviance*" and endanger a long-term view of markets[245].

### 2.4.2 **Cyber risks**

The preponderant risk of tomorrow's market and participants are the **cyber risks**. Today, half of the exchanges in the world announced recurrent attempt of attacks[246]. The financial world is not well equipped to defend itself against those risks as stated by the ESMA in 2015[247], and the costs of damages are important ($450 billions/year)[248]. Some exchanges, like NYSE, are very conscious of those risks, but protection requires investments (time, staff, money)[249].

This problematic situation is **linked to HFT** in the sense that the procession of data at non-human time[250] (leaving no control[251]) can be extremely harmful[252]. Those effects can be visible. For instance, the diffusion of fake news (sanctioned under art.12 par.1 let.c MAR[253])

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[239] SORNETTE / VON DER BECKE, p.11.
[240] CONTRATTO, p.153.
[241] SEC, *Findings of may 6th*, p.35 ff.
[242] BIAIS / WOOLLEY, p.11 ; CONTRATTO, p.151 f. Speaks of: « *monoculture of algorithm* ».
[243] CONTRATTO, p.151.
[244] http://bit.ly/1kIAtKh
[245] GO-SCIENCE, p.79 f. ; IOSCO, *Regulatory issues report 2011*, p.29.
[246] http://bloom.bg/1WeeYC1
[247] ESMA, *ATG 2015*, p.10. notably regarding outsourcing
[248] CSIS, p.2.
[249] http://on.ft.com/1BCZGJS
[250] See Appendix 5: Human versus algorithms ecosystem and Appendix 10: time reaction of the market.
[251] CONTRATTO, p.152 ; see PARTNOY.
[252] In a latter part, we will assess the requirement of MIFID II to be able for algorithms to be able to asses « *plausible* » informations.
[253] See also in Switzerland: Art.161bis SCC.

via the creation of fake tweets (e.g. recent case 28% decrease[254]) or fake stories on the RSS feed of a newspaper[255]. Additionally, the effects can be much less visible and enhance market manipulation. For instance, the "*phishing*" [256] of information having an influence on stock price (e.g. merger)[257] can easily be found, by hacking small structures[258] and become very lucrative[259] without being visible[260]. The problem is that the orders do not look suspicious at all and, when combined with HFT methods, become totally invisible. This is the reason why FINRA stresses the importance of firewall, antivirus, and other means such as education regarding those risks[261]. In 2014, the FINMA stating that technology made misconduct especially risky[262]. As examples, we mention first a recent case where a microsecond delaying order malware was installed into the system of a hedge fund performing HFT to front run it[263]. The second example relates the hacking of a corporate announcement permitting $100 mio dollars of profit in 40 minutes[264].

Another risk link to HFT is **operational risk**[265]. It consists in all the bugs of the algorithm: "*natural failure of the hardware*"[266]. Those failures appear often in practice[267] and are sometimes presented as "*error trade*"[268] by HFTr to expel their responsibility[269] (N.B. It could be named "*The Frankenstein syndrome*"). This is problematic especially in

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[254] http://www.sec.gov/news/pressrelease/2015-254.html
[255] CSIS, p.16: linking to a Turkish case.
[256] See ESMA, *MAR DTS*, p.131.
[257] CSIS, p.16.
[258] (e.g law firms or accounting firms)
[259] http://bit.ly/1NwIVpu
[260] Further, the firm could even have no incentive to report an intrusion inside its systems: http://bit.ly/1NwIVpu
[261] FINRA, *Annual report 2015*, p.31.
[262] FINMA, *Annual report 2014*, p.33.
[263] http://bloom.bg/1WeeYC1
[264] See Hackers of news case (U.S.): http://www.sec.gov/news/pressrelease/2015-163.html
[265] SORNETTE / VON DER BECKE, p.13.
[266] BIAIS / WOOLLEY, p.15.
[267] See *supra* nº 4.4 ; appendix 1 Question 11
[268] IOSCO, *Regulatory issues report 2011*, p.37 and p.39 concerning flash orders.
[269] E.g. case with Flaw. See Oschers' case (US): http://www.sec.gov/news/pressrelease/2015-236.html ; See the Citigroup's case (U.S.): http://www.sec.gov/news/pressrelease/2015-171.html.

manipulation cases (e.g. Flash orders)[270], or during disruption as in the Flash crash where a "*broken algo*"[271] was alleged. It is not excluded that those bugs have a systemic relevance[272].

[270] SORNETTE / VON DER BECKE, p.13 ; Adler, p.168.
[271] IOSCO, *Regulatory issues report 2011*, p.29.
[272] CONTRATTO, p.152.

# 3 Regulations of HFT in Switzerland and Europe

*"It is always difficult to forbid something per se via regulations, as it will emerge in a different form somewhere else because professionals are rational in their quest to work at the limit of legality"*[273]

In this section, we give an overview of the new regulation of HFT under the FMIA and the MIFID II (*infra* n°3.1). We will then look more closely at specific points of the European regulation (*infra* n°3.2).

## 3.1 FMIA and MIFID II

We choose here to study Swiss and European regulations under the same point because they are highly interconnected and, when put next to one another, help us assess all details of the measures to be taken. Whenever possible, we will analyse references relating to HFT American cases in order to give practical examples of those requirements[274].

### 3.1.1 Swiss and European regulations

The **Financial Market Infrastructure Act** (FMIA) was recently adopted by the Swiss parliament[275]. The law and its ordinance (OIMA)[276] will enter into force on the 1st of January 2016. The FMIA aims at unifying the current legislation[277] and to make it compatible with international standards. This law will install the basis of a framework for HFT "*and eventually limiting it*"[278]. This regulation is motivated by the principle of prudence (art.74 par.2 Cst.) and proportionality, notably in sight of the risk of Flash Crash[279]. Its existence highlights HFT as being a risk *in abstracto*. The FMIA follows a euro-like approach (EU-

[273] SORNETTE / VON DER BECKE, p.19 f.
[274] Further, U.S. cases are much more disclosed than in the EU.
[275] End of the referendum possible on the 8th of October 2015.
[276] Note, the OIMA is completed by the OIMA-FINMA (currently under audition),which gives the view of the FINMA.
[277] This law partially abrogates the SESTA/SESTO , the NBA and the BA. See FC, *Report OIMA*, p.2.
[278] FC, *Message FMIA*, p.17 f. (loos translation).
[279] CONTRATTO, p.154. ; Notably with the MIFID II, EMIR,… See lists comple of difference FC, *Message FMIA*, p.28 ff.

compatibility)[280] due notably to the large numbers of interactions between Swiss and European Markets[281].

In Europe, the **MIFID II / MIFIR** (level 1 regulation) regulation is seen as a "*cornerstone*"[282] for the European market planning to harmonise its regulatory framework[283]. Both entered into force on 2.7.2014 and into application on 3.01.2017 (see timeline)[284]. The regulation is complemented by technical standards (level 2 regulation). The consultation and discussion paper relating to those standards are now closed and the final Drafts on ITS and RTS were recently published (28.09.2015)[285]. In the future, a special report assessing the effect of the MIFID II requirement on HFT must be handed in before 2019 (art.90 (1) let.c MIFID II). The focus is now on level 3 regulation.

### 3.1.2 **Generality**

In Switzerland, the financial **landscape** is composed by the SWX in Zürich and the Bern exchange (BX) in Bern, the latter being of lesser importance. A specific aspect of the Swiss market is that it is self-regulated (art.27 LMIF)[286] under the FINMA surveillance, which conducts prudential and market supervision[287]. The self-regulation constitutes one of the main differences with MIFID II[288][289].

We begin with some **generalities on HFTr.** In Switzerland, HFT is often used by proprietary trading firms, Hedge funds or banks[290]. The HFTr has to request[291] to register (art.10 par.2

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[280] KERN ALEXANDER / SCHMIDT, p.45 ; FINMA, *Annual report 2014*, p.57 ; FC, *Message FMIA*, p.28 ff.
[281] FC, *Message FMIA*, p.17.
[282] KERN ALEXANDER / SCHMIDT, p.45 f.
[283] KERN ALEXANDER / SCHMIDT, p.46.
[284] Appendix 12: MIFID II timetable
[285] The European Commission has a three month delay from then to endorse those standards.
[286] FC, *Message FMIA*, p.16.
[287] FINMA, *Annual report 2014*, p.8 f. KERN ALEXANDER / SCHMIDT, p.47 ; see also art.3 ff. SESTA.
[288] FC, *Message FMIA*, p.28.
[289] Another important difference: The MIFID II / MIFIR (Art.2 MIFIR) recognize: RM, MTF, OTF as infrastructure of the market. The FMIA recognize RM and MTF but not OTF, which can create discrepancies: KERN ALEXANDER / SCHMIDT, p.47, p.51. Further the FMIA (art.112) and the MIFIR (art.28) imposes to negotiate on those infrastructures.
[290] See RIOULT, p.94.

SESTA) as a trader to the FINMA and must fulfil the Capital requirement[292]. Under MIFID II, the uses of HFT fall under MIFID II (art.2 let (b) and (d) ii MIFID II). Then, HFTr must obtain a license (art.5 ff. MIFID II) as an "*investment firm*"[293] and be registered in a MS[294]. This procedure of authorisation is completed by a draft on technical and implementing standards[295]. We note that the previous exemption HFT from the commodities market under MIFID I disappeared[296].

### 3.1.1 **Organization of trading**

The first point concerns the **organisation of the trading** (art.28 FMIA ; art.48 MIFID II). Those requirements were thought to enable efficient surveillance and investigation[297] and moreover protect against market manipulation[298].

#### 3.1.1.1 Recording obligations

On the side of the "***trading platforms***" (art.26 par.1 let.a FMIA)[299], which means Regular Markets (e.g. SWX) plus Multilateral-trading platforms, it will be required to record the trading venues of the market participant on securities (art.2 let.b FMIA). Furthermore, it includes also all venues on external markets either declared or that the platforms knows of. Those records must contain the list of indications listed under art 28 par.2 FMIA[300], on the executed orders, which notably includes the orders cancelled[301], or modified[302] (alignment with FINRA's opinion)[303]. Under MIFID II, the requirements are similar. Investment firms

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[291] See art.17 SESTO ff. to see the content of the request.
[292] (See *infra* n°2.4.1)
[293] See definition art.4(1) i MIFID II ; FIA, *HFT report 2014*, p.1. ; see art.2(d) ii MIFID II,
[294] MÜLLER, p.387.
[295] ESMA, *Cooperation*, p.20 ff. and p.32 ff. ; to be implemented in 2017.
[296] See art.2 par.1 let.d and let.e MIFID II.
[297] FC, *Message FMIA*, p.50.
[298] See also art.31 par.1 FMIA.
[299] Including MTF. The OTF are not part of the Infrastructure under FMIA.
[300] ID participants, moment, the stock traded, number, amount, price.
[301] E.g. ESMA, *ATG*, p.93: demands that Trading platforms have automated alerts to detect it.
[302] FC, *Message FMIA*, p.50. ; FC, *Report OIMA*, p.18.
[303] FINRA, *Annual report 2015*, p.16.

must also record the transaction and the order (art.25 and 26 MIFIR) reference is made to the development of the ESMA[304] and the details of those organisational requirements[305].

The obligation to conserve those records last 10 years (Art.19 FMIA), under MIFID II it is minimum five (art.16(7) MIFID II)[306]. The records must be made available upon request.

From the "***market participants***" (art.2 par.1 let.d FMIA) point of view, a novelty is that according to art.38 FMIA and 17(2) MIFID II, the recordings obligations will also apply to them. The records must be chorological[307] and bears on all their proprietary[308] trades and the trades made for their clients[309]. The FINMA, in art.1 par.2 and 3 OMIA-FINMA, respectively the ESMA[310], determines the form and data to be recorded (art.36 par.3 OMIA; art.30 par.2 OMIA; art.26 (4) MIFIR). We note that HFTr must keep "*adequate*" records on the algorithms and the strategies used for its implementation[311].

The obligation can last up to 10 years (art.7 AMLA). An intentional failure to record can incur fines of up to 500'000 CHF (art.149 FMIA). Those records must be made available upon request.

3.1.1.2 Obligation to declare

In addition, market participants will have the **obligations to declare** (art.39 FMIA; art.17 (2) MIFID II)[312], all their orders on stocks and derivatives (art.2 let.c FMIA, only if they rely on an underlying stock, e.g. ETF)[313] to the platform and market surveillance authority[314] when they use AT[315] (art.30 par.2 OMIA). Those declarations are composed by the data listed

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[304] See ESMA, *DP*, p.496 ff.
[305] See whole list: ESMA, *RTS/DTS Annexe 1*, p.251 ff.
[306] EY, p.8. The requirement e.g. in Germany is 10 years.
[307] RIOULT p.86.
[308] See definition under the FINMA Circular 2008/5, nº17 ff.
[309] FC, *Report OIMA*, p.19. ; see definition under the FINMA Circular 2008/5, nº46 ff. ; see ESMA *DP*, 443 ff. (p.446): « *Containning, clients' nationality, residency, passport number and special ID number from the firm* ». See also p.502 ff.
[310] See ESMA, *RTS/DTS*, p.205, where reference is made to the ESMA, *CP*.
[311] ESMA, *DP*, p.453.
[312] FC, *Report OIMA*, p.20 ; KERN ALEXANDER / SCHMIDT, p.51.
[313] Comparison with trading platforms see paragraph above.
[314] MÜLLER, p.387.
[315] (and then HFT)

under art.37 OMIA[316] and determined by the FINMA. Under MIFID II, the MS fix those parameters (art.17 (2)) It aims at the identification of the economic beneficiary of the trade, notably if traders use DEA, middle men or "dirty" accounts, like in the U.S. Milrud's case[317]. Furthermore, HFTr are exempt from declaring in certain cases (art.37 par.4 OMIA). Those notifications will probably have a high cost for regulators, which will be required to process and expertise it (estimation in the EU 1 billion/year)[318].

An intentional failure to declare cause fines of up to 500'000 CHF (art.149 FMIA).

3.1.1.3 Cancelling and modification fees

The modification or cancellation of order, can justify[319] a **higher fee** (art.31 par.3 OIMA and 48(9) MIFID II)[320] at the exchange. In consequence, exchanges are encouraged to regulate in the sense of the penalization of HFT detrimental strategy[321], which is in our view detrimental to liquidity and unrealistic considering the gain of liquidity HFTr provide to platforms.

### 3.1.2 **Guarantee of an ordered trading**

The second point relating directly to HFT is the "**guarantee of an ordered trading**" stated under art.30 FMIA (art.17 (1) and 48 MIFID II). The trading platforms, including MTF (see art.42 FMIA)[322], must be appropriately geared[323] and be resilient in order to guarantee ordinated trading or business continuity[324] (note that the direct mention of HFT in D-FMIA, directly mentioning HFT, has been removed)[325]. This should be especially the case during

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[316] Basically: ID participants, moment, the stock traded, number, amount, price. See the details of the modalities under FC, *Report OIMA-FINMA*, p.12 ff.
[317] See Milrud's case (U.S.): http://www.sec.gov/litigation/complaints/2015/comp-pr2015-4.pdf.
[318] ADIL, p.2.
[319] Under MIFID II, this fee is justify by the « *burden* » HFT causes.
[320] FC, *Report OIMA*, p.18 ; ESMA, *DP*, p.280 ff.: with an explanation of the discipline that they want to apply notably in the continuity of algorithm testing (p.284).
[321] RIOULT, p.88.
[322] See art.40 and art.41 OIMA ; FC, *Report OIMA*, p.21.
[323] (see also art.14 FMIA)
[324] ESMA, *ATG*, p.61.
[325] See art.30 D-FMIA.

intense stress[326] caused by "*perverse effects of HFT*"[327] (or *"rogue"* according to art.67 MIFID II). Those requirements address AT in general but HFT in particular[328].

3.1.2.1 System and control of the risk

**Trading platforms** are required to promulgate a general set of rules that enhance: post-trade and pre-trade transparency, resilience, equitable, efficient and ordinated trade (art.30 and art.31 OIMA)[329]. Under MIFID II, those requirements should take into account the "*nature, scale and complexity*" of the firm's business[330] and can adapt to more stringent requirements. It will be required for them to conduct real-time monitoring[331]. Additionally, it will also be required to have enough skilful staff to conduct review or else[332].

**Market participants** are also required to implement system and controls of the risk (art.31 par.2 let.a-d OMIA; art.17 (1) and (2) MIFID II)(FINRA also gives recommendation in this sense)[333]. Generally speaking, markets participants shall not create perturbation[334] and shall not be used for market manipulation. Interestingly, the IT risks are addressed; Investment firms under MIFID II must have systems that ensure the confidentiality, integrity (reliability) and availability of data (e.g. against cyber attack)[335]. Under MIFID II, several pre-trade entry controls are required[336] such as: maximal order limit, value (fat finger), long/short position[337]

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[326] The latent idea is the Flash Crash of may 6th 2010 ; see also RIOULT, p.86 f. ESMA, *DP*, p.205: « *the situation where the ability of a trading venue to process and match orders and make prices available to market participants is compromised where there is an increase in the number of messages being sent to and received* ».
[327] FC, *Message FMIA*, p.52.
[328] See the name of art.31 OIMA.
[329] For the detailed list of the requirement see: ESMA, *DP*, p.240 ff.
[330] ESMA, *DP*, p.206 f. See notably the elements to be assessed, p.207, notably mentionning « *The percentage of HFT activity over the total turnover of the venue* »
[331] ESMA, *DP*, p.240 ff.
[332] ESMA, *ATG,* p.91 and 93 ; FC, *Message FMIA*, p.49 f.
[333] FINRA, *Annual report 2015*, p.16.
[334] HFT however has potentially a tendency to do so (see *supra* n°2.2).
[335] ESMA, *DP*, p.221 f. ; ESMA, *RTS/DTS annexe 1*, p.217. ; see *supra* n°2.4.2).
[336] ESMA, *DP*, 223 f.
[337] ESMA, *RTS/DTS annexe 1*, p.214 f.

(cf. *infra* n°3.1.2let.3.1.2.6). Finally, requirements of an ordered trading require a robust self-assessment twice a year[338].

In order to have **practical views**, we will now look at U.S. jurisprudences, for instance the Latour case, where "*fair and orderly trading*" was at risk[339]. An HFT company fragmented its informatics systems and an "*erroneous*"[340] change in the coding enabled it to send illicit orders and gain significant profit. The criteria here was that Latour lacked a "*direct and exclusive control*"[341] and adequate post trade surveillance[342]. Another U.S case is that concerning Morgan Stanley'[343], where HFT firm failed to put in place adequate risk controls on their DEA, which permitted a given trader to commit fraud. Further, the Citigroup case concerns minimum compliance and internal control systems that can be required from a trader having the position of broker-dealer[344], which includes controls that employee do not trade based on material non-public information obtained through their clients for instance[345]. This case is interesting in relation to the compliance that big banks use when they occupy the role of a broker-dealer and use HFT (similarly an UBS' case of risk control, compliance system and trade on information of clients[346]).

3.1.2.2 Identification of orders, clients and algorithms

Firstly, trading platforms are required to be able to **identify orders** generated by AT. The orders to be identified are defined (briefly and negatively) in the FMIA's message as those "*not only conveying orders without an algorithms decide their sending*" (loos translation)[347].

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[338] ESMA *DP*, p.206 f.
[339] ESMA, *DP*, p.205: Definition of a disorderly trading. Short-term changes in volume, volatility, or increases of message
[340] See *infra* n°2.4.2.
[341] See Latour's case (US):http://www.sec.gov/news/pressrelease/2015-221.html.
[342] Idem.
[343]See Morgan Stanley's case (US):http://1.usa.gov/1zBb9JK.
[344] E.g. firm placing proprietary tradings orders as trading for the account of its client. See http://bit.ly/20TUyyf
[345] See the Citigroup's case (U.S.): http://www.sec.gov/news/pressrelease/2015-171.html.
[346] http://bit.ly/1H2C5ZC
[347] FC, *Report OIMA*, p.18. "*Une négociation automatisée n'est pas algorithmique si le système ne sert qu'à transmettre ou à confirmer des ordres, sans qu'un algorithme numérique ne détermine leur déclenchement ni leurs différents paramètres*. » See *supra* n°1.5.

From the HFTr point of view, they will have to declare using AT and further record and individually identify their orders as such whenever they use it (art.31 par.2 OMIA; art.17 (2) MIFID II).

These requirements create a massive amount of data since the huge majority of the trading probably occurs through AT[348] (e.g. 99.6% in Australia)[349]. An ESMA report in 2015 contradicts this opinion and finds that the volume handled by AT is much less, but it excludes several parameters[350]. The certitude is that these identifications will be hard to make, while concurrently creating supplementary costs.

Second, the trading platforms (including Multilateral trading platforms, see art 45 FMIA and art.41 OIMA) are required to "*identify the participants… and the algorithms used*" (loos translation)[351] (art.31 par.1 let.b and let.c OIMA). We note that the **identification of HFTr** ("*ID Trader*")[352] aims at the firms, but also the clients (or the beneficiary[353]) and the clients behind a DEA (art.48 par.7 MIFID II)[354]. Under MIFID II, the lack of adequate risk control and identification forbids participants to use DEA (art.17 (15) MIFID II).

Finally, the trading platforms must **identify algorithms** responsible for decision-making, execution, and strategies employed (or "*ID Algo*") by a unique code (cf. *supra* n°1.5)[355]. The platform must find practical solutions at their "*discretions*"[356] to comply with this requirement adequately. However, it seems illusory to us that platforms would be able to do it properly (time/cost)[357], not. considering their evolving nature. The ESMA has its own doubts

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[348] http://bit.ly/1T03yfa
[349] ASIC, *report*, p.73.
[350] See ESMA, *ATG*, p.55.
[351] FC, *Report OIMA*, p.18.
[352] ESMA, *DP*, p.450: « *persons responsible for the decision making and trade execution enhances the role of transaction reports as a market monitoring tool* ».
[353] See Milrud's case where fake accounts were linked in China. ; ESMA, *RTS/DTS*, p.373.
[354] Under MIFID II, We note that DEA access are forbidden if there is no adequate risk control art.17(15) MIFID II.
[355] ESMA, *DP*, p.454.
[356] ESMA, *DP*, p.453
[357] SORNETTE / VON DER BECKE, p.20.

as well[358]. Furthermore, even if platforms have the whole composition of algorithms, we believe they will not have the capacity to decode whole strategies nor to keep updated records[359] due to probable overflow[360] and costs[361].

3.1.2.3 Test of algorithms

Both the trading platforms[362] and market participants[363] (also outsourced)[364] are required to **test algorithms**[365] (Art.31 par.2 let.e nº1 OMIA; see also 48 (6), and (12) let.g MIFID II)[366] in order to guarantee the resilience and ability of the system to handle high volumes of orders and messages (art.31 par.2 let a OMIA). Those tests concern only algorithms conveying the order execution (but not non-automated pure investment decision)[367]. Additionally, stress tests will occur on an initial and on-going basis[368] according to precise methodology[369].

It is a way to "*impose certain AT techniques* " on the platforms, which notably limits unexecuted orders[370]. For instance, algorithms shall have an internal system, or legal infrastructure, to slow down if the platforms become saturates with orders (Art.31 par.2 let.e nº2 OMIA) and shall be conceived to limit unexecuted orders. Most likely, the requirement

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[358] ESMA, *RTS/DTS*, p.385: "*The feedback indicated that industry practice did not operate in the proposed way and that when a number of implied order strategies are offered, the number of different possible combinations were significant*".
[359] See notably infra 1.5, on the renewal of algorithms. Even in the Commentary of MIFID II, this requirements seems impossible to fullfill. The ESMA say it leaves « *discretion* » but say that practical solution will have to be found. See ESMA, *DP*, p.453 f.
[360] ESMA, *DP*, p.454.
[361] ADIL, p.2
[362] ESMA, *RTS/DTS*, p.214 ff.
[363] ESMA, *RTS/DTS*, p.197 ff.
[364] ESMA, *DP*, 2014: Note, that: « *investment firms that are not a member or participant, but access the venue by means of DEA, either have to make use of non-live trading venue testing environments themselves or require their DEA provider to conduct the tests on their behalf*. » ; lists of requirement to tests ESMA, *RTS/DTS, Annexe 1*, p.260 f.
[365] N.B. The implementation of this requirement is not really very clear under FMIA/OMIA.
[366] http://bit.ly/1NwKS5h
[367] ESMA, *RTS/DTS*, p.196: « *Investment decision algorithms that are executed by non-automated means are out of scope of the algorithm testing requirements contained in the Regulation* ».
[368] ESMA, *DP*, p.213 and p.214 f.
[369] ESMA, *RTS/DTS Annexe 1*, p.207 ff.
[370] FC, *Report OIMA*, p.18.

limiting orders could also increase transactions costs[371] for different actors in the market[372] and reduce liquidity (market-making being affected)[373].

This disposition seems rational, however, we can determine that the platforms, highly willing to have HFT acting on their markets[374], will devise an even more resilient system instead of implementing low levels of cancelation and modifications. Moreover, the testing of algorithms, which "*behaves as designed (and) complies with the investment firm's regulatory obligations*"[375] is interesting from a legal theory aspect[376]. It implies the idea that, in the near future, coding could encompass notions such as the integrity of market or social welfare and build invisible regulations[377]. To conclude, those data will shed light on HFT, as today nobody knows what exactly HFT does[378].

3.1.2.4 Minimum tick size

Minimum tick size is a key point that concerns the minimal variation (**minimum Tick size**)[379] in price required in order to pass orders (art.31 par.2 let.e n°3 OMIA; art.48 (6) and art.49 MIFID II)[380]. Under MIFID II, the differences in tick size regimes[381] are harmonized among the MS[382]. The setting of such tick sizes is complex and very precise[383]. It must be "*small enough to avoid increasing viscosity and big enough to ensure a relevant cost to overbidding"*[384], which has both an effect on liquidity and the integrity of the market. The ESMA studied two viable options to calculate tick size; due to its length, reference is made to

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[371] ADIL, p.2.
[372] ESMA, *RTS/DTS, Annexe 2*, p.194 ff. Notably indirect cost bearing by clients or trading firms.
[373] ESMA, *RTS/DTS*, p.238.
[374] http://on.ft.com/1KBrAHf
[375] ESMA, *RTS/DTS*, p.196.
[376] http://bit.ly/1LngZ4u
[377] ESMA, *RTS/DTS*, p.196: « *ensure that the algorithmic trading system or algorithm behaves as designed, complies with the investment firm's regulatory obligations*. »
[378] Appendix 1 Question 6
[379] http://bit.ly/1MPfewK
[380] ADIL p.2
[381] The regimes will apply for shares, depositary receipts, exchange traded funds, certificates and other similar financial instruments.
[382] ESMA, *DP*, p.289.
[383] See RIOULT, p.89.
[384] ESMA, *DP*, p.291.

it here[385]. It notably uses the table of the FESE to try to be normative. Those novelties are part of the "*impos(ition of) certain AT techniques* " to HFTr and address the issue that HFTr create "*illusory*" liquidity (cf. *supra* n°2.1).

3.1.2.5 Contract with market-makers

Another important requirement lies on the written contract between (all) [386] **market-makers** [387] and trading platforms (art.30 par.3 OIMA and 17(3) MIFID II) [388]. This requirement will permit platforms to require a certain presence from those actors depending on the stress of the markets (see detail[389]). Additionally, it introduces an obligation for HFTr to bring a relatively continual supply of liquidity to the market. Consequently, liquidity will dry up while also leading to the outlawing of front running on large orders[390]. Furthermore it could reduce the interest actual position of market-making if rebate[391] and advantages[392] are modified too.

3.1.2.6 Technological safeguards

The **technological safeguards** are a necessity acknowledged by international standard setters like IOSCO and ESMA [393] in today's context of automated markets [394]. They enable management of risk as described above (cf. *supra* n°3.1.2 and 3.1.2.1). In the following paragraph, we study several of these safeguards.

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[385] ESMA, *DP*, p.291 ff. whole lists: ESMA, *RTS/DTS Annexe 1*, p.278 ff.
[386] http://bit.ly/1QHqIZ4
[387] See *infra* n°1.5 ; definition under MIFID II Art.4(7) MIFID II: "'*market maker' means a person who holds himself out on the financial markets on a continuous basis as being willing to deal on own account by buying and selling financial instruments against that person's proprietary capital at prices defined by that person* ". ADIL ,p.2: Further, if the activity is partial, market-making activity will be realised from the moment where a majority of order/trades trigger the market maker rebate.
[388] Art.30 par.3 OIMA ; see definition of market-maker under the FINMA Circular 2008/5, *Erläuterungen zum Begriff Effektenhändler*, n°39 ff.
[389] Appendix 23: Market-making requirement MIFID II
[390] ADIL, p .2.
[391] Most of the time on a per share basis.
[392] Appendix 1 Question 7.
[393] IOSCO, *Regulatory issues report 2011*, p.37.
[394] BIAIS / WOOLLEY, p.16.

The first are the **circuit breakers**[395] (or "*trade halts*"), which are a real-time[396] reactions used to stop trading either on market (wide/single stock) or base on a limit (up/down). The RM must implement circuit breakers (art.30 par.1 and par. 2 OMIA; art.48 (6) MIFID II) because they help to prevent greater damages[397]. At SWX, they have two types: the "*stop trading*" (drop of 1-2%) and the "*avalanche stop*" (drop >2%)[398]. Both stop trading on the affected stock for an adapted time from 30 seconds to a whole day[399]. After a set of checks, the safeguard then triggers it back or cancels problematic trades. Trade halts are efficient but also relativize the traditional vision of an "*invisible hand*"[400] over the markets: sometimes paralysis is better than a killing stroke[401]. Finally, trade halts create delays, which potentially allow for the application of directional strategies since the data and the stock are no longer synchronised[402].

A second risk control is the "***kill switch***"[403] permitting for RM to halt participants, notably important ones[404] in order to avoid systemic risk of important trading loss[405]. Furthermore, under MIFID II, the "*Kill button*" is mandated as a monitoring tool[406]. The benefit of these safeguards is not yet fully assessed[407].

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[395] CONTRATTO, p.157.
[396] See *infra* n°3.1.3
[397] N.B. damages can be as important at stock level or at derivatives of an underlying stock: BIAIS / WOOLLEY, p.17.
[398] Appendix 1, Question 8 and 9.
[399] The time is constantly adapted.
[400] Concept of Adam Smith.
[401] http://cnnmon.ie/1kwYhRF
[402] http://bit.ly/1YbkJOD
[403] FINRA, Annual report 2015, p.14.
[404] (e.g. Hedge fund)
[405] JONES, p.40.
[406] ESMA, *RTS/DTS Annexe 1*, p.211 f. ; ESMA, *DP*, p.218: « *allow firms to identify as soon as practicable any issues that may negatively affect the fair and orderly functioning of the markets, and that allow them to take appropriate action to address these issues. This includes the ability to immediately cancel all of the firm's outstanding orders at all trading venues to which the firm is connected by means of a "kill button"* ». http://bit.ly/1MUXRAr
[407] ADIL, p.2.

Finally, we can name **others** as the "*plausibility check*" that avoid things as the "*fat finger syndrome*"[408] to happen. Another protection is the "*architecture throttle*"[409], which avoid traffic congestion[410]. Further the RM must also foresee "*emergency procedure*", for instance if an earthquake[411] occurs[412]. Lastly, platforms shall install systems able to discover unlawful trades and strategies[413].

### 3.1.3 **Surveillance**

**Surveillance** of authorities concerns regular trading platforms (art.32 FMIA; art.69 MIFID II) but also MTF (art.41 OMIA)[414]. It must be independent, personal, and material,[415] and always efficient (e.g. stress period) (art.23 par.2 OMIA ; art.32 OIMA). In case irregularities (insider trading,…) are discovered, a report[416] has to be sent to the competent authorities (e.g. FINMA: art.31 par.2 FMIA), who then have the possibility to investigate or not (84 par.2 FMIA)[417], which very often requires international cooperation (Art.42 FMIA ff.)[418]. Surveillance authorities, like FINMA, only take civil measures against natural or legal persons[419]. It can sanction HFTr via: declaratory rulings, confiscation, order disgorgement, or bans (art.29-37 FINMASA)[420].

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[408] See the n°2 of Appendix 18: Eurex chain risks.
[409] ESMA, *ATG*, p.87. Recommended by ESMA.
[410] See the n°3 of Appendix 18: Eurex chain risks.
[411] CONTRATTO, p.159.
[412] ESMA, *ATG*, p.27: those procedure are mostly implemented in EU.
[413] Appendix 1, Question 8 and 9. Appendix 1 Question 10
[414] Note, the FMIA do not considers OTF as part of the financial infrastructure, as MIFID II does.
[415] FC, *Message FMIA*, p.28: We note that FMIA do not forbid to trade for its own account on its own MTP so long independence and interest of the clients are maintained (art.44 let.c FMIA), which is a difference with MIFID II
[416] Under MIFID II, the « *STOR* » Suspicious transaction and order reports ; see ESMA, *MAR DTS*, p.279 ff.
[417] See Appendix 1 Question 10
[418] http://bit.ly/1MPfj3B
[419] http://bit.ly/1RWeomq
[420] FINMA, *Annual report 2014*, p.33 ; The ban can have adverse effect too: FINMA, *Annual report 2014*, p.74.

More specifically, the **monitoring of algorithmic orders** in real time is not possible[421]. ESMA stated that it will *per se* have a delayed ("*t+1*") but should have as an objective[422] close to real time estimation[423] of no more than 5 seconds[424]. Furthermore, monitoring shall include a real time reaction tool for algorithms that behaves unexpectedly: e.g. the "*kill button*", and an appropriate risk exposure calculator[425].

### 3.1.4 Tax on the financial transaction

A drastic attempt to regulate HFT is to indirectly impeach it through **taxation on the financial transaction** (TTF) (on stocks, options, derivatives)[426]. The TTF can partially or entirely affect HFT depending on the taxation of: initiating, cancelling, and modifying transactions [427] or their rate (0.1%- 0.5%) [428] (e.g. France 0.2%) [429]. The TTF has the advantages of theoretically[430] providing a significant amount of money ($30-100 billion)[431] and of giving the public opinion the impression that the financial world pays for the crisis[432]. However, the advantages of the TTF are highly debated[433].

In **Europe**, the TTF has not come to a consensus and therefore eleven countries (see map list) [434] decided to unify in a reinforced cooperation to implement it, which affected

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[421] ESMA, *DP*, p.203.
[422] ESMA, *DP*, p.203.
[423] ESMA, *RTS/DTS Annexe 1*, p.215. ; see also risk benefit analysis ESMA, *RTS/DTS Annexe 2*, p.201.
[424] ESMA, *DP*, 204 ; ESMA, *RTS/DTS Annexe 1*, p.215.
[425] ESMA, *DP*, p.218 f. ; ESMA, *RTS/DTS Annexe 1*, p.216 f.
[426] Appendix 1 Question 12
[427] CHESNEY, p.107 ; http://www.cnbc.com/id/45044011 ; BIAIS / WOOLLEY, p.16.
[428] BIAIS / WOOLLEY, p.17.
[429] N.B. it shall be around 0.01 % for derivative. In Switzerland, similar amount: 0.1% for stocks, 0.01% for derivatives http://bit.ly/207vAe8
[430] SMADJA, p.74 ; "*In the end of its studies on the French TTF case ends up with the conclusion that the calculation and effects are full of uncertainty and potentially risky, notably for the real economy*".
[431] http://bit.ly/1RxXZnE
[432] Appendix 1 Question 12 ; SMADJA, p.74.
[433] http://bit.ly/1LY4Uqj
[434] See the map of Appendix 15: Agreeing Member state of the Financial tax. Adopted in 2013, put in place from the 1st of January 2014.

Switzerland by forcing it to adopt compliance regulation[435]. In Italy HFT has disappeared because of the TTF[436]. The heterogeneity of application of the TTF greatly reduces its effectiveness[437]. In **Switzerland**, the TTF has failed to prevail, for the moment at least[438]. If it had prevailed, we would have had to notably revise the LT because it would have created a double taxation (emission and negotiation of stocks and obligations). Switzerland is currently in a stand-by position, awaiting international consensus on the TTF[439]. **Outside of Europe**, we can mention that Hong Kong applies such a tax[440]. In the USA, a TTF (on cancellation) was recently (2015) proposed by Hilary Clinton[441].

## 3.2 European specificities

A first specificity under MIFID II, without equivalent under FMIA, is to **define HFT** (art.4 (40) MIFID II) for the first time (see appendix for the text)[442]. The definition is threefold, and focuses on the technical aspects of HFT. An HFT is then a technique, which uses (1) infrastructure to minimise latency, (2) a system's determination of order initiation, (3) high messages rates[443]. It is interesting to note that speed is not part of the definition and that this definition differs from the methods used in the ESMA report presented above[444]. In addition, according to the definition, once an actor falls into this category, he is treated as HFT for all EU its trading venues. These results highlight the complexity and possibly the uselessness of a definition for HFT.

The second specificity we wish to address is, under art.50 MIFID II, the **harmonized clocks**[445] which aim to synchronise the business clock under UTC reference time to record

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[435] http://bit.ly/1S6REjZ
[436] http://bit.ly/1kICBBR
[437] HFT only have to avoid the MS' markets applying the tax.
[438] It seems that if the situation in Europe became more favourable, notably in the leading financial countries, like GB, Switzerland, the Federal Counsel could change its mind. http://bit.ly/207vAe8
[439] http://bit.ly/207vAe8
[440] Stamp duties in Hong-Kong of 0.1%.
[441] http://bit.ly/1kICBBR
[442] See the text under Appendix 25: Definition of HFT under MIFID II.
[443] Including quotes and cancellations.
[444] See *supra* n°1.2.
[445] http://bloom.bg/1O5JgjT

the date and time of any reportable event[446] in the EU (already in 2016?[447])[448]. This change has an impact on HFT because, with a divergence limit of 100 ms, it limits the possibilities of arbitrages and market abuses[449] and creates more integrity.

In the same vein, MIFID II created an equal access to post-trade data on equity and equity-instruments[450], called the **Consolidate tape[451]** (art.65 MIFID II). It sends data (in an unified format, types), as close to real time it is technologically possible, or on a reasonable commercial basis, gathered on trading platforms and market participants[452]. Investment firms must then report in "*real time*" (< 1 min (aim) - 5min)[453] cancelation from AT[454]. The information will only be given free of charge after 15 minutes.

Several feeds[455] already exist that permit access to valuable data for substantive fees[456]. This phenomenon is problematic regarding the question of integrity[457] and equal access to information. Experience has revealed that live feeds appearing to be to slow (e.g. SIP feed in the U.S.A[458]) did not solve those issues[459]. The concept of consolidate tapes goes in the right direction, however, we highly doubt that it will change anything considering the speed of HFTr.

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[446] Appendix 21: Harmonized clocks
[447] http://regulation.fidessa.com/2015/10/06/does not-esma-time-fly/
[448] For the whole reasonning and a cost/benefit analysis see ESMA, *RTS /DTS, annexe 2*, p.535 ff.
[449] ESMA, *RTS/DTS*, p.387.
[450] In the future maybe it will be extent also to non-equities like instrument: EY p.5
[451] http://bit.ly/1kwYmor
[452] EY p.5.
[453] ESMA, *RTS/DTS*, p.44 ff. (46).
[454] ESMA, *RTS/DTS*, p.43 f.
[455] E.g given by exchanges, or company like Reuters, Bloomberg.
[456] EY p.5.
[457] See ITG's Case (U.S.): http://www.sec.gov/news/pressrelease/2015-164.html. ; http://bit.ly/20TUM8z
[458] http://cnb.cx/1KBrhMG
[459] The RM and the OTC platforms also sell feeds see also *supra* n°3.1.1 and infra n°4.5.

# 4 Market manipulations and HFT

"*The relative lack of HFT-related cases is consistent with the interpretation that HFT is not giving rise to more abuse, or alternatively that such abuse is much harder to detect*"[460]

In this section, we take a closer look at the relationship between HFT and market manipulations. After setting the general regulations applying (*infra* n°4.1), we study three types of manipulations: Spoofing (*infra* n°4.2), insider dealing (*infra* n°4.3) and front-running (*infra* n°4.4). Then, we briefly mention the issues of dark pools (*infra* n°4.5). Before addressing the question of the investigations and sanctions (*infra* n°4.6).

## 4.1 Regulations

In **Switzerland**, market manipulations are regulated under the SESTA/SESTO. This regulation will be amended by the FMIA and taken alike without adding matters[461]. The circular of the FINMA 2013/8 completes the legislation. The legislation considers administrative and criminal sanction[462]. These protections against market manipulation are *ex post* and can be cumulated with others, for instance contract law protections[463]. The market manipulations require that the author knows or, should have known, of a manipulation, but do not require a real effect on the market[464].

In Europe, the MIFID II regulation as seen above[465] was coupled with a regulation on market abuse: the MAR. The MAR entered into force on 2.07.2014 and amended the MAD I. Europe also adopted the MAD II, completing MAR. The MAD II contains the harmonised criminal offences of insider dealing and market manipulation and prescribes the maximum criminal penalties. The European legislation on market abuse is applicable to all the markets participants whatever the judicial form they take[466].

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[460] GO-SCIENCE, p.89.
[461] FC, *Message FMIA*, p.18. See *supra* n°3.
[462] MÜLLER, 386 ; note that the SCC, not. art.161bis SCC, are still available.
[463] KORSMO, p.606.
[464] MÜLLER, p.387.
[465] See *supra* n°3.
[466] MÜLLER, p.387.

## 4.2 Spoofing

The abuse on the markets with automated venue is **new wine in an old bottle**; even if the tools that changed the corpus stayed the same. Spoofing is considered as a typical dark strategy used by HFTr[467], which can be implemented in many schemes[468]. However, even if the definition supposes an element of velocity to take advantage of the illusion, the abuse is still possible for any types of traders[469]. Spoofing can have large repercussions. For instance, China recently launched a campaign against spoofing after the phenomenon led to a 3.5 trillion selloff[470].

**Swiss law** defines spoofing as the action of "*placing orders in the trading system in order to create an illusion of supply or demand and then deleting them prior to execution*"[471]. It constitutes market manipulation sanctioned under administrative law (art.33f SESTA/ art.143 par.1 let.b FMIA) and also under criminal law (art.40a SESTA / 155 par.1 let.a FMIA; and evt. art.161bis SCC[472]). This behaviour can be sanctioned by up to three years of jail or, if the benefit exceeds 1 mio CHF, up to 5 years (art.155 par.2 FMIA). Additionally, traders are required to employ effective systems and risk controls to prevent Spoofing[473].

In **European law**, spoofing falls under 12 par.2 let.c iii) MAR[474], where HFT is specially mentioned. The volume of daily trades, the number of cancellations, and the short time span, are described as indicators of this manipulation (MAR, Annexe 1, let.A). Furthermore, it is a criminal offence under art.5 par.2 MAD II. The MAD II requires sanctions up to 4 years

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[467] (*supra* n°1.5)
[468] e.g. Appendix 17: HTG spoofing scheme ; http://bit.ly/1YbkXFi ; http://bit.ly/1FyN8Gj
[469] Appendix 1 Question 11 ; Milrud's case (U.S.): http://www.sec.gov/litigation/complaints/2015/comp-pr2015-4.pdf
[470] http://bloom.bg/1PQf4ut Recently also an investigation for a $6 billions dollars spoofing in the U.S. http://bloom.bg/1QDYBee
[471] FINMA Circular 2013/8 n°30 (16 ff.). ; WEBER, p .4: « *carries out any transaction or executes buy- or sales orders, of which such person knows or should know that this will send a false or misleading signal in relation to the offer, demand or price of securities admitted for trading on a stock exchange or on a similar platform in Switzerland*. ».
[472] Note that the Criminal requirements over the intention are different.
[473] See FINMA Circular 2013/8, n°30 and n°62.
[474] Definition: "*creating or being likely to create a false or misleading signal about the supply of, or demand for, or price of, a financial instrument, in particular by entering orders to initiate or exacerbate a trend* ».

(art.7 par.2 MAD II). In its guidelines, the ESMA names spoofing as an issue to take into account for trading platforms[475].

From the research we have done, we saw that HFT was often considered as the **black sheep** and accused among others traders (e.g. Facebook IPOs' case[476]) without many proof of it. It was rather rare even two years ago to find cases in relations with HFT[477]. The problematic was presented in a UK studies stating that: "*The relative lack of HFT-related cases is consistent with the interpretation that HFT is not giving rise to more abuse, or alternatively that such abuse is much harder to detect*"[478].

The situation concerning spoofing by HFTr is currently **still uncertain**. Some studies have shown that HFTr do not conduct systematic manipulation[479]. Excessive messaging was in fact caused mostly by dysfunctional algorithms rather than by intentional traders[480]. This is the whole problem, because "*error trade*" and "*dysfunctional algorithms*" are very difficult to spot (see the CS' case[481]) and to prove (see *infra* n°4.6)[482]. So far, small errors and dysfunctions cannot be considered as misconduct. This is the reason why; the MIFID II and FMIA tend to create more technical impossibilities or compliance systems and databases for answering to HFT (*infra* n°3.1 ff. e.g. fees, testing, recording,…) rather than classical law relying on interdictions.

Nevertheless, some **certainty appears** from the practical cases concerning HFT arising alongside with the effort of transparency and data gathering of the markets. Considering the recent evolution of EU law, the effects of the regulations are not yet observable. However, in the U.S., spoofing is today a very relevant topic, since several cases are denounced every

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[475] ESMA, *ATG*, p.91.
[476] JONES, p.39 ff ; http://bit.ly/1kVXhpS
[477] See LEIS, p.46.
[478] GO-SCIENCE, p.89.
[479] ASIC, *sheet*, p.7.
[480] ASIC, *report*, p.90.
[481] IOSCO, *Regulatory issues report 2011*, n°42. See also the spoofing scheme of the HTG case: Appendix 17: HTG spoofing scheme.
[482] SORNETTE / VON DER BECKE, p.13 ; See infra n°4.6: "*Just entering and cancelling a lot of shares, or buying and selling in rapid succession, do not prove spoofing. Perhaps you had a legitimate motive, and who can look into your heart to find out?".*

week[483] and, in November 2015, the first spoofing case (Mr. Coscia) was judged[484] under the definition set in 2010 by the Dodd Frank Act[485]. The Coscia's case is not isolated, e.g. the Oscher case already mentioned in the footnotes[486], where fragmentation of market was used: "*Oscher took advantage of our interconnected markets by placing non bona fide orders on one exchange, and then buying or selling the spoofed securities at artificial prices on other exchanges*". We can also mention another, less recent case from 2010: the Trillium case[487], conducting a classical scheme of spoofing.

As stated under the first paragraph of this section, spoofing can be implemented through a multitude of schemes. One has been recently explained in the HTG's case[488]: spoofing creating a "*unique signature*" consisting in three phases: build-up (1), cancelling (2) and flipping (3). The speed of execution was the element that betrayed the manipulators: "*The frequency and speed with which the build-up, cancel and flip progression took place eliminates the possibility that this pattern was anything other than orchestrated. The Doe Defendant(s) could not have legitimately changed their mind as to the direction of the market so quickly, so often, and with such precision*[489]". See the appendix for further explanation[490]. See also Bloomberg's virtual animation: "*How to catch a spoofer*" retaking the scheme[491].

Furthermore, we stated in the first paragraph the relative importance of velocity. This relativity can be illustrated by the Milrud's case where HFT's firm were tricked by manual spoofing through the use of "*hot keys*" on a keyboard (activated by humans and not computers) by Chinese[492]. The SEC retained spoofing. This case helps us to realize that definitions are relative, shaky and not necessarily linked perfectly to HFT[493].

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[483] http://bv.ms/1LY6jx0 ; http://bit.ly/1LfZYId: example of spoofing denounciation on gold.
[484] http://bloom.bg/1HQCQzY ; http://1.usa.gov/1Wen2xm
[485] For an analyse under Dodd Frank Act, see: http://bit.ly/1WZmfRk
[486] See Oschers' case (US): http://www.sec.gov/news/pressrelease/2015-236.html
[487] See LEIS, p.48 ff.
[488] http://www.nanex.net/aqck2/HTG_Complaint.pdf ; http://bit.ly/1FyN8Gj
[489] http://www.nanex.net/aqck2/HTG_Complaint.pdf, p.4.
[490] Appendix 17: HTG spoofing scheme.
[491] http://bloom.bg/1PVzRKM
[492] See Milrud's case (U.S.): http://www.sec.gov/litigation/complaints/2015/comp-pr2015-4.pdf
[493] http://bv.ms/1FS84u0

Another interesting jurisprudence is the Hold's case[494]. The first reason of this interest is that the manipulation came from an outsourced HFTr, passing through a DMA[495]. Hold was convicted for not being able to recognize the manipulation passing in their systems. This outsourcing issue allows one to discuss the second reason of interest for this case: OTC markets. Both have in common to stand out partially or totally out of the scope of regulators and hence being non-transparent. This shows that HFTr wishing to commit abuses often try to find a "*dark path*". We will talk about dark pools in a latter section[496].

Last but not least, the Da Vinci case[497] highlights that spoofing can be conducted using large and small orders. However, it is a practice requiring a lot of professionalism and "*must be calibrated perfectly in order to be successful*". Spoofing contains therefore an inherent risk of failure.

In conclusion, we showed that HFT cases, relating HFTr's behaviour from zero to five years ago, are still present today. Further, the improvement of the quality of the data will probably make spoofing cases more apparent[498].

### 4.3 Insider dealing

The **superior trading ability** of HFT and their frequent use of private feeds of information (e.g. ITG case)[499] raise the question of the fairness and integrity of markets[500]. In principle,

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[494] See Holds' case: https://www.sec.gov/litigation/litreleases/2014/lr23143.htm ; http://on.wsj.com/1OLaU8p

[495] In relation with this outsourcing, MIFID II talks about DEA, direct electronic access, this discussion could be interesting in the context of outsourcing, see about it ESMA, *RTS/ITS*, p.211.

[496] See *infra* n°4.5.

[497] See http://bit.ly/1MJCbWA: « *The defendants typically used a mixture of large and small orders entered on one side of the LSE's order book to create a false impression of supply or demand in a particular stock. These orders were not intended to be traded. The large orders were carefully placed at prices close enough to the best bid or offer prevailing on the LSE at the time to give a false impression of supply and demand, but far enough away to minimise the risk that they would be traded. The small share orders (typically around 100 shares) were used to improve the best bid or offer price* ».

[498] An U.S. prosecutor of spoofing scheme (HFT) also going in this direction http://bloom.bg/1HQCQzY

[499] See ITG's Case (U.S.): http://www.sec.gov/news/pressrelease/2015-164.html.

[500] IOSCO, *Market risk trends 2014*, p.16 ; SHORTER / MILLER, p.12.

insider trading does not concern HFT in particular. However, in the U.S. its capacity to create an asymmetry of information with other market participants through the means set above[501] has caused its condemnation as a form of "*insider trading 2.0*"[502]. U.S. law on insider trading could change in the near future in order to take into account the reality of the access of information on the market (not. considering HFT)[503]. The issue is notably often related to flash orders, which are forbidden in Switzerland[504].

**Insider dealing** (art.142 al.1 FMIA / art.8 par.1 MAR) is given when: "*prior non-public information with effects on the price (*art.2 let.j FMIA / art.7 let.a MAR) *is used before it is disclosed in the market*" [505]. Art.8 par.1 MAR, states that it counts even for the orders sent, cancelled or modified on the information. Additionally, as seen above (*supra* n°3.2), the MIFID II addresses several propositions to create homogeneity in the access of information, notably with the consolidate tape.

The question of insider dealing and HFT is more about a future **debate** on the question "*to determine the extent to which informational advantages gained by high-frequency traders should be tolerated* »[506]. For the moment, there is no clear limit setting what is allowed. This situation is problematic because, following the articles defining inside information *(*art.2 let.j FMIA / art.7 let.a MAR), all the typical characteristics of HFTr (e.g. colocation, very effective processor, SOR, private feed, expert-network[507]) could potentially constitute insider

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[501] See *supra* n°1.3.
[502] http://cnnmon.ie/1Qomer2 ; Appendix 4: Front running.
[503] http://nyti.ms/1Nxba4X "*Any attempt to change the ground rules for insider trading prosecutions will inevitably raise complex questions about what types of information and trading practices should be targeted (….) So if the definition of insider trading should be expanded, it is worth taking into account how the markets have changed* ».
[504] RIOULT, p.95.
[505] Circular FINMA 2013/8, p.15 We note that during the consultation, those effects on the price where on purpose not really clearly defined. An HFTr could then ask an investigator to prove the relevance of the information on the market price, which, for very small amount, could be extremly difficult.
[506] http://nyti.ms/1Nxba4X
[507] http://nyti.ms/1PO63Dd

trading, since they provide a slight advantage[508]. Why would HFTr invest a penny in technologies if it did not give them an advantage[509]?

This debate should be resolved keeping in mind that a perfect solution does not exist. Indeed, it is almost impossible to convey all information "*under embargo*" and disclose it to all the markets participants at the same time. The scale of time at which HFT operates will further raise a lot of difficulty to find an equitable solution. In our view, the guesswork (e.g. quote matching[510]) and traders willing to invest in technology should not be sanctioned. The benchmark for the disclosure of the information to the public sphere should be fixed according to the time an unlimited willing trader would take to access it[511]. The access of information relies there on a competition law issue[512]. Moreover, there should be some display obligations for those having special access (e.g. inside a trading platforms).

### 4.4 Front running

**Front running** is a derivate form of insider trading (art.7 par.1 let.d and 8 par.1 MAR[513] and art.142 par.1 FMIA)[514]. The two notions are sometimes mixed under the same term. Here, we choose to take the traditional view[515] defining it as: "*the illegal practice of a stockbroker executing orders on a security for its own account while taking advantage of advance knowledge of pending orders from its customers*"[516]. The difference resides in the additional presence of the client, which can give rise to additional claims (contract law)[517]. Furthermore,

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[508] See RIOULT, p.88.
[509] http://cnb.cx/1KBrhMG
[510] MACINTOSH, p.10, Quote matching is not illegal, since the information upon which it is based does not derive from direct knowledge of another entity's trading activity, but from guesswork.
[511] http://cnb.cx/1KBrhMG ; PWC, p.4.
[512] PWC, p.4.
[513] We note that the MIFID II is more precise because it includes this notion of client, whilst the FMIA put it under the insider trading case and does not make any distinction.
[514] http://bit.ly/1NnS97b
[515] See ADLER, p.167 ff. ; http://cnb.cx/1NxbIb3
[516] The front running broker either buys for its own account before filling customer buy orders that drive up the price, or sells for its own account before filling customer sell orders that drive down the price.
[517] E.g. An HFTr trading on information of its clients that causes him a prejudice could be seen first as a insider trading and secondly as a lesion of its contracts (e.g. art.398 CO).

it raises the question of eventual conflicts of interests, notably when platforms or firms are willing to sell trading orders data.

The MIFID II and FMIA foresee several provisions that indirectly fights against Front-running. Notably, through the resolution of **the conflict of interest** with several actors that could feed the HFTr with data. First, rules concerning market operators and investment firms using an MFT or OTF are reinforced to prevent conflict of interest (art.18 (4), art.23 MIFID II; art. 20 and art.44 FMIA). They must notably put systems controls in place and, for those active in a wide range of activities (e.g. big banks, cf. recital n°56 MIFID II), to make clear separation between their proprietaries activities[518]. Further, the MIFID II foresees that markets operators using MTF or OTF will not be allowed to conduct proprietary trading on their own system. The FMIA does not go as far as to allow them to trade if conflicts of interest are preserved (art.44 let.c FMIA)[519].

Furthermore, we briefly mention that under MIFID II new rules concerning the **best execution** are being implemented, notably aiming to prevent conflict of interest in OTF (art. 20 MIFID II, not. par.7). Moreover, it imposes the investments firms' obligation as to provide detailed information to their clients (e.g. disclosure of the top five trading venues) and forbids them to route clients towards specific platforms to earn money (art. 27 par.2 MIFID II).

The HFTr are very interested in obtaining data from OTC platforms, such as in dark pools (e.g. Australia)[520]. This results in the certain short-term profit they can gain out of it[521]. We now take several **practical cases** to understand how HFT can be used to front run. Those cases show the importance of transparency and the scheme and risk control that could be used.

The first case concerns CS. It highlights the obligation to explain in detail to Clients how the platform operates. The case shows that **CS** sold clients' non-public information from its dark

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[518] FC, *Message FMIA*, p.59. E.g. a recent UBS case of front running in an automated environment relating this question: http://bit.ly/1H2C5ZC
[519] FC, *Message FMIA*, p.28.
[520] ASIC, *sheet*, p.5.
[521] For instance, the Hedges funds are pictures as "*juicy prey*" for HFTr by LEWIS. FINMA, *Annual report 2014*, p.32.: FINMA talks of a "*corporate culture of misconduct*" relying often on short term profit and putting the interest of the client in second place.

pool to HFTr in order enabling HFTr to trade (front-run) against CS own Client's[522] (settlement for $80 mio). A similar case is at **UBS**. UBS made favouritism for market makes HFTr. The bank didn't disclose information on the operation to their clients, but did it to HFTr, permitting them to front run the clients[523].

Even if the presence of HFTr is not always attractive, the Clients must be able to assess it. Similarly, in the **Barclays'** case[524], where marketing material was falsified to hide the importance HFTr played in the dark pools, also highlights this duty. Another example of the duty of the platforms can be found in the **Paradigms's** case. It is explained that the consent of clients is required if traders are willing to participate on both side of the trades[525].

A further case is that of **ITG's**. The platforms used non-public information in its dark pool to trade against Clients, via their proprietary desks[526]. This case shows the possible fragmentation and difficulties to catch people front running. Similarly, the **Citigroup** case presents a situation where a firm, lacking internal risk control and surveillance, failed to detect that its affiliate company benefited from non-public information of their Clients[527]. This last case is particularly interesting because it permits us to draw a parallel with the MIFID II/FMIA regulation, which tries to create a technological compliant environment (not. via algorithmic testing): "*Today's high-speed markets require that broker-dealers and investment advisers manage the convergence of technology and compliance* »[528].

## 4.5 Dark pools

**Dark pools** are private trading platforms through which orders can be sent anonymously[529]. They always represent an important part of the volume traded ("*dark liquidity*"). For instance,

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[522] http://bloom.bg/1KaOp7U
[523] The case is about trades on micropenny stocks (<1 penny), the HFTr were pitched on this possibilities but not the client, which gave them the possibilities to front run orders. See http://bloom.bg/1ONuL3u ; http://1.usa.gov/1NTtLwH
[524] http://bloom.bg/1HL6qfk
[525] See Paradigm's case (U.S.): http://1.usa.gov/U3JlNl.
[526] See ITG's Case (U.S.): http://www.sec.gov/news/pressrelease/2015-164.html.
[527] See the Citigroup's case (U.S.): http://www.sec.gov/news/pressrelease/2015-171.html.
[528] Ceresney J. See the Citigroup's case (U.S.): http://www.sec.gov/news/pressrelease/2015-171.html.
[529] BAISH/BAUMANN/WEBER, p.188.

40 % of stocks are traded off exchanges[530] in the U.S. with around 50% off exchanges in the EU[531]. CS and UBS own the two biggest dark pools[532]. There are several advantages for trading in a dark pool, notably: price discounts on large orders, reduction of costs, and less competition[533].

There is a strong relation between **HFT and dark pools**[534] even given their distinct nature. The usage of dark pools is a tool for HFT[535] it enables HFTr to recognize important orders and link them to participants[536], thus enabling front-running as seen above[537] (transparency and price formation[538]). This situation where dark pools feeds HFTr with clients information creates a potential conflict of interest.

The **FMIA and MIFID II/ EMIR** address many new rules concerning dark pools[539]. Dark pools will have a notably new, pre-trade transparency requirement (however a waiver exemption exists, see art.5 EMIR)[540] displaying volume and depth of orders and specifying the size of outstanding, unmatched orders (art.46 FMIA, and art 42, art.43 OMIA). A post-trade reporting requirement is to be determined by the FC[541] but normally occurs at the end of the trading day[542] (see also *supra* n°3.1.1 and *supra* n°3.2)[543]. Furthermore, dark pools will be affected by new rules on best executions of orders and will face restriction on the volume of trading possible on equity and equity-like products (double volume cap)[544]. Regarding only

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[530] http://cnb.cx/1NwPyIq
[531] ZIMMERMANN, 103 f.
[532] Note that in Switzerland, SWX uses its' own Dark pools named « *Swissblock* ».
[533] BAISH/BAUMANN/WEBER, p.182 f.
[534] See for instance a practical case of this problematic: http://bit.ly/1PyWLer
[535] LEWIS, p.44.
[536] ASIC, *sheet*, p.2.
[537] See *supra* n°4.4.
[538] FC, *Message FMIA*, p.60.
[539] Note that, in the U.S.A, the SEC is also currently proposing to enhance transparency and oversight on ATS, including Dark pools. http://www.sec.gov/news/pressrelease/2015-261.html
[540] It was an issue that no pre-trade transparency existed ZIMMERMANN, p.112.
[541] FC, *Message FMIA*, p.60.
[542] FC, *Report OIMA*, p.21.
[543] See EY, p.5 ff.
[544] http://bloom.bg/1l4dc5C

the question of HFT, these new requirements will then indirectly impact the behaviour of HFTr.

## 4.6 Investigation and sanctions

"*Our use of innovative analytical tools to find suspicious trading patterns and expose misconduct demonstrates that no trading scheme is beyond our ability to unwind"*

In the complex environment of automated trading, **a major challenge** lies in the development of efficient investigation tools[545]. The more the market becomes complex and fragmented; the more it will result in opportunities to conduct invisible market abuses[546]. As mentioned above[547], the current cases concerning HFT are growing in number.

For the moment, there are still many difficulties in acquiring **data** considering all relevant elements of the financial transaction. This element is however crucial to create a proper global monitoring of markets and hence efficiently prevent market manipulation. The access of data is endangered by opacity among algorithms and strategies. Furthermore, financial surveillance relies often on national authorities[548], which evolves in fragmented markets environments[549], and has necessarily less means than a multi-national would. Even if cooperation among countries and platforms[550] works and improves results (e.g. art.32 FMIA)[551], the rationality of any rogue trader will push him to go to places where the surveillance is less developed to find the breach, as practice showed[552]. In 2014, FINMA's report showed that most of the cases, both external and internal, had an international range[553].

Today, the openness of the world and the possibilities to trade given by the technology negatively impact the capacity to investigate schemes properly[554]. The MIFID II and

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[545] ESMA, *MAR CP*, p.11.
[546] SORNETTE / VON DER BECKE, p.13.
[547] *Supra* n°4.2.
[548] IOSCO, *Regulatory issues report 2012*, p.31.
[549] Appendix 1 Question 10.
[550] IOSCO, *Regulatory issues report 2012*, p.31 f.
[551] Appendix 16: Investigations and rulings of the FINMA
[552] http://bit.ly/1QDVO43 ; http://on.wsj.com/1OLaU8p ; See Milrud's case (U.S.): http://www.sec.gov/litigation/complaints/2015/comp-pr2015-4.pdf ;
[553] FINMA, *Annual report 2014*, p.74.
[554] See Appendix 2: map of European fibre in water

FMIAs'[555] enhancement of declaration and recordings obligations is a step in the right direction. However, if "*professionals are rational in their quest to work at the limit of legality"*[556], the regulators should have the necessary oversight to control it. Otherwise they will end up without being able to explain to the public how trillions of dollars are lost during crashes.

The second point is a consequence of HFT's development and the enormous[557] flow of data required to monitor and investigate markets[558]. We face a necessary **automation of investigation** tools[559]. In reality, few markets have the necessary gear to know what is happening in real-time on their markets[560]. There are two possibilities: *"Either HFT is not giving rise to more abuse, or alternatively that such abuse is much harder to detect*"[561]

Several recent projects have been launched to create analytical tools of the markets. We can name one in the U.S., MIDAS[562], and one currently developing in Europe[563]. To our knowledge, except those two, there is no automatized way to track market abuse[564]. Even though automation has given some results[565], the combination of human thinking is still necessary considering the complexity of data[566]. One of the reasons is that automation relies

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[555] See *supra* no3.1.1
[556] SORNETTE / VON DER BECKE, p.19 f.
[557] ADLER, p.187 ff.
[558] SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015: A funny example of this automation is the impossibility to use the program excel during investigation's concerning HFT because it is limited at 1 mio lines. MIFID II adress this issue: http://bit.ly/1OcmOVy
[559] See ESMA, *MAR DTS*, p.36 f.
[560] Appendix 1 Question 10. ; IOSCO, *Regulatory issues report 2012*, p.3: talking of real time or seconds/ hours / days surveillance basis e.g. See the Citigroup's case (U.S.): http://www.sec.gov/news/pressrelease/2015-171.html.: Reviewing it on a daily basis ;
[561] GO-SCIENCE, p.89.
[562] http://www.sec.gov/marketstructure/midas.html#.ViZEa86qfSM ; SPÉCIAL INVESTIGATION, *Les nouveaux loups de Wall Street*, 2015: The project has been criticized because it is managed by HFTr, which are the best experts able to handle it skilfully. It is potentially an issue because they get the exact view of what the regulator can and cannot see. E.g. see also http://bloom.bg/1YgmDNJ http://bloom.bg/1YgmDNJ
[563] *Idem*.
[564] Appendix 1 Question 10
[565] See Hackers of news case (U.S.): http://www.sec.gov/news/pressrelease/2015-163.html
[566] http://bit.ly/1H538hg

also on learning from previous examples and the scheme of market manipulation, which can evolve constantly. In the end, we know very little about the composition of perverse strategies[567]. As stated by SWX, the chance of getting caught by such investigation tools is very low[568]. Most of the time, whistle-blowers[569], big mergers[570], or acquisitions[571] result in the identification of HFTr's manipulation with no thanks to the tools established to track it.

A further difficulty is a procedural one: the **burden of the proof**. In practice, investigations must be very detailed when authorities allege violation[572] and need to prove intention for criminal prosecution[573], or that the trader should have known of market abuse[574]. Of the many accusations launched against HFT, very few could be proven[575]. Acts such as spoofing have only resulted in two cases judged in the U.S for now[576]: "*Just entering and cancelling a lot of shares, or buying and selling in rapid succession, do not prove spoofing. Perhaps you had a legitimate motive, and who can look into your heart to find out?"*[577].

As seen above[578], the MIFID II and FMIA indirectly regulate this issue, notably by encouraging higher fees on cancelation. Another way followed by the FINRA is to educate firms to recognize manipulation[579]. We note that an alleviation of the burden of proof could also be a solution.

Lastly, we would like to mention that the ratio: the amount of time dedicated to the investigation (often several years) to fines resulting from misconducts (notably in Europe) is

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[567] Appendix 1 Question 10.
[568] *Idem*.
[569] See Paradigm's case (U.S.): http://1.usa.gov/U3JlNl . See also: http://on.ft.com/1BCZGJS e.g. Navidad has been found like that.
[570] See Zeringue's case (U.S.): http://www.sec.gov/news/pressrelease/2015-37.html
[571] Golf lovers, see Stewart's case (U.S.): http://www.sec.gov/news/pressrelease/2015-90.html
[572] http://bloom.bg/1PQf4ut The history of CFTC litigation of manipulation claims under the pre-Dodd-Frank provisions demonstrates that proving intent can be very difficult for the government in trading cases.
[573] MÜLLER, p.383 and p.386.
[574] MÜLLER, p.387.
[575] LEIS, p.48.
[576] http://bv.ms/1LY6jx0
[577] http://bv.ms/1FS84u0 ; http://nyti.ms/1Nxba4X
[578] *Supra* n°3.1.1.
[579] http://bloom.bg/1lp7xYf

not proportionate[580]. However, as seen above[581], the MIFID II and FMIA regulate indirectly this issue by heavily sanctioning non-compliance on recording and declaration obligations.

[580] FINMA, *Annual report 2014*, p.57: saying that it relies on it ;http://1.usa.gov/1Wen2xm. See Oscher's case (US): http://www.sec.gov/news/pressrelease/2015-236.html
[581] *Supra* n°3.1.1 and *supra* n°4.2.

## Conclusion

In conclusion, this work addressed several pieces of the complex puzzle that is HFT. We saw how difficult it is to define and precisely situate this practice among the general automation of trading on today's markets. In this sense, the access to global data on the activity of HFT is crucial yet still too rare. HFT has found a legitimate place on the ecosystem of the markets and plays an important role. Moreover, for the moment, nothing can prove that they behave more roughly than others traders, except if we believe that the very functioning of HFT is an abuse, which is not our opinion.

We believe that HFT is an ideal example of the technological complexity the regulation will be required to face in the future. Moreover, the access to data, the transparency, and the possibility to trace participants is crucial. One of the interesting reactions is the development of a compliant use of technology, notably via algorithms testing. In this sense, it is an effective tool for the law to regulate complex situations via compliant algorithms. Furthermore, the use of norms indirectly forbidding its practice, such as fees on cancelation, seems effective so long it be implemented globally. However, these uses may seem backwards in regards to the vision of advancing in technology and free markets, and could prove detrimental for the interest of markets and their participants.

We feel that several aspects of current regulation are part of a growing fear of regulators regarding loss of control of the market. In this regard, we note that attempts, such as the definition of HFT emerging under the MIFID II, are pointless and fruitless, since the present and near future evolving nature of HFT is far beyond the threefold definition presented and does not necessarily concur at the international level.

Finally, we believe that whatever the opinions are about HFT we cannot do without them: "*we have developed speed but we have shut ourselves in*"; they are essential to our markets and a natural development. The regulation of certain practices is most likely, in part, necessary according to the risks that HFT poses. However, we believe that "*we think too much*" and today's regulations are too complex and pose tremendous challenges for all participants.

**List of Appendicies**

# 1. Appendix 1: Interview SWX exchange

1. Do High Frequency Traders are active on Swiss markets? Would you say they are "very" active? How do you define them? Can you estimate how many they are?
2. HFT is developing at a high pace. Would you say HFT is more a preoccupying change or a normal technological development among others? In your opinion, does this answer align with the ones that could be given by traders or investors on your markets?
3. You offer a service of colocation. It contributes to the creation of an equal access to the market for anyone and also intends to stop or mitigate a "race to the bottom" in the "war for speed". Did you notice this aim was better fulfilled thanks to colocation? How successful this service has been? How and why did you end up choosing the speed of 35 millisecond you offer for colocation? Would you say we are "HFT friendly" in Switzerland?
4. Did you remark any positives effects since HFT developed on your market in general?
5. Did you remark any negatives effects since HFT developed on your market in general?
6. What are the favorites strategies HFT usually used on your market? Did you notice any side effects? What are the main strategies?
7. Some exchanges offer money to traders who increase liquidity of their market (market-maker). Do you? Why? What do you think of this practice?
8. Did you remark some (more) sudden changes in volatility or liquidity since the HFT developed (sudden spikes up or down)?
9. The traditional question: is a "flash crash" possible in Switzerland? The less one: does "mini flash crash" sometimes occur? Do you have some emergency procedures for cases related to HFT?
10. One of the issues of HFT is the difficulty to retrace an eventual market abused. What are the technical measures that exist to prevent those abuses and track their authors? Are they effective? Does it need to evolve often? Would you say it is effective?
11. What do you think should be the approach of the regulator(s) (Swiss / European) towards those new phenomenon?

12. What do you think of an imposition on every financial transaction (e.g. law Tobin)?

13. Do you believe today's market is "rigged" or has become too complex?

14. What is the use of HFT for real economy or long-term investors?

**Protagonists:**

2. Mr. Gabriel Jaccard, law Student at the University of Zurich: abbreviation "**G.J.**".

# Introduction

## 1. Question 1

- **G.J.:** Thank you. If you do not mind, we will switch to the first question. First angle, I wanted to know what perspective you had of HFT on your market?
- Yes, actually, we have to start a little bit earlier with the definition of HFT. It is always a big topic, because it is not clear. EU politicians and experts of the markets have tried to define it. As you know it was a very hot topic 12 months ago, notably with the publication of the book "Flash boys" (written by Michael LEWIS).
- **G.J.:** Economists are confused too?
- Yes, it seems like, as we do not have a clear definition yet! HFT is not clear. Is it about number of messages flying around? Is it about low latency only? Is it about strategies? What is it? ... So far we have based our calculations on "EPTA" members (European principal trade association).
- **G.J.:** Is it a flag approach?

- No, this is not a flag approach, they just sign in in the association and say "I'm an HFT". Sometimes, making it public is not so good, because there are some pros and cons. Based on the list they hold, we know who is officially acting as a HFT or not. In general it is always difficult to assess who is acting as HFT especially without a definition. And very important is also the aspect of different market structures. Flash boys and EU market structures differ. Flash boys books has described the US market structures, with more exchanges and they have certain rules that say that you have to transfer orders to different exchanges… so it is comparable easy to find it out for a HFT client. Here we have a different system: we have no transferring rules like that. So we can send orders to one exchange then you have to delete it and send it to the other one. People sometimes ignore this fact. That is one of the main problems!

- **G.J.:** Have you ever run some numbers to figure out in Switzerland the low / high estimation of HFT?

- Yes we've done it few weeks ago and it was around 20 - 25%.

- **G.J.:** It appears they act on several markets?

- Yes, it is depends on the strategy. In general it seems that HFT has stabilized over the last months. There is a certain saturation in this market I would say.

- **G.J.:** Yes, … and finally we let them the possibility to exist. Why not? The ESMA has produced a report of 2014 with some kind of definitions for HFT, through direct approach, indirect approach, flag approach, etc. Do you take this report as a first element of definition? Even if you said there were no definition, but there are lots of people trying and, for example, they take some constituting elements in the report….

- Of course we have seen it!

- **G.J.:** Do you take it as the first stone of the definition?

- It gives some guidance, but it is not 100% clear what they have done…. Because they have only taken equity in blue chips from different markets in Europe So we have e.g. this approach of two messages per second on one venue. . We also run some numbers, but it was a bit misleading … because as I said before… the example of an universal bank… imagine one of the desk is doing HFT, but what about the rest? Do they fall under this category of HFT if they are using the same connection? So it is more complex than the studies stated. That is a general problem.

- **G.J.:** I agree.

- There is more… this 2 and 4 % are… We have done something about our blue chips, so SMI market. Let's take an example, so if traders, or machines are acting in one security… let's say it is falling under the HFT definition, with the 2 messages per second. Imagine now this HFT is trading a Novartis stock and also some smaller stocks which is not falling under the HFT rule. This said the trader is still seen categorized as HFT from the stock exchange perspective

- **G.J.:** Yes, ok so the numbers can be misleading in certain situation.

- Yes indeed! We have to define it in the future. The upcoming regulation is going in the direction of flagging, but there is still no clear picture of how it should work. So to resume: the numbers are around 20-25%, and today the definition is not clear and we define it thanks to association who says who is a HFT, so we run numbers and that's it.

## 2. Question 2

- **G.J.:** When I read the EU report, I saw they based their analysis on the website of the trading firms to detect the HFT activity … this analysis seems shaky indeed ... Thanks for this first answer. We saw the HFT developed, which it did at high pace, would you say it is more preoccupying or is it more a normal new step? We live in the era of technology, finally it is a new step or …?

- I'd say it is kind of a normal thing… what triggered HFT, it think is more important. Without fragmented market, HFT would not have that space. E.g. Novartis is traded on different exchanges, and you have all kinds of not derived securities. For example, Novartis is traded here, and the structured products or the future is traded in other places … so these links are more complex and often cross-boarder.

- **G.J.:** Yes, it creates dimension through distance and time… so latency!

- Yes, this is also a factor. If exchanges would not haven followed, let's say through technics, then this market is dead! … you know the ICE in the US, they try to delay orders and all these things… we always come back to the basis of equal treatment, so all players on all market equal treatment, pricing, access, behaviours,…. Everything is equal! We could also say, " Should we give an advantage to the slower traders?" Answer is: No, it does not make sense! Everything is equal. And we are taking care of cost, because we can say that it is a race if you can invest more in the cost, and then you get an advantages, … so we also try to bring it down the cost to a level… because the smaller banks always argued " The cost are too high, we ca not follow this rule" thatis why we answer: "Ok, pricing low on this side, trading is another side".

- **G.J.:** We will come back in detail to colocation in a later question. But, colocation is one of the elements of the definition stated in the report of ESMA… and I was wondering what were the fees to enter in colocation in your market?

- At ours it costs around 1'250 CHF per month.

- . **G.J.:** Ok. It was only to know if you respected equal treatment also here… If I can just resume what you said, you take an exterior point of view and look at the players and promote equal treatments among them.

- Even more than just promoting – as this is the main duty.

- **G.J.:** Ok.

- .:... without equal treatment we would not have a license from FINMA, it is as easy as that.

- **G.J.:** Do you thinks this opinion aligns with the one of the other market participants that have to face everyday HFT?

- Experienced we made has always explanation… sometimes it needs explanation, description, information… and as I said, …the flash boys books and the market structures in the US and the EU are important things you need to explain. Sometimes, it is more about technical issues, or trader making mistakes.

- **G.J.:** But they do not complain about HFT? The do not ask you to do some stuff? They do not say… you do not have FINMA coming around and saying, "oh we have an issue with HFT … "

- No.

## 3. Question 3

- **G.J.:** Ok. We talked a little bit about colocation in the previous question and I was wondering how did you end up with the final speed 35 milliseconds? We talked about the cross border strategies that could be use by HFT. Did you try to be the fastest as possible in the link?

- It was not our initial goal…. Yes, we have a provider of our matching engine and he has created a new exchange… a new platform respective system and we have used it. That is the explanation for 35 milliseconds.

- **G.J.:** Yes, but it can open new possibilities of strategies depending on the speed… so it was my question whether you choose to be fastest as possible and to reduce latency or…

- Hmmm no! The trigger was not the latency game in the system itself. We always have to see the whole picture. If a trader in the UK sends an order to us it takes 10 milliseconds or something ... or 12… so not micros anymore! A trader from Zurich Paradeplatz or whatever to our data center 500 micros. So this 35 is just an internal round-trip in the matching engine. An example, so you are sending something in, it enters let's say at a door, and it is executed and goes back to the door. But the way to the climb is the sensitive aspect: the latency! So, if you take the whole picture it is irrelevant. Of course fast is in essence good but if you look at HFT or a general trading members, it is more important they have a stable system. So they do not want that it be 35 in the morning and 500 in the evening less than speed.

- **G.J.:** Ok. So you say stability is more important than latency.

- Yes.

- **G.J.:** We evocate the race to the bottom, the war for technology, speed, etc… and the money that has to be involved in order to keep a first rank. So, would you say that first is this service of colocation successful? And did it end the war for speed that I was mentioning?

- If I would knew it! Probably yes, probably not

- **G.J.:** How many register?

- I cannot tell you the exact number. It is not one and it is not fifty. But it is more than you believe (laughs).

- **G.J.:** So it only depends on the strategies they want to…?

- Yes… but it is a wider topic… I can explain you… if you have some kind of ETF market maker…. … someone has to make the market. So one guy (drawing) has a lot of information and he has to create a price in form of a spread, bid and ask, and has to publish it to the platform and members. If this guy is slow, other people can cut him off… so he has to be fast. So if you do market making, and there are good strategies to make money out of it, that is why they do this…

- **G.J.:** Some markets will even pay for a market maker…

- Yes.

- **G.J.:** In the US at least…

- It happens also in Europe, but now they have skipped it. It is also interesting to know why!

- **G.J.:** We will come back to that in a following question

- Yes, but colocation alone was not a business case, but it is another opportunity to give access close the exchange.. For example traders who is located in the UK can get closer to the exchange. This was the reason. So it is more about bringing them to trade on our exchange.

- **G.J.:** Ok, thanks. So are we HFT friendly in Switzerland?

- …. This word friendly is a little… ah… I would more say a "yes" than a "no". But I do not see any country in Europe, which is not! They are ALL friendly! (laughs) You have this German HFT law for example, I think it is some kind of message for the public.…

- **G.J.:** Yes. I thinks also it was very abstract. They just put a time speed limit and they say "oh you are an HFT if you up this".

- Yes... so frankly… there is no difference to the exchanges in New York. The markets center in EU are all.. you know… they are all the same, there are no other flagging…, which we have to do … equal treatment is key… it is not about friendly or not friendly to someone.

## 4. Question 4 and 5

- **G.J.:** Ok. Now we will maybe go to the developments questions. Hmm it is … I did not really now how to put that… but we remark some positives / negatives effects of the HFT in general… and further the general positives aspects (liquidity,… etc.) did you remark since HFT arrives any new features… I know it is a question of definition but since they really appeared in your market any changes?
- Spreads have improved. It is kind of…
- **G.J.:** So it is a win-win for everyone if the spread improved?
- Yes…. Yes… win-win I would maybe disagree because there are certain people in this world who like spreads, as they are making money out of these spreads. So now there are other people on board who tighten the spread…. So it is not a win-win for all!
- **G.J.:** But how much closer? Something remarkable?
- Yes, I would say so. It is much more remarkable on the medium and small caps than blue chips.
- **G.J.:** Did you hear about the case of the Bloomberg tweet and the white house in the US?
- No…
- **G.J.:** It was a tweet that was edited by Bloomberg and actually since US HFT have created algorithm and computer that can read the tweet and act in knowledge of it, in three second the market just begun to fall…and the problem was that the tweet was a fake because the internet site of the white house had been hacked…
- Yes, there are also strategies on how many clicks on Google. If the ranking is high they now something is going on.
- **G.J.:** I heard that they now use those Google information too. For example for Greece they calculated the number of time the word "debt" was submitted to make some projections.
- Yes I mean it is data, it is essential… the thing is it good or bad?!
- **G.J.:** Maybe sometimes even personal data…I think the whole point goes around economic, politic and ethic. If the three are mixed it is complicated… and one can take a step ahead of the others.

- It is a philosophical question: good or bad, what is really needed for the exchange… Is it back to basics: capital raising? So what is it… and yes… believe me we are discussing this topic almost every day.

- **G.J.:** Do you sometimes use some ethical association to take a view on a particular issue? I know in France they do it sometimes…

- Yes… we also have a direction of sustainable things we are looking at.

- **G.J.:** There is a lot of talk now on ethical changes in the economy. Notably because of the bank failure….

- Yes but if a company… let's say Nike, is listed on our exchange. They are producing theirs goods in Bangladesh is it…why should it be supported by an exchange? So it depends on how far you go…

- **G.J.:** The negatives effects? Finally, I read few reports and I met few persons that really gave me positives aspects. Most of the time they just paint HFT as a terrible thing. What do you think of it? Is it more negative, if you do pro and cons? Which imbalance more weight on its side?

- I do not want to gossip.I want to base my analysis on facts: No, there were no negatives effects. I can tell you why. We have spent time and money to create those "ordinary trading" aspects. So if all the stocks are going down because of something or a miss-programmed algorithm machine then we will stop trading in this security. We have spent a lot of time on those kinds of triggers. Also if someone is sending e.g. thousands of messages in a second because the system is crazy then we are stopping them, it is not manual, the system stops it.

- **G.J.:** Do you think you are always one step ahead in those technical protections?

- Yes… however it is dangerous to say "ahead". I do not see any issue today. I do not see more issue in this complexity of fragmented markets…. So to bring data together to find out what they have done is a difficult topic. Especially we have different formats in Europe, this is a problem or can be a problem.

- **G.J.:** So any risk, any negative aspects?

- Yes. Because we have lots of limitations and technical safeguards in the beginning, when they send something, and afterwards too. So in the middle, we have done a lot of thing. I can say just for our market I do not see any risk that could be a problem. It is more a question of complexity of the European global market.

- **G.J.:** Ok. I heard about the "illusory liquidity", the liquidity that some searchers declares HFT is creating but in fact does not exist. What do you think of that?

- It is called spoofing, it is easy and not allowed: to insert something and delete within a short timeframe to influence the market, it is market manipulation. And it is forbidden for all, not only for HFT!

- **G.J.:** Is it not a negative aspect?

- If you do market making: you want to be in the book. I do not see it as a negative thing.

- **G.J.:** Ok…A report appeared 2 weeks ago concerning volatility and liquidity on the US market. It stated that volatility has increased and it put the blame notably on HFT. The boss of the SEC, stated also that the liquidity was illusory, which gave rise to real doubt of benefit effects of HFT. Did you read this report? Could we say the same in Switzerland?

- We discussed price discovery, which is also link to liquidity in the end. Because if the news are absorbed by the market faster then the volatility increased. But if we look at the volatility index of the last 3-4 years, you would be surprise because it went done. So volatility is down since the crisis.… massively and however we have more HFT traders in Europe…. So it would be a counter argument for the volatility aspect. In the US we have the problem that you have more markets, more fragmented markets and you have no strong markets in those markets.

## 6. Question 6

- **G.J.:** Ok…. Maybe we will do the question 6. What are the favorites strategies you now HFT do usually use on you market? Do you know some of them (even if we do not have really definition of the actors)?

- Anybody would say: "I know exactly", they are lying. Nobody knows exactly. Of course we know tick arbitrage. We know market arbitrage, so when you trade on two markets ... maybe there are ten big categories of arbitrage strategies but below there are thousands! If you change one parameter it is a new strategy in the end. So really to answer the question: nobody will answer you, because if you go to an HFT "boutique", we say boutique, they will not answer.

- **G.J.:** Yes because it is how they make money. But do you have a general idea then?

- Yes based on statistics also, it is just statistics on public information…. We try also to rebuild strategies and this kind of things.
- **G.J.:** Yes, but you never get the real recipe of the chocolate?
- True, because e.g. we do not have the data of what this guys have done on other markets… we do not have the data!
- **G.J.:** Yes, so the only one who has the data is the HFT firm itself and you ca not access it?
- Yes, but there is this new regulation that will change it. So we could have the data potentially.
- **G.J.:** But only at certain condition…
- Yes only if there is an issue … yes but this is difficult. They also talk about harmonized clocks in MIFID II, and in Europe. When we are talking on microsecond, it is even more difficult. I'm not a technician but somebody told me that, it will harmonize time in Europe, and Switzerland will also follow it. We will follow it but it is a difficult one. The problem is you could potentially figure out what's going in a microsecond between two places. Maybe just an interesting example: The 15th of January (end of the "taux plancher" in Switzerland) is dealing with Swiss to Euro, and it was a big event, and you can imagine people were trading like hell and were confused. We analyzed the data of this date an time in the morning and we looked at the HFT traders, their were just a few seconds out the market and then came back directly into the market and this was also good to see that there were no liquidity gap, low trading during this lapse. But when they have been immediately back in the market within second liquidity goes up again. So it was good, it was a good test, kind of stress test, which we had of HFT trading. So HFT can bring positive elements. Further, we had no breaches or so… it was very good. Of course this day was special, very special in the exchange world.

## 7. Question 7

- **G.J.:** Interesting… More specifically, do you offer money in your exchange for market maker / taker?

- We are not paying any money no… But we have lower prices for people who are making the market and we charge less, but only if, and there is always the "if" attached to it they fulfill certain obligations, they have to sign obligation and then they get something. If not, they have to pay the higher price or they get the penalty form FINMA. So market making has advantages, which anyone need for liquidity, but there are conditions.

- **G.J.:** So there is a condition of what … sending…?

- Volume on the market… spread, and time. It is normally the three elements. Sometimes it is also in certain stock… let's say ETF, we have 850 ETF on our platform and one market maker Is allocated to 10 ETF, he has to fulfill it… we have something introduce in the equity market too to improve the spreads. It exists on certain products an SMI, so small/ medium enterprise, it has no liquidity… so banks do not want to trade these products because there are so illiquid. So you need someone who is really driving it, and we cannot do it ourselves so we need those third parties who provides liquidity.

- **G.J.:** What do you think of the market-taker / -maker in the exchanges, do you think it is normal?

- It came with MIFID a bit and… competition created this kind of style, cause everybody is like: "oh we need the best spread, we need the best volume… it is always the best.. But in the end somebody has to do the best because we cannot do it…

- **G.J.:** But is it not an exacerbate competition?

- No, no it resides in competition. But it is not so bad I think because in principle everybody could do it, and it is also a risk if you post liquidity on the book so you ca not really change it that's why you have to pay a lower … to pay money, I would say it is not good because then you drive people in trading behaviors, which we do not want in the end. There is this whole topic of "inducement" : when you are forced to trade more than you want because when you reached a certain step, you do not have to pay. It was a big story in the UK.

## 8. Question 8 and 9

- **G.J.:** Ok. We will now talk a little bit about the spikes. Sometimes we see… in fact let's begin with question 9 and the question of the flash crash. Is a flash crash possible in Switzerland? It is the very traditional question…and the answer I know is "no" (laughs)…

- Exactly: No. And I can tell you why. First of all, we have safeguards, so safeguarding rules, we have a stop trading, which means that if the price fall under X %, or yes… 1 or 2 % the market will stop for 30 seconds. Then it could also step down and you would not see it, so that's why we also have the avalanche stop, which means that if the stock fall in two minutes over, whatever, 10%, then it will stop it for a longer time. So the first is step by step, and the other for a longer time period. And we are always adapting those time periods. For example, for blue chips, it is lower than for the other ones. A drop cannot happen then. We have a team looking at the market everyday, every second and they can say "no" or it is "ok", and trigger the continuing button or not.

- **G.J.:** So it stops the market and then all the litigious trade are cancelled?

- No, the trades are not cancelled. They are not happening. It is in the book, the book stops. And then the market controller can say ok: "what is the situation, what is going on", and they can even stop it for the whole day if they want. But we are also interested in moving on. After the checking they may it start again. We also have an active market control.

- **G.J.:** And is the avalanche stop and the other are often used?

- Yes, but I do not have the numbers. Avalanche is a few per years. The other occurs more often because the cap is reached more easily.

- **G.J.:** One question about the avalanche: has it been there for a long time?

- We introduced it before the discussion really came up (knocking wood), so it was really good move! It was in 2008.

- **G.J.:** Ok so the avalanche is one of the safeguards. Are there many others or...few?

- These two elements and the active market control, which can also delete orders or say… spot unright trades and delete it… or cancel it…. And that's it.

- **G.J.:** So those two are enough. Now the question 8. In the opposite way, it can happens, and it does that sometimes HFT create not a drop but an upper spike. The same mechanisms apply?

- Yes, it works up and down. Normally everybody focus on drop, but we forget that we can do as much money on a spike.

## 10. Question 10

- **G.J.:** We talked about the market abused and we know the EU is leading the way with its directives. We know also there is a new law in Switzerland that will lead also the features of the market of tomorrow and HFT. It is difficult to retrace the potential market abused, notably because of the speed. We said before that it was a question of data, and notably that data could be asked to the firm, which traded the stock (e.g.). Do you think it is a growing issue? … Because we lack data sometimes in order to prove a market abuse exists. Should we be more precise in the law to prevent them?

- A definition is limited, so you need to kind of have a broader definition, and it is a good thing we have in Switzerland by the way because we ca not follow all the development.

- **G.J.:** Do you have enough access to data for example?

- Yes… in a fragmented market this is a problem I ca not say "please come back to the old days, one stock was on one market" but it does not work. Competition is a good way to put the prices down this is absolutely right and we agreed on. Market data is a problem, not only certain country in Europe but also within Europe. We have no other side today. ESMA has a project to have a kind of harmonization of data, but they are officiating in the dark….. It is… we have a lot of data and… to find strategies of market abuse…. It is a case-by-case basis, base on certain patents, because there is no manual view of … you cannot analyze it. You need a system that you program, so a surveillance system to look at data in an automatized way.

- **G.J.:** I read about a story in the US. It was a case where a stock was trade one millisecond before the information came out. It was the whole question of insider trading. And they said finally it was luck, which guided them to the discoveries of those actions. It was the question to know if we program a machine to trade one millisecond, how could they be arrested? Because finally it is the good old insider trading but taking at a new level…

- Insider trading can be anything….

- **G.J.:** But is it new technology a more dangerous tool in the hand of people willing to use it that way?

- We know what insider trading is. In the old day, we have done it manually, I saw something and I trade it. Today, it is more of Google methods as we discussed it. The news are so fast… if the news are correct or wrong I do not care but we can speculate on it within microseconds. But is it insider trading or am I just fast? If I'm trading before the event, somebody has to say: "have you trade based on this event? Or is it just because you have just speculated on something?".

- **G.J.:** What do you think are the chance to get caught finally? If you know on 14th a company stock is probably going to explode on 15th at 13 PM…

- I would not say there is no chance but….. We need to say: "you've done it". To identify it would be ok, but to say "guilty or not guilty"…. It is very difficult. Insider trading and we know one…. You can see it in the news there are lot of traffic before the merger came out… also in the public… so what happens, this you can analyze and it is easy cause you have all clear messages. But there are all smaller things, and then you can say is this information relevant? Was it relevant for the trade, for the decision…. Difficult, difficult…. Big things are easy to identify, smaller things… difficult.

- **G.J.:** How would you define "big"?

- A merger, for example would be obvious…. Or you see also the list of company, this "ad-hoc publicity requirement", so if something is going on you have to report it and if you see something before coming from the CEO, you are a little bit confuse… so this kind of things. And… .I worked in Germany for the exchange and you know a German football club was listed, and one of the players had an accident and broke its leg. Is it publicity? Because it influences share prices. This kind of thing…. And then we had someone who traded before and we were a bit stun but he had down it… so it was… difficult, but it was small.

- **G.J.:** So you write a report, you transfer it to FINMA?

- Yes, you give it to FINMA and it is a the end the…

- **G.J.:** But finally they receive what? A hundreds of those and they just treat… ?

- It is a big question today; you've just seen the LIBOR case and the 14 years sentence today. You know it is kind of a message you know…. It is a poor guy because someone else has done it… just to create a…message…. Maybe it was right, but is it one guy who can modify the LIBOR? Sorry, but I do not believe that, that's a joke…

- **G.J.:** The technical measures has to evolve often, we talked about how difficult it was to stay at the top level. Is there some kinds of collaboration worldwide to keep the records on the best standards, the best protection?

- Yes, you have in general the IOSCO, which is giving out standards. You also have the ESMA,… that give guidance. So we follow FINMA, IOSCO principles and ESMA. I would say it is the general frame.

## 11. Question 11

- **G.J.:** What do you think should be the approach of Swiss or European regulator? More frameworks? For example, the art.4 MIFID II and its definition of HFT, stating the definition of algorithmic trading and not HFT in particular. Is it a good way to give a wide definition say everything that fit in this landscape should be seen as it?

- I try hard to understand what they want to do… what they want to achieve….

- **G.J.:** If you were at their seat?

- Yes… good question. I think this rule would never exist, I would not phrase it or I would phrase it more general in the sense that every trader has to follow these principles and not "HFT" because, why should they have stronger obligation than a normal trader? Insider trading happens also with normal traders who are doing manual trade. So, I would say general approach would be good, but you know…it is in the law…it will not change! We have the definition of algorithmic trading, we have to live with it, but it is okay you know,… it is okay, it is not like completely non-sense but I think it is not target… it is just a message to the public or whatever…

- **G.J.:** But… as you said it is in the law, but maybe, potentially, it wo not apply because it is too complicate to put in the realities such a definition. What do you think of a responsibility, not a rule but a principle that state definition and consequences but only stating "ok, we have a factual situation where a trader messed it, and a responsibility hanging on more facts, for example the course fall 1000 points in 10 minutes. A kind of general principle like 41 CO (Obligation right) where you would have conditions four conditions: damages, etc…

- We do not have this freedom, we are not an island, we have to follow in principle EU and/or worldwide standards. It is the case… But I think it would be good, it needs certain rules focused on the problem and not on the wishes. We have a problem, please define it! Because nobody has really define any problem of HFT in Europe interestingly. However, a rule has been created, but based on what? No clue. Explanation text MIFID: no clue… It is strange is not it? If there is a market failure: yes we can do everything, but not based on …yes what…. And the flagging… . To jump to the next question it does not make any sense: "I am an HFT and now? ". Really I try to understand… but I cannot.

- **G.J.:** Ok…

- This information does not even go to the public. Let's say I am a trader in a bank sending an order to SIX Swiss exchange, I see oh ok nice HFT. I know X or Z is a HFT trader, and now? If I find something I can go to this trader but I ca not do it now, it is out of flag. I can say this trader has done this strategy, what's going on? I do not need this flag….

## 12. Question 12

- **G.J.:** What do you think about taxation on the financial transaction (e.g. Tobin law)? It was an European idea, it also leak to the US and to Switzerland. What do you think of it?

- … What do you think of it?

- **G.J.:** I think it would kill it. I could just stop writing this thesis now. There is a precedent in Italy.

- First of all I think that a transaction tax would eliminate HFT undoubtly. But what do you want to achieve, back to this question. What does it achieves? A man in Germany said: "yes they have to pay for the crisis" it sounds good…

- **G.J.:** So it is a political topic…

- Yes, but actually it will kill it is own market, the people will go to Singapore and have a nice life. So if it was a global one, I would say okay, but not locally. It would kill the market. And I do not see any reason for such a tax. In Switzerland we have already the stamp duty, so we already have some kind of taxation. (…. And the message to make the people to pay for the crisis can be good, but you have to do it in different ways. …And I thing that has nothing to do with HFT. Of course, the margin of HFT will go down,,,, but… yes… in EU we only have 11 countries who support this idea …. So it is a mixed view. But I do not thing it makes sense in Switzerland because we should then get rid of stamp duty,… because otherwise it would be a double taxation.

## 13. Question 13

- **G.J.:** More philosophical question now: Do you believe the market is "rigged" as stated by M. LEWIS in its book?
- European market is not. Swiss one is not.
- **G.J.:** Globally?
- In the US it is really a problem.
- **G.J.:** It is part of the question of how market is fragmented. Europe is not the same as in the US, as I understood your view.

- Yes, correct. As an example, I am a bank and I want to trade whatever, US instrument. I go to one exchange send it to 51 to sell, the others has the same instrument for 51.5, 51.7,…. So he knows that 51 is not the best price for him, he has to send the information. This information goes back to the central and goes to the consolidate tape. All the data about all the instruments are here. So he has to fulfill best execution at the best price. So based on this, he can see it has not the best price. The order then goes back, so it is always a comparison, a check against this book. Then it goes to all the others sellers until it finds the best price. The thing is the first guy who received the information is also sending market data, to an HFT for example. The HFT can then see that the order sent appear and disappears, and it knows that it is a question of time before the offer of 51 is going to reach the other participant. This principle does not exist in Europe. So you have a fragmented market but you do not have best execution rule with this central data. That's why it is easy to game it. Because they are selling also market data to other markets participants. The exchange here has the duty only to execute when the price is the best… but there is also latency here. It is good intention but far too complex.

## 14. Question 14

- **G.J.:** Final question, you said it was too complex. One of the reproaches made to HFT is the disconnection between HFT and reality, or real economy. When flash crash happened, e.g. Procter and Gamble stock fall to around 4 cents. An economist said that this price was an illusion, nothing happened in 10 minutes that make P&G stock worth this amount. What about the traditional view of the market with this function of raising capital? What about the traditional investor?

- It is a difficult question. This could be discussed with price discovery… so… this disconnection does it really exists, question mark (?). What is the true of a price, of a stock? Because we have also a speculation bubble without HFT. So these days we are not either good or bad. The new market in Germany years 2003-2004 it had a big bubble, and it had nothing to do with HFT. So people believed that a very unique company it had nothing to do with HFT dealing or something. It is more a wrong view on certain companies or prices, and on these days it was not wrong, people thought it was a right price. So disconnect? Because it is a true, it is a fact. If it is created by a machine… based on information, Maybe … and it is a big maybe if a machine is 90% of a volume in a stock, Maybe it is not the truth, at a certain level question mark? Or is it in the opposite the really the true because this machine has more information than you and I as human?.... No clear answer…. Price discovery is good… but what is the real truth… it always…. Needs a level, a certain level of certain things. I think the market is good when you have different parties on board. You need investor, you need algorithmic trader, you need whatever pension funds,.. you need qualified investors, you need different things on a market. And people have different views… it is a normal behavior of a market… price formation of a market always works with different views, that's why price are moving machine or not. No clear yes and no clear no. But there are different aspects and views.

- **G.J.:** Would you say that, when I link this question to the answer of the question 2 about HFT not being so much a preoccupying thing but more a natural development,… finally we have new players, evolving inner the rules, not creating a systemic risk, so….

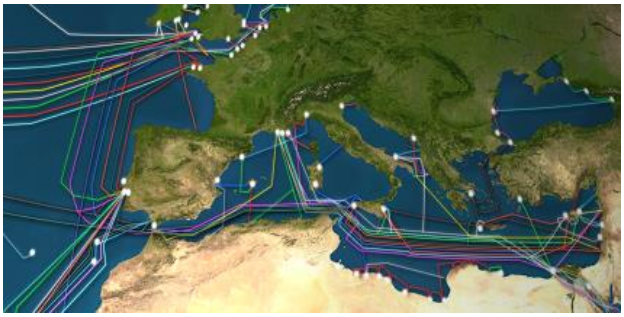
- There is different players, different technics we should not go in the direction of playing it over the price. If it increases the cost for all people based on making the HFT happy, then we are going in the wrong direction, but if we have some kinds of normal level, then it is a wide approach. And you know 2015 is not 1990, market has not that much evolved. Only regulation has evolved and based on this regulation complexity has evolved… so who has really triggered it.

- **G.J.:** Maybe the political views have triggered some fears of the people against the market since the crisis.

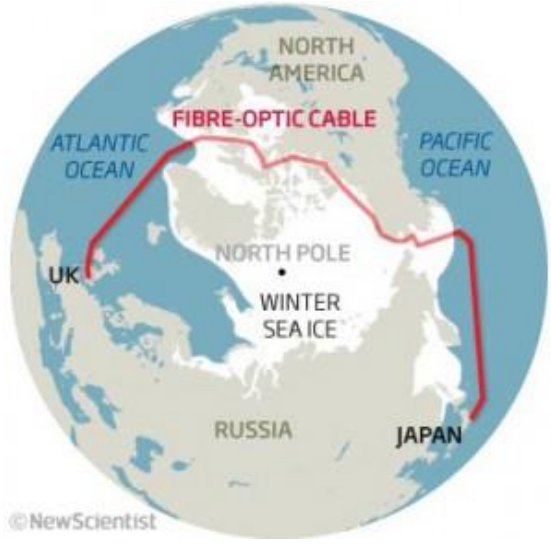
- Yes, that's why I recall the need for explaining… whatever is being decided. But it is not easy to explain and to understand.

- **G.J.:** It could not be more true….
- Of course I read some stuff they understand and I do not! But also exchanges…. It is a whole world…. And If you think of MIFID it is like a thousand pages… it would be mad… I am reading it because it is my job and it is interesting but it is a lot of paper and very technical. Now everything is faster… you can trade on a mobile,…. It is not for the worst. We have to watch it out, maybe redefine certain things but not like completely change it to the other side. Things are missing, … and the flag approach… what does it mean? Now everybody have lots of data on flag approach…and now? I think it just creates cost now.
- **G.J.:** I am done with the question, I am really thankful for your time and your answers.

2. Appendix 2: map of European fibre in water

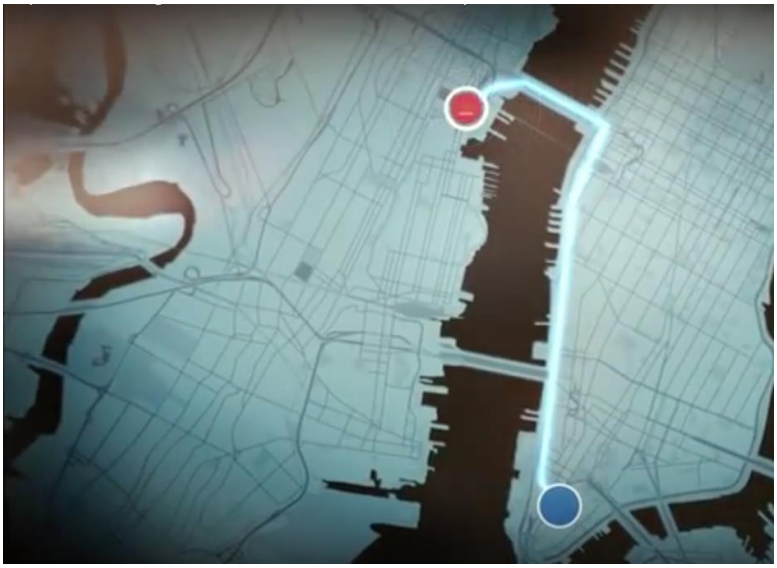


3. Appendix 3: Transatlantic fibre




4. Appendix 4: Front running

1. Trader (in blue) sends its order to the exchange A (in red). The trader in blue wants to buy 100 stocks X at 5$.



2. Exchange A supplies 40 stocks X at 5$, the order has to go to the exchange B in order to supply the rest (60). An HFT Traders collocated in Exchange A gets the information of the Trade and use it is superior speed capacities to buy all 20 stocks X available at exchange B. The HFT traders knows that he can sell it to you for 5$ at least.

B

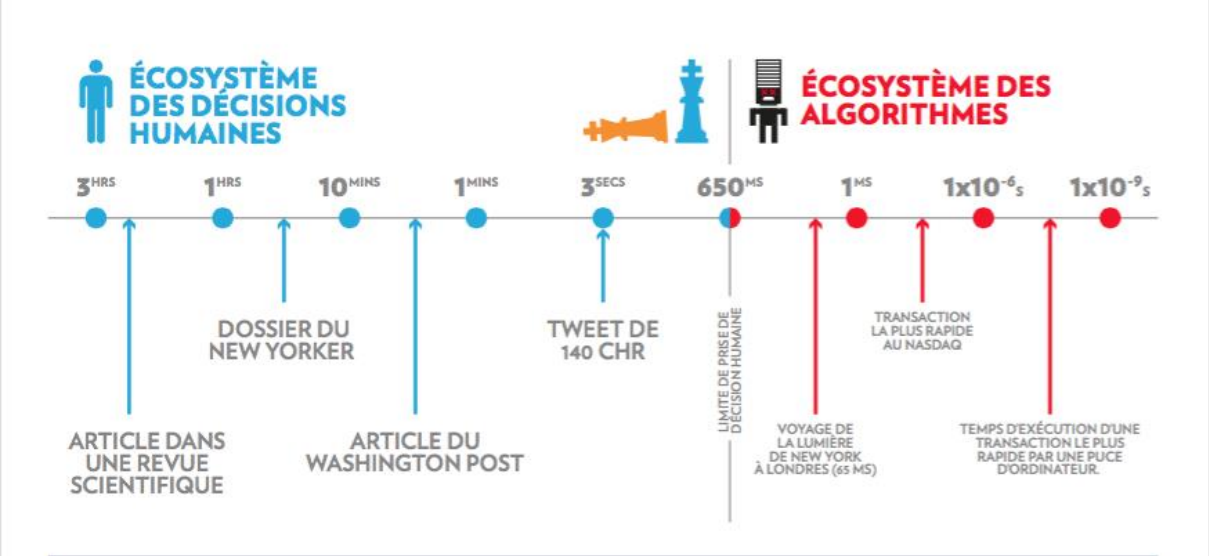
A

3. The HFT traders goes to all the Exchanges in the region (Market C and D) and buy the rest (40) of the stock available. This is called Front-running.

Exchange C

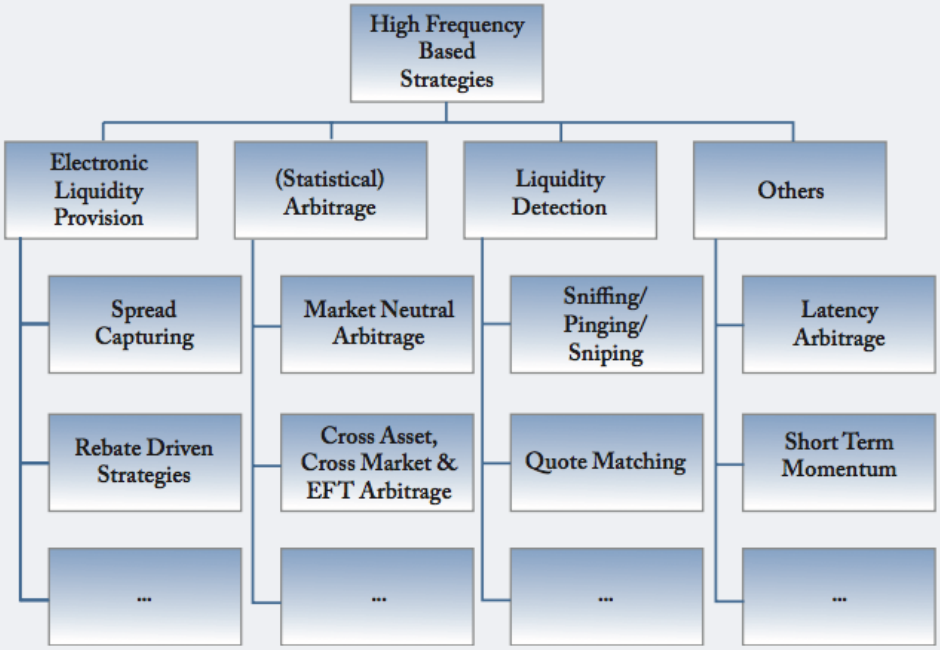
Exchange D

5. Appendix 5: Human versus algorithms ecosystem




6. Appendix 6: Strategies table

**Figure 1: Strategies Employed by High Frequency Traders**




Source: Gomber et al., at 25.

**Liquidity provision**

- The majority of HFT-based strategies are liquidity provision strategies as every form of liquidity provision in electronic markets requires extremely fast response times.
- The reason is all provided bids and offers are based on certain sets of information.
- When information changes, this implies different prices, bids and offers.
- Accordingly, liquidity providers need to be as fast as possible in: a) receiving the new information, b) transforming the new information into new prices, bids/offers and c) update the bids/offers provided to the exchange.
- The faster the liquidity provider can act, the lower the risk of liquidity provision and the higher the quality of provided quotes.
- **Primary source of income: Spread.**

**(Statistical) arbitrage**

- Take advantage of price differences (market inefficiencies) between economically identical or similar products.
- Actors calculate fair product values/spreads, and in case of any deviations, they sell the more expensive product, and purchase the cheaper product.
- This way, unjustified price differences between economically related products are eliminated.
- Arbitrage assures clients fair pricing across all markets/products and thereby reduces their information costs in fragmented markets.
- Primary source of income: Short term market inefficiency.
- **Primary source of income: Spread.**

* *Hagströmer, Nordén (2012) found that 63 - 72 % of HFT trading volume is provided by liquidity provision strategies .*

**Short term momentum-strategy**

- New information leads to new price levels.
- These strategies attempt to generate profits by reacting swiftly to new information.
- As a result, new information is reflected in the market prices extremely fast.
- Besides new information, market moves can generate trading signals ("riding the short term trend").
- **Primary source of income: Short term shift in general price level.**

**Liquidity detection-strategy**

- Detection of hidden orders or orders that are generated by execution algorithms.
- The aim is to gather information about the direction of the customer flow and thus the market prices.
- Often used by electronic liquidity providers in order to recognize the market direction at an early stage.
- **Primary source of income: To take advantage of short term trends or avoidance of losses when providing liquidity.**

## 7. Appendix 7: New York / Chicago fibre


## 8. Appendix 8: Difference between HFT and AT

**Common for HFT and AT**

1. Pre-designed trading decisions
2. Used by professional traders
3. Observing market data in real-time
4. Automated order submission
5. Automated order management
6. Without human intervention
7. Use of direct market access

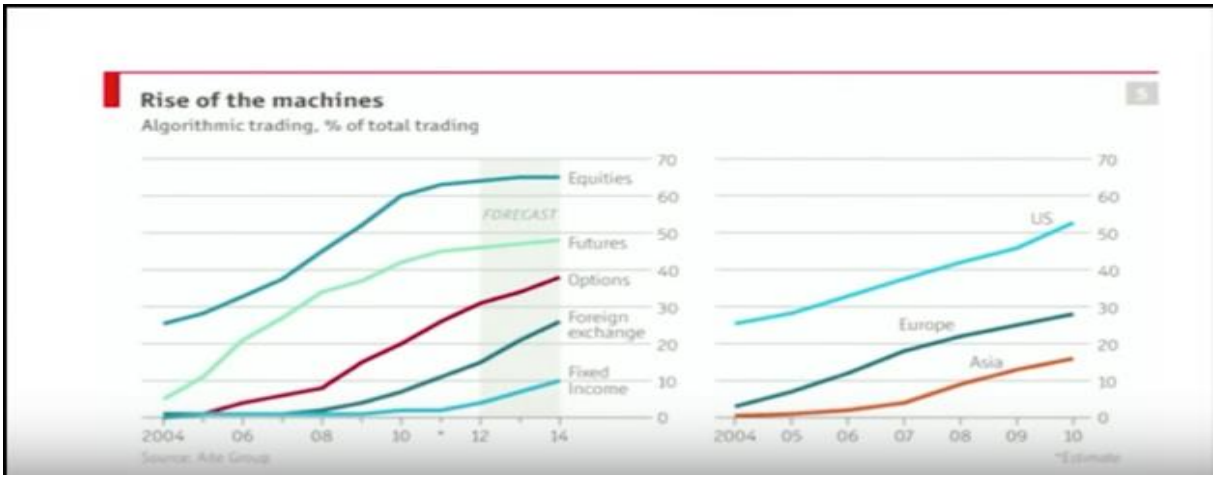
**Specific for AT excl. HFT**

1. Agent trading
2. Minimize market impact (for large orders)
3. Goal is to achieve a particular benchmark
4. Holding periods possibly days/weeks/months
5. Working an order through time and across markets

**Specific for HFT**

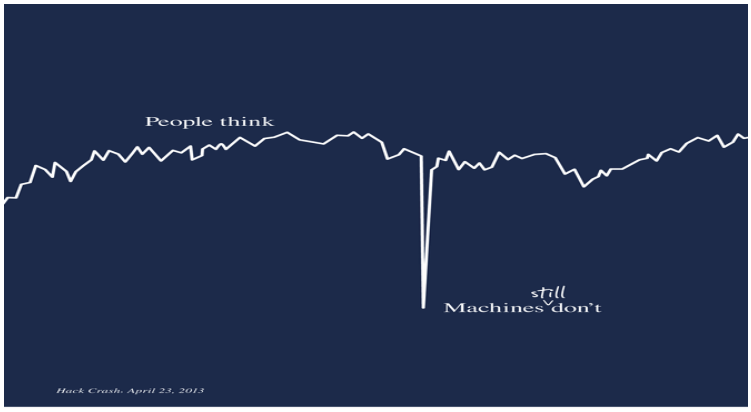
1. Very high number of orders
2. Rapid order cancellation
3. Proprietary trading
4. Profit from buying and selling (as middleman)
5. No significant position at end of day (flat position)
6. Very short holding periods
7. Extracting very low margins per trade
8. Low latency requirement
9. Use of co-location/proximity services and individual data feeds
10. Focus on highly liquid instruments

9. Appendix 9: Percentage of AT in the world per securities




10. Appendix 10: time reaction of the market

# 11. Appendix 11: Advertising

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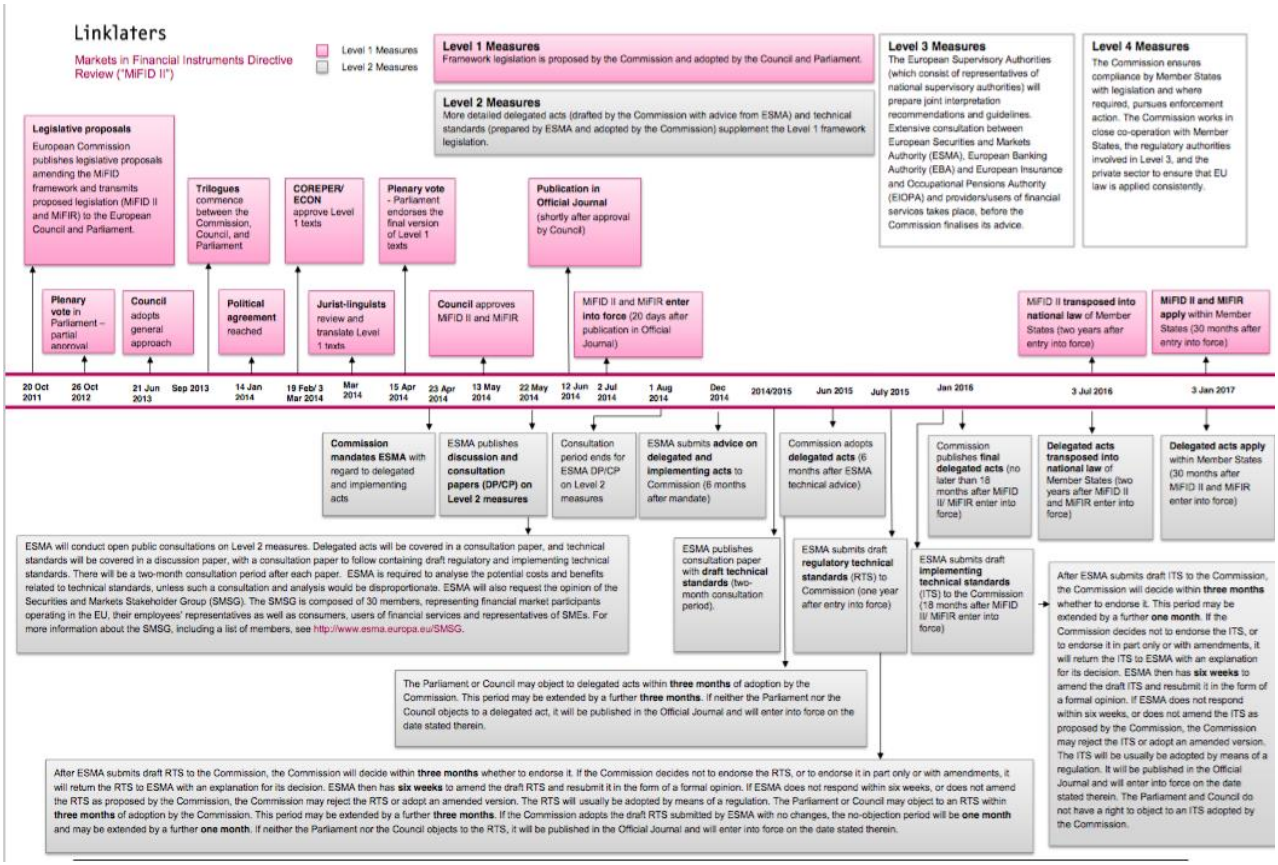
# 12. Appendix 12: MIFID II timetable

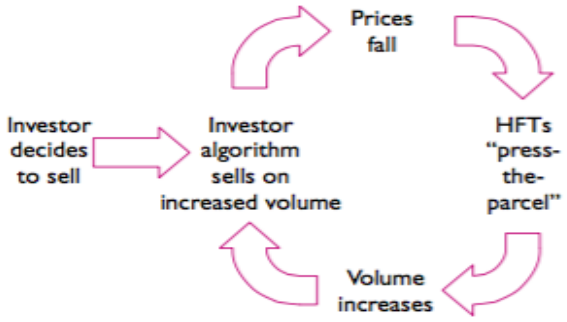


## 13. Appendix 13: Volume feedback loop

**Volume feedback loop**

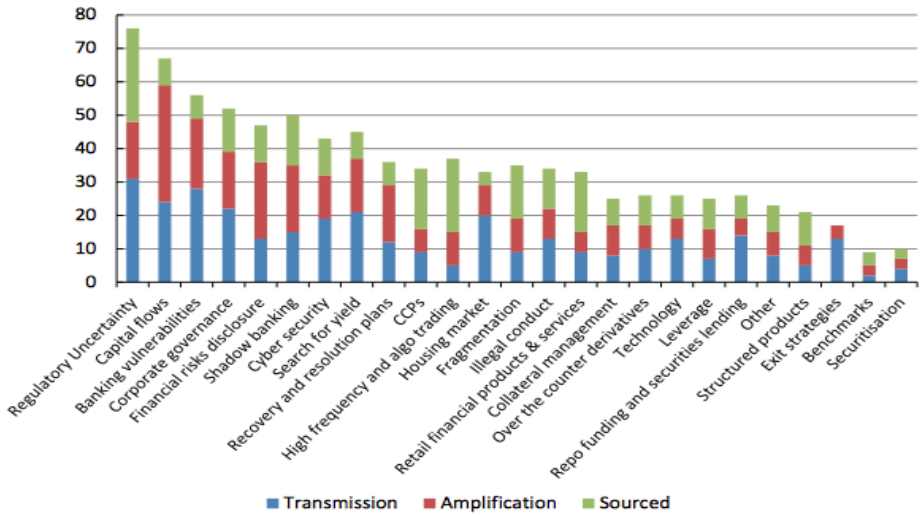
Whether the analysis in the official US Commodities and Futures Trading Commission/Securities and Exchange Commission (CFTC/SEC) report[25] of the Flash Crash events of 6 May 2010 turns out to be accurate and complete or not (see DR4 and DR7[26] for further discussion), it does illustrate a potential driver of risk. The CFTC/SEC report describes a possible scenario whereby some HFT algorithms may *directly* create feedback effects via their tendency to hold small positions for short periods. Such a 'hot-potato' or 'pass-the-parcel' dynamic occurred on 6 May 2010 when trading amongst high frequency traders generated very large volumes while hardly changing the overall net position at all (see Figure 4.9 where a sale leads to a price drop and an increase in HFT inventories which HFT then quickly try to reduce, leading to increased trading volumes, which in turn encourage the original algorithm to sell more). Because financial instruments were circulating rapidly within the system, the increase in volume triggered other algorithms which had been instructed to sell more aggressively in higher volume markets (presumably on the basis that higher volume means lower market impact), selling into the falling market and closing the loop[27]. Circuit breakers and algorithm inspection may prevent some of these loops developing.

**Figure 4.9: Volume feedback loop**



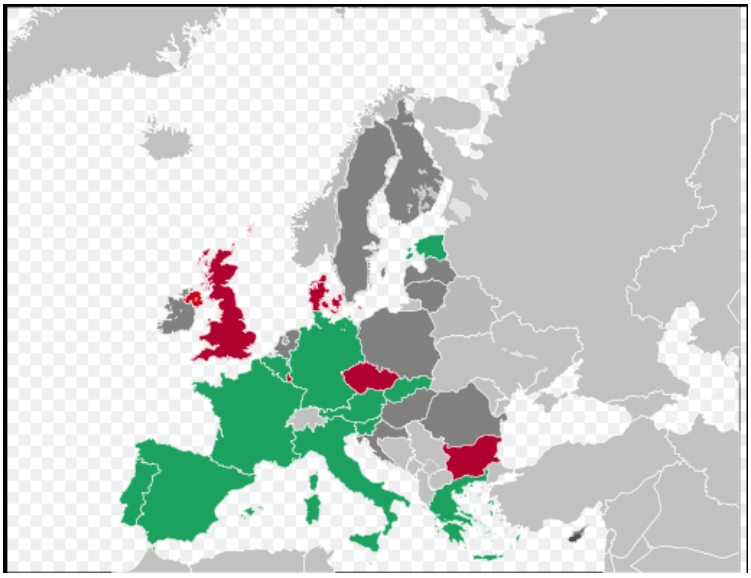

## 14. Appendix 14: Risk categories

**Figure 7: Risk categories and whether they are transmitted through securities markets, amplified by securities markets or sourced from securities markets themselves**

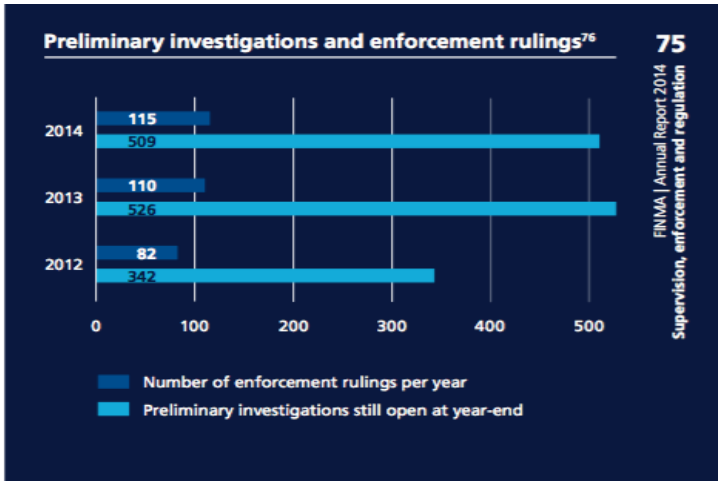


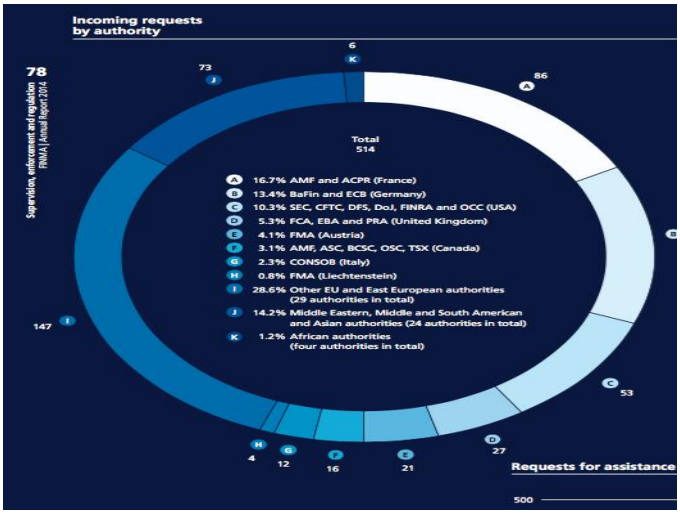

Source: IOSCO Research Department

15. Appendix 15: Agreeing Member state of the Financial tax

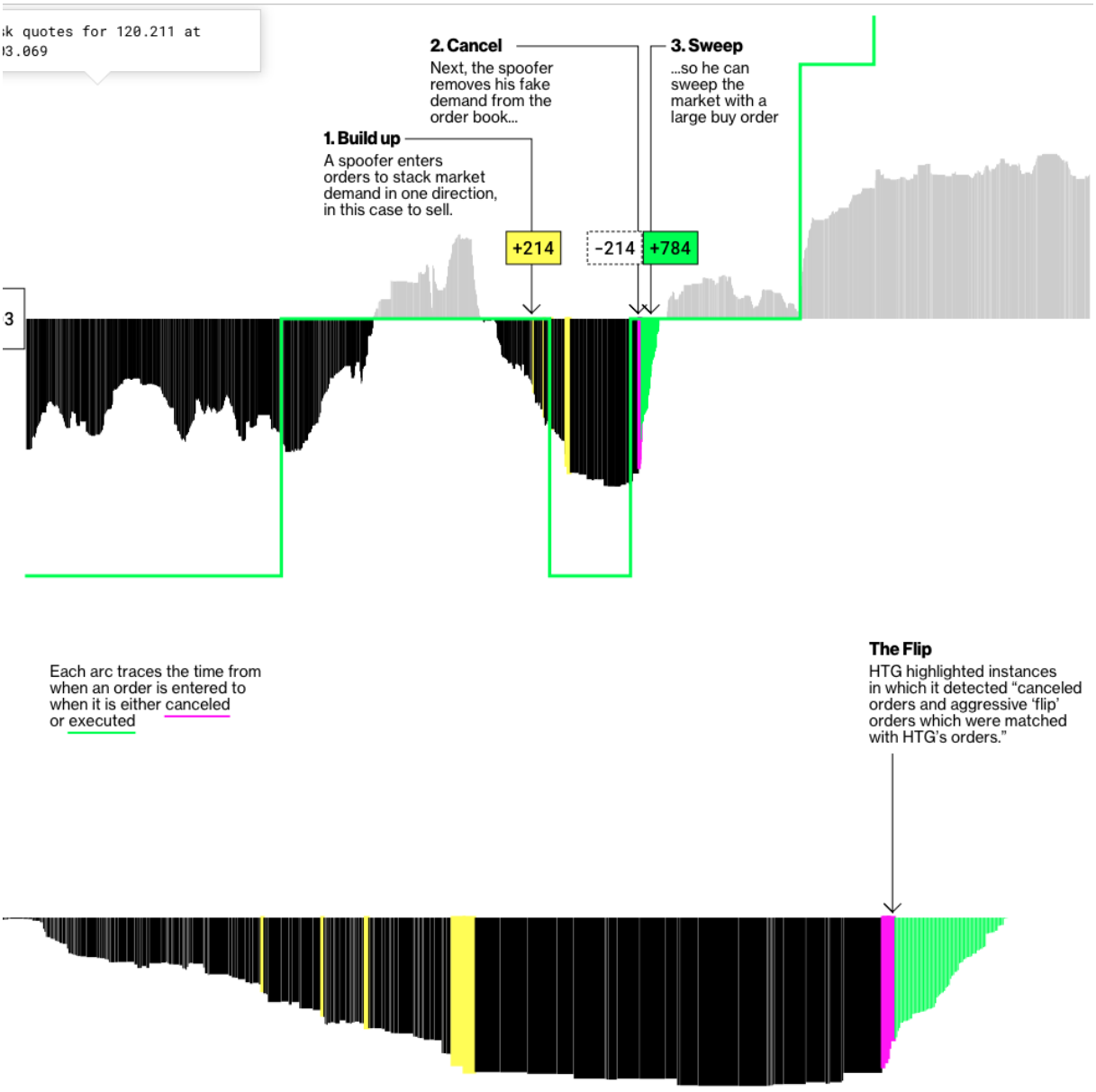


16. Appendix 16: Investigations and rulings of the FINMA

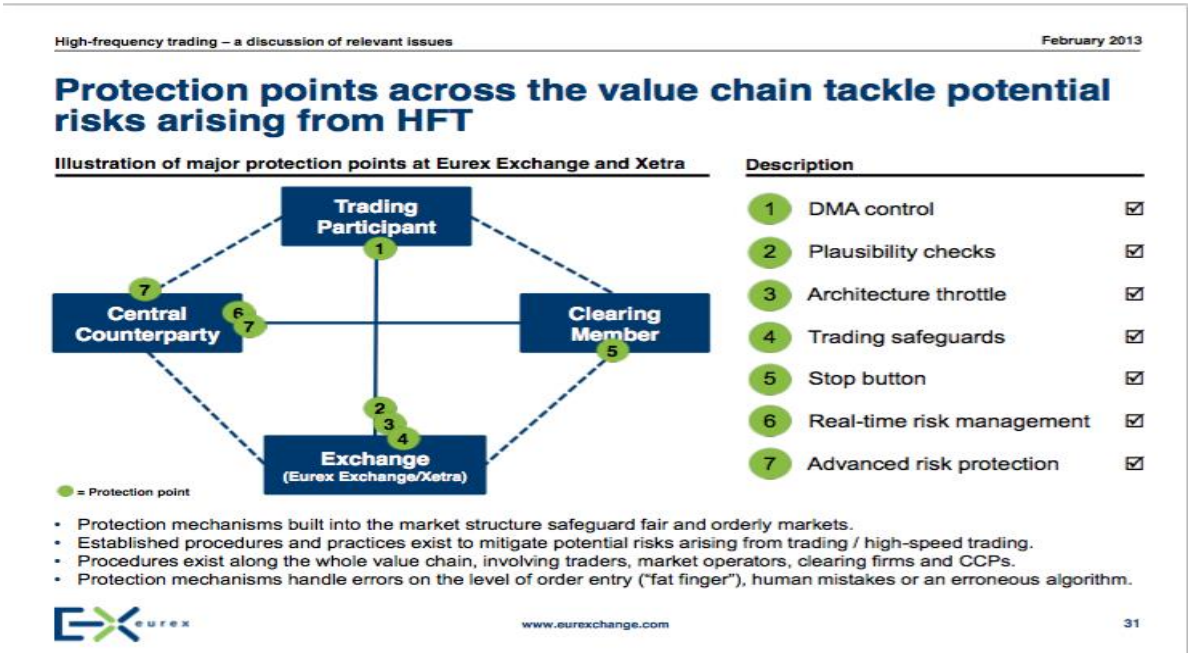


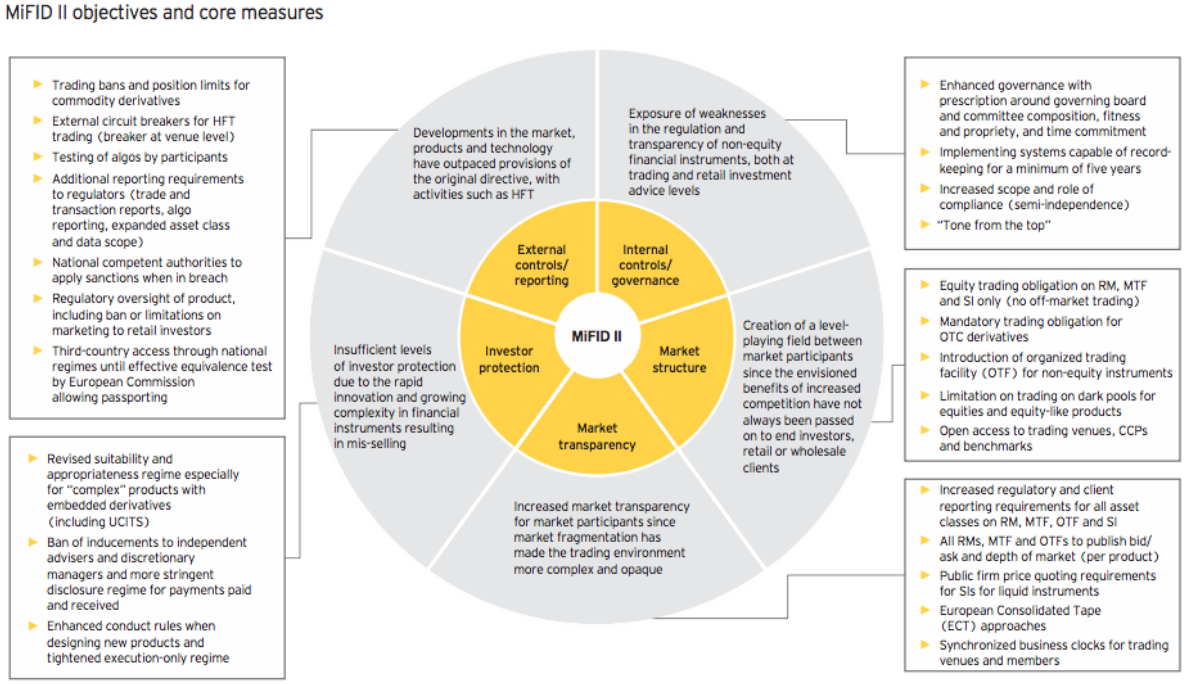
# 17. Appendix 17: HTG spoofing scheme



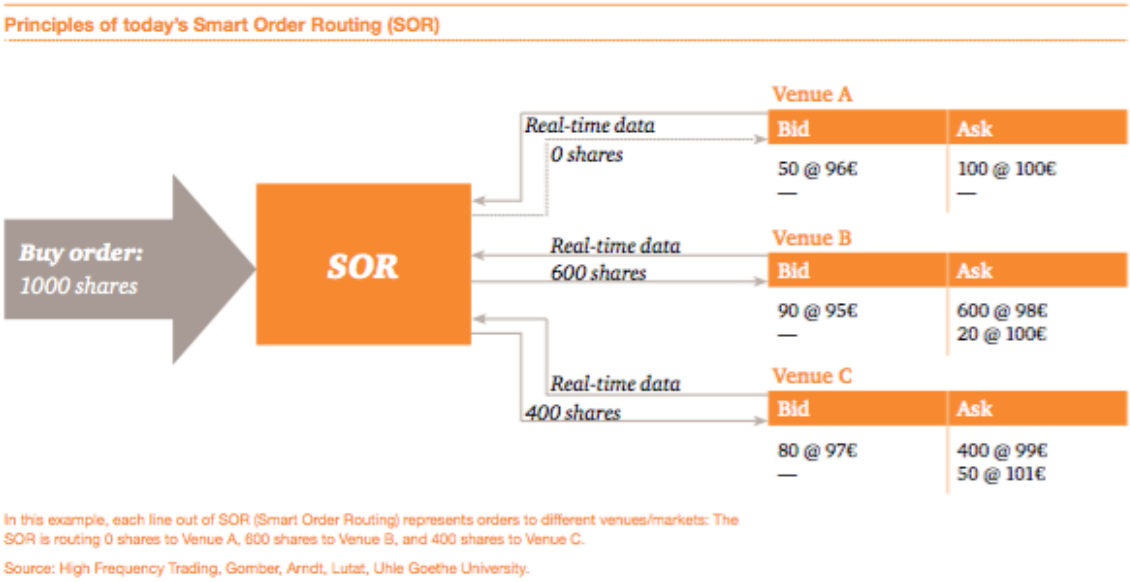
## 18. Appendix 18: Eurex chain risks




## 19. Appendix 19: MIFID II objectives and measures



## 20. Appendix 20: Smart Order Router




In this example, each line out of SOR (Smart Order Routing) represents orders to different venues/markets: The SOR is routing 0 shares to Venue A, 600 shares to Venue B, and 400 shares to Venue C.

Source: High Frequency Trading, Gomber, Arndt, Lutat, Uhle Goethe University.

## 21. Appendix 21: Harmonized clocks

# 22. Appendix 22: HFT and Dark pool U.S.

| Adopted | Under development or consideration |
|---|---|
| **Timestamp:** Beginning in April 2015, exchanges will add a timestamp in consolidated data feeds to indicate when a trading venue processed the display of an order or execution of a trade, thereby providing more information about latency | **Anti-disruptive trading rule:** Address the use of aggressive and destabilizing trading strategies in vulnerable market conditions when they could most seriously exacerbate price volatility |
| **Exchange transparency:** Exchanges now disclose how they are using consolidated and direct data feeds | **Regulatory authority:**<br>• On March 25, 2015, the SEC proposed rules to require that broker-dealers trading in off-exchange venues become members of a national securities association (such as FINRA)<br>• FINRA is separately considering expanding registration requirements to broker-dealer employees responsible for crafting or supervising algorithmic strategy |
| **Off-exchange transparency:** In May 2014, FINRA began disseminating aggregate information on the trading volume of individual alternative trading systems (ATSs) | **Off-exchange transparency:** FINRA is considering expanding transparency initiative to include non-ATS over-the-counter trading (thereby covering all off-exchange venues) |
| **Systems compliance & integrity (Reg. SCI):** Exchanges, ATSs that exceed certain trading volume thresholds, and certain other entities are now required to have comprehensive policies and procedures in place for their technological systems. The new rules also provide a framework for these entities to take corrective action when systems issues occur; provide notifications and reports to the SEC regarding problems and changes; inform members and participants about systems issues; conduct business continuity testing; and conduct annual reviews of their automated systems | **Risk management rules:** Improve firms' risk management of all types of trading algorithms and enhance regulatory oversight of their use |
| **Limit up-limit down pilot:** Generally prevents trades in exchange-listed stocks from occurring outside of a specified price band around the current market price (generally 10% for less liquid stocks and 5% for all others) [Unless extended—as it has been several times since approved in 2012—the pilot is set to expire Oct. 23, 2015.] | **ATS operational information:** Expand the information that ATSs disclose to the SEC about their operations and make that information available to the public |
| | **Order routing practices:** Set out minimum disclosures about order routing and execution quality that institutional investors could request from their brokers<br>**Order types:** Exchanges are developing rule changes, to be published for comment, clarifying the nature of their various order types, how they interact with each other, and how they support fair, orderly, and efficient markets |

## 23. Appendix 23: Market-making requirement MIFID II

VOLATILITY

| Type of circumstance | Characteristics | Required presence time | Incentives |
|---|---|---|---|
| **Exceptional** | 1. Extreme volatility (interruption of trading)<br>2. Political and macroeconomic events<br>3. Disorderly trading conditions<br>4. Investment firm unable to maintain prudent risk management:<br>• Technological issues<br>• Risk management issues (capital or clearing problems)<br>5. (for non-equity:) Suspension of pre-trade transparency by NCA<br><br>*Exceptional circumstances do not include regular or pre-planned information events (e.g. publication of macroeconomic statistics)* | 0% | -- |
| **Stressed** | • Declared by trading venue<br><br>• Price discovery process and liquidity materially affected by either:<br>(a) Significant change in the number of messages;<br>(b) Significant short-term changes in market volume; or<br>(c) Significant short term changes in price (=volatility, includes "fast markets"). | >50% | Required, higher |
| **Normal** | | >50% | Optional, lower (but: no incentives w/o MM scheme) |

## 24. Appendix 24: Volatility increased or not?

| HFT dampens volatility | HFT has no effect on volatility | HFT causes volatility |
|---|---|---|
| • Credit Suisse (2010) | • Chaboud, Chiquoine, Hjalmarsson and Vega (2009) | • Zhang (2010) |
| • CME Group (2010) | • Frino, Lepone, Mistry (2010) | • Boehmer (2011) |
| • Brogaard (2011) | • Hendershott and Riordan (2009) | |
| • Castura, Litzenberger, Gorelick, Dwivedi (2009) | • UK Treasury Foresight Committee (2011) | |
| • Hasbrouck and Saar (2011) | • Groth (2010) | |
| • Hagströmer, Nordén (2012) | • Bank of international Settlements (2011) | |
| | • Jarnecic, Snape (2010) | |

## 25. Appendix 25: Definition of HFT under MIFID II

**Art.4(40) MIFID II**

A "high-frequency algorithmic trading technique" is defined as: an algorithmic trading technique that is characterised by:

(a) infrastructure intended to minimise network and other types of latencies, including at least one of the following facilities for algorithmic order entry: co-location, proximity hosting or high-speed direct electronic access;

(b) system-determination of order initiation, generation, routing or execution without human intervention for individual trades or orders; and

(c) high message intraday rates which constitute orders, quotes or cancellations.