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DO NOT THROW THE BABY OUT WITH THE BATH WATER

An Analysis of the Potential Effects of the Legal Measures Adopted in
the EU and the US in Response to the Proliferation of High Frequency
Trading

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Abstract

Following the recent expansion of High Frequency Trading and other types of Algorithmic Trading, the financial markets law of the EU and the US has seen the introduction of numerous new rules, all of which have been adopted within a rather tight timeframe. The main purpose of these measures is, and has been, to counter the chaos allegedly characterising markets.

As the conditions are in fact neither as extreme as is often claimed nor always a result of Algorithmic Trading of any kind, many of the new provisions seem to conflict with superior rules demanding that markets promote economic growth. To see how the new rules can be expected to impact markets and their participants, this thesis first identifies the actual, by law demanded, purposes of the markets; namely to achieve a more efficient allocation of resources, meant to forward the recently stated pursuit of economic growth. It then determines how to measure market performance using metrics such as liquidity, volatility and confidence. After that, the actual effects of HFT are sought, with an overall positive outcome. To enable the concluding analysis of the rules, the new provisions themselves are then presented and examined. Once the analysis – which finds both suitable and unsuitable rules – is completed, a closing statement on the legislative process is delivered.

Preface

Having spent the better part of my life trying to maximise the probability of a bright future, I regard this paper as a conclusion of sorts. It constitutes the last frontier to the executive stage of my existence and should provide some evidence of the knowledge I have accumulated thus far. Taking all the credit for the result would, however, not be fair. I have received assistance from a number of people, all worthy an individual presentation.

For starters, the utmost degree of gratitude shall be extended to my tutor, Jens Andreasson, for, at a speed comparable to that of the trading systems studied, delivering excellent advice on a difficult topic and for, also at other occasions, being a very competent lecturer, proven capable of upholding a high level of educational quality. Without the assistance of Mr. Andreasson, I might, most importantly, have caused more frustration amongst legal scholars than there is cause for, by making my disinterest in predefined methods far too manifest and by not clearly disclosing the limits of my research.

Gratitude shall also be shown to numerous other lecturers who have supported me in quest to achieve a rather deep understanding of law and its contextual framework; to my dear comrades (none mentioned, none forgotten), who have endured my pedantic, yet exuberant, behaviour for nearly five years and supported me in my pursuit of a degree in law; to my parents for granting me access to 7.5 massive square meters of accommodations in the cellar of their residence, for providing me with electricity, water and food and for, occasionally, not disturbing me; to B for causing me to wake up sometime around four o' clock in the "morning", nearly every day/night, and for providing me with literature; to other relatives for providing support; to any antagonists, for helping me develop my understanding of reality and my argumentation skills; and to time, for moving forwards. Without your collective support, composing this piece would have been significantly harder or, at least, more expensive.

Floda, December 2016

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Abbreviations

Legal Authorities

CFTC	U.S. Commodity and Futures Trading Commission
ECJ	European Court of Justice
ESMA	European Securities and Markets Authority
FINRA	Financial Industry Regulatory Authority
RFA	Registered Futures Association
SEC	U.S. Securities and Exchange Commission
SRO	Self-Regulatory Organisation

Market Types

ATS	Alternative Trading System
MTF	Multilateral Trading Facility
OTF	Organised Trading Facility

Legal Source Material

CFR	Code of Federal Regulations
MAD	Directive 2003/6/EC of the European Parliament and the Council of 28 January 2003 on insider dealing and market manipulation (market abuse)
MAD II	Directive 2014/57/EU of the European Parliament and of the Council of 16 April 2014 on criminal sanctions for market abuse (market abuse directive)
MAR	Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC
MiFID	Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC

MiFID II	Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU
MiFIR	Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012
NASD	National Association of Securities Dealers
Regulation AT	(Proposed) Regulation Automated Trading (17 CFR Parts 1, 38, 40, and 170)
Regulation CAT	Regulation Consolidated Audit Trail (17 CFR § 242.613)
Regulation NMS	Regulation National Market (17 CFR § 242.600-613)
Regulation SCI	Regulation Systems Compliance and Integrity (17 CFR Parts 240, 242, and 249)
U.S.C	United States Code

Other

AT	Algorithmic Trading
ATs	Algorithmic Traders
DEA	Direct Electronic Access
HFM's	High Frequency Market Makers
HFT	High Frequency Trading; High Frequency Trader
HFTs	High Frequency Traders
n.	(Foot)note

1 Introduction

1.1 Background

In a world undergoing a seemingly endless technological advancement, few areas of society are left unaffected. The financial markets¹ certainly pose no exception. Ever since the invention of the first rudimentary computers, they have been the subject of a continuous process of automation, transforming pits to server networks.² This upheaval undoubtedly has been met with mixed emotions. While some have welcomed the increased speeds and the greater ease with which trades may now be conducted, others have found the new systems less appealing and complained rather loudly. Although the complaints have not been entirely without cause, as there have been several instances where computerised trading has proven troublesome, the issue is far more complicated than portrayed in tabloids. In fact, there is a fairly solid collection of evidence indicating that the most renowned and detested consequence of the automation – the birth of High Frequency Trading (commonly abbreviated “HFT”) – has had a positive impact on market efficiency.³ As these findings are rarely spread to the wider public, the general view does, however, tend to be exceptionally critical. The automation is often seen as some sort of menace, enabling a transfer of funds from the retirement savings of poor people to the pockets of rich and filthy bankers.⁴

In an inevitable response to the critique put forward and some famous incidents – such as the flash crash of May 6, 2010⁵ – the regulators of the jurisdictions affected have sprung to work, giving the financial markets law a supposedly needful update. As the process of automation was – in the United States and the European Union – partly spurred by the enactment of certain rules

¹ For an explanation of the term, see Levinson, *Guide to Financial Markets* (5 ed., The Economist 2009), p. 1-13.

² See section 2.1.

³ See section 3.3.

⁴ See Patterson, *Dark Pools: The rise of A.I. trading machines and the looming threat to Wall Street* (Random House 2012), p. 56.

⁵ See section 3.4.2.

meant to foster investor protection and venue⁶ competition during the 00s, it has, this time around, been very important for the legislative apparatuses to be successful in their attempts to attain market efficiency. At the same time, they have indeed been forced to swiftly deal with a very complicated reality. Seeing that the issue at hand is thus both pressing and complex, while the knowledge of the general public is harmfully deficient, performing an analysis of the potential effects of the new legislation affecting HFT would indeed be a noble task. There are of course quite a few research reports in existence already – as well as impact assessments written on behalf of the legislatures⁷ – but the papers endeavouring to provide an analysis of the upcoming legislation are, if any, limited in number. To help reduce this shortage of research on the legal aspects of HFT, which are often forgotten by economists, this writing will study the suitability of the recent regulatory developments, meant to “deal with” the phenomenon.

1.2 Purpose

Trying to loyally satisfy the need for impartial impact assessments, this thesis has as its core purpose to examine whether the financial regulations adopted and suggested in response to HFT – within the EU and the US – are compatible with the superior objectives of the markets, set by the legislatures. For the imagined goal to be reachable, it is, apart from finding the market objectives,

⁶ Throughout the text quite a few umbrella terms are used to describe the different forms of financial markets. For the sake of clarity, it ought, already at this stage, to be said that the terms “venue”, “market” and “exchange” are used interchangeably. When nothing else is suggested they refer to all types of organised trading systems intended for the transfer of financial instruments, including European Regulated Markets, Multilateral Trading Facilities and Organised Trading Facilities; and US Organized Exchanges and Alternative Trading Systems. See art. 4.21-23 Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU [2014] OJ L 173 (hereinafter referred to as “MiFID II”); 7 U.S.C. § 1a(1) and (37); 15 U.S.C. § 78c(a)(1) and (2).

⁷ See for example European Commission, *COMMISSION STAFF WORKING DOCUMENT: IMPACT ASSESSMENT: Accompanying the document COMMISSION DELEGATED REGULATION supplementing Regulation (EU) No 600/2014 of the European Parliament and of the Council with regard to definitions, transparency, portfolio compression and supervisory measures on product intervention and positions* (2016), <http://ec.europa.eu/finance/securities/docs/isd/mifid/160518-impact-assessment_en.pdf>, accessed November 29, 2016; U.S. Commodity Futures Trading Commission, *Regulation Automated Trading, Notice of proposed rulemaking* (2015), <<http://www.cftc.gov/idc/groups/public/@newsroom/documents/file/federalregister112415.pdf>>, accessed November 22, 2016.

crucial to determine the effects of HFT, the content of the new financial markets law and the implications the latter has on the former – that is how the recent measures affect market performance in general and HFT in particular. As something of a positive side effect, the thesis might also increase the interest in HFT amongst legal scholars and, thereby, induce them to participate in fostering a more complete understanding of the issue.

1.3 Delimitations

Conducting research on the topic of HFT and financial markets law could easily lead to the consummation of the better part of a lifetime. To avoid any such inconveniences, a few limitations have been made. Perhaps most protruding is the decision to study US law solely at federal level and EU law only at union level.

As regards the US law, the delimitation is motivated by the inevitable fact that most of US financial markets law is adopted at the federal level.⁸ Equally predictable is the decision not to review any national legislation of the EU member states. As the implementation of MiFID II has been postponed⁹ there is a pressing lack of materials to analyse, and delving into the limited number available would – on account of the high degree of uniformity – not bring the realisation of the purpose any closer, while using up resources – the time and energy of both the reader and the writer – that can be put to better use elsewhere.

A further reduction of scope does, theoretically, follow the decision not to examine other types of Algorithmic Trading (hereinafter referred to as “AT”) than HFT. In practice, the implications of only investigating HFT are, however, limited, since HFT is – in the opinion of both the US and the EU lawmaker – subordinate to AT, and by far the most regulated algorithmic trading technique in existence.¹⁰ Thus, the greater part of the thesis will, regardless of the delimitation, be of relevance also to those using other AT techniques than HFT.

⁸ See section 3.1.4.1.1.

⁹ See Directive (EU) 2016/1034 of the European Parliament and of the Council of 23 June 2016 amending Directive 2014/65/EU on markets in financial instruments [2016] OJ L 175.

¹⁰ See section 2.2.

1.4 Methodology – Theoretical Framework

1.4.1 The Method(s) Used

To achieve the purposes stated, the thesis has had to be composed according to a collection of procedural principles, possibly appearing to bear closer resemblance to a promiscuous farrago of legal methods than one pure school of thought. It has a rather firm foundation in *legal positivism and emotivism* – manifested in an adherence to established hierarchies of legal sources and an absence of arguments based on dogmas. In other words, it only compares the effects of the relevant law with such ideals as may be derived from the legal sources highest in rank within the jurisdictions studied, using empirically supported logics.¹¹ The quest to determine whether the legal measures conform with said objectives is, however, not an undertaking typically associated with legal positivism, which usually has as its objective to find valid law.¹² Although the thesis could very well serve as part of the decision basis for a constitutional court, it does not engage in proper, positivist, judicial review, since that would require a far more detailed inquiry into the correct interpretation of the rules in focus and the relevant processes of contesting the legality of subordinate provisions than the circumstances allow for. Instead, the writing finds additional support in *law and economics*, to conduct a study of economic effects at a combined micro and macro level, where rules are categorised according to their functions, and surveyed collectively – not as single provisions with separate wordings. If anything, the aggregate method could therefore be classified as *pragmatic*. It seeks to satisfy a specific research objective decided in advance and makes use only of the theories necessary for success. As this might raise concerns about impartiality and stringency, and make it difficult to decide whether the research conducted should at all be classified as any sort of legal science, some further clarifications are called for.

¹¹ See Green, 'Legal Positivism' in Zalta (ed), *The Stanford Encyclopedia of Philosophy* (2009), <<http://plato.stanford.edu/archives/fall2009/entries/legal-positivism/>>, accessed November 29, 2016.

¹² Cf. Hellner, 'Positivism och metod inom rättsvetenskapen' in Frändberg et al. (eds.), *Festskrift till Stig Strömholm* (Iustus 1997), p. 351 ff.

1.4.2 The Degree of Impartiality

Attending first to the matter of impartiality and stringency, the answer is not what ought to be expected. For it to be possible to independently identify a phenomenon to study, it is, in fact, mandatory not to have a pre-set method. Some sort of terminological fundamentals must, of course, exist, as the phenomenon otherwise could neither be identified nor have its perimeters established.¹³ If, however, a specific method is followed from the start, factors of relevance to the research objective could be deemed irrelevant or awarded a higher value than there are grounds for. This comes as all of jurisprudence – including legal methods – is a physically non-existent social construction, incapable of being true or false due to it being engineered by individuals having no interpretative prerogatives and being founded in some axiomatic tenet, which has to be accepted for the whole arrangement to work.¹⁴ When seeking objectivity, the only way to succeed is, consequently, by avoiding confinement to the subjective beliefs inherent in a system. Instead, the demands of the purpose chosen and the wider reality must be allowed to steer the choice of theories. Only then may actual independence and accuracy be achieved.

1.4.3 The Jurisprudential Basis

In logical sequence, the thesis *should indeed be considered jurisprudential, regardless of its interdisciplinary character*. It seeks to determine whether a specific set of rules conform with superior ones and treats other sciences merely as ancillary – to be employed only when there is a need to study how the real world is affected. The dependence on economy is, for example, nothing else than an unavoidable consequence of the objectives of the rules studied. Trying to ascertain their effects using only law would not at all be feasible, on account of law and all other sciences being unable to provide the tools necessary for an external analysis. Thus, in stark contrast to what is often argued, any test of suitability, referring to any norm – whether it be law in the strict sense or only some nonbinding principle of morale – *has to apply theories originating in a field of science other than the*

¹³ So long as the terms used describe only the objective reality, in a descriptive manner, and thus do not involve morale, the conceptual stage is rather unproblematic.

¹⁴ Possibly with the exception for certain forms of emotivism, which mainly acknowledges that there are no absolute truths for social sciences to uncover – distinguishing them from natural sciences. Emotivism is, however, not very useful for any other project than one seeking to identify biases inherent in other methods. Cf. Hellner (n. 12), p. 354 f.

purely legal, as the effects of law depend on its impact on the actions of individuals living in inter-communion with other subjects and objects. A teacher working at a kindergarten will, for instance, not be able to determine the suitability of prohibiting children from defecating on the floor if their preferences, the wider reality in which they exist and act, and the relevant theories on how they interact – like psychology – are not taken into consideration, along with the substance of other, related, rules. Even the strictest genres of legal positivism – condemning any attempts to review law – ought for that reason to permit extraneous theories to be used whenever there is a need to understand how a rule should be worded or interpreted to forward a superior objective.¹⁵ To render the philosophical ideas presented less abstract, the correlation between the purpose; the method; and the structure of the different parts of the thesis, is presented below. Before then, the limitations of the method must, however, be disclosed.

1.4.4 The Limitations Inherent in the Method

In consequence of the purpose, delimitations and methods chosen, the thesis neither provides a full account of law nor an impact analysis being applicable in all circumstances. Regarding the content of law, there is not much to add to the former sections. The examination of it is performed at a *system level* and does not go into extreme detail, making it insufficient as a sole source of valid law in any sort of judicial proceedings requiring a thorough inquiry.

Equally inappropriate would it be to try applying the findings of the thesis in another context than that studied. Due to the absence of involuntary tenets existing by nature – like the laws of physics – the findings are *only applicable in a liberal market economy*. Trying to use any of the solutions suggested in a totalitarian centrally planned economy – such as that existing in a communist jurisdiction – would therefore be utterly unsuitable. Additionally, none of the findings can, without previous review, be transferred to another time or milieu, where the conditions of trade diverge from those studied, as the analysis pays regard both to the objectives of law and the reality it has to deal with. Some degree of attentiveness is, consequently, advised.

¹⁵ Notice how it is not claimed that other sciences would always be relevant. In a jurisdiction where judicial review does not exist, there will only be rooms for arguments when no rule exists, or when its proper interpretation is dubious. Cf. Agell, 'Rättsdogmatik eller konstruktiv rättsvetenskap' in Frändberg et al. (eds.), *Festskrift till Stig Strömholm* (Iustus 1997), p. 37-48; Hellner (n. 12), p. 358 ff.

1.5 Outline – How the Purpose Has Shaped the Method and the Structure

As hinted several times above, a definition of the object at heart of the analysis has to be found before all else, so that it can be determined which rules and objectives are at all of relevance. Accordingly, section 2 initiates *the material, theoretical, part* of the thesis by providing a definition of HFT, founded mainly in legislation, and setting the outer boundaries of the whole research project. In due order, sections 3.1.1-3.1.6 then seeks out the objectives of the markets – the reality within which HFTs interact with other subjects by exchanging certain objects – primarily using legal acts and cases. As the objectives are expressed in very imprecise terms, at another level than the existing research on the effects of HFT, they are then translated into more specific units of measurement in sections 3.1.7 and 3.2, using macroeconomic, microeconomic and corporate finance theories. Following that, the effects of different forms of HFT, on the ideal market order, are examined in section 3.3, through a study of and account for the collective findings of research reports on the topic. As a final frontier to the analysis, the relevant rules are then, in section 3.4 – the part coming closest to the positivist pursuit of finding valid law – presented in an order decided by their function.

Representing something of an inverted echo of section 3, the material segment of the *analysis* – sections 4.2-4.4 – starts by merging the findings of sections 3.2-3.4, to determine what impact individual rules can – in terms of metrics – be expected to have on the efficiency of markets and whether they should, depending on the effects purported, be considered suitable. To make the results of the initial analysis more comprehensible, section 4.3 then explains how the individual effects might, cumulatively, affect traders – applying also the description of market objectives and functions given in section 3.1.7. Rounding off the analysis, section 4.3 tests whether the aggregate effects are, at what represents a macro level, compatible with the rather diffuse objectives highest in rank, presented in sections 3.1.3-3.1.6.

To conclude the thesis, section 5 *summarises the findings* and explains what might have caused them, by, in large, propagating further for methodological awareness. Section 5.1, thus, provides an explanation of the outcome of the analysis and presents some additional theories on what it tells, while sections 5.2-5.5 try to explain what has caused the specific results, what there is to learn, what can be expected in the future and what the thesis adds to existing research. As a finale, section 6 offers some brief recommendations for further research, justified by the findings.

1.6 Materials

1.6.1 Sources Used

Moving across many scientific fields and being rather extensive in its scope, the thesis deals with quite a wide spectrum of sources. As mentioned in the former section, legal acts and cases; research reports on the effects of HFT, of which there are a lot;¹⁶ and economic theories presented in textbooks, are at centre. Beyond that, law is sought in preparatory works and various other soft law instruments, as well as some textbooks and internet sources, while other information – on technology, the behaviour of market participants and the like – originates, chiefly, in newspaper articles.

In an effort to ensure that no false data is permitted to affect the findings, no dubious sources are used as reference material. What shall be considered “dubious” probably needs to be described more closely. Due to the thesis neither going easy on dogmas nor populism, mainly the logical stringency of the arguments forwarded has been put to the test. Whenever the information collected has not been of a nature allowing such an assessment – as is the case with pure accounts of physical conditions – the reputation of the provider has instead been considered. At all other instances, the reader is more than welcome to test the tenability of the arguments, instead of merely checking who else has expressed them.

1.6.2 Other Writings on the Topic

As was concluded earlier, the number of writings concerning HFT has grown rather large.¹⁷ Nevertheless, none of the available sources stands out as some sort of standard work for scientific purposes. Instead, the most acclaimed piece ought to be *Flash Boys* by Michael Lewis,¹⁸ which of-

¹⁶ A search for “high frequency trading” at Google Books generates some 16 700 hits. See Google Books, search results for “*high frequency trading*”, <<https://www.google.com/search?tmb=bks&q=%22high+frequency+trading%22>>, accessed November 29, 2016. This, apparently, makes some thorough crosschecking possible.

¹⁷ See n. 16.

¹⁸ See Lewis, *Flash Boys* (W. W. Northon and Company 2014).

fers only a partial portrayal of the whole phenomenon. A reason for this might be the great difficulties associated with trying to understand what HFT really is and how it works.¹⁹ For those having that objective, certain investigatory papers written by the EU and the US legislatures should probably suffice as an introduction.²⁰ If, however, the intention is to delve into HFT, reading research reports is a must. A great number of such writings may be accessed via a database run by the Social Science Research Network.²¹ Other than that, impact assessments, analysing the effects of legislation, are provided both by the EU and the US regulatory authorities.²²

¹⁹ See section 2.

²⁰ See for instance European Securities and Markets Authority, Bouveret et al., *Economic Report: High-frequency trading activity in EU equity markets* (2014), <https://www.esma.europa.eu/sites/default/files/library/2015/11/esma20141_-_hft_activity_in_eu_equity_markets.pdf>, accessed November 15, 2016; Miller et al., Congressional Research Service, *High Frequency Trading: Overview of Recent Developments* (2016), <<https://www.fas.org/sgp/crs/misc/R44443.pdf>>, accessed September 1, 2016.

²¹ See Social Science Research Network, *SSRN eLibrary*, <<https://www.ssrn.com/en/>>, accessed November 30, 2016.

²² See European Commission, *Better Regulation: Final Impact Assessment (IA) reports 2016 - Impact Assessment* (2016), <http://ec.europa.eu/smart-regulation/impact/ia_carried_out/cia_2016_en.htm#fisma>, accessed November 30, 2016.

2 Brief Introduction to High Frequency Trading

2.1 Rise of the Robots²³ – The Automation of Trading

2.1.1 How It All Started

It ought to come as no surprise that the financial markets of today are very different to those of the early 20th century. The majority of trading no longer requires direct human interaction, which has caused the number of intermediaries to plunge and new means of trading to emerge. Nowadays, a great part of all trades executed are initiated by *automatic computer systems*, reacting to information – in the form of input signals – within microseconds. Although this transformation is often described as sudden, it has in fact been in motion since the first rudimentary computers capable of making calculations were invented.²⁴

At the start of the technological revolution of trading, computers were used only as tools meant to facilitate *technical analysis*. As time progressed and the computing capacities of systems rose, the algorithms used could become increasingly advanced. This, understandably, had the effect of even further reducing the need for human intervention. When, in the early 1990s, the capabilities of the exchanges, the networks connecting them to traders²⁵ and the systems used by the latter reached a certain point, fully automated trading was a fact.²⁶

The first automatic systems traded only in equities, as the futures markets were slightly slower to react to the increasing demand for electronic execution.²⁷ In the times that followed the initial years of computerised trading, the quest for speed saw an exponential growth. More and more participants begun implementing automatic strategies and the capacities of systems soon reached

²³ A heading borrowed from the title of a book written by Martin Ford (Ford, *Rise of Robots: Technology and the Threat of a Jobless Future* (BASIC BOOKS 2015)) and, apparently, a video game (Mirage Technologies (Multimedia) Ltd., *Rise of the Robots* (1996)).

²⁴ See Aldridge, *High-Frequency Trading: A Practical Guide to Algorithmic Strategies and Trading Systems* (1 ed., John Wiley and Sons 2009), p. 7-19.

²⁵ Throughout the text, the terms “trader” and “participant” will be used synonymously, unless anything else is indicated.

²⁶ See Aldridge (n. 24).

²⁷ *Ibid.*, p. 7-13.

beyond previously imagined horizons, stiffening the competition and making it increasingly important to reduce latency to the minimum. This not only had the effect of prompting those seeking speed to upgrade the hardware of their systems, but also to explore more extreme solutions – mainly aimed at reducing the travel time of incoming and outgoing signals. Understanding what motivated these more radical measures requires knowledge of the very reason why speed matters, as well as a basic comprehension of the factors affecting the time it takes for an order to be effectuated.²⁸

2.1.2 What Drove the Development

Starting with the grounds for seeking speed, the rules of execution used by exchanges, operating as limit-order markets, should bring clarity.²⁹ When an order arrives it is either executed immediately or put in queue to be executed once a matching one arrives. Its position, relative to other orders, is determined by its time of arrival, making it critical to communicate an intent to trade before any competitors.³⁰ Thus, the longer it takes for information, in the form of signals, to travel to and from the systems, the longer it will take before an order is executed, and the smaller the chance of success in exploiting some inefficiency. As the foremost factor affecting speed, apart from processing power and coding, is the travel time of signals, the most extreme attempts to gain an advantage over opponents have concerned connectivity.³¹

As regards connections, it is important to note how total travel time is dependent on two factors. For starters, there are different *techniques to transfer data*. By using fiber optics, a participant

²⁸ See *ibid.*, p. 13-19; Capgemini, *High Frequency Trading: Evolution and the Future How the emergence of high frequency trading is altering the financial landscape as firms look to make money on the millisecond*, <https://www.capgemini.com/resource-file-access/resource/pdf/High_Frequency_Trading__Evolution_and_the_Future.pdf>, accessed October 30, 2016.

²⁹ See Menkveld, *The Economics of High Frequency Trading: Taking Stock* (VU University Amsterdam; Tinbergen Institute - Tinbergen Institute Amsterdam (TIA) 2016), p. 7, <https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2815294_code49904.pdf?abstractid=2787542&mirid=1>, accessed November 30, 2016.

³⁰ See U.S. Securities and Exchange Commission, *Investor Publications: Trade Execution* (2013), <<https://www.sec.gov/investor/pubs/tradexec.htm>>, accessed November 30, 2016.

³¹ Cf. Reid, *HFT 'eyesore' upsets leafy England* (CNBC 2016), <<http://www.cnbc.com/2016/03/02/hft-eyesore-upsets-leafy-england.html>>, accessed November 30, 2016; Westbrook et al., *High-Frequency Traders Find Microwaves Suit Their Need for Speed* (Bloomberg 2014), <<https://www.bloomberg.com/news/articles/2014-07-24/high-frequency-traders-find-microwaves-suit-their-need-for-speed>>, accessed October 10, 2016.

will, for instance, be able to achieve greater speeds than anyone using dial-up access – all else equal.³² If, however, all participants competing for the same order stock use the same type of connection, they are forced to find other means of differentiating themselves from the rest of the pack. The only way to do so is by shortening the *distance* to the markets – which is the second factor affecting total latency. This harsh reality eventually compelled traders to place their trading systems in buildings located as close as possible to the exchanges and, ultimately, led to the collocation of systems inside the facilities of the exchanges, for a fee.³³ Following that alteration of practice, the automated trading was able to fully evolve into HFT, forming a new subcategory that would soon come to stand for a majority all trading volume.³⁴

2.2 Attributes Specific to High Frequency Trading

2.2.1 Defining High Frequency Trading

Since the current market sphere is far more complex than the brief lesson in history might appear to suggest, a complete understanding of HFT necessitates a more detailed survey of its distinguishing features. According to one of few textbooks on the topic, what separates HFT from other methods of systematic trading is a high speed of execution and an absence of overnight holdings³⁵ – a definition that obviously lacks in precision³⁶. Fortunately, the legislatures of both the EU and the US have released more detailed descriptions of HFT, which are strikingly alike in substance. According to article 4.1.40 MiFID II, a “high frequency algorithmic trading technique” equates:

“an algorithmic trading technique characterised by:

³² See uSwitch, *Broadband history*, <https://www.uswitch.com/broadband/guides/broadband_history/>, accessed November 30, 2016.

³³ See Rogow, *Collocation: The Root of All High-Frequency Trading Evil?* (The Wall Street Journal 2012), <<http://blogs.wsj.com/marketbeat/2012/09/20/collocation-the-root-of-all-high-frequency-trading-evil/>>, accessed September 20, 2016.

³⁴ See section 3.3.6.1.

³⁵ See Aldridge (n. 24), p. 21 ff.

³⁶ As shall be seen, only a speedy execution and a lack of overnight holdings might not even qualify as algorithmic trading.

- (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”.

The EU description is matched by the following definition, supplied by a working group of the U.S. Commodity Futures Trading Commission:

“High frequency trading is a form of automated trading that employs:

- (a) algorithms for decision making, order initiation, generation, routing, or execution, for each individual transaction without human direction;
- (b) low-latency technology that is designed to minimise response times, including proximity and co-location services;
- (c) high speed connections to markets for order entry; and
- (d) high message rates (orders, quotes or cancellations).”³⁷

As the article and the working group definition imply, high frequency trading is as a form of algorithmic trading, characterised, partly, by an infrastructure relying on co-location, proximity, high speed direct electronic access or a combination thereof, to *lower the time it takes for a decision, automatically made by a system, to be effectuated*; partly by the generation of *a high number of intraday messages*.³⁸ This slightly esoteric description probably leaves most readers, who do not work with HFT or the like, utterly confused, wherefore some further clarifications are needed.

2.2.2 Demystifying the Concept

As the presence of algorithms is the foremost factor uniting all types of systematic trade, defining AT should form a suitable starting point for an inquiry into the many ingredients included in the recipe for HFT. Article 4.1.39 MiFID II describes “algorithmic trading” as follows:

³⁷ See CFTC Technical Advisory Committee Sub-Committee on Automated and High Frequency Trading, *Working Group 1 Presentation* (2012), p. 3, <<http://www.cftc.gov/idc/groups/public/@newsroom/documents/file/wg1presentation062012.pdf>>, accessed September 17, 2016.

³⁸ Cf. U.S. Securities and Exchange Commission (n. 20), p. 1-2.

“[...] 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.”

As can be seen, the central element of AT is the existence of a decision-making process at least paying regard to trading parameters, *controlled by an algorithm*. Consequently, both fully automated – systematic – and partly manual trading methods are covered, provided that they are controlled by algorithms, which make decisions based on certain input signals falling within the fairly broad, undefined, category of “trading parameters”. In other words, the decisions made by algorithms must concern trading strategy and therefore may not solely have to do with the manner in which strategic choices, already made, are effectuated.

Other than the presence of a set of rules translated into code, the existence of an *effective infrastructure* constitutes the single most important predictor of speed. As explained recently above, the data to which an algorithm responds needs to be transported from its source to the system, which then needs to reply by sending data – *intraday messages* – containing information about orders and the like, to the exchanges and other intermediaries. Recalling also what was said about priority and the need for speed, it should be obvious that those who manage to transmit their orders in the most expedient manner will have an advantage over others. Therefore, as was then indicated, HFTs are particularly keen to have their machines placed as near as possible to the exchanges – commonly referred to as *proximity* – or, if that is allowed, even within their facilities – commonly referred to as *co-location*. Additionally, in an attempt to reduce latency even further, traders seek to use the fastest hardware available and to streamline their code. An effective infrastructure thus minimises latency by all means possible and tends to lead to a technological arms race.³⁹

To summarise, high frequency trading is not, at its core, a particular strategy, but rather *an umbrella term encompassing certain methods of employing already existing strategies*.⁴⁰ Those methods all share a high speed of execution, a high number of intraday messages and some sort of automation of strategic decisions. Although this does render some strategies more profitable than others, it does

³⁹ See Lewis (n. 18), p. 60 ff.

⁴⁰ See U.S. Securities Exchange Commission (n. 13), p. 7 f.

not necessarily make the less lucrative ones impossible to use or, for that sake, dictate the terms of trading for HFTs. A deeper dive into the tactics used is therefore necessary to ensure a proper understanding of the phenomenon. Such a comprehensive insight is, however, not needed until the effects of HFT are studied, wherefore the concept will not be explained in greater detail at this stage.

3 Theory

3.1 The Purposes of the Financial Markets

3.1.1 Methodological Clarifications

With reference to what was said in the section on methodology, it is necessary to find the objectives of the markets before the effects of HFT may be determined and classified. Settling on a point of departure, enabling the upcoming analysis, also requires the application of legal theory on how to discern the purposes either specifically chosen for or imposed on legislation. Due to such theory differing between the two jurisdiction chosen,⁴¹ they need to be treated separately. Prior to that, a rigid explanation of what separates the identification of purposes from the identification of actual functions is mandatory, as some readers might otherwise have trouble seeing why materials other than economics textbooks – describing how the markets actually work – are of any relevance.

3.1.2 Separating Law from Economics

The main motive for, yet again, detailing the practical implications of the more or less extorted decision to found the study of law in the teachings of – amongst other methods – legal positivism, is the lack of discretion and ignorance seemingly present amongst large clusters of economic and legal scholars. In a great number of textbooks on economics, business and law, the markets are, without further, presumed to have certain purposes – the most common being to *facilitate economic growth*.⁴² Although the authors of the books aimed at may very well prove to be completely correct in their assumptions, whatever materials they produce without properly deducting the intentions of the lawmakers will be methodologically flawed and therefore incapable of resisting critique. The cause for this also has already been mentioned in the section on methodology –

⁴¹ Both the EU and the US obviously can be split into far more jurisdictions than so. Nevertheless, for the purpose of the thesis they may be regarded as only two jurisdictions, since the rules studied are adopted by two legislative bodies.

⁴² Cf., for example, Bradfield, *Introduction to the Economics of Financial Markets* (Oxford University Press 2007), p. 93 ff.; Bowie, *Business Ethics in the 21st Century* (Springer Science & Business Media 2013), p. 148 ff.

there exist no superior objectives for law to fulfil, wherefore the suitability of any legislation can be measured only against the more or less diffuse objectives chosen by the legislature in the specific case or imposed on it by superior sources of law.⁴³ Any sort of review of law must consequently be preceded by an identification of its purposes, conducted in accordance with the theory of interpretation valid⁴⁴ within the jurisdiction being subject to scrutiny. As shall be seen, sifting out the often diffuse intentions a non-existing body, suffering from a multiple personality disorder, is not always as straightforward as it may seem. In addition, notwithstanding their dubious methods, the careless academics may very well steer the development of law by making unfounded assumptions by which others – including those enforcing and creating law – then abide.

3.1.3 Finding Law and Its Objectives in the European Union

3.1.3.1 Methodological Traits and the Hierarchy of Sources

Of the jurisdictions studied, that formed by the European Union is particularly inclined to be affected by theories originating in other fields of science than the purely legal. Due to its unique character, the law of the European Union has to be studied in a rather distinctive manner. Most importantly, it is at all times necessary to consider not only the purposes of the legislative acts being of particular interest, but also *the objectives of the union as a whole*. This follows the requirement not to apply directives or regulations in contradiction with the superior, primary law, treaties – the Treaty on European Union (hereinafter referred to as “TEU”) and the Treaty on the Functioning of the European Union (hereinafter referred to as “TFEU”).⁴⁵

⁴³ The financial markets are, like every part of society, nothing else than an invention. They are not dictated by laws of nature and thus do not exist in the proper meaning of the word. Claiming that they would have some kind of motive therefore is only bizarre.

⁴⁴ To be read as “applied and thus given effects”, cf. section 1.4.

⁴⁵ See EUR-Lex, *Glossary of summaries: European Union (EU) hierarchy of norms*, <http://eur-lex.europa.eu/summary/glossary/norms_hierarchy.html>, accessed December 7, 2016; art. 288-291 TFEU.

Owing to the principles of sincere cooperation,⁴⁶ “effet utile”⁴⁷ and supremacy/primacy of European Union law over the law of the member states,⁴⁸ all members of the union are also bound to *disregard any national law conflicting with binding union law*⁴⁹ – whether it be primary or secondary⁵⁰ – adopted in an area where the union has an either exclusive or shared competence to legislate. As a result, discrepancies in the content of law should, at a national level, only be allowed to exist if the superior union legislation in force is broad enough to accommodate differing interpretations, which may very well, despite the aforementioned ambition to uphold a cohesive system, be the case when provisions primarily stating objectives are to be implemented and applied in different contexts.⁵¹ The objectives themselves should, on the other hand, always be the same, since acts needing implementation are nothing else than means to an end, set by the union legislature. When the union has made use of its exclusive or shared competence to adopt legislation, as happens to be the case with the greater part of financial market law,⁵² a search for the intentions of the legislature can therefore, in most instances, be limited to an examination of union law, whereas valid law must, once it has been implemented, be sought both in union law and na-

⁴⁶ See art. 4.3 TEU. Also known as the fidelity, good faith or solidarity clause, cf. Foster, *EU law: Directions* (5 ed., Oxford University Press 2016), p. 137.

⁴⁷ See Case 30/59 *De Gezamenlijke Steenkolenmijnen in Limburg v High Authority* [1961] ECR 1; Case 6-64, *Flaminio Costa v E.N.E.L.* [1964] ECLI:EU:C:1964:66.

⁴⁸ See Case 26-62, *NV Algemene Transporten Expeditie Onderneming van Gend & Loos v Netherlands Inland Revenue Administration* [1963] ECLI:EU:C:1963:1; Case 6-64, *Flaminio Costa v E.N.E.L.* [1964] ECLI:EU:C:1964:66; Case C-106/77, *Amministrazione delle Finanze dello Stato v Simmenthal SpA* [1978] ECLI:EU:C:1978:49; Case C-106/89, *Marleasing SA v La Comercial Internacional de Alimentacion SA* [1990] ECLI:EU:C:1990:395; declaration 17, consolidated version of the Treaty on the Functioning of the European Union (2012) OJ C 326/47.

⁴⁹ See art. 2.1 and 2.2 TFEU; art. 5 TEU.

⁵⁰ A category including directives, regulations and decisions.

⁵¹ If the objectives are vague or the conditions of application diverge, different measures of implementation might, in different member states, be allowed or needed for the fulfilment thereof.

⁵² See Quaglia, ‘*The EU and Global Securities Markets Regulation*’ in *The European Union and Global Financial Regulation* (Oxford University Press 2014), <<http://www.oxfordscholarship.com.ezproxy.ub.gu.se/view/10.1093/acprof:oso/9780199688241.001.0001/acprof-9780199688241-chapter-4>>, accessed December 7, 2016.

tional law, unless the acts needing implementation are strict enough to make impossible any differing methods of implementation. This, unmistakably, provides further justification for the decision not to study any incomplete implementing measures of individual member states.

3.1.3.2 *The Power of Soft Law*

Somewhat harder to assess and employ is the rather diverse collection of *soft law instruments*. While generally not binding vis-a-vis member states, they can, on account of the principles of legitimate expectations and equality, indeed bind the issuing institutions, through what is known as a self-binding effect, and indirectly enforce their contents on member states.⁵³ If, for example, the commission has issued an action plan, interpretative guidelines or some other document, it may, as a consequence, be forced to abide thereby. This clearly has the potential of affecting the content of valid law, but, more importantly, can also *simplify the identification of purposes*, due to such information being far more frequent in soft law instruments than in hard law.⁵⁴

Regardless of the importance soft law may have *to the institutions*, it remains difficult to appreciate the relative authority of non-binding materials aimed at *controlling others*. An example of this, being of interest in the search for objectives, is the preambles of directives and regulations. While often expressing the intentions of the legislature, as well as supplying critical background information, the introductory notes of sorts are not considered formally binding.⁵⁵ Using them as sources, in the search for objectives, would, thus, seem to contradict the most fundamental principles of legal positivism. Nevertheless, they must indeed have some bearing, as they otherwise should not exist. Determining exactly what their import is would, however, stretch beyond the limits of this thesis, wherefore they are, for the remainder of it, assumed to have only some semi-binding powers by facilitating interpretation.⁵⁶

Lastly, it is worth observing that the intentions of the regulators, on account of their vague wording, usually do not serve an independent purpose even if they are formulated as binding

⁵³ See Senden, 'Changes in the Relative Importance of Sources of Law – The Case of EU Soft Law' in Neergaard and Nielsen (eds.), *European Legal Method – in a Multi-Level EU Legal Order* (DJØF Publishing 2012), p. 239 f.

⁵⁴ Ibid.

⁵⁵ See Case C-162/97, *Nilsson and Others* [1998] ECR I-7477.

⁵⁶ See Senden (n. 53); Mietinen et al., *Travaux to the Treaties: Treasures or trivia?* (2015), <<https://eustudies.org/conference/papers/download/71>>, accessed

rules.⁵⁷ Their actual effects, consequently, would not have been much different even if they were located in binding parts of legal acts. Additionally, as this thesis does not have as its primary aim to find law, but rather to conduct an audit of it, paying regard to purposes stated in non-binding materials should not jeopardise its accuracy, so long as they emanate from the legislature and conform with binding ones.

3.1.3.3 *The Adjudication Process of the European Court of Justice*

As for the relative importance of sources, it should be said that the European Court of Justice (hereinafter referred to as “ECJ”) – entrusted with the power to contest the validity of legal enactments through judicial review – tends to take into account an exceptionally broad range of information.⁵⁸ It does so within the scope of a *purposive approach* – commonly referred to as an evaluative comparative method – in an effort to ensure that the objectives of the union are upheld.⁵⁹ When the correct reading of, for instance, the union legislation on financial markets is to be ascertained, the court will therefore consider not only the wording of some subordinated act, but also economic theory on how best to achieve the aims stated in the treaties and other superior acts. The separation of law and economics consequently is not as firm as it might seem, to which regard must be paid at all times.

3.1.4 **Purposes of the EU Financial Markets**

When applying the method provided, the first step is to follow the hierarchy of. Thus, starting with the primary law treaties, article 3.3 TEU ought to be considered most relevant to the financial markets. It states that all measures taken by the union must promote the “[establishment of] an internal market”, “the sustainable development of Europe based on balanced economic

⁵⁷ Trying to apply art. 3.3 TEU would, for instance, prove extremely difficult if there were no more detailed rules in existence.

⁵⁸ See Europa.eu, *About the EU: Court of Justice of the European Union (CJEU)*, <https://europa.eu/european-union/about-eu/institutions-bodies/court-justice_en>, accessed December 7, 2016.

⁵⁹ See Nielsen, ‘Towards an Interactive Comparative Method for Studying the Multi-Layered EU Legal Order’ in Neergaard and Nielsen (eds.), *European Legal Method – in a Multi-Level EU Legal Order* (DJØF Publishing 2012); Hettne and Eriksson (eds.), *EU-rättslig metod* (2 ed., Norstedts Juridik 2011), p. 158 ff.

growth and price stability, a highly competitive social market economy” and “scientific and technological advance”. Furthermore, it obliges the union to strive for “economic cohesion”, wherefore there should not be any substantial room for discretionary implementation, causing incoherence.⁶⁰ To some extent, the economists, seemingly prioritising economic growth over all else, are therefore correct in their assumptions.

Below the treaties in rank, a number of directives and regulations, of relevance to the functioning of the financial markets, can be found.⁶¹ A feature common to all of them is a near absolute absence of rules explicitly stating any sort of market purposes. Their preambles give several accounts of what distinguishes functional markets from dysfunctional ones – most notably efficiency, confidence and stability – but serve only a handful express indications of purposes by – in what appears to be a routinely manner – mentioning economic growth and the creation of jobs.⁶² Had the analysis been confined to hard law instruments and preambles, the prospects of finding any more precise objectives would consequently be meagre. Luckily, the recently adopted soft financial markets law is unexpectedly rich in content.

In the most recent commission communication on financial services policy – COM (2014) 279: A reformed financial sector for Europe⁶³ – four central market functions are emphasized. Firstly, the markets are said to “provide lending to households and businesses”; secondly, they

⁶⁰ Cf. art. 53 TFEU.

⁶¹ See, in particular, Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC [2004] OJ L 145/1 (hereinafter referred to as “MIFID”); MiFID II; Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012 [2014] OJ L 173/84 (hereinafter referred to as “MiFIR”); Directive 2014/57/EU of the European Parliament and of the Council of 16 April 2014 on criminal sanctions for market abuse (market abuse directive) [2014] OJ L 173/179 (hereinafter referred to as “MAD II”); Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC [2014] OJ L 173/1 (hereinafter referred to as “MAR”).

⁶² See, for example, recitals 5 and 17 MiFID; recitals 4, 5 and 11-13 MiFID II; recitals 1,2, 11-13, 23 and 24 MAR.

⁶³ See European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A reformed financial sector for Europe*, COM (2014) 279 final (2014), <http://ec.europa.eu/finance/general-policy/docs/general/20140515-erfra-communication_en.pdf>, accessed October 15, 2016.

are claimed to “allow individuals to save and invest for their future and channel savings to support the economy”; thirdly, they are held to “help corporations and households to better manage and insure against risks”; and fourthly, it is suggested that they “facilitate payment transactions”.⁶⁴ Although the objectives listed may appear fairly specific, it is not clarified how they shall generate economic growth or, for that sake, how they relate to the aforementioned characteristics of a functional market. Despite this inconvenience, it is, in fact, possible to extract more precise objectives and to describe the markets in further detail by reference to the actions of the legislature.

The route to enlightenment goes, not through the immense catalogue of opinions expressed by the legislature, but through the even greater, constantly expanding, series of instances where the legislature has either knowingly remained inactive, when made aware of some new phenomenon, or acted in support of it. A majority of all societal inventions are, as shall be deliberated further in section 3.1.7, not brought to life by the legislature. In opposite, they are created by individuals acting according to their self-interests. Financial markets indeed follow the pattern in this respect, wherefore their actual functions can be *claimed* to coincide with their purposes, to the extent that there is neither any hard nor soft law to the contrary. Yet again, it is therefore necessary to recognise the value of economic theory; a further inquiry into the purposes of the markets needs to examine their actual functions, as described by economists. Before then, the legal system and markets of the United States of America must, though, undergo the same scrutiny, so that any redundant repetition can be avoided.

3.1.5 Finding Law and its Objectives in the United States of America

3.1.5.1 Methodology and the Hierarchy of Sources

Being a federal republic with a common law legal system, the US could be expected to differ greatly from the EU and its less united member states, in terms of legal method.⁶⁵ Nevertheless, as far as financial markets law is concerned, there are more similarities than variations. US legislation is superior to court decisions, but can be subject to court review, focusing on its conformity

⁶⁴ Ibid., p. 2.

⁶⁵ See Farnsworth, *An Introduction to the Legal System of the United States* (3 ed., Oceana Publications Inc. 1996), p. 1-14.

with legislative acts of higher rank.⁶⁶ Of all such pieces of legislation, the constitution is positioned at the top, trailed, in falling order, by treaties; federal statutes; and “federal executive orders and administrative rules and regulations”, below which state legislation and municipal acts are arranged.⁶⁷ Furthermore, as is the case within the EU, the majority of financial markets law has been enacted at a level above that of individual member states, in what is said to be an attempt at ensuring cohesion and prevent regulatory arbitrage.⁶⁸ The method applied to seek out the purposes of the US capital markets consequently resembles that used in the study of EU law, in that fundamental principles must be taken into consideration at all times and that state law is of lesser importance, due to its inferior status. As a contrast to the many points of contact, there is, however, one particular disparity, having a major impact on the distribution and sectioning of legal sources, that needs attention.

3.1.5.2 *Regulatory Authorities of Importance*

In the US, the greater part of all legislation passed does not emanate directly from the congress – being comparable to the European Parliament. Instead, the task of adopting the bulk of legislation – in the form of regulations – has been assigned to a series of authorities of varying genres, each responsible for specified areas of law.⁶⁹ Within the section of financial markets law, there are no less than eleven such bodies, of which three – the Securities and Exchange Commission (SEC),⁷⁰ the Commodity Futures Trading Commission (CFTC)⁷¹ and the Financial Industry Regulatory Authority Inc. (FINRA)⁷² – play particularly important roles in the control of HFT and

⁶⁶ Ibid., p. 42-43, 61 and 75.

⁶⁷ Ibid., p. 61-64.

⁶⁸ See Davies and Green, *Global Financial Regulation: The Essential Guide* (Polity Press 2008), p. 161 f.

⁶⁹ Only somewhat resembling the EU order, where more detail legislation is adopted by the European Securities and Markets Authority.

⁷⁰ Being responsible for much of the supervision and regulation of the securities market, the SEC stands for a great part of all financial markets law studied. Cf. 15 U.S.C § 78d.

⁷¹ Assigned with a mission largely equal to that of the SEC, yet focusing on the futures market, the CFTC is also responsible for the creation of much relevant legal material. Cf. 7 U.S.C § 2.

⁷² As a private body, FINRA stands out amongst its alleged peers. It was formed when the New York Stock Exchange (NYSE) and the National Association of Securities Dealers (NASD) merged their regulating departments and is thus responsible for “for rule writing, firm examination, enforcement and arbitration and mediation functions, along with all functions that were previously overseen solely by NASD, including market regulation under contract

other types of AT.⁷³ This does, however, not mean that it would be sufficient to examine only the legal acts enacted by those entities. In opposite, the purposes of the markets will have to be sought in a very broad category of sources, including those determining the objectives and responsibilities of the authorities, and soft law instruments, which happen to have a standing comparable to that of corresponding sources in the EU.

3.1.5.3 *The Adjudication Process of the US Judiciary*

As a result of there being a great number of statutory and regulatory provisions covering financial markets law,⁷⁴ the majority of legal processes, concerning financial issues, will be settled through the application of legislation, rather than case law.⁷⁵ When applying said sources, the judiciary follows a certain pattern of interpretation, exhibiting quite a few similarities with that of the ECJ.

Firstly, whenever possible it endeavours to *give effect to the intention of the legislature*. This is achieved either by the use of historical documents illustrating the legislative process or by the employment of a more complicated process aimed at examining which issue(s) existed before the legislation was passed and how the two correlate. In either case, the judiciary is forced to *determine the actual effects* of a particular reading, which requires it to make use of theories from other fields of science – of which economics is the most prominent whenever the question demanding an answer is of a financial nature.

for NASDAQ, the American Stock Exchange, the International Securities Exchange and the Chicago Climate Exchange”. See Financial Industry Regulatory Authority, *NASD and NYSE Member Regulation Combine to Form the Financial Industry Regulatory Authority – FINRA* (2007), <<http://www.finra.org/newsroom/2007/nasd-and-nyse-member-regulation-combine-form-financial-industry-regulatory-authority>>, accessed November 22, 2016.

⁷³ See Murphy, *Who Regulates Whom and How? An Overview of U.S. Financial Regulatory Policy for Banking and Securities Markets* (Congressional Research Service 2015), p. 1 and 2, <<https://fas.org/sgp/crs/misc/R43087.pdf>>, accessed December 7, 2016.

⁷⁴ See US *Regulation National Market System* (hereinafter referred to as “Regulation NMS”), (17 CFR § 242.600-612) (2005); *Regulation Automated Trading* (hereinafter referred to as “Regulation AT”), (17 CFR § 1, 38, 40 and 170) (proposal) (2015, supplemented 2016); *Customer Clearing Documentation, Timing of Acceptance for Clearing, and Clearing Member Risk Management*, (17 CFR § 1, 23, 37, 38 and 39); *Regulation System Compliance and Integrity* (hereinafter referred to as “Regulation SCI”), (17 CFR § 242.1000-1007) (2014); *Consolidated Audit Trail* (hereinafter referred to as “CAT”), (17 CFR § 242.613); *Risk Management Controls for Brokers or Dealers with Market Access*, (17 CFR § 240.15c3-5) (2011).

⁷⁵ Cf. 17 CFR; 7 U.S.C. § 1; 15 U.S.C. § 2B.

Secondly, by reason of the fairly firm doctrine of precedent – *stare decisis* – and a preference for uniformity, those deciding the outcome of a case must pay regard not only to the direct consequences to the parties involved, but also to the indirect effects on the society as a whole, caused when the interpretation settled on is followed in the everyday life and transactions of other citizens. In what ought to be considered a disturbingly repetitive manner, it is therefore essential to once again note the importance of economic theory. When ascertaining or construing *de lege lata*, it is *not possible to reach any precise conclusion without the aid of economics*, describing the effects of actions.⁷⁶

3.1.6 Purposes Specific to the United States of America

Unlike the constitutional treaties of the EU, the US constitution contains little of value to the search for objectives. It does state that the welfare of the people shall be promoted, but does not give any clues as to the means by which said goal is to be achieved and what function the financial markets have in the equation.⁷⁷ To some extent, the same can be said of the federal statutes, which seem warier of what should be prevented than what is desirable. For instance, 17 CFR § 242.1001 obligates markets to ensure that their trading systems can counter disruptions, while § 242.15C3-5 tells that traders must instate systems aimed at preventing disorderly trading, but neither tells exactly what an *orderly* market is. More specific statements may be found in regulatory notices, but neither those give all the answers. On the contrary, it is often mentioned that financial markets “are essential for capital formation, job creation, and economic growth”, but not specified how.⁷⁸ This leads to the same conclusion as that drawn when the objectives of the EU markets were discussed. The legislature has *knowingly* left out details on the precise purposes of the markets, whereby it has left it to those participating in the trade to determine for themselves which objectives to pursue. As a result, economics does, after all, at least in theory, both supplement and – where a hierarchy exists – rule over subordinate sources of law.

⁷⁶ See Farnsworth (n. 65), p. 77 ff.

⁷⁷ See the preamble of the US Constitution.

⁷⁸ See U.S. Securities and Exchange Commission, *Regulation Systems Compliance and Integrity* (2015), p. 4, <<https://www.sec.gov/rules/final/2014/34-73639.pdf>>, accessed December 7, 2016.

3.1.7 The Actual Functions of the Financial Markets – Equating Law with Economics

3.1.7.1 *How Markets Came to Be and What It Has to Do with Finding Their Purposes*

Having illuminated the great reluctance towards rules stating objectives and, far more importantly, the significance of the conscious inaction of the legislatures, it seems reasonable to equate intent with function – unless the latter were to be incompatible with the former. In other words, it should be possible to find the purposes of the markets in the economic theory describing their actual functions. To someone requiring more rigorous evidence of legislative intent, such a conclusion might not be satisfactory as there could be several reasons for legislative passivity, of which approval is only one. Luckily, further evidence supporting the hypothesis can be found in economic history.

As indicated before, the initial exchange of services and goods, partaken by humans, begun when it was first understood that the combination of specialisation and cooperation brought a greater net sum of benefits than any rudimentary form of sole proprietorship. This happened at a time when there were no rules regulating the transfer of resources, making it clear that markets, as a phenomenon, predate the financial regulation. It was not until it became clear that the existing safeguards for honesty and fulfilment of contractual obligations – merely being the value of a good reputation and the possibility of retribution – were insufficient that the judiciaries were forced to regulate market activities. Therefore, it appears safe to say that the *regulatory authorities have not created the markets or set their purposes, but only intervened when they have not functioned as intended.*⁷⁹ With that sorted, the renowned economic theory can, hopefully, be applied without causing unease.

3.1.7.2 *Common Core Functions – Optimisation, Growth and Mutual Satisfaction*

Taking the hitherto presented opinions, objectives and facts into consideration, observing that all markets are in some way related to the exchange of objects and services, should be fairly easy. As was mentioned above, the main cause for this flow of tangibles and intangibles – of varying value – is the need for *preferential satisfaction*. Different individuals and entities have different needs, at different points in time. If pleasing said needs requires a change in the composition of the resources held by an individual, or entity, an exchange must take place before contentment can be

⁷⁹ See Levinson, (n. 1), p. 1-13.

reached.⁸⁰ Thus, at their core, all markets serve the purpose of bringing individuals and entities with inversely related interests together, permitting them to please their unique desires by mutually beneficial transactions.⁸¹ However, in doing so they also serve countless other objectives, varying slightly with the nature of the valuables traded.

Of perhaps even greater value than the facilitation of preferential satisfaction is the *optimisation of the allocation of capital*. By allowing participants to freely decide with whom and on which terms to contract, the financial markets, theoretically, steer flows of capital to the participants and instruments bringing others the utmost degrees of contentment. This, first, works to enrich the most efficient individuals and entities offering their services in the markets and, second – as a consequence of the effects on the allocation – tends to *maximise the total economic output, or rather production of benefits*, of the markets, causing economic growth.⁸² To properly understand the forces driving this development it is critical to, at very least, be familiar with the classes of instruments available, their respective roles and the nature of the markets on which they are traded.⁸³

3.1.7.3 *Types of Markets and Their Functions*

Whenever trading in financial instruments is discussed it is probably natural to think of investors exchanging already existing and listed assets. The financial markets are, however, more complicated than so. Instruments must be issued and admitted to trading before they can change hands. This has led to a distinction between *primary and secondary markets*. Primary markets are, as the name implies, those at which the initial public offering occurs, while the subsequent resale ensues on secondary ones. Regardless of how distinct this might make the markets appear, there is,

⁸⁰ Cf. section 3.2.1.

⁸¹ Ibid.; Friedman, *Capitalism and Freedom* (The University of Chicago Press 1982), p. 19 ff.; Friedman et al., *Free to Choose: A Personal Statement* (Harcourt Brace Jovanovich 1980), p. 11-27.

⁸² See Smith, *On the Wealth of Nations: Book I: Of The Causes of Improvement in the Productive Powers of Labour, and of the Order According to which Its Produce Is Naturally Distributed Among the Different Ranks of the People: Chapter I: On the Division of Labour* (Metalibri 2007).

⁸³ When discussing the purposes of financial instruments, it appears more common to speak of markets than classes of instruments. There is, however, little consistency in the systematisation of markets and several techniques of doing so; they may be divided into categories based on the nature of the securities traded, on the level at which trade occurs, on the term of the contracts and so on. If, instead, the instruments themselves are described, such inconveniences can be avoided, provided that the difference between primary and secondary markets are explored.

throughout the whole process, in fact never need for more than one market to be involved. What that entity does – to cover all functions – is to adopt different identities depending on the circumstances.⁸⁴ To understand how the division of markets is of any relevance to the analysis of HFT – which mainly takes place in secondary markets – an account of the functions of the different identities adopted by markets must be presented.

Identifying the characteristics separating primary markets from secondary fortunately is very easy. To begin with, the issuer of whatever instrument is traded will only see its funds increase during the initial issuance in the primary market. The transfer of an existing asset thus does neither result in any additional inflow of capital to the issuer, nor any outflow from the holder. That might make it appear as if the secondary markets are not relevant to the actual allocation of capital.⁸⁵ Coming to such a conclusion is, however, possible only if the correlation between primary and secondary markets is ignored.

When an investor or creditor considers contracting with an issuer it will pay regard both to the potential consequences of owning whatever security is offered and to what can be done if there was to be a change of plans. As regards the latter issue, the possibility to sell an instrument undeniably constitute a viable technique of mitigating risk. If an investor knows that there is an effective secondary market, it will not require as high of a risk premium as it otherwise would. For that reason, *secondary markets that function well help bring down the costs of capital.*⁸⁶ They do, though, also provide investors with a supplementary opportunity for speculation. To understand how that works, some comprehension of the functions of different instruments is required.

3.1.7.4 *Types of Instruments and Their Functions*

Classifying financial instruments, it is common to speak of debt securities, equity securities and derivatives. For the purpose of this thesis, it is not necessary to conduct any sort of deep dive into the features of each and every one. Instead, it is sufficient to note that all instruments have the purpose of *enabling a borrower or issuer to conduct business operations that would not have been possible without the additional funding provided and to allow a lender or equity holder to exchange a sum of capital at one point in time for a larger sum in the future.*⁸⁷ For it to be possible to determine exactly how HFT affects

⁸⁴ See Investopedia Staff, *A Look At Primary And Secondary Markets* (Investopedia 2016), <<http://www.investopedia.com/articles/02/101102.asp>>, accessed October 7, 2016.

⁸⁵ Ibid.

⁸⁶ Ibid.

⁸⁷ See Levinson (n. 1), p. 1-13.

the efficiency of the markets in upholding these functions, a fuller knowledge of how market performance is measured must be attained. It is thus essential to account for the metrics used when measuring market performance before the effects are described.

3.2 Market Quality Metrics

3.2.1 The Foundation of and Justification for Metrics

3.2.1.1 *How the Motives of Participants Unite Market Functionality with Allocation Efficiency*

The motives for participating in the activities carried out in the markets should, at this stage, be notorious. Those exchanging resources of any sort, in free markets, thereby attempt to satisfy their individual preferences. Equally obvious is the undisputable fact that markets are composed of their participants, whose actions fuel them. Combining those two realities – as was done in section 3.1.7.2 – it becomes clear that *functional markets enable participants to optimally suit their needs and to, indirectly, generate an ideal allocation of resources, mirroring the decisions made by all involved parties*. Thus, explaining how participants forward their interests in the markets will also give some understanding of what makes markets functional – or rather how the adequacy of markets is determined by the actions of participants and how the latter are affected by anomalies.

3.2.1.2 *How Participants, Hopefully, Pursue Their Ambitions*

When examining the processes defining any kind of market participation, it is crucial to proceed in chronological order, or else it will be hard to understand how different (sub) processes correlate. Repeating what was stated in sections 3.1.7.1 and 3.1.7.2, any sort of engagement begins with the formation of an *intention*, stemming from the preferences of an individual. When examining how best to pursue whatever urge exists, a participant will start by *collecting any accessible information* on the available alternatives. Using said information, it then conducts some sort of *analysis*, aimed at ascertaining the possible outcomes of the options – whether they be the issuance, sale or acquisition of securities. If the result of the analysis of some particular alternative is overwhelmingly

positive – as it will be if a positive Net Present Value (commonly referred to as “NPV”) is generated – the participant will, supposedly, decide to execute it.⁸⁸ Once a decision has been effectuated, the participant then *observes* how the value, or any other measurable feature of the instrument, changes over time, partly by making own assumptions of future movements, based on information collected; partly by studying the actual, real-time variations in price, as set by other transactions of similar instruments. Depending on the outcome of the continuous monitoring, the participant may then make other decisions, if possible,⁸⁹ which initiate the whole process anew. Trading and other sorts of market participation can, therefore, be viewed as a never-ending repetition of the same procedures, all steered by changing preferences and an inconstant reality.⁹⁰

3.2.1.3 *The Characteristics of Purposeful Markets*

Judging by the aforesaid, only markets that *enable participants to collect the information necessary for well thought out decisions and, later, to securely and inexpensively effectuate them should be considered effective*. In other words, markets must be transparent, or otherwise capable of transferring data to stakeholders, and organised so that the execution of orders is predictable and produces accurate data.⁹¹ If all requirements are met, markets will be capable of attracting serious participants, who have *confidence* in their serviceability and are willing to use them in the conduct of their business. This will, in turn, have positive effects on the bourses, or other entities, running the markets, as higher levels of confidence usually equate higher fees, extracted from clients. Every single market participant, who is not engaged in some sort of murky business, aimed at deceiving others, consequently benefits from more accessible and correct information and more reliable order execution systems.⁹²

⁸⁸ NPV is the of Present Value of benefits reduced by the Present Value of costs. See Berk, *Corporate Finance* (3 ed., Pearson 2014), p. 60 ff. and 206 ff.

⁸⁹ It is often harder for debtors to transfer their obligations than it is for creditors to transfer their rights. Cf. Mäntysaari, *The Law of Corporate Finance: General Principles and EU Law: Volume II: Contracts in General* (Springer Science & Business Media 2009), p. 299 ff.

⁹⁰ See Berk (n. 88).

⁹¹ As regards the production of data the ambition should be to make the efficient market hypothesis reality, cf. Berk, (n. 88), p. 294-300.

⁹² This is developed further in the analysis, se section 4.

3.2.2 Types of Metrics

3.2.2.1 *The Fundamental Characteristics of Markets Directly Affected by Their Operators*

Measuring the ability of markets to satisfy the needs of participants – being tantamount to transfers made according to their believed interests – demands several metrics, as there are several aspects of the trading process to review. As hinted in the previous section, it is, for one thing, necessary to assess *the ease of collecting and interpreting information*, and, for another, to determine *how much effort must go into the execution of a decision*. Combining those two, a third value, constituting more of a measure of success, telling *how willing investors are to participate* in the activities in the markets, can be approximated.

Starting with the subject of information, the decisive factors are *the cost of acquisition, the accuracy and the complexity*. While the cost and accuracy can be determined rather easily, through a calculation, it is far more difficult to appreciate the level of complexity. However, thereby not said that the complexity would be impossible to measure. If some information is hard to interpret, it will leave traces of additional spending – of time and money – and perhaps generate incorrect decisions. Furthermore, it should often be possible to find some sort of consensus on when the available data is too complex.

Moving on to the efficiency of execution, the foremost elements to consider are, as with information, *costs, accuracy and complexity*, which are all interrelated. The costs arising when a transaction is executed can be of many natures – including fees for trading and expenses associated with running certain machines – but typically stem from unforeseen alterations in price or changes in actual value. As such, they are partially dependent on the accuracy of execution, which is, at its centre, a reflection of predictability. Markets employing accurate methods for execution allow participants to predict the ultimate outcome of their orders, provided that neither the systems nor the rules controlling them are too complicated.

Depending on how efficient the markets are in providing information and executing orders, potential and existing participants will form diverging opinions of them. In the best of worlds – where common people and potential participants are not fed with misleading propaganda – the opinions formed by the latter will reflect their confidence in the abilities of markets to help them forward their interest and control their choices of venue. In other words, efficient markets gain popularity due to participants being confident in their functionality – either by virtue of a favourable depiction in the media, an actual ability to help participants reach the highest possible levels of preferential satisfaction or a combination thereof – and help optimise the allocation of capital,

not only by distributing resources more efficiently than their competitors, but also by impelling potential participants to at all use the markets in their quest for contentment.⁹³

3.2.2.2 *The Specific Characteristics of Markets Relying Mainly on the Actions of Participants*

Apart from the metrics responding directly to actions of market operators, which are often overlooked, there are other ones, more widely used in the research on the effects of HFT. In contrast to the aforementioned ones, they can only be indirectly affected by market operators and are, to great extent, products of the level of confidence. As such, they measure the supply of quotes, in terms of ease of execution, and the stability of markets, as an average of alterations in price.

With regard to supply, the most common unit of measurement is *liquidity*. The market for a particular asset is said to be liquid if orders of some size can be executed quickly, without causing any larger changes in price. Although liquidity is primarily aimed at assessing secondary markets, measuring the liquidity of primary ones is also possible, yet harder due to the different means of contracting. Regardless of where it is measured, the metric can be split into numerous subcategories.⁹⁴

The ability of markets “to match supply and demand efficiently [...] [which] can be measured by the bid-ask spread”, is usually referred to as *tightness*. The tighter the market, the lower the transactions costs, as there is less of a spread to cross when executing an order. *Market depth* – the sizes of orders – and *breadth* – the number of orders/potential counterparties – measure “the ability of a market to absorb large trade volumes without a significant impact on prices and can be approximated by the amounts traded over a period of time (turnover) and quote sizes”.⁹⁵ In other words, deep and broad markets feature many sizeable quotes, facilitating the rapid execution of large orders. Depending on exactly how tight and deep the markets are, their *immediacy* – the time it takes for orders to be executed – and *resilience* – “the speed with which price fluctuations arising

⁹³ As described in section 3.1.7, the exchange of resources on markets make both parties better off than before, wherefore transfer of assets has a value in itself.

⁹⁴ See International Monetary Fund, *Financial Soundness Indicators: Compilation Guide* (International Monetary Fund 2006), p. 14 f, <<https://www.imf.org/external/pubs/ft/fsi/guide/2006/pdf/fsiFT.pdf>>, accessed December 12, 2016; International Monetary Fund, *IMF Working Paper: Measuring Liquidity in Financial Markets* (International Monetary Fund 2002), p. 4 ff., <<https://www.imf.org/external/pubs/ft/wp/2002/wp02232.pdf>>, accessed December 12, 2016.

⁹⁵ See International Monetary Fund, *Financial Soundness Indicators: Compilation Guide* (n. 94), p. 15.

from imbalances in trades are dissipated” – will vary.⁹⁶ Liquidity is, consequently, related to the metric measuring market stability – being volatility.

Volatility is, in its purest form, a calculation of price fluctuations over time. Instruments, the values of which vary greatly when they are traded in secondary markets, are said to be highly volatile, whereas more stable ones are considered less volatile. As changes in value, reflecting alterations in factors considered by sound participants in their rational analyses, are somewhat predictable, volatility must not always be conjoined with risk – defined as uncertainty. Nevertheless, it is, in the majority of cases, correct to link volatility to risk. Changes in value do not emerge without cause and most often cannot be foreseen; had it been different, future declines and surges would have already been considered when the price was first set. In other words, the reality surrounding traders and their assets is too complex to be mapped by human beings, having limited processing powers and a deficient knowledge. A lower volatility is, therefore, preferable to a higher – all else equal.⁹⁷

3.2.2.3 *How It All Connects*

Reading between the lines and recalling what was stated in section 3.2.1.3, it is easy to notice how confidence – as a measure of the availability of information and the efficiency of execution – correlates to liquidity and volatility, which are, in turn, interdependent. Generally, the interest to engage in market activities will rise if confidence increases. Confidence, in turn, depends on how well markets function. If liquidity is high, the efficiency of markets, measured as predictability, will be higher than if it not, resulting in lower volatility and more rapid price discovery – due to the greater number of participants limiting the influence of human error by increasing the number of trades and extinguishing arbitrage opportunities. Thus, *liquid markets, with a low volatility, will generate confidence, further increasing the liquidity, and lowering the volatility, in a seemingly endless process of optimisation.*⁹⁸

⁹⁶ Ibid.

⁹⁷ See Berk (n. 88), p. 316-319 and 323-328.

⁹⁸ Cf. Levine, *Stock Markets: A Spur to Economic Growth* (Finance & Development 1996), <ftp://208.157.148.123/PDC/ECGL%20files/Archived%20Years/2013-2014%20ECGL%20files/02--Capital%20Markets/2.%20Stock%20Markets%20A%20Spur%20to%20Economic%20Growth%20Ross%20Levine.pdf>, accessed September 10, 2016.

Since it is hard to break such a self-strengthening, or weakening, pattern, the entities running the markets might appear to have little influence over the actual success of the markets. In accordance with what was said about the cost of information and the accuracy of execution in section 3.2.2.1, such an interpretation would, however, be flawed. This is because *predictability is far more dependent on system infrastructure, the nature of the applicable rules and the functionality of the legal system than it is on liquidity and volatility*. The one single factor having the greatest effect on the efficiency of markets and their ability to generate economic growth by optimising capital allocation is, most likely, the principles controlling the order execution systems, in part derived from law.⁹⁹

Last but not least, the major power of those spewing their sentiments on the often uninformed public, mentioned above, must not be forgotten. Very few participants possess an understanding comprehensive enough to make them fully unsusceptible to the attitudes of others. The high or low *confidence of one participant can, on that account, spread to others*, even if no other metrics are affected by whatever circumstance is debated. When the effects of HFT are studied in the upcoming section, constantly bearing the elevated importance of public confidence in mind is thus essential.¹⁰⁰

3.3 The Effects of High Frequency Trading

3.3.1 Completing the Picture

To follow up on section 2.2, a deeper inquiry into the tactics characteristic for HFT has to be conducted before the effects are examined. As was then mentioned, HFT is more of a method to implement different tactics than a strategy in itself. The examination of it thus needs to differentiate between the dissimilar strategies, having diverging effects, which are in fact employed by traders.

When deciding how to proceed with the categorisation of strategies, only limited support can be found in literature, as there are very few established patterns to follow. This ought not to cause any astonishment; research on HFT has only been performed for about a decade and there is still much left to learn. Nevertheless, it is important to bring the slight uncertainty, caused by

⁹⁹ Ibid.

¹⁰⁰ Cf. Engelberg et al., *The Causal Impact of Media in Financial Markets* (2009), p. 28-31, <http://www.econ.yale.edu/~shiller/behfin/2009_11/engelberg-parsons.pdf>, accessed November 22, 2016.

the lack of precedent and consensus, into attention, since it forces anyone trying to settle on a system for classification to proceed with caution.

To uphold a high degree of precision, the analysis of effects conducted in this section rests mainly on one broad distinction between *manipulative and non-manipulative strategies*. Within the latter category, further difference is made between passive and aggressive tactics – the implications of which will be made clear later on. This acknowledgement of pluralism not only renders the whole inquiry more intelligible. It also forwards accuracy, as the existing disparities are not ignored. Regardless, more in way of critical preparatory work is necessary for there to be proper accuracy and independence. Researching HFT is, for several reasons, a substantial challenge. If the factors making it so are not presented before the material part of the inquiry is instigated, the reader might value the reports accounted for higher than there are grounds for, wherefore it is crucial to proceed with an examination of difficulties associated with studying the effects of HFT before anything else.

3.3.2 Difficulties Associated with Conducting Research on the Effects of HFT

Whenever a new phenomenon comes into being – in any field of science – examining it is deemed to be tough. There mostly will not exist any fully applicable standards of assessment and even when there are, applying them in a new setting will, nearly without exception, be burdensome. Unfortunately, HFT does indeed follow the suggested pattern with unprecedented loyalty. To fully understand it, mastering advanced programming, computer science, econometrics, finance, economics and behavioural science, is necessary. Since there are very few people possessing such a unique set of competencies – of which even fewer have proven willing to risk their source of income and purpose – many of the reports existing should be considered unreliable.¹⁰¹ There are however some far more pressing issues than so.

¹⁰¹ As the codes created belong to the employer in the majority of scenarios, even trying to describe the functions of trading systems could risk leading to unwanted sanctions. Cf. Hope, *High-Frequency Trading's Fight Over Secret Code* (The Wall Street Journal 2014), <<http://www.wsj.com/articles/SB10001424052702303563304579445381552266144>>, accessed October 10, 2016.

The perhaps most evident one is the *pace of change*. According to Moore's law and a few other theorems, the processing power of computers constantly grows at an increasing speed.¹⁰² This makes the machines used only some limited time ago very different from those used today – affecting both the speeds of execution and the choices of strategy. Thus, when studying the effects of HFT it is important to be wary of the potential obsolescence of the data used.

Another problem needing illumination is the *inaccuracy of the datasets* used in some analyses. In a great number of reports, the alleged findings rest on dubious assumptions rather than facts. This is due to the impossibility of securely identifying HFTs from publicly available data, in which the identity of individual participants is unknown. To be able to reach any sort of conclusion, some researchers have made use of proxies, supposedly separating most traders from those engaging in HFT. Although such approaches are likely to at least be indicative, they are far from unerring as they tend to mix other types of traders – who use fast systems/smart routers only for order execution – with HFTs. Furthermore, the features of some strategies, in themselves, make it hard to draw any conclusions, as they rely on an emittance of false signals.¹⁰³ Trying to interpret the results of the research in a regular manner therefore is not suitable. Instead, trustworthy papers will have to be sought in (other) literature reviews.

To conclude, there are a number of elements affecting the precision of existing reports. Drawing any sort of definitive conclusions, accordingly, cannot be recommended. Nonetheless, it is imperative to concisely study and account for the existing reports. Most presumed readers of a thesis on law do not possess the knowledge required of a person seeking to achieve a complete understanding of the matter at hand, but should be able to critically value the findings and conclusions brought into attention. For that reason, the following study – starting with non-manipulative strategies – can, or rather has to, be held rather short.

¹⁰² See Shankland, *Moore's Law: The rule that really matters in tech* (CNET 2012), <<https://www.cnet.com/news/moores-law-the-rule-that-really-matters-in-tech/>>, accessed November 5, 2016; Moore, *Cramming more components onto integrated circuits* (Electronics, Volume 38, Number 8, 1965), <http://web.eng.fiu.edu/npala/eee6397ex/gordon_moore_1965_article.pdf>, accessed December 10, 2016.

¹⁰³ See U.S. Securities Exchange Commission, Staff of the Division of Trading and Markets, *Equity Market Structure Literature Review Part II: High Frequency Trading* (2014), p. 4 ff., <https://www.sec.gov/marketstructure/research/hft_lit_review_march_2014.pdf>, accessed September 10, 2016.

3.3.3 Effects of Non-Manipulative Strategies

3.3.3.1 Passive Strategies

3.3.3.1.1 Market Making

What unites all passive strategies is the supply of bid and ask quotes for others to trade against – a definition plainly bearing some likeness to that of market making.¹⁰⁴ Market makers provide liquidity by “holding a certain number of shares of a particular security in order to facilitate the trading of [it]”.¹⁰⁵ In doing so, they *earn profits when other traders cross the bid-ask spread* – either buying at the ask price or selling at the bid price.¹⁰⁶ As the spread is, at most times, rather small, reaching high volumes is a must for there to be long-term profits. In fact, exchanges may give even further incentives for a maximisation of volume, by paying market makers some smaller amount of money for each trade executed or giving them rebates, and so on.¹⁰⁷

Even though many passive HFTs earn their profits in a manner consistent with that of market makers, they often do not formally fulfil the same function. This, most notably, makes them less exposed to risk, as they are allowed to withdraw their quotes in times of uncertainty, and, consequently, might lower the quality of the liquidity provided by them.¹⁰⁸ Despite all that, most research performed indicates that HFTs, engaging in passive strategies equivalent to market making, *increase liquidity, decrease volatility and significantly reduce transaction costs*. There are however some variations worthy of an illumination.

¹⁰⁴ Cf. Miller et al., Congressional Research Service (n. 20), p. 3-5.

¹⁰⁵ See Investopedia, *Market Maker*, <<http://www.investopedia.com/terms/m/marketmaker.asp>>, accessed September 29, 2016. Cf. art. 17.4 MiFID II.

¹⁰⁶ See Gomber et al., *High-Frequency Trading* (Goethe Universität Frankfurt am Main 2011), p. 16-18 <https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1858626_code381855.pdf?abstractid=1858626&mirid=1>, accessed November 2, 2016.

¹⁰⁷ See Dolgoplov, *Linking the Securities Market Structure and Capital Formation: Incentives for Market Makers* (2013), p. 32 ff., <<http://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1459&context=jbl>>, accessed December 10, 2016.

¹⁰⁸ See Dolgoplov, *Regulating Merchants of Liquidity: Market Making from Crowded Floors to High-Frequency Trading* (University of Pennsylvania Journal of Business Law 2016), p. 659, <<http://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1514&context=jbl>>, accessed December 11, 2016.

Firstly, as regards liquidity, the results are not uniform.¹⁰⁹ For it to be deeper, tighter and more immediate, High Frequency Market Makers (hereinafter referred to as “HFMs”) – regardless of their formal designation – *need to be both fast and informed*. What calls for this particular combination of characteristics is the simple notion that system performance affects the tactics used in trading. If a machine either is not capable of updating its quotes fast enough to avoid becoming a victim of predatory techniques used by others, resulting in costly adverse selection, or to foresee future changes in quote levels, it will be programmed to act more cautiously, generating smaller quotes and increasing the spreads between them.¹¹⁰

Considering the great difference in speed and processing power – separating regular, manual and slow, market makers, from HFTs applying the same technique – the width of the problem should become abundantly clear. Some participants will always be slower and less informed than their peers, prompting them to apply more conservative strategies. The greater the proportion of quotes supplied by those, slower and uninformed traders, the lower the liquidity will become after the entrance of faster ones, as the slower must compensate for their disadvantage, in order not to lose all profits by adverse selection, and vice versa.¹¹¹ After some time, the issue should, however, solve itself per automatic, as fast HFMs ought to manage to outcompete their less capable competitors.

Secondly, when it comes to volatility, the results are correspondingly multifarious. HFMs can both increase and lower volatility, depending on the circumstances. The positive effects are attained when informed HFMs manage to *establish the impact of events faster than slower traders, without having any orders executed*, resulting in a more predictable and cost-efficient price discovery. This is achieved primarily by the rapid supply and cancellation of quotes – a process known as *quote flickering* – which, due to no orders being executed, requires no actual transfer of capital and thus results in fewer cases of adverse selection.¹¹²

¹⁰⁹ This is not only due to the slight divergences figuring in reports – it also depends on there being issues with the methods for approximation of liquidity. See European Securities and Markets Authority, *Order duplication and liquidity measurement in EU equity markets: ESMA Economic Report No. 1, 2016* (2016), p. 23 and 24, <https://www.esma.europa.eu/sites/default/files/library/2016-907_economic_report_on_duplicated_orders.pdf>, accessed December 12, 2016.

¹¹⁰ Cf. Menkveld, (n. 29), p. 6-7.

¹¹¹ Ibid., p. 7-13.

¹¹² Ibid., p. 19-20.

As all events are not analysed correctly by machines, there are also instances of ineffective price discovery, resulting in an increased volatility. HFMs can, for instance, *value some particular information – such as changes in quotes supplied by others – incorrectly* and wrongly adjust their own quotes. In extreme situations, this might lead to so-called flash crashes. Seeing that those are not specific to market making, and rather unusual, they will be discussed in further detail in section 3.3.6.2, on particular events for which HFT has at least partially been to blame.

Lastly, bearing what has been said about decreasing spreads, more efficient price discovery and higher degrees of automation in mind, realising that the introduction of passive HFT has *reduced transaction costs*, mainly owing to liquidity being tighter, should not be hard. Computer machines of the types used by HFTs are indeed costly to acquire and maintain; putting them to use does, however, not cause any noteworthy additional expenses, wherefore only a limited gain per trade – a small bid-ask spread – is required for contribution margins to be positive. When comparing this to manual market making – conducted by human beings often demanding astronomic salaries – the cause for the steep declines in price should be easily identifiable. The cost reduction is, however, neither definitive nor statistically reliable.¹¹³ To some, costs have risen, rather than dropped, owing to the superior ability, of HFMs, to predict future developments and alter quotes, which is discussed further in section 3.3.5, on generic effects.¹¹⁴

3.3.3.1.2 Arbitrage

Resembling more of a subcategory to market making than an independent strategy, passive arbitrage involves the supply of quotes either in identical instruments in different markets or in different instruments, bearing some likeness, in separate markets. In that capacity, it is meant to take advantage of inefficiencies in price, emerging either when the level of bid or ask quotes of an instrument, such as a fund, do not accurately reflect the value of its individual elements, or when the price of a particular instrument is not synchronised in all markets.¹¹⁵ Arbitrage trading thus *makes the law of one price and the efficient market hypothesis reality* by eradicating any alterations in quote

¹¹³ See *ibid.*, p. 22; Brogaard et al., *High Frequency Trading and Price Discovery* (2013), p. 32 ff., <<http://ssrn.com/abstract=1928510>>, accessed October 20, 2016.

¹¹⁴ Cf. Kwan et al., *High-frequency trading and execution costs* (2015), p. 22-24, <<http://www.cifr.edu.au/assets/document/HFTExecutionCosts%20Kwan%20WP.pdf>>, accessed October 20, 2016.

¹¹⁵ Cf. Miller et al., Congressional Research Service (n. 20), p. 4.

levels not justified by external factors. Through it, transaction costs are lowered for those trading instruments that are listed on several exchanges or available in many forms, who no longer need to examine every market in search of the best prices.¹¹⁶ Furthermore, by limiting the implications of choosing some particular exchange, HFTs engaging in arbitrage trading also tend to *foster competition* between marketplaces. As is envisaged by nearly every economic theory, this forces markets, which are in need of volume, to evolve in directions beneficial to any potential participants, who can provide it.¹¹⁷ Since the factors deemed most important to traders are the availability of information, and the costs and predictability of execution, markets will have to compete by making their executions processes more informative, less expensive and more predictable – chiefly by lowering fees and stabilising order matching. Irrespective of how great the selling points of high frequency arbitrage trading might appear, it does, however, like market making, not come without unwanted side effects.¹¹⁸

Research has proven both passive and aggressive arbitrage trading to be capable of raising costs for traders trying to execute large orders in lit venues. The reason for this is the rather understandable need of such traders to split sizeable orders into smaller ones – portioned out in sequence or sent to different venues – so that the exceptionally large supply or demand is not flashed and made to unnecessarily affect prices *ex-ante*. Although the technique might make it harder for the average trader, at either side of the spread, to discover the change in liquidity, passive and aggressive HFTs alike are often programmed to notice such attempts of secrecy and to *outrun the larger traders to other markets, only to impose adverse selection costs on them* by raising or lowering quote levels.¹¹⁹ As transaction costs for large investors are thereby increased, arbitrage trading does not only improve efficiency.¹²⁰

Rather important to notice are also the increased *systemic risks* resulting from the high degree of market interconnectivity that comes with arbitrage trading. As the exchanges and the instruments traded in them become more interdependent, the threat of disastrous chain reactions – following such misinterpretations of data as was hinted in the previous section – increases.¹²¹ To protect

¹¹⁶ Cf. Berk (n. 88), p. 71.

¹¹⁷ Cf. Gomber (n. 106), p. 9-12; Menkveld (n. 29), p. 17-19.

¹¹⁸ Cf. sections 3.1.7 and 3.2.

¹¹⁹ See Menkveld (n. 29), p. 13-14.

¹²⁰ It would, as a response, be possible to argue that price discovery is improved, since changes in supply and demand cannot be disguised.

¹²¹ Cf. Jain et al., *Does high-frequency trading increase systemic risk?* (2016), p. 27, <https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2816202_code1522600.pdf?abstractid=2816202&mirid=1>, accessed December 11, 2016.

themselves from such events, traders invest in their systems and adjust their strategies. While the effects of the changes to the software are wholly dependent on the content of the code, and thus cannot once and for all be deemed either good or bad, most researchers seem to agree that the investments in hardware are wasteful. Due to the issue being one shared with aggressive strategies, it is discussed further in section 3.3.5. Indicating that it is problematic is, however – for the sake of fairness – necessary already at this stage.

3.3.3.2 *Aggressive Strategies*

Midst the coding practices having a predominantly negative effect on the functionality of the financial markets, aggressive, non-manipulative, strategies can be found. Akin to passive strategies, the aggressive ones are rather heterogeneous. This comes as the only factor uniting them is the endeavour to “[take] out stale quotes” of slower traders when prices change.¹²² Expressed differently, HFTs using them do not, like passive traders, place quotes for others to take. Instead, they try to impose adverse selection costs on others, by using their superior speed and data processing power to quickly take advantage of temporary pricing inefficiencies.¹²³

When translated into strategy, the aggressiveness corresponds to so-called run games and order anticipation, partaken also by HFMs. *Run games* take place after some event impacting prices is disclosed. At that moment, aggressive HFTs try to take out quotes placed by slower traders before they are adjusted or withdrawn, in response to the news. Through said technique, participating HFTs are said to lower confidence and prompt the potential victims to act more conservatively, which could decrease the depth and tightness of liquidity. The possible effects are, however, not only negative. Due to price discovery being sped up, market inefficiencies will not exist for as long as they otherwise would, which could indeed increase confidence.¹²⁴

A directional¹²⁵ technique closely related to run games is the, in part already described, preying on large orders, referred to as *order anticipation*.¹²⁶ Like passive HFTs using arbitrage trading methods, aggressive ones react to order flow statistics indicating an increase or decrease in demand

¹²² See U.S. Securities and Exchange Commission, Staff of the Division of Trading and Markets (n. 13), p. 7.

¹²³ *Ibid.*

¹²⁴ See Menkveld (n. 29), p. 14-17.

¹²⁵ See U.S. Securities and Exchange Commission, Staff of the Division of Trading and Markets (n. 13), p. 8.

¹²⁶ The process is described at length in Lewis (n. 18).

and try to take advantage of temporary pricing inefficiencies. As opposed to the passive custom of simply updating quotes, aggressive traders do, however, try to trade in the direction of large orders, affecting prices, immediately after noticing a demand – sometimes wrongfully referred to as “front running”¹²⁷ – to later change their direction of trading to that opposite of the initial – either selling at prices higher than those first paid for the instrument or buying at prices lower than those then sold for – making a profit by reducing liquidity. The initial trading may be conducted either in the same exchange, in anticipation of upcoming orders, or in other markets, with the same purpose, albeit within an often tighter timeframe.¹²⁸

Regardless of there being several methods to counter the efforts of passive and aggressive HFTs to foresee large orders,¹²⁹ the net transaction costs for large investors appear to have increased. Those entities are forced to deal with seemingly maniacal changes of quotes and attempts of others to outrun their thought processes – in sum making execution of large orders more complex and less predictable. To try avoiding such nuisances, many of them have fled to murkier waters, delineated more closely in section 3.3.5.3, on generic effects. Aggressive strategies thus, to large extent, share negative effects with passive ones, yet add some additional ones and increase the magnitude of the disadvantages. In fact, a substantial portion of the total effects has little to do with the character of the strategies, as will be explained in section 3.3.6. Before then, the manipulative strategies do, however, need to be accounted for, in order to enable a full and precise comprehension of the plethora of techniques used by HFTs.

¹²⁷ To try identifying a demand, HFTs send several small orders to the exchanges, implementing a process known as *pinging*. See European Central Bank, *Macroprudential Bulletin: Issue 2/2016* (2016), p. 26, <<https://www.ecb.europa.eu/pub/pdf/other/ecbmpbu201610.en.pdf?4ff75059d461c8853fe7e7b1082f697c>>, accessed November 10, 2016.

¹²⁸ This becomes far easier in a fragmented marketplace, where arbitrage opportunities exist. A high frequency trader can then place bates on one exchange to later outrun the larger traders to others. As is described in section 3.4.2.2, the US Regulation NMS makes this technique far more profitable. Cf. Menkveld (n. 29), p. 13-14; U.S. Securities and Exchange Commission, Staff of the Division of Trading and Markets (n. 13), p. 5-6.

¹²⁹ Cf. WSJ Staff, *Thor Enters the High-Frequency Trading Arms Race* (The Wall Street Journal 2011), <<http://blogs.wsj.com/marketbeat/2011/01/14/thor-enters-the-high-frequency-trading-arms-race/>>, accessed December 11, 2016.

3.3.4 Effects of Manipulative Strategies

3.3.4.1 *The Core of Deceit*

Similar to the non-manipulative strategies, the deceitful ones all have some distinguishing features in common. As their designation implies, they rely on *misleading other market participants*. Recalling what was said about fundamental strategy and the motives for engaging in market activities, it should be clear that the deceitful behaviours cause harm by rendering information misrepresentative and analyses erroneous. Furthermore, in view of speed, processing power and automation being the three most distinct features of HFT, the means of deceit should be rather clear. Traders either take advantage of their superior speed, computational capacity or lower costs of interaction to create false signals for others to act on. The most frequent strategies matching the description are momentum ignition, spoofing, layering and quote stuffing, all of which are worthy of a deeper exploration, focusing on their purposes.¹³⁰

3.3.4.2 *Strategies Steering the Direction of Prices*

A trait shared by most manipulative strategies is an ambition to steer the prices of instruments in some particular direction. To achieve this result, HFTs initiate a procedure known as *momentum ignition*, consisting of two steps.¹³¹ They first *spoof* the other market participants using a method known as *layering*. It involves placing buy or sell orders not meant to be executed or of a relatively small size, at levels either exceeding the best bid quote – to cause a rise in prices – or falling below the best ask quote – to cause a fall in prices – in an endeavour to deceive others into following their lead. Once a change in course has been accomplished, the orders sent by the HFT who initiated the process are cancelled, to immediately be replaced by their contraries – sell orders if the first were buy orders and vice versa.¹³²

In its entirety, momentum ignition has a number of severely destructive effects. It increases transaction costs and volatility for whoever decides to act according to the false signals created

¹³⁰ Cf. U.S. Securities and Exchange Commission, Staff of the Division of Trading and Markets (n. 13), p. 5 ff.

¹³¹ It should, for the sake of fairness, be noted that strategies intended to create rises or falls in prices have existed since long before HFT was first introduced. See *ibid.*

¹³² See European Securities and Markets Authority, *Final Report ESMA's technical advice on possible delegated acts concerning the Market Abuse Regulation* (2015), p. 20-21, <<https://www.esma.europa.eu/sites/default/files/library/2015/11/2015-224.pdf>>, accessed December 11, 2016.

and, obviously, decreases the informative value of prices, in the short term. Over a longer time period, the reduced value of information and increased transaction costs lead to an ineffective allocation of capital, caused partly by the incorrect pricing, partly by the reduced confidence amongst participants less willing to trade, ultimately leading to a lower liquidity.¹³³

3.3.4.3 *Techniques Confusing Others and Slowing Them Down*

As a complement to momentum ignition and the like – for situations when it is more important to inhibit others from acting at all than it is to make them act in a specific manner – some HFTs focus on sending extreme amounts of information to exchanges, in an effort to slow others down and to make them disoriented.¹³⁴ Regardless of it mainly affecting other HFTs, the technique – known as *quote stuffing* – has several unwanted consequences in the short term.

By flooding the markets with orders not meant to go through, the acting party makes it harder for others to correctly value the instruments affected. This compels them to act more cautiously, typically resulting in wider spreads and smaller depths. It can also increase their transaction costs, by forcing them to trade at incorrect prices and by raising their costs of collecting information. Lastly, in conformity with momentum ignition, it lowers confidence and liquidity in the long term, ultimately leading to a dysfunctional allocation of capital.¹³⁵

3.3.5 **Generic Effects of HFT**

3.3.5.1 *Investments in Technology*

Having accounted for the repercussions of specific strategies, what remains is to describe the generic effects of HFT and the effects of different kinds of HFTs competing – some of which have already been mentioned. Of those dependent on competition between passive, aggressive

¹³³ Cf. U.S. Securities and Exchange Commission, Staff of the Division of Trading and Markets (n. 13), p. 6 ff.

¹³⁴ See Egginton et al., *Quote Stuffing*, p. 3 ff., <<https://www.business.msstate.edu/magnolia/pdf/quote-stuffing.pdf>>, accessed December 11, 2016; Lauricella et al., *SEC Probes Canceled Trades* (The Wall Street Journal 2010), <<http://www.wsj.com/articles/SB10001424052748703882304575465990082237642>>, accessed December 11, 2016.

¹³⁵ See Egginton (n. 134), p. 13 ff.

and manipulative traders, the *investments in technology* are probably most obvious to the wider public. The rivalry between HFMs and their more aggressive cousins has had a tendency to induce all participants, and the exchanges, to invest heavily in technology. This arms race of sorts has, above all, led to costly acquisitions of connectivity hardware. Some firms have devoted millions of dollars to buying towers used for transmitting microwave signals, with the sole purpose of reducing latency by microseconds.¹³⁶ In the eyes of many critics, this constant quest for technological advancement is wasteful, as the money invested in it could, in their opinion, be used elsewhere.¹³⁷ In reality, such propositions should be considered less relevant as *both jurisdictions studied are liberal capitalist democracies*, which are forced to accept the fundamental premises of liberalism – in particular the complete lack of interest in the result of the distribution of assets – if they do not seek to create a system full of regulatory conflicts, caused by logical inconsistencies, debated further in section 4 and 5.

Since any form of intervention motivated by a disapproving of the final result – constituting investments in technology – would counter the very central liberal principle of non-intervention, it may be concluded that the spending of companies and individuals is not a question of public policy, but one of corporate governance. If companies choose to invest in technology – whereby they both benefit their businesses and support the technological development at large – their decisions should not be questioned by anyone else than their shareholders.¹³⁸ Additionally, it could be doubted whether the adversaries of HFT have really considered all positive effects of the technological progress. It is a well-known fact that the increased speeds, following from upgrades, benefit all but the ill minded traders, since the risk for events unaccounted for decreases when the time of execution is reduced. As is said elsewhere, there is, however, some limit, beyond which the risk for such unintended events should become so small that the costs of extra investments exceed the gains. If the spending were to prove both excessive and systemic in kind; and capable of damaging the allocation of resources, regulation altering the incentives of traders should be considered.¹³⁹ By reason of the exchanges being run for profit in a competitive market,

¹³⁶ See Sprothen, *Trading Tech Accelerates Toward Speed of Light* (The Wall Street Journal 2016), <<http://www.wsj.com/articles/trading-tech-accelerates-toward-speed-of-light-1470559173>>, accessed December 11, 2016.

¹³⁷ Cf. Budish et al., *The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response* (2013), p. 1-8, <http://econ.as.nyu.edu/docs/IO/30782/Budish_10292013.pdf>, accessed December 11, 2016.

¹³⁸ Cf. Friedman (n. 81), p. 112 ff.; Thomsen et al., *Corporate Governance: Mechanisms and Systems* (McGraw-Hill Education 2012), p.4 ff.

¹³⁹ Cf. sections 3.1.7 and 4.3.

the risk of such a development should be small, provided that the market participants possess some ability to correctly value their options.

3.3.5.2 *A More Even Distribution of Adverse Selection Costs*

Dependent on competition are also the aforementioned run games and other activities causing down- or upward moving spiral shaped transaction patterns, attended by all types of HFTs. In the process of determining the price impact of some event, HFTs will not always manage to find equilibrium simply by updating/flickering their quotes. Instead, they often trade instruments between themselves until the top or bottom has been reached. Owing to there being a large number of partakers, the process has proven to *reduce the adverse selection costs* otherwise borne by single traders, by sequentially distributing them amongst more entities.¹⁴⁰ This not only reduces short time volatility, by smoothening the path to a new price level, but also protects single entities from costs that would risk eradicating their whole profits, whereby competition and long-term liquidity is promoted.¹⁴¹ As the route to a new price level is not always straight, the intermediation chains can also lead to disturbances of the kind described in section 3.3.6.2 on specific, harmful, events.

3.3.5.3 *Rerouting of Orders to Dark Pools*

To protect themselves, chiefly from order anticipation and fast market makers, many large institutional investors have sought refuge in alternative trading venues, better suited to their needs. What nearly all those have in common is a limited pre-trade disclosure, meant to make it harder for predatory traders to anticipate a demand for liquidity and some sort of pricing mechanism deriving the values of instruments from other markets. Since this allows larger traders to avoid having their orders lit up and made public, the venues have been rewarded with the less flattering designation of “dark pools”. The trading conducted in them is not subject to the rules that apply to regulated markets, which makes it possible to extend the investor protection very far or to decrease it substantially.¹⁴²

¹⁴⁰ See Menkveld (n. 29), p. 14-17.

¹⁴¹ Ibid.

¹⁴² See Picardo, *An Introduction To Dark Pools* (Investopedia 2014), <<http://www.investopedia.com/articles/markets/050614/introduction-dark-pools.asp>>, accessed December 11, 2016; Shorter et al., *Dark Pools in Equity Trading*:

The exact outcome of the migration to unlit markets is reliant both on their serviceability and the repercussions caused on the ordinary, lit, equivalents. According to research, dark pools have an impact both on liquidity and volatility. *When large orders are moved, the depth of the markets is altered.* As very few participants would be ignorant enough to execute entire orders, of sizes markedly impacting the prices of the instruments traded, at once, in lit venues, the difference should, however, not be that remarkable. More prominent is perhaps the reduced volatility.¹⁴³

Following the rerouting of orders, there should be fewer opportunities for predatory order anticipation, lowering the overall costs for slow traders. In addition, the *higher share of informed participants in ordinary markets, resulting from the flight of uninformed ones, should positively impact price discovery, while reducing adverse selection costs.* All in all, a moderate use of dark pools would therefore appear to have a very positive impact on volatility, while not majorly influencing liquidity.¹⁴⁴ There are, however, some indications to the contrary.

One fairly clear example of this is the charges brought against Barclays and Credit Suisse by the SEC. Both had failed to operate their dark pools as advertised, by allowing HFTs to prey on orders in the otherwise unlit environment.¹⁴⁵ Moreover, allegedly harmful behaviour has been found to exist in other dark markets, where HFTs have taken advantage of lower executions speeds to prey on slower traders. Despite all that, and other downsides,¹⁴⁶ the *advantages of dark pools have been found, possibly, to outweigh the disadvantages,* which gives some indication of the gravity of aggressive and manipulative trading.¹⁴⁷

Policy Concerns and Recent Developments (Congressional Research Service 2014), <<https://fas.org/sgp/crs/misc/R43739.pdf>>, accessed December 11, 2016.

¹⁴³ Cf. Degryse et al., *The impact of dark trading and visible fragmentation on market quality* (2011), p. 28., <<http://www.tinbergen.nl/~sofie2012/papers/DegryseJongKervel2011.pdf>>, accessed October 6, 2016.

¹⁴⁴ European Central Bank (n. 127).

¹⁴⁵ See U.S. Securities and Exchange Commission, *Press Release: Barclays, Credit Suisse Charged With Dark Pool Violations* (2016), <<https://www.sec.gov/news/pressrelease/2016-16.html>>, accessed November 16, 2016.

¹⁴⁶ Efficient price discovery could, for example, be impeded by the delayed publication of transactions, as an instrument is at risk of being traded at prices not reflecting the actual ratio of supply and demand.

¹⁴⁷ See Detrixhe, *Speed Traders Exploit U.K. Dark Pools, But Not Enough to Matter* (Bloomberg Markets 2016), <<https://www.bloomberg.com/news/articles/2016-09-15/speed-traders-exploit-u-k-dark-pools-but-not-enough-to-matter>>, accessed December 11, 2016.

3.3.5.4 *An Increased Market Fragmentation*

As signalled repeatedly above – most notably in section 3.3.3.1.2, when passive arbitrage trading was discussed – the lower search and execution costs of HFTs enables them to trade in more markets than manual traders, even when they do not consciously attempt to take advantage of temporary inefficiencies. When that happens, liquidity becomes more fragmented and other incentives for choosing a specific market than its liquidity gain importance, forcing the entities running exchanges to try appealing to traders by offering other advantages. If – as was also said in section 3.3.3.1.2 – this leads to lower costs and an increased predictability, then all participants should benefit, whereas the attraction of liquidity using some deceitful technique, would have a different outcome.¹⁴⁸

3.3.5.5 *Easier Rebalancing of Portfolios*

A last generic effect of HFT is a less demanding portfolio rebalancing procedure for other traders. The ability to quickly alter the composition of a portfolio is clearly valuable since it reduces the overall risk of trading. It is, though, debateable whether the marginal gains from additional speed still exceed the marginal costs when latency has been reduced to microseconds. If that is not the case, then the continuing investments in increased speed are not very helpful. Nevertheless, they remain a question of corporate governance, as opposite to public policy, so long as the imperfection is not systemic in nature.¹⁴⁹

3.3.6 The Magnitude of HFT and Historical Events in Which It Has Played a Part

3.3.6.1 *Frequency of HFT*

As the actual significance of the effects of HFT is dependent on its presence, it is necessary to determine just how extensive the usage of it is. Some indications to this end have already been made hereinbefore, but the true magnitude of it has never been discussed. Like the study of the effects themselves, an unerring inquiry into the matter cannot be performed since there are no

¹⁴⁸ See Menkveld (n. 29), p. 17-19; Fioravanti et al., *The impact of stock market fragmentation on European stock exchanges* (Consob 2011), p. 31 and 32, <<http://www.consob.it/documenti/quaderni/qdf69en.pdf>>, accessed December 11, 2016.

¹⁴⁹ See Menkveld (n. 29), p. 21.

absolutely accurate means of determining how active certain participants are – especially not those holding instruments for very short periods of time. Yet, estimations have been made by several researchers and institutions. Midst the more up-to-date ones is a paper from the SEC and two reports from the CFTC. According to the former, HFT accounts for slightly more than half of all trading volume in the US equity markets¹⁵⁰ and almost half of it in the EU equivalents.¹⁵¹ The latter ones present even larger numbers for most futures markets,¹⁵² reaching as high as nearly eighty percent in the markets for foreign exchange futures.¹⁵³

In spite of the potential inaccuracies, there exists no need for any deeper examination of the methods used. HFT would not have gained such an impact and fame if it had not seen a hasty expansion. Thus, establishing any exact numbers is not necessary – *HFT is a force to be reckoned with, no matter its exact frequency in the markets.* This will be more than evident after the upcoming account of notable events, in which it has played a part, has been presented.

3.3.6.2 Important Events for Which HFT Was Partly to Blame

3.3.6.2.1 The Flash Crash of May 6, 2010

An incident that ought to have escaped the attention of few interested parties is the dramatic fluctuations in prices, mainly of equities listed in US equity markets, that occurred on May 6, 2010. A significant number of instruments then lost nearly all of their market value or – in some instances – had their prices multiplied to preposterous figures, within minutes, only to return to normal levels just as quickly. As is stated in a joint report by the CFTC and the SEC, “during the

¹⁵⁰ Equity markets are, as the designation implies, markets for equities. They thus allow securities representing some form of ownership, such as shares, to change hands. See Levinson (n. 1), p. 132 ff.

¹⁵¹ See Gerig, *High-Frequency Trading Synchronizes Prices in Financial Markets* (U.S. Securities and Exchange Commission, Division of Economic and Risk Analysis Working Paper, 2015), p. 1, <<https://www.sec.gov/dera/staff-papers/working-papers/dera-wp-hft-synchronizes.html>>, accessed October 29, 2016.

¹⁵² Markets for futures enable the transfer of futures, which happen to be agreements to transact at certain terms in the future. See Levinson (n. 1), p.169 ff.

¹⁵³ See Haynes and Roberts, *Automated Trading in Futures Markets* (U.S. Commodity Futures Trading Commission, Office of Chief Economist, 2015), <http://www.cftc.gov/ucm/groups/public/@economicanalysis/documents/file/oce_automatedtrading.pdf>, accessed October 29, 2016; U.S. Commodity Futures Trading Commission, *Remarks of Chairman Timothy Massad before the Conference on the Evolving Structure of the U.S. Treasury Market* (2015), <<http://www.cftc.gov/PressRoom/SpeechesTestimony/opamassad-30>>, accessed October 29, 2016.

20 minute [sic] period between 2:40 p.m. and 3:00 p.m., over 20,000 trades (many based on retail-customer orders) across more than 300 separate securities, including many ETFs, were executed at prices 60% or more away from their 2:40 p.m. prices”.¹⁵⁴

What caused the sharp decline was not, in opposite to what could easily be expected, primarily, HFTs running faulty systems, but a number of circumstances working together. To begin with, the markets were unusually volatile already before the flash crash, on account of the European debt crisis. When a particularly large trader, in the middle of this uncertainty, initiated the sale of 75 000 E-Mini S&P 500 futures contracts¹⁵⁵ – valued at some 4.1 billion dollars (“the largest net change in daily position of any trader in the E-Mini since the beginning of [that] year”)¹⁵⁶ – the first step towards a proper crash was taken.

The algorithm assigned with the task of selling the contracts¹⁵⁷ initiated its task at a pace far too high, transferring thousands of them to, amongst others, HFTs, at decreasing prices. As the HFTs were programmed not to hold more than a certain number of instruments, for a short time, it did not take long until they began trading the assets acquired between them in an extremely rapid downwards moving spiral pattern. This, unfortunately, induced the algorithmic execution system used by the large trader to increase its pace even further.¹⁵⁸

In the chaos that unravelled, the extreme price movements spread to other markets and instruments, as participants – primarily HFTs engaging in cross-market arbitrage – first sold their holdings of, mainly, the S&P 500 SPDR exchange-traded fund¹⁵⁹ – with matching underlying assets – to benefit from the undue difference in price between it and the closely linked E-mini S&P

¹⁵⁴ See U.S. Commodity Futures Trading Commission and U.S. Securities and Exchange Commission, *Findings Regarding the Market Events of May 6, 2010: Report of the Staffs of the CFTC and SEC to the Joint Advisory Committee on Emerging Regulatory Issues* (2010), p. 6, <<https://www.sec.gov/news/studies/2010/marketevents-report.pdf>>, accessed 1 November 2016.

¹⁵⁵ “An electronically traded futures contract one fifth the size of standard S&P futures, E-mini S&P 500 futures and options are based on the underlying Standard & Poor’s 500 stock index. Made up of 500 individual stocks representing the market capitalizations of large companies, the S&P 500 Index is a leading indicator of large-cap U.S. equities.” See CME Group, *E-mini S&P 500 Futures Contract Specs*, <http://www.cmegroup.com/trading/equity-index/us-index/e-mini-sandp500_contract_specifications.html>, accessed 1 November 2016.

¹⁵⁶ See U.S. Commodity Futures Trading Commission and U.S. Securities and Exchange Commission (n. 154), p. 2.

¹⁵⁷ A so called *smart order routing* system. See Gomber et al. (n. 106), p. 19-20.

¹⁵⁸ See U.S. Commodity Futures Trading Commission and U.S. Securities and Exchange Commission (n. 154).

¹⁵⁹ *Ibid.*, p. 1-2.

500 futures, to then – when predefined thresholds were passed – halt their trading, making liquidity in several equities vanish. It was not until a fault safe on the Chicago Mercantile Exchange temporarily halted trading – for a few seconds – that the prices began stabilising. Subsequent to that, most instruments regained the majority of their value, but left many investors wondering.¹⁶⁰

Particularly important to learn from the crash is just how interdependent the trade of different instruments, listed in different markets, have become, following the introduction of ATs in general and HFTs in particular, into the already fragmented markets created by MiFID and Regulation NMS. Furthermore, it shows that complications can arise when human traders either faultily program their machines or wrongfully implement automatic strategies. The algorithm guilty of executing the 75 000 sales only took the volume traded in the specific instrument during a specific period into account when it set the size of orders and the frequency of execution. Had it also considered price and been equipped with some sort of automatic fail-safe, the crash probably would never have occurred.¹⁶¹

3.3.6.2.2 Other Relevant Incidents Related to HFT

Following the events of May 6, 2010, ATs of all sorts could be expected to have tweaked their systems to avoid future havoc. Although this ought in part to be true, more accidents occurred in the years that followed. One that caught quite a lot of attention and serves to show how those not employing sufficient risk controls are at risk of purging themselves from the markets, is the coding error made by Knight Capital Group in 2012. The securities trading firm “made a coding error in an automated equity router, and then incorrectly deployed new code in the same router”, causing “the firm’s automated trading system [to] inadvertently [build] up unintended positions in the [US] equity market, eventually resulting in losses of more than \$460 million”.¹⁶²

Some more systemic incidents of scale have also occurred. On October 15, 2014, the US treasury market saw an unprecedented level of volatility, resulting in “intraday moves [...] [that]

¹⁶⁰ Ibid., p. 5-6.

¹⁶¹ As regards the legal aftermath, see Viswanatha, *Flash Crash’ Trader Navinder Sarao Pleads Guilty to Spoofing* (The Wall Street Journal 2016), <<http://www.wsj.com/articles/flash-crash-trader-navinder-sarao-pleads-guilty-to-spoofing-1478733934>>, accessed December 11, 2016.

¹⁶² See Commodity Futures Trading Commission (n. 7), p. 52.

have been observed only on three occasions in the previous 25 years, all driven by significant policy announcements”, for which HFT was found to be partly responsible.¹⁶³ A rather alike fate then struck the US equity markets on August 24, 2015, when “an unusual price volatility”, to some extent worsened by HFTs, brought declines of more than five percent to the E-Mini S&P 500 and more than twenty percent, to more than forty percent of NASDAQ-100 companies, shortly after the market opening.¹⁶⁴ In addition, there are several examples of comparable, yet less significant, events from other jurisdictions, indicating that the problem has not been isolated to the US markets.¹⁶⁵ Nevertheless, it should be noted that none of the incidents following the 2010 flash crash have been quite as severe and that *human error has always been at the centre* of the turmoil, wherefore machines should not be given all the blame.¹⁶⁶ In addition, it could be said that not all crashes are bad, as most of them do, after all, reflect the occurrence of important events, which should have an impact on price.

3.4 Legal Measures Affecting High Frequency Trading

3.4.1 Overview of the Recent Legislative Progress

With the objectives, effects and recent events sorted, the turn has come to the financial markets regulation. Regardless of how inaccessible some of the materials referred to in the other descriptive parts may have been, none of them trumps the legal source material. Grasping even the most fundamental aspects of the relevant financial markets law requires an ability to navigate through layers upon layers of regulative patterns, forming a turbid pile of what could, by a layman, easily

¹⁶³ See Bouveret et al., *Fragilities in the U.S. Treasury Market: Lessons from the “Flash Rally” of October 15, 2014* (International Monetary Fund 2015), p. 5 and 12-22, <<https://www.imf.org/external/pubs/ft/wp/2015/wp15222.pdf>>, accessed December 12, 2016.

¹⁶⁴ See U.S. Securities and Exchanges Commission, Staff of the Office of Analytics and Research Division of Trading and Markets, *Research Note: Equity Market Volatility on August 24, 2015* (2015), p. 1 ff., <https://www.sec.gov/marketstructure/research/equity_market_volatility.pdf>, accessed December 12, 2016; Pisani, *What happened during the Aug 25 ‘flash crash’* (CNBC 2015), <<http://www.cnbc.com/2015/09/25/what-happened-during-the-aug-24-flash-crash.html>>, accessed December 12, 2016.

¹⁶⁵ See Commodity Futures Trading Commission (n. 7), p. 51 ff.

¹⁶⁶ Seeing that HFTs have been able both to cause declines and to then counter them, their effect is not solely negative. On the contrary, they could be claimed to have minimised the damage done by human beings.

be confused with gibberish. To avoid letting the prevailing obscurity render the exposition incomprehensible, the functions of the rules debated and their roles in the recent explosion of automated trading will be put in focus, instead of their formal designation or origin. This translates into two divisions; one separating a *first generation* of rules, implemented within the EU and the US during the 00s,¹⁶⁷ from a *second generation*, either adopted or suggested during the 10s; and one arranging the second generation measures into subcategories defined by the functions of the rules included.¹⁶⁸ More precisely, the category of first generation measures comprises:

- Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC (MiFID) (effective per¹⁶⁹ November 1, 2007); and
- US Regulation National Market System (Regulation NMS), (17 CFR § 242.600-612) (2005) (effective per August 5, 2005).

In a similar fashion, the more extensive group of second generation measures accommodates:

- EU measures:
 - Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (MiFID II) (effective per January 3, 2018);
 - Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012 (MiFIR) (effective per January 3, 2017);

¹⁶⁷ Only the legislation having a measureable impact on HFT will be considered, wherefore the first generation of market abuse regulation is omitted.

¹⁶⁸ To avoid confusion, it should be said that there are, in reality, more than two generations of legislative revisions in both countries, wherefore the division should only be seen as a narrative tool.

¹⁶⁹ The effective date refers to that of the implemented legislation, at member state level.

- Directive 2014/57/EU of the European Parliament and of the Council of 16 April 2014 on criminal sanctions for market abuse (market abuse directive) (MAD II) (effective per July 3, 2016); and
- Regulation (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC (MAR) (effective per July 3, 2016).
- US measures:
 - Adopted and proposed by the CFTC:
 - Regulation Automated Trading (Regulation AT), (17 CFR § 1, 38, 40 and 170) (proposal) (2015, supplemented 2016);
 - Interpretative Guidance and Policy Statement on Disruptive Practices, (with regards to 7 U.S.C § 6c(a)(5)) (2013) (effective per May 28, 2013); and
 - Customer Clearing Documentation, Timing of Acceptance for Clearing, and Clearing Member Risk Management, (17 CFR § 1, 23, 37, 38 and 39) (2012) (effective per October 1, 2012).
 - Adopted by the SEC:
 - Qualification and Registration of Associated Persons Relating to Algorithmic Trading, (NASD Rule 1032(f)) (2016) (effective per January 30, 2017);
 - Regulation System Compliance and Integrity (Regulation SCI), (17 CFR § 242.1000-1007) (2014) (effective per February 3, 2015);
 - Consolidated Audit Trail (CAT), (17 CFR § 242.613) (2012) (effective per October 1, 2012); and
 - Risk Management Controls for Brokers or Dealers with Market Access, (17 CFR § 240.15c3-5) (2011) (effective per November 30, 2011).

Since the first generation measures are included only to ensure a proper understanding of the second generation ones – by showing how legislation can come to father unwanted side effects

when the circumstances change – it will have its effects described already in the upcoming section, while the *material part* of the corresponding impact analysis, with regard to the second generation measures, follows in the analysis.¹⁷⁰

3.4.2 First Generation Rules

3.4.2.1 MiFID – The EU Response to Weak Investor Protection and Competition

The single most important first generation legislation of the EU, adopted in 2004, is, without a doubt, MiFID. It was written at a time when interexchange competition and investor protection was considered too weak and was, therefore, given the main objectives of fostering competition between venues and furthering the protection of investors.¹⁷¹ These ambitions have, to varying degrees, been met. There are far more exchanges today than there were before MiFID entered into force and investors should – if they are not drenched in information – at least be certain that their orders are properly executed.¹⁷² Portraying the progress as one free of unexpected surprises would, however, be very misleading. Of particular interest in this context are its massive, multi-faceted, effects on HFT.

To begin with, the envisioned competition, forwarded mainly by the *repeal of the concentration rule* – found in Council Directive 93/22/EEC of 10 May 1993 on investment services in the securities field [1993] (commonly referred to as “ISD”) – which demanded the execution of orders to

¹⁷⁰ The description of second generation measures, clearly, must, to some extent, deal with effects, as it otherwise would not even be possible to decide how to categorise the rules according to their functions.

¹⁷¹ See section I.3 Commission Proposal for a Directive of the European Parliament and of the Council on investment services and regulated markets, and amending Council Directives 85/611/EEC, Council Directive 93/6/EEC and European Parliament and Council Directive 2000/12/EC [2003] OJ C 71E/62, <<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52002PC0625&from=EN>>, accessed December 12, 2016.

¹⁷² See European Commission, *Financial services: improving European rules for a more robust framework for all financial actors and instruments* (2010), <http://europa.eu/rapid/press-release_IP-10-1677_en.htm?locale=en>, accessed December 12, 2016.

be performed only in regulated markets,¹⁷³ gave rise to an uninvited fragmentation.¹⁷⁴ As was indicated in sections 3.3.3.1.2 and 3.3.3.2, on different forms of arbitrage trading, the disintegrating development that followed happened to cultivate HFT and simplify some predatory techniques. The slower traders/preys were, however, not left totally defenceless. A set of exemptions from the general requirement for pre-trade transparency, established by art. 29 MiFID and art. 18 and 20 Commission Regulation (EC) No 1287/2006,¹⁷⁵ enabled the quite extensive flight to dark pools described in section 3.3.5.3, where some sort of shelter from aggressive HFTs was offered. Although the research accounted for has found neither of these changes *particularly* problematic – as their total advantages supposedly outweigh their total disadvantages – they have caught the eye of the regulator.¹⁷⁶

Another factor undeniably furthering the legislative interest in HFT is the exemption found in art. 2.1 d MiFID, excluding those who – like most HFTs¹⁷⁷ – trade on their own account (commonly referred to as *proprietary trading*) from much of the supervision and authorisation otherwise required. Without any such preconditions to market participation, keeping an eye on the activities

¹⁷³ Then defined as a market for “[transferable] securities”, “[units] in collective investment undertakings”, “[money]-market instruments”, “[financial]-futures contracts, including equivalent cash-settled instruments”, “[forward] interest-rate agreements”, “[interest]-rate, currency and equity swaps” and “[options] to acquire or dispose of any instruments[listed], including equivalent cash-settled instruments”; appearing on a specific list; functioning regularly; being subject to regulations regarding market access, admission and trading, issued by the competent authorities in the jurisdiction where it operates; and requiring compliance with certain transparency requirements. See art. 1.13 and annex B ISD.

¹⁷⁴ See Gresse, *Market fragmentation in Europe: assessment and prospects for market quality* (Foresight Government Office for Science 2012), p. 19 ff., <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/289026/12-1052-dr19-market-fragmentation-in-europe-assessment-for-quality.pdf>, accessed December 12, 2016.

¹⁷⁵ COMMISSION REGULATION (EC) No 1287/2006 of 10 August 2006 implementing Directive 2004/39/EC of the European Parliament and of the Council as regards recordkeeping obligations for investment firms, transaction reporting, market transparency, admission of financial instruments to trading, and defined terms for the purposes of that Directive [2006] OJ L 241/1.

¹⁷⁶ One reason for this could, of course, be that a positive development should never be considered enough if there is room for improvement.

¹⁷⁷ See Chlistalla, *High-frequency trading: Better than its reputation?* (2011), p. 9, <https://www.dbresearch.com/PROD/DBR_INTERNET_DE-PROD/PROD000000000270960.pdf>, accessed December 12, 2016.

of many HFTs has proven hard. Combining that with the lack of special regulatory requirements, making HFT relatively profitable, and the widespread confusion, it is easy to see what motivated MiFID II.¹⁷⁸ Regardless of how pressing the issue was believed to be in the EU, the situation did, however, as was indicated in section 3.3.6.2, get far worse in the US.

3.4.2.2 Regulation NMS – Unifying the US Financial Markets and Countering Opportunism

In a spirit similar to that of the EU legislature, the SEC sought to promote competition between markets and to prevent intermediaries from harming clients, by enacting a plethora of rules chiefly governing the execution of orders.¹⁷⁹ As was the case with the later adopted MiFID, Regulation NMS succeeded in its ambition to increase competition. Unfortunately, it also came with quite a few unplanned side effects, bearing striking resemblance to those of the EU equivalent, yet being even more noteworthy. In other words, it caused both fragmentation and an expansion of HFT.

What brought the changes was an attempt to ensure that no trade occurs at a price less favourable than the absolutely best one available – the *National Best Bid and Offer* (commonly referred to as the “NBBO”).¹⁸⁰ No matter how noble said idea might have seemed in theory, it proved problematic in practice. The main reason for this was, and still is, the wording of the so-called *Order Protection Rule* or *Rule 611*, which explicitly forbids the execution of most orders at price levels less advantageous than the NBBO.¹⁸¹ If an exchange “or any other broker or dealer that executes orders internally by trading as a principal or crossing orders as agent” receives an order covered by the Order Protection Rule, it must either (re)route it to the market(s) offering the NBBO or cancel it.¹⁸²

¹⁷⁸ Cf. European Commission, *COMMISSION STAFF WORKING PAPER IMPACT ASSESSMENT Accompanying the document Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Markets in financial instruments [Recast] and the Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Markets in financial instruments* (2011), p. 10-11, <http://ec.europa.eu/finance/securities/docs/isd/mifid/111020-impact-assessment_en.pdf>, accessed December 12, 2016.

¹⁷⁹ See U.S. Securities and Exchange Commission, *Regulation NMS: Final rules and amendments to joint industry plans* (2005), p. 5-7 and 12-21, <<https://www.sec.gov/rules/final/34-51808.pdf>>, accessed December 12, 2016.

¹⁸⁰ See 17 C.F.R. § 242.600(b)(42).

¹⁸¹ See 17 C.F.R. § 242.611.

¹⁸² See 17 C.F.R. § 242.600(b)(72).

When automatically deciding how to act, the intermediary is obligated to use the NBBO calculated by a so-called *Securities Information Processor* (commonly referred to as “SIP”), which collects and compares information from all exchanges, as its decision basis.¹⁸³ Had it not been for the fact that markets are allowed to simultaneously send the information disseminated to the SIPs also to others, including HFTs, the scheme might have worked. Owing to HFTs being able to calculate the NBBO much faster than the SIPs and to act on the information gathered before other investors, the system has, however, instead *given rise to a great number of arbitrage opportunities of limited, if any, benefit to the markets.*¹⁸⁴

Comparing the rather inflexible system of the US to that introduced by MiFID, understanding why HFT has become more popular in the US markets is far from burdensome. Art. 21.1 MiFID stipulates that “investment firms [shall] take all reasonable steps to obtain, when executing orders, the best possible result for their clients taking into account price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of the order” and that they, “whenever there is a specific instruction from the client [...] [] [must] execute the order following [it]”. Already from that, it is possible to tell that intermediaries¹⁸⁵ acting in the EU must take into account far more factors than only the price. When the implementing measure – art. 44 Commission Directive 2006/73/EC of 10 August 2006 implementing Directive 2004/39/EC of the European Parliament and of the Council as regards organisational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive – is read, this becomes even more evident. The relative importance of the factors listed in art. 21.1 MiFID depends on the characteristics of the client submitting the order and the content of the order itself. Consequently, proceeding in a manner that allows HFTs to engage in predatory techniques is not allowed if another reasonable option, better suited to the needs of the client, is available.¹⁸⁶

¹⁸³ See 15 U.S.C. § 78c(a)(22)(A).

¹⁸⁴ See Lewis (n. 18), p. 98; Gomber et al. (n. 106), p. 39-40; McNamara, *The Law and Ethics of High-Frequency Trading* (17 Minn. J.L. Sci. & Tech. 71 2016), <<http://scholarship.law.umn.edu/mjlst/vol17/iss1/2>>, accessed 1 November 2016.

¹⁸⁵ Not including exchanges.

¹⁸⁶ See art. 44 Commission Directive 2006/73/EC of 10 August 2006 implementing Directive 2004/39/EC of the European Parliament and of the Council as regards organisational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive [2006] OJ L 241/26.

3.4.3 Second Generation EU Measures

3.4.3.1 *Structure of the Measures*

In conformity with the situational analysis of the legislative landscape, forming a complete understanding of the second generation EU financial legislation requires more than a study of only a few individual rules. There are no less than four relevant first level measures, followed by even more second level measures, needing attention. As it is beyond the scope of this paper to account for all of them, some limitations and simplifications have had to be made. For that reason, this part only brings the rules either directly or, with notable force, indirectly affecting HFT into attention and, in compliance with the aforesaid order, focuses on actual functions. The result is five subsections presenting rules intended to control the use of AT strategies; rules aimed at preventing trading system errors; rules designed to increase the systemic stability by increasing market resistance; rules meant to facilitate the monitoring of both ATs and HFTs; and, lastly, rules of which the purpose is to directly affect confidence, to increase transparency or to counter the growth of dark liquidity.

3.4.3.2 *Measures Affecting the Strategies Chosen for AT Systems*

It is safe to say that the legislature has had as its core objective to steer HFTs away from strategies of questionable effect. The most notable examples of such trading techniques are the manipulative strategies described above. By flooding the markets with orders without having a proper intent to trade in the direction indicated thereby, HFTs have proven capable of steering price movements and to slow down competitors. As this behaviour has a very manifest adverse effect on the efficiency of markets and thus allocation, it is rather unsurprising to find that it is dealt with in several articles.¹⁸⁷

To begin with, art. 7 MAD II and art. 15 MAR forbids any form of *market manipulation*, which, by art. 5 MAD II and art. 12.1 a and b MAR, is defined as a behaviour likely to produce misleading signals “as to the supply of, demand for, or price of, a financial instrument” or to “secure [...] the price of one or several financial instruments [...] at an abnormal or artificial level”, “unless the person [...] engaging in [such a] [...] behaviour establishes that [...] [it has] been carried out for legitimate reasons, and [conforms] with an accepted market practice”. In addition to that, art. 12.2

¹⁸⁷ See section 3.3.4.

MAR adds “any other form of deception or contrivance”. Already from the cited rules, it is possible to deduce how some manipulative strategies employed by HFTs are to be prohibited. Such a broad approach, corresponding with the former order, has however not been considered sufficient, as it has proven incapable of fully hindering the use of some manipulative strategies.¹⁸⁸ To avoid leaving any form of gaps, the legislature has made sure to include far more manifest examples in MAD II than those offered by its predecessor.

Reading art. 12.2 c MAR, it is easy to tell which techniques are in focus. According to said rule, “the placing[,] [...] cancellation or modification [of orders], by any available means of trading, including [...] electronic [...], such as algorithmic and high-frequency trading strategies, [...] which has one of the effects referred to in paragraph 1(a) or (b), by [...] disrupting or delaying the functioning of the trading system of the trading venue or being likely to do so; [...] [by] making it more difficult for other persons to identify genuine orders on the trading system of the trading venue or being likely to do so, including by entering orders which result in the overloading or destabilisation of the order book; or [...] [by] 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” fulfils the requirements for market manipulation. Foretelling which exemptions might be made under the accepted market practices regime, mentioned above and found in art. 13 MAR, is at current difficult, due to there, seemingly, being an absolute absence of such proposals.¹⁸⁹

¹⁸⁸ See recital 38 MAR; European Commission, *COMMISSION STAFF WORKING PAPER IMPACT ASSESSMENT Accompanying the document Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on insider dealing market manipulation (market abuse) and the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on criminal sanctions for insider dealing and market manipulation* (2011), p. 109 f., <<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011SC1217&from=EN>>, accessed December 12, 2016.

¹⁸⁹ A search for “accepted market practices” generates no hits in the ESMA database. See European Securities and Markets Authority, *ESMA Library*, <<https://www.esma.europa.eu/databases-library/esma-library/%2522accepted%2520market%2520practices%2522>>, accessed December 11, 2016.

Continuing on the path of interference, art. 17.3 MiFID II requires ATs *pursuing a market making strategy*¹⁹⁰ to carry it out continuously, except under exceptional circumstances; to enter into written agreements with the trading venue in which they are active; and to have in place systems and controls ensuring that they fulfil their obligations. Even though the rule does not forbid any strategies, it does indeed influence the choices made by ATs, of all kinds. The requirements to supply liquidity on a continuous basis and to enter into agreements, add more factors for traders to consider in their analyses of available options. ATs are, however, not the only ones affected. Art. 48 MiFID II provides a matching set of rules applicable to trading venues, forcing them to “have in place [...] written agreements with all investment firms pursuing a market making strategy” and “schemes to ensure that a sufficient number of investment firms participate in such agreements which require them to post firm quotes at competitive prices with the result of providing liquidity to the [markets] on a regular and predictable basis”.¹⁹¹ ATs will thus be subject to pressure, coming from two directions. To impel them to act as intended, instead of changing to some less desirable strategies in the face of unwanted coercion, venues are allowed to offer incentives, awarded at equal terms, *provided that they do not contribute to disorderly trading*.¹⁹² Moreover, the exemption for exceptional circumstances, allowing market makers to halt trading in times of extreme volatility; “disorderly trading conditions where the maintenance of fair, orderly and transparent execution of trades is compromised”; or when an inability “to maintain prudent risk management practices” arises, is meant to counter some of the worst risks otherwise associated with a continuous supply of liquidity.¹⁹³

A final set of rules, closer linked to the choice of strategy than the general pursuit of stability, can be found in art. 48.9 and 49 MiFID II. Art. 48.9 regulates the charges imposed on traders. It forces venues only to use *fee structures* which “do not create incentives to place, modify or cancel

¹⁹⁰ Defined as the “posting [of] firm, simultaneous two-way quotes of comparable size and at competitive prices relating to one or more financial instruments on a single trading venue or across different trading venues, with the result of providing liquidity on a regular and frequent basis to the overall market[, when dealing on own account]” in art. 17.4 MiFID II.

¹⁹¹ See art. 5 COMMISSION DELEGATED REGULATION (EU) .../... of 13.6.2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council on markets in financial instruments with regard to regulatory technical standards specifying the requirements on market making agreements and schemes [2016] (hereinafter referred to as “Regulation C(2016) 3523 final”); art. 18.5 MiFID II, as regards MTFs and OTFs.

¹⁹² See art. 48.3 and 48.9 MiFID II; art. 7 Regulation C(2016) 3523 final.

¹⁹³ See art. 3 Regulation C(2016) 3523 final.

orders or to execute transactions in a way which contributes to disorderly trading conditions or market abuse”. In a likeminded spirit, art. 49 requests of venues the use of certain minimum *tick sizes* – minimum values of change in price – whereby it is assumed that the frequency of orders and the short time volatility shall decrease.¹⁹⁴ In sum, the legislature has consequently sought to discourage strategies which create disorderly market conditions, while increasing the relative appeal of others.

3.4.3.3 Measures Preventing Trading System Errors

In a reality where the flawless materialisation of intentions is still a matter for fables, minimising the effects of dysfunctional trading systems is obligatory – if not else, then at least to ensure an effective implementation of the rules intended to minimize the use of certain strategies. MiFID II contains several provisions aimed at *counteracting erroneous outputs* from trading systems; the perhaps most fundamental one being art. 16.2, calling on investment firms to ensure their general compliance with the directive. Following its lead, art. 16.4 demands continuity and regularity in performance, while art. 16.5 requires an effective risk management. All investment firms must therefore ensure that their trading practices are reasonably free of faults, by incorporating functions minimising the risk of inaccuracies.¹⁹⁵

Owing to the perceived complexity of AT, in all its forms, the EU legislature has not contented itself with only creating technology neutral rules, equally applicable to all investment firms. On the contrary, it has produced a number of more specific ones, exclusive for ATs. Amongst those, art. 17.1 MiFID II offers most detail. It forces “investment [firms] that [engage] in algorithmic trading [to] have in place effective systems and risk controls suitable to the business [they operate] to ensure that [their] trading systems are resilient and have sufficient capacity, are subject to appropriate trading thresholds and limits and prevent the sending of erroneous orders or the systems otherwise functioning in a way that may create or contribute to a disorderly market”.

¹⁹⁴ See European Commission (n. 178), p. 25-26.

¹⁹⁵ For more detailed rules, see art. 21-23 COMMISSION DELEGATED REGULATION (EU) .../... of 25.4.2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council as regards organizational requirements and operating conditions for investment firms and defined terms for the purposes of that Directive [2016].

These requirements are then, by art. 17.5, extended also to machines run by others using the infrastructure of a registered investment firm, which is a member of an exchange, to gain *direct electronic access* (commonly referred to as “DEA”)¹⁹⁶ to the latter without being members themselves. ATs must consequently *embed their systems in an outer layer of fail safes*, increasing the likelihood of them and others using their passage abiding by the rules. In addition, such firms shall, according to the same article, employ, for one thing, “effective systems and risk controls to ensure the trading systems cannot be used for any purpose that is contrary to [MAR] or to the rules of a trading venue to which [they are] connected”; and, for another, “[fully tested,] effective[,] business continuity arrangements to deal with any failure of [the] trading systems”. To make possible the pre-implementation tests envisioned, art. 48.6 MiFID II imposes an obligation on venues to provide algorithmic traders with an opportunity to test their machines in a controlled environment, before letting them off the leash. The legislature has thus gone to some lengths in its efforts to prevent ATs from causing distress in the markets, by adopting measures forcing all parties involved to control their risks at all stages.

3.4.3.4 Measures Increasing the Resistance of Markets and Related Entities

Regardless of how hard the legislature and the market participants try to counteract chaos on their own, they are not very likely to be fully successful. It has for that reason been necessary to include venues and other entities – principally clearing agencies¹⁹⁷ – in the collected efforts to bring stability. Art. 18, 19, 47 and 48 MiFID II makes this abundantly clear by forcing market operators to instate arrangements capable of *dealing with and, to some degree, predicting risks* of disruptions. More specifically, markets must function *continually* and uphold *orderly trading conditions* even in times of extreme market stress. To manage this, market operators shall, by order of art 48.4 and 48.5 MiFID II, “have in place effective systems, procedures and arrangements to reject orders that exceed pre-determined volume and price thresholds or are clearly erroneous” and “be able to temporarily halt or constrain trading[, using circuit breakers,] if there is a significant price movement in a financial instrument in that market or a related market during a short period and, in exceptional cases, [...] be able to cancel, vary or correct any transaction”. Venues must thus do

¹⁹⁶ For a definition of DEA, see art. 4.41 MiFID II.

¹⁹⁷ Entities “[reconciling] the reports of all brokers involved [in a trade] to make sure that all parties are in agreement as to the price and the number of shares traded”. See Levinson (n. 1), p. 165.

their best to prevent disturbances from ever occurring and, if that was to fail, at least limit the damage caused.

3.4.3.5 *Measures Facilitating Supervision, Evaluation and the Imposition of Sanctions*

Conforming to the general judicial pattern of orders, supervisory measures and sanctions, the legislation to be presented supplements the abovementioned rules – aimed at controlling the choices of participants – with others ensuring their effectiveness. By command of art. 5 MiFID II, all persons “[providing] [...] investment services and/or [performing] [...] investment activities as a regular occupation or business on a professional basis” must *apply for authorisation* with the competent authorities.¹⁹⁸ This does, with few exceptions, include HFTs, who, unlike before, are no longer exempted from the authorisation requirement if they engage in proprietary trading. Instead, art. 2 MiFID II exempts them from most exemptions, making HFT closer scrutinised than most other trading methods.

The intention to closely survey the wider group of ATs has also resulted in an obligation, found in art. 17.2 MiFID II, applicable to investment firms, who must *notify the competent authorities* “of [their] home Member [States] and of the trading [venues] at which [they] engages in algorithmic trading as [...] [members] or [participants]” of their doings. By virtue of said responsibility, the authorities will, in theory, always be informed of any ongoing AT. The legislature has, however, not stopped at raising awareness. In addition to the rules demanding notification, there are some forcing investment firms to *describe their algorithmic strategies* and *record all their trading activity*, accompanied by yet more stipulations, imposing supplementing obligations on venues.

Art. 17.2 MiFID II, first, compels ATs to “provide, on a regular or ad-hoc basis, a description of the nature of [their] algorithmic trading strategies, details of the trading parameters or limits to which the [systems are] subject, the key compliance and risk controls that [they have] in place to ensure the conditions laid down in paragraph 1[, accounted for in section 3.4.3.3,] are satisfied and details of the testing of [their] systems”; and, second, along with art. 16.6 and 16.7, requires that they keep records “in relation to the matters referred to in [that] paragraph” – including their strategies – and all their trading activities. The corresponding duties of venues, expressed in art. 26 and 27 MiFIR, do not comprise the recording of all trading activity. Instead, venues shall document orders, including cancellations, and transactions, using a technique that specifically distinguishes the messages sent by ATs from any other. To facilitate the study of the intended activity

¹⁹⁸ Cf. art. 4.26 and 67 MiFID II.

– for the purpose of data collection and to ease the monitoring detailed below – art. 48.10 MiFID II instructs markets to make possible “by means of flagging from members or participants, [the identification of] orders generated by algorithmic trading, the different algorithms used for the creation of orders and the relevant persons initiating those orders”.

Since it clearly is not enough merely to make the dealings of ATs known and to ensure there are records of their activity, both the venues and the competent authorities are obliged, by art. 22, 31, 48.3 and 54 MiFID II, to *monitor AT activity*. While the duty of venues is an extension of their general obligation to prevent disorderly market conditions, accounted for in the previous section, that of the authorities is, partly, a corollary of their task to authorise participants and review that authorisation, partly a prerequisite to their other mission of imposing sanctions. To promote a smooth interplay between the two groups of entities, art. 31 and 54 MiFID II and art. 16 MAR calls for venues to *inform the authorities of any potential infringements*.¹⁹⁹ If the authorities were to find that any of the many rules listed in art. 70 MiFID II, including those described above, have been breached, at least *administrative sanctions* must follow, whereas a breach of art. 3-6 MAD II – prohibiting insider dealing; unlawful disclosure of inside information; market manipulation, or the inciting; aiding and abetting; and attempting of either – according to art. 7-9 MAD II shall result in proportionate *criminal sanctions*, imposed on those responsible, including legal persons. Moreover, said parties could, according to art. 8, 22, 44 and 71 MiFID II, risk having their *authorisations withdrawn*, forcing them to end their practice. The means of control, with which the competent authorities are assigned, ought therefore not to be considered toothless. Nonetheless, art. 90 MiFID II – updated by art. 1.6 Directive (EU) 2016/1034 of the European Parliament and of the Council²⁰⁰ – and art. 52 MiFIR – revised by art. 1.12 Regulation (EU) 2016/1033 of the European Parliament and of the Council²⁰¹ – instructs the commission to *report on the effects of the second*

¹⁹⁹ The authorities may, of course, notice the irregularities on their own as they are entitled to access the data needed without there being any suspicions. See art. 69 MiFID II.

²⁰⁰ Directive (EU) 2016/1034 of the European Parliament and of the Council of 23 June 2016 amending Directive 2014/65/EU on markets in financial instruments [2016] OJ L 175/8.

²⁰¹ Regulation (EU) 2016/1033 of the European Parliament and of the Council of 23 June 2016 amending Regulation (EU) No 600/2014 on markets in financial instruments, Regulation (EU) No 596/2014 on market abuse and Regulation (EU) No 909/2014 on improving securities settlement in the European Union and on central securities depositories [2016] OJ L 175/1.

generation legislation on AT and HFT by 3 March 2020, while art. 38 MAR imposes a corresponding duty to be performed by 3 July 2019.

3.4.3.6 Measures Increasing Confidence and Controlling Dark Trading

Beyond the rather wide spectrum of rules already dealt with, there are some having a more distant or diffuse, yet important, relation to HFT. The rules referred to are either aimed at enhancing the confidence of other participants; at preventing the same group from giving HFTs certain potentially harmful incentives; or at minimising some specific external effects of HFT, which makes their impact on automated trading only indirect. What separates these provisions from the abovementioned ones is, however, not the purposes they fulfil, but those they do not. Most other provisions of relevance do, as will be elaborated further in the analysis, also affect the confidence of investors, the structure of incentives and the magnitude of other effects, wherefore neither of those characteristics are unique.

With regard to confidence, the most prominent rule, not yet mentioned, having a notable impact on the extent of HFT, is art. 48.8 MiFID II, calling for *transparent, fair and non-discriminatory conditions for co-location*. When venues offer to house the systems of ATs within their perimeters, they must thus do so on terms made public. Explicitly intended to bring transparency are also the rules dealing with trading in dark pools and other unlit environments. Laid down in art. 3-11 MiFIR, they introduce *limitations to the total volume of equity instruments traded in venues where orders are not made public prior to being executed* and where prices are either derived from the price levels on other markets or determined according to some specific negotiation scheme. Such transactions may not, in any single venue, exceed four percent of the total trading volume in all venues, in a specific instrument, during the past twelve months, or, in all unlit markets together, exceed eight percent of the same number. Particularly large orders are, however, still not subject to such restrictions and may even result in deferred post-trade transaction reports, wherefore the protection from predators has not vanished completely.

A final rule, briefly examined when the first generation legislation was accounted for, is the “[obligation] to execute orders on [the] terms most favourable to the client”, otherwise known as *best execution*. Compared to its predecessor, the rule – art. 27 MiFID II – is rather recognisable. Investment firms shall still “take all sufficient steps to obtain, when executing orders, the best possible result for their clients taking into account price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of the order” and let the total definitive result be decisive, rather than some single factor, thereby further limiting the

incentives for HFTs to engage in predatory techniques. An investment firm executing an order sent by a client – as an intermediary – consequently may not choose an option of greater benefit to itself than some other if the latter is favourable to the client, which sums up the total ambition of the relevant second generation EU legislation fairly well; it seeks to prevent HFTs from enriching themselves at the expense of slower traders.²⁰²

3.4.4 Second Generation US Measures

3.4.4.1 *Structure of the Measures*

In line with what should be expected, the US legislation is in its actual substance strikingly similar to its EU counterpart. There are some rules having an impact on the strategic choices of traders, some requiring them to have in place risk controls ensuring that no deviations from the intended order occur, some imposing corresponding obligation on markets, some intended to facilitate monitoring and sanctioning and a few more having an effect mainly on confidence. A notable difference is, however, the greater fragmentation of US measures, caused by the division of law-making powers and responsibilities mainly between the SEC and the CFTC.²⁰³ As this does not have that great of an impact on the rules themselves, other than affecting their scope, simply copying the outline and delimitations used in the section on EU legislation should be appropriate, since it brings uniformity.

3.4.4.2 *Measures Affecting the Strategies Chosen for AT Systems*

To try *directing HFTs away from manipulative strategies* the SEC has made use of the existing market abuse regulation – chiefly 15 U.S.C § 78i and 78j – to impose penalties on firms found to have engaged in different sorts of abusive activities. Through said practice, it has affirmed that the sending of orders, either not meant to go through or not representing an honest will to trade, to exchanges, with the purpose of causing artificial price movements, is illegal.²⁰⁴ Seeking to achieve an equivalent level of lucidity, the CFTC adopted the Interpretative Guidance and Policy State-

²⁰² It is thus especially important to ensure that no conflicts of interest exist. See art. 27.2 MiFID II with references.

²⁰³ The SEC oversees the trading in securities and thus enacts rules relating to such instruments, while the CFTC manages the trade in futures and therefore regulates that area. See section 3.1.5.1.

²⁰⁴ See Congressional Research Service (n. 20), p. 11 and 12.

ment on Disruptive Practices, with regards to 7 U.S.C § 6c(a)(5), listed in section 3.4.1 above. Beyond explaining that intentionally reckless behaviour affecting the closing period; and the emittance of bids and offers either lower or higher than the best quotes available, is illegal, it also provides an important definition of spoofing. Said strategy is held to encompass the “submitting or cancelling [of] bids or offers to overload the quotation system of a registered entity, [...] [the] submitting or cancelling [of] bids or offers to delay another person’s execution of trades, [...] [the] submitting or cancelling [of] multiple bids or offers to create an appearance of false market depth, and [...] [the] submitting or canceling [sic!] [of] bids or offers with intent to create artificial price movements upwards or downwards”.²⁰⁵ It is therefore fair to say that the existing legislation on disruptive activity, both in securities and futures markets, prohibits the use of certain manipulative strategies.

A matter not handled in as similar of a manner within the US and the EU is the quest for a stable provision of liquidity. In difference to the EU legislature, the US has chosen not to explicitly force ATs using market making strategies to enter into agreements with the exchanges. Instead, they seem to rely on more general provisions. In the matter of securities markets 17 CFR § 242.1001 and 1004 requests that market operators and clearing providers, employ arrangements ensuring that trade is conducted in an orderly manner, deliberated further below; and, as regards futures markets, a requirement – found in the proposed 17 CFR § 40.28 – that *incentive schemes for market makers do not reward abusive trading*. The US markets are consequently given far more wiggle room than their EU peers in determining how best to uphold an orderly trading environment.

Another area where the US has chosen a different path than the EU is that of incentives to trade. While the EU has chosen to require a certain configuration of fee structures and to demand a specific minimum tick size, the US has still to change the order introduced by Regulation NMS. 17 CFR 242.610(c) still prohibits the imposition of fees exceeding \$0,003 per share for security quotations the prices of which are \$1.00 or more and fees exceeding 0,3 percent of quotations priced below \$1.00; while 17 CFR 242.612 still requests that bids, offers, orders or indications of interest “priced in an increment smaller than \$0.01” for securities “priced equal to or

²⁰⁵ See Commodity Futures Trading Commission, *Interpretative Guidance and Policy Statement on Disruptive Practices* (2013), p. 2, <https://secure.fia.org/downloads/dtp_factsheet.pdf>, accessed November 20, 2016. Note also FINRA Rules 5210 and 6140.

greater than \$1.00 per share” and bids, offers, orders or indications of interest “priced in an increment smaller than \$0.0001” for securities “priced less than \$1.00 per share” are not “[displayed], [ranked], or [accepted] by exchanges. However, the SEC has initiated what it calls a *Tick Size Pilot Program*, intended to investigate the effects of varying tick sizes. As the experiment has only been in action since October 3, 2016, its effects still remain unclear.²⁰⁶ In their entirety, the efforts of the US to induce HFTs to pursue passive strategies have thus been less intrusive than those of the EU.

3.4.4.3 Measures Preventing Trading System Errors

Far more extensive than the measures expected to minimize the use of undesirable strategies is the collection of rules aimed at preventing trading system errors. 17 CFR § 240.15c3-5, adopted shortly after the 2010 flash crash, requires that traders being members of exchanges, and thus having direct access thereto, *implement financial and regulatory risk management controls* preventing the emittance of orders, both from their own systems and from the machines of others offered DEA, surpassing pre-set thresholds or being contrary to regulatory requirements. To ensure that such controls are functional, the members employing them must survey their performance and take any corrective measures necessary. As it might, supposedly, be difficult to fully translate the requirements into whatever tongue ATs use, FINRA has “spoiled” them with an interpretative guidance and policy statement on control practices for automated trading systems.²⁰⁷ It divides the arrangements to be made into five subcategories, namely “General Risk Assessment and Response”, “Software/Code Development and Implementation”, “Software Testing and System Validation”, “Trading Systems” and “Compliance”, which, collectively, recommend ATs to ensure that every stage of the process from development to post-trade review is subject to sufficient controls.²⁰⁸ It is, for instance, requested that ATs test their code before putting it to use and that they can easily disable their whole systems when called for.

²⁰⁶ See U.S. Securities and Exchange Commission, *Investor Alert: Tick Size Pilot Program – What Investors Need to Know* (2016), <https://www.sec.gov/oiea/investor-alerts-bulletins/ia_ticksize.html>, accessed November 23, 2016.

²⁰⁷ See Financial Industry Regulatory Authority, *Regulatory Notice 15-09, Equity Trading Initiatives and Control Practices for Algorithmic Trading Strategies* (2015), <http://www.finra.org/sites/default/files/notice_doc_file_ref/Notice_Regulatory_15-09.pdf>, accessed November 23, 2016.

²⁰⁸ See Financial Industry Regulatory Authority, n. 207, p. 5-7.

Risk controls for ATs are also present in Regulation AT. The proposed 17 CFR § 1.80 requires “AT Persons to implement pre-trade risk controls, order cancellation systems, and other measures reasonably designed to prevent [disruptive trading and compliance issues]”.²⁰⁹ According to the same proposal, “[such] controls include, but are not limited to, maximum AT Order Message frequency and maximum execution frequency per unit time; order price parameters and maximum order size limits; order cancellation and Algorithmic Trading disconnect systems; and connectivity monitoring systems for AT Persons with DEA”.²¹⁰ In short, ATs active in futures markets must consequently, like those trading in securities, make sure that their systems do not contribute to turmoil and be able to shut them down if they were to prove unstable. Said order is, in relevant parts, more or less identical to the EU equivalent, which also demands thorough checks of regulatory compliance, yet does not dictate a certain system design.

3.4.4.4 Measures Increasing the Resistance of Markets and Related Entities

Staying loyal to the trend of regulatory similarities, the SEC has adopted and the CFTC has proposed rules on market capacity and risk controls. What they all share is an aim to accomplish market stability, manifested especially by resilience. To that end, 17 CFR § 242.1001(a)(1) states that organised securities markets and ATs alike “shall establish, maintain, and enforce written policies and procedures reasonably designed to ensure that [their functionality supporting systems] and, for purposes of security standards, indirect [functionality supporting systems], have levels of capacity, integrity, resiliency, availability, and security, adequate to maintain the [...] [entities] operational [capabilities] and promote the maintenance of fair and orderly markets”. The proposed 17 CFR § 40.20, building on the existing § 38.255 and the proposed § 1.80, likewise demands that operators of futures markets establish pre-trade risk controls dealing with the threat of disturbances, caused mainly by ATs, and the increased system loads in general.²¹¹ Since it would not be enough only to involve market operators in the efforts to bring stability, those offering clearing services are, by 17 CFR § 242.1000-1004 and § 39.14, also required to implement risk management controls.

In both cases, the listed provisions are either followed by – as with the proposed 17 CFR § 40.21-22 – or containing more detailed stipulations – like § 242.1000-1004 – forcing operators to

²⁰⁹ See Commodity Futures Trading Commission (n. 7), p. 103-104.

²¹⁰ Ibid.

²¹¹ Ibid. p. 204-205.

test, monitor and review the functionality of their arrangements and to provide ATs with facilities for the controlled testing of algorithms. Moreover, under extreme circumstances, it shall be possible to disengage traders contributing to disorderly conditions, to cancel erroneous orders and to take corrective action. All in all, the US measures seem to cover all parts of market operations in all relevant markets, including dark pools qualified as ATs of a certain size,²¹² making them comparable to the EU legislation in scope.

3.4.4.5 Measures Facilitating Supervision, Evaluation and the Imposition of Sanctions

Equally detailed as the rules on market resistance are the provisions meant to promote actual compliance. As such, they force certain persons to register with the authorities, to keep records of trading activity and to compose reports on compliance, all of which is intended to facilitate supervision. Summarily, the *obligations to register* bring those formerly flying below the radar into scrutiny. Since a great part of all participants in both securities and futures markets are already registered with the authorities, not all ATs are affected by the regulatory changes.²¹³ Instead, either those “primarily responsible for the design, development or significant modification of an algorithmic trading strategy relating to equity, preferred or convertible debt securities[,] or [...] responsible for the day-to-day supervision or direction of such activities”, who are now required to qualify for registration with FINRA; and those combining DEA with AT to participate in the trade in futures markets, who are proposed to be forced to register with the CFTC and to become members of a registered futures association,²¹⁴ will see changes by virtue of the upcoming NASD Rule 1032(f)²¹⁵ and the proposed 17 CFR § 1.3 respectively.

As the registration of ATs would not be very valuable if there was no activity to monitor, ATs and market operators share responsibilities to *keep records of their trading activity and arrangements to*

²¹² Cf. 17 CFR § 242.300 and § 242.1000, requiring ATs to reach certain volumes to fall within the scope of Regulation SCI.

²¹³ Cf. Lerner et al., *SEC Proposes FINRA Registration for High-Frequency Traders – But at What Cost?* (2015), <<https://www.crowell.com/NewsEvents/AlertsNewsletters/all/SEC-Proposes-FINRA-Registration-for-High-Frequency-Traders-But-at-What-Cost>>, accessed December 13, 2016.

²¹⁴ A self-regulatory organisation creating rules of conduct and the like for its members to abide by. See National Futures Association, *About NFA: Who We Are*, <<https://www.nfa.futures.org/NFA-about-nfa/index.HTML>>, accessed December 13, 2016.

²¹⁵ Entering into force January 30, 2017. See Financial Industry Regulatory Authority, *Qualification and Registration of Associated Persons Relating to Algorithmic Trading* (2016), p. 1, <<https://www.finra.org/sites/default/files/Regulatory-Notice-16-21.pdf>>, accessed December 13, 2016.

ensure regulatory compliance. For ATs the newly adopted rules primarily cover risk controls and source codes. 17 CFR § 240.15c3-5(b) stipulates that a “broker or dealer [trading in securities] shall preserve a copy of its supervisory procedures and a written description of its risk management controls as part of its books and records”, which is, by the proposed 17 CFR § 1.83 and § 40.22, also required of those trading in futures, who are, in addition, by 17 CFR § 1.84, proposed to be obligated to store *source code* used by their machines. When it comes to markets no matching rules exists in the proposed Regulation AT, while 17 CFR § 242.1005 forces securities markets to keep records of their procedures to mitigate risks. Regardless of this variance, markets of both types should be forced to keep records, as the very broad 17 CFR § 38.950, already in force, tells that all activity in, and of, futures markets shall be saved for five years. Less alike are, however, the measures related to the recording of trading activity. 17 CFR § 242.613 instructs the securities markets and FINRA to jointly develop “a national market system plan to govern the creation, implementation, and maintenance of a consolidated audit trail and central repository” for the storage of “accurate, time-sequenced record of orders beginning with the receipt or origination of an order by a member of a national securities exchange or national securities association, and further documenting the life of the order through the process of routing, modification, cancellation, and execution (in whole or in part) of the order”. The system shall, by giving all members of exchanges separate identifiers and demanding that they, as well as the exchanges themselves, synchronise their clocks, simplify the monitoring of trading activity. A similar rule for futures markets has yet to be proposed.²¹⁶

Supplementing the recordkeeping obligations of securities markets, 17 CFR § 242.1002 instructs them to *notify the SEC of system disruptions*, compliance issues and intrusions, thereby drawing issues potentially related to AT in general, and HFT in particular, into the attention of the authority. If it were to find that closer scrutiny is needed, more intel could be gathered by the issuance of a subpoena. In a corresponding process in the futures markets, the proposed 17 CFR § 1.84(b) would allow the CFTC to *gain access to code repositories by a special call*, presumably less stringent than the process of asking for a subpoena.²¹⁷

²¹⁶ See U.S. Securities and Exchange Commission, *Consolidated Audit Trail: Final Rule*, p. 88, note 241, <<https://www.sec.gov/rules/final/2012/34-67457.pdf>>, accessed November 20, 2016.

²¹⁷ See U.S. Commodity Futures Trading Commission (n. 7), p. 47-60. See also the proposed 17 CFR § 40.26, regarding requests, by the CFTC, for information and data on participation in market making schemes.

Lastly, market participants who do not adhere to the rules applicable to them may both *face sanctions and lose their registration*. This is, however, nothing new, as the rules are the same for regular traders, albeit referring to other obligations.²¹⁸ Like earlier, it can thus be concluded that the US rules are rather alike those of the EU. Most ATs shall be registered and keep records, whereas the markets are obligated to record trading activity, maintain own records of risk controls and monitor trading activity. Likewise, there are means to get access to the source codes used by traders.

3.4.4.6 Measures Increasing Transparency

Left over after the hitherto conducted examination are a few rules meant to bring transparency, and thus confidence. As regards securities markets, primarily 17 CFR § 242.1002(c) is of interest. It states that *information about system disruptions, compliance issues and intrusions shall be disseminated* to those affected thereby – including all participants if the incident has affected critical functions of the market systems.²¹⁹ Anyone participating in the trade in securities may therefore gather data on incidents affecting it, allowing an evaluation of the exchange traded in to be performed.

Correspondingly sparse are the rules demanding transparency for futures markets included in Regulation AT. The proposed 17 CFR § 38.401(a)(1), for instance, requires markets to *make available information on the specifications of their electronic trading systems*, “including but not limited to those pertaining to the operation of its electronic matching platform that materially affect the time, priority, price, or quantity of execution, or the ability to cancel, modify, or limit display of market participant orders”.²²⁰ In addition, the proposed 17 CFR § 40.25 stipulates that a market publicly submitting a rule, *detailed a market making scheme*, to the CFTC, shall, amongst other things, describe the purpose of the scheme, the eligibility criteria, the benefits offered and the measures for participants to meet. Markets shall consequently provide participants with data, related to HFT, deemed necessary in the choice of venue.

²¹⁸ See 7 U.S.C. § 13-13c and 15 U.S.C. § 78u and 78ff.

²¹⁹ See also 17 CFR § 242.1000, providing definitions of “SCI events”.

²²⁰ See U.S. Commodity Futures Trading Commission (n. 7), p. 477 f.

4 Analysis

4.1 Structural Clarifications – Where Previous Parts Fit in the Analysis

Repeating again what has been stated several times before, the purpose of this thesis is to examine the potential effects of the newly adopted and upcoming EU and US measures adopted and proposed in response to the proliferation of HFT. After an extensive account of the objectives assigned to the markets, the effects of HFT and the content of the relevant financial markets law, it is possible to proceed with such an undertaking. To avoid leading off from a state of confusion, an explanation, adding to that presented in the section on methodology, of how the previous parts connect to the analysis and how it is structured, ought first to be presented.

Since it is not possible to deliver any final judgements on overall suitability before the specific effects and their implications are known, the analysis has had to be split into three main parts. The first examines the potential effects and suitability of the specific measures dealing with HFT in terms of metrics and related concepts. It thus indicates how market efficiency is affected, primarily according to the rules laid down in section 3.2, on market quality metrics. Seeking to make the proposed effects more comprehensible, the second part then investigates what implications they may, cumulatively, have on the specific functions of the markets, for individual participants. To achieve its aim, the section summarily compares the total findings of the first part with those of section 3.1.7.3, on the different types of markets and instruments. Concluding the analysis, the third part then applies the findings of sections 3.1.4, 3.1.6, 3.1.7.1 and 3.1.7.2, regarding more general market objectives, on the conclusions of the first two parts of the analysis, trying to determine if the measures adopted, can, in their entirety, be expected to live up to the objectives explicitly and implicitly set by the legislatures. As there are not that many material difference between the two jurisdictions, there will not be that many opportunities to conduct comparisons. In order not to let this affect the quality of the thesis, suggestions of better solutions will instead be made when available.

4.2 The Effects and Suitability of Specific Legal Measures

4.2.1 Some Fundamental Assumptions

Throughout the analysis, those participating in the trade in financial markets are presumed to act in what they assume is their best interest. For the better part of the particular community, this translates into *maximal economic growth, within some specific timeframe*.²²¹ As the purpose of this thesis is not to give a perfectly accurate picture of the interests of every single participant, the intention shared by most is presumed to be the prevailing and others are not investigated further.²²² This, naturally, renders the conclusions drawn a tad bit imprecise in some cases, but should, on the whole, not cause any material flaws. Those moving the largest sums of capital have, most often, acquired them intentionally and do, after all, have the greatest powers to influence the functionality of the exchanges – which are nothing else than networks allowing valuables to change hands.

4.2.2 Defining the Suitable Order

Going on a normative rant would not be possible without some sort of basis for assessment. As should by now be known, the financial markets form a hub of sorts, meant to enable an *effective allocation of resources, leading to an optimal use thereof and, ultimately, economic growth also on a societal level*.²²³ More precisely, the markets serve investors, seeking to exchange funds at one point in time for funds and interest at another; and borrowers, both sharing the intention of investors and, in relation to them, having the inverse interest. In other words, investors supply borrowers with funds expecting a return on investment (commonly referred to as “ROI”) greater than that offered by alternative opportunities of investment and borrowers seek funds expecting an investment opportunity to produce a return greater than the interest paid to the investor/lender, which should be lower than that requested by others.²²⁴

What markets can do to promote an optimal allocation of resources has also been discussed in sections 3.1 and 3.2. Recounting what was then said, the foremost responsibility of marketplaces,

²²¹ Cf. section 3.1.7.

²²² Note that this is not the same as saying that they will succeed in their quests or, for that matter, be better of making the decisions they make. Cf. Frank, *Microeconomics and Behavior* (8 ed., McGraw-Hill/Irwin 2010), p. 55-94 and 237-262.

²²³ See section 3.1.7.

²²⁴ See Levinson (n. 1), p. 1-13; Berk (n. 88), p. 352-354.

of all types, is to *ensure that total transaction costs are kept to a minimum*. Information should be easily accessible and correct, while the execution of orders needs to be predictable and inexpensive. Combining the assumed characteristics of market participants with the suitable market order, a pattern of regulatory and systemic simplicity thus appears. The legislature should only intervene if the main market efficiency metrics – liquidity, volatility and confidence – are not at optimal levels due to being negatively affected by some phenomenon. So long as that is not the case, legislative continence is advised – especially considering the costs intimately linked to compliance with extensive regulatory requirements.²²⁵

4.2.3 Potential Effects of the Measures Meant to Control the Conduct of HFTs

4.2.3.1 Prohibitions Against Market Abuse

Any effort to prevent abusive market behaviour might seem like a noble commitment. Very few participants ought to have any form of interest in being subject to abuse and those engaging in it, logically, should not be worth protecting. In actual fact, the effects of any provision are, however, not primarily dependent on the adjectives used to describe the behaviour controlled. Assuming that the prohibition of strategies dubbed abusive should, automatically, lead to a decreased volatility, or a change in whatever other metric is used, would therefore only reflect an incorrect procedure.

As regards the EU and the US measures prohibiting market abuse, the common denominator, when speaking of HFT, appears to be an interest in preventing the use of orders not meant to go through, creating a misleading picture of supply and demand and falsely affecting price levels, or delaying trading by overloading market systems. At the surface this might seem like a well-thought-out idea, in view of it *prohibiting several manipulative strategies* found to increase volatility, to decrease liquidity and to lower confidence. Digging deeper, more consequences, of a less abundant nature, do, however, emerge.

²²⁵ Considering the objectives of the markets, it is rather obvious that the costs and benefits must be measured in terms of allocation efficiency and that no extraneous factors may be allowed to affect the decision whether or not to regulate.

Firstly, the wording of both the EU and the US measures²²⁶ appears to *prohibit quote flickering* – the rapid sending, altering and retracting of orders – if it is found to disrupt or delay trading and to make the identification of genuine orders more difficult.²²⁷ This could prove troublesome as quote flickering is not only associated with manipulative trading, but also part of several highly beneficial strategies.²²⁸ Most importantly, those engaging in market making continually change their quotes to avoid becoming victims of adverse selection. If²²⁹ they were disallowed from doing so, liquidity could be presumed to fall and volatility to rise, while the reduced adverse selection costs for those involved in the process of price discovery would likely vanish, resulting in a decreased market efficiency.²³⁰

Secondly, although somewhat extenuated above, the standalone effects of labelling some conduct abusive, should not be underestimated. When ambiguous actions, performed by profitable entities, are condemned by the legislature, those lacking insight often presume the worst. Thus, even if the more beneficial forms of trading, only having some point of contact with those prohibited, were to be left materially unaffected, the wider population could, due to a lack of knowledge and a reliance on second-hand material, form *negative opinions of AT not called for* and, in consequence, act in a manner utterly irrational and harmful – chiefly by retracting funds from the markets to invest them elsewhere, thereby reducing liquidity. Preventing such effects from arising should be considered just as important as averting harmful actions in the first place, wherefore the choice, of both regulators, not to explicitly exclude certain beneficial strategies can be regarded as quite alarming. Nevertheless, it should be confessed that neither legislature has endless

²²⁶ Referring to art. 5 and 7 MAD II; art. 12, 13 and 15 MAR; 15 U.S.C. § 78i and 78j; the Interpretative Guidance and Policy Statement on Disruptive Practices (with regards to 7 U.S.C § 6c(a)(5)).

²²⁷ An effect highly contingent on the capacity of market systems, which is beyond control of individual traders.

²²⁸ See sections 3.3.3 and 3.3.5.

²²⁹ Predicting how the rules will be interpreted is at this moment rather difficult. As noted in n. 227, whether delays will be caused by high message rates depends mainly on the capacity of order matching systems and the total system loads, which cannot be controlled by an individual participant. Furthermore, determining the *actual* mens rea of a computer or its owner ought to be hard.

²³⁰ Cf. section 3.3.3.1.

powers to affect the opinions of those either directly or indirectly participating in the trade. Anyone feeling threatened by a development will oppose it²³¹, notwithstanding its compatibility with superior legislative objectives. The only thing definitely laying within reach of the legislature is the phrasing of provisions, beyond that works like this and the reporting of tabloids should probably be considered most influential.

4.2.3.2 *Market Making Agreements and Incentives*

If the prohibition of abuse should be regarded as a condemnation of specific strategies, then the rules applicable to the operations of markets makers ought to be regarded as a praising. The call for agreements, specific to the EU, and the more general demand for continuity, also present in the US system, undoubtedly reflects an appreciation of the services provided by market makers.²³² That should, though, as the previous section tells, not be taken as a pretext for a general favouring of ATs employing a market making strategy.

Especially within the EU, the new measures could prove more prone to discourage market making than to promote it. What calls for said conclusion is the dissuasive effect of force. Once those previously free to act as they choose are forced to enter into agreements, they have to account for an additional risk, linked to the obligation to provide liquidity under conditions potentially not ideal. Unless the incentives offered outweigh the value of this uncertainty, the regulatory change would only make the strategy less attractive. Considering also the requirement that liquidity be provided on a continuous basis, albeit not in times of utter chaos, and the prohibition of particularly beneficial contracts, there is an obvious *danger of a reduction of market makers and thus liquidity*, if HFTs switch to less advantageous tactics, generating larger profits, while not being equally favourable, if not destructive, to others.²³³

No matter how bad the effects of force may be, relentlessly spewing hostility on the adopted and proposed solutions would not be entirely fair. Aside from the possibility that HFTs currently

²³¹ In the specific case it must be mentioned that many of those complaining are not harmed by a process countering overall market efficiency, but rather made subject to competition previously absent. In that capacity, they often provide services less efficient than those offered by ATs, wherefore their complaints need to be taken with reservation.

²³² See art. 17.3 and 48 MiFID II; 17 CFR § 242.1001 and 1004; proposed 17 CFR § 40.28.

²³³ Cf. Detrixhe, *High-Frequency Traders Catch a Break in EU Market-Making Rules* (Bloomberg 2015), <<https://www.bloomberg.com/news/articles/2015-09-29/high-frequency-traders-catch-a-break-in-eu-market-making-rules>>, accessed December 14, 2016.

making the markets were to find the incentives provided sufficiently valuable to continue providing liquidity on terms decided by contract, the actual substance of the demands imposed is worthy of closer scrutiny.²³⁴

To begin with, it is hard to see how anything negative would follow from the general obligations to maintain incentives promoting orderly conditions, present in both jurisdictions. Unless the rules are misinterpreted, they should not contribute to anything else than an increased market efficiency, as that is exactly what they call for. Additionally, the decision to address the formation of incentives, rather than trying to create more specific rules commanding a predetermined mode of implementation, could prove very clever indeed. By avoiding to interfere with the means of reaching market efficiency, in detail, the regulations *allow for diverging tactics and, thus, progress through competition*. Had it been different, such opportunities would be absent and the varying degrees of force faced by market making ATs would have been far greater.²³⁵

In sum, the effects of the measures therefore depend on the incentives in fact provided, the exact definition of “exceptional circumstances” and the available alternatives, in terms of strategies. Seeing that some tactics formerly used are already forbidden, with more prohibitions to come, it is far from unreasonable to expect some *expansion of market making*, so long as the terms set for it are reasonable and provided that quote flickering remains both legal and cost-efficient. Nevertheless, drawing any sort of definitive conclusions is, at this stage, not possible. It can be concluded that the EU markets would probably be better off without an element of force, which only creates reluctance towards the liquidity-providing strategy, but the whole truth cannot be uncovered until more time has passed.

4.2.3.3 Fee Structures Promoting Tranquillity

Taking into consideration the assumed consequences of the rules on abuse and market making, it should not be all that hard to understand what may follow from the provisions on fee structures,

²³⁴ Regardless of the lack of force in the US, it should be noted that many US HFTs active in securities markets have, voluntarily, entered into agreements to act as designated market makers – indicating that the interest in providing liquidity has not been affected to any material extent. Cf. Massa, *High-Speed Firms Now Oversee Almost All Stocks at NYSE Floor* (Bloomberg 2016), <<https://www.bloomberg.com/news/articles/2016-01-26/high-speed-firms-now-oversee-almost-all-stocks-at-nyse-floor>>, accessed December 14, 2016.

²³⁵ Cf. what is said about competition in section 3.3.5.4.

coming to the EU.²³⁶ *If the fees levied for certain forms of interaction, like cancellations, are raised, the strategies reliant on those will become less desired*, relative to alternative ones, forcing the participants employing them either to seek other means of trade or to alter some specific parameters of the tactics used to avoid having their profitability significantly lowered.²³⁷ As manipulative activities are already forbidden, the obligations ought mainly to affect market makers, continually updating their quotes to reflect changes in price and thus cancelling large numbers of orders. This probably will not lead to an increase in liquidity and should not be expected to reduce volatility. Instead, increased fees for cancellations ought to amplify spreads and to decrease the depth of liquidity – all in consequence of traders trying to avoid costly adverse selection and to raise their margins to compensate for a reduction in the number of trades.²³⁸ Another outcome is, however, not unthinkable if the condition that only disorderly trading be prevented is interpreted according to the findings of current research. Expecting that to happen might, judging by the aforementioned provisions and some of those to come, however, be a bit farfetched.²³⁹ A better solution would therefore, probably, be to simply leave the fees be. Adding another layer of “protection” to that already in existence, being at risk of harming market efficiency, cannot be considered an optimal solution.

Analysing the US measures is a bit harder since there are no specific ones directly relevant to HFTs. The rules put in place by Regulation NMS only limit the upper levels of fees and therefore should not have any greater effect on markets subject to competition, unless the costs of operating an exchange were to rise steeply to levels where the fees cannot cover the expenses.²⁴⁰ Until

²³⁶ Referring to art. 48.9 MiFID II.

²³⁷ Cf. Frank (n. 222), p. 96-120.

²³⁸ As is noted in section 3.3.3.1.1, HFTs employing market making strategies rely on executing large numbers of trades, since the spread is kept as small as possible. That dependence on volume will only grow with time, due to competition constantly increasing.

²³⁹ Throughout the entire sum of legislation, the legislature gives the impression of wanting to prevent quote flickering and the like, regardless of it being found to have a positive net impact on market efficiency by contemporary research. It therefore seems wise to assume that the legislature, at present, holds such actions responsible for disorderly conditions. With that not said that it would be impossible to argue for another interpretation.

²⁴⁰ Cf. 17 CFR § 242.610(c).

then, mainly changes of the best execution policy introduced by the same regulation, discussed below,²⁴¹ should help prevent harmful effects of HFT.

4.2.3.4 *Tick Size Regimes*

Likely to reduce intraday message rates, and thus to make HFT less attractive, are also the EU and US measures requiring certain minimum tick sizes.²⁴² When small-scale changes of quotes are allowed, traders may “jump the queue”²⁴³ at costs lower than those incurred when ticks are bigger. As smaller ticks also allow traders to come closer to the limits of their valuations, quotes will be changed more often than otherwise when ticks are small.²⁴⁴ In theory, such opportunities for optimisation should lead to a more accurate pricing and, thus, a more efficient allocation of funds. Regardless of how true that is, there are more factors to consider.

Additional orders equate additional costs, due to an increasing load on trading systems, necessitating higher computational capacities. If the marginal costs, following from investments in hardware and the like, were to exceed the marginal utility, of a more efficient allocation, further reductions of tick sizes should be avoided. In case the opposite is true, it would, however, be better to further reduce them.²⁴⁵ Owing to the impossibility of determining how the marginal cost and utility curves will develop in advance, both jurisdictions would be better off leaving the decisions to the exchanges, who would then have to identify the equilibrium in competition with others. Thus, it should for now be enough to note merely that tick sizes matter.

²⁴¹ See section 4.2.7.3.

²⁴² See art. 49 MiFID II; 17 CFR § 242.612.

²⁴³ To be read as “have their orders put first in line to be executed”.

²⁴⁴ Cf. Frank (n. 222), p. 96-120.

²⁴⁵ Cf. Frank (n. 222), p. 4-15 and 83 ff.

4.2.4 Potential Effects of the Measures Intended to Minimize System Failures

4.2.4.1 General Risk Controls

Far less problematic than the provisions meant to affect the strategic choices of HFTs is the sum of rules forcing ATs to implement risk controls ensuring that their systems do not generate erroneous trades or contribute to disorderly market conditions, present in both jurisdictions.²⁴⁶ Luckily, most ATs *already have such arrangements in place*,²⁴⁷ as it is in the interest of no one to send erroneous orders to markets.²⁴⁸ An additional burden of compliance consequently should only arise if some definition of “orderly market conditions” effectively disallowing any activity necessary for HFT to work were to be implemented or if any implementing measures to come²⁴⁹ were to be too strictly construed, in a fashion less efficient than any potential alternative.²⁵⁰ Such a strict order could also cause other issues.

Those forced to apply the regulation might start prioritising regulatory compliance over actual system performance, potentially causing them to develop inefficient risk controls. Along similar lines, the probable inflexibility of the rules could, in itself counteract competition and inventiveness, likewise leaving those regulated and other participants worse off. Expressed in different terms, traders could falsely believe themselves to benefit from implementing only an absolute minimum of risk controls or feel hindered from improving their systems by reason of a fear of reprisals. Like the other rules adding an extra layer of protection on top of the existing incentives not to engage in market abuse, the need for the obligations could thus be questioned. Unless others, who are not to blame, are hurt by the use of insufficient risk controls, the loss of money suffered by those using incomplete AT systems would only be tantamount to a subprocess of natural selection, beneficial to overall market efficiency by weeding out irrational traders from the markets. Consequently, as the rules are currently construed, HFTs might, in the worst case scenario, develop inefficient, but legally satisfactory, risk controls and have to increase

²⁴⁶ See art. 16 and 17 MiFID II; 17 CFR § 240.15c3-5; 17 CFR § 1.80.

²⁴⁷ See Tata Consultancy Services, *High Frequency Trading: Enforcing the Right Controls*, p. 6, <http://www.tcs.com/SiteCollectionDocuments/White%20Papers/Consulting_Whitepaper_High-Frequency-Trading_1212-1.pdf>, accessed December 5, 2016.

²⁴⁸ As a rather famous example of what can happen when things go wrong, the malfunction of the system once used by Knight Capital may again be mentioned. See section 3.3.6.2.2.

²⁴⁹ Cf. for example art. 17.7 MiFID II.

²⁵⁰ This is particularly true of the US rules, dictating a particular configuration of controls. See section 3.4.4.3.

their margins to cover added compliance costs, which would risk increasing volatility and lowering the tightness of liquidity; and in the best case scenario simply implement processes they would otherwise not have in place, strengthening their resistance and reducing volatility.

4.2.4.2 *Business Continuity Arrangements*

Differing slightly from the general rules on trading system risk controls, the provisions on business continuity arrangements, likewise present in both jurisdictions, deserve a separate exposition.²⁵¹ Since they are at risk of forcing HFTs to create schemes ensuring a continuous participation in market activities even under circumstances when that may not be of interest, they could, like forced market making agreements, give rise to *competitive disadvantages*, which those entities would have to compensate for elsewhere. If, however, no such mistakes in the interpretation and implementation of the rules was to be made, which is, unfortunately, rather unlikely,²⁵² there should not be any reason for concerns.

4.2.5 **Potential Effects of the Measures Aimed at Increasing Market Resistance**

4.2.5.1 *Pre-Trade Risk Controls*

The general obligations of markets to incorporate systems fostering stability could be expected to have effects comparable to the rather alike conditions faced by ATs. For that to be entirely true, markets would, however, have to fulfil purposes at least analogous to those of traders, who are predominantly moving capital. Since markets “only” bring together participants with inversely related interests, and thus do not take part in trading, the functions of the two types of entities are, in fact, not at all equal, wherefore the effects should instead be presumed to differ greatly.²⁵³

Unlike individual traders, having limited powers to harm others, unless they engage in market abuse, market operators can, without effort, cause trouble for the economies of entire nations and beyond. The reason for this is, quite simply, the far grander number of counterparties with whom they interact and contract. Whereas HFTs are only in contact with other investors and, of

²⁵¹ Referring to art. 16 and 17 MiFID II, 17 CFR § 240.15c3-5 and proposed 17 CFR § 1.80.

²⁵² The intention evidently is to change the current order, where HFTs have the right to cancel trading at own discretion. Had it been different, no obligation would have been introduced.

²⁵³ Cf. section 3.1.7.

course, markets, market operators are involved in all trades conducted on their platforms. Moreover, markets are not nearly as interchangeable as traders. Regardless of the increasing competition and fragmentation of liquidity, it is harder to change market than to choose another buyer or seller.²⁵⁴ Many instruments are not listed on more than one exchange and even for those that are, the number of substitutes is limited. It can therefore be concluded that *individual participants, and the society at large, are in a considerably greater need of stable markets than stable counterparties in transactions*. A need for stable markets must, however, not be linked to a need for regulation regarding pre-trade risk controls. There are several ways to ensure stability, of which legislation demanding certain arrangements is only one.

What speaks against regulating risk controls principally is the menaces described in the previous section, being compliance costs,²⁵⁵ inflexibility and the danger of a blind faith in the competence of the legislature to foresee all needs of those controlled – all of which must be taken into consideration. In contrast to what is true of traders, there are, though, also some very notable advantages associated with forcing market operators to incorporate specific arrangements to counteract instability.

Firstly, as dysfunctional markets have more notable effects on the society at large, it is particularly important to secure *public confidence* in their soundness. One way of achieving this is to establish a rigid set of rules demanding that market operators minimize their exposure to risks by installing adequate system capacities, some ability to reject orders at risk of causing disorder and the provision of testing facilities.²⁵⁶ Due to a common misconception, according to which those working in finance are incapable of seeing the consequences of opportunism, such legislation should be more efficient in securing public trust than the equivalent self-regulation.²⁵⁷

Secondly, partly as a consequence of the need for confidence, some degree of regulatory fundamentals could help *promote competition*, by allowing market participants to invest their time in studying more important factors than the internal control systems of market operators when

²⁵⁴ Not that the identity of the buyer or seller would be of any actual importance in the first place.

²⁵⁵ It should be said that most markets, like ATs, already have prudent risk controls in place, wherefore compliance costs should mainly come from compliance reviews, not from the introduction of new arrangements, unless any implementing measures to be adopted were to be worded too strictly.

²⁵⁶ Cf. art. 18, 19, 47 and 48 MiFID II; 17 CFR § 242.1000-1004; proposed 17 CFR § 1.80 and 40.20-22.

²⁵⁷ Cf. Parliamentary Commission on Banking Standards, *Changing banking for good: First Report of Session 2013-14: Volume II: Chapters 1 to 11 and Annexes, together with formal minutes* (House of Commons London: The Stationary Office Limited 2013), p. 85-104, <<https://www.parliament.uk/documents/banking-commission/Banking-final-report-vol-ii.pdf>>, accessed December 15, 2016.

choosing between venues. The regulatory conditions could, however, also lead to a result far less coveted if to the rather worn out issue of defining orderly markets were to be dealt with in a sloppy fashion.

A flawed understanding of what constitutes a stable market is, also in this context, at risk of causing trouble in both jurisdictions. The rules requiring markets to establish systems rejecting orders surpassing pre-set thresholds could prove troublesome if they were tuned to hinder healthy quote flickering, or otherwise programmed to prevent traders from sending large quantities of intraday messages without devious intent. Furthermore, control measures, like circuit breakers, could cause certain instruments to be secured at unnatural price levels if they were to be set to intervene too often and thus hinder an efficient price discovery. In other words, sharp rises or declines should not, per se, be presumed to be the cause of wrongful trading in an environment where highly informed and fast HFTs figure and *temporary halts will never prevent the ultimate changes in price from occurring*. Systems better, for that reason, not be too firmly tuned, or else they will only make matters worse by creating bubbles.²⁵⁸

4.2.5.2 *Post-Trade Risk Controls*

Less controversial than most other measures are the post trade risk, or rather damage, controls. Obligating the institution of procedures enabling the adjustment of voidable trades is not likely to be perceived as revolutionary since such functions already exist.²⁵⁹ Besides, they are completely reliant on the existence of other rules, telling which trades shall be nullified, to have any function whatsoever. It is thus safe to say that the introduction of techniques to *limit the extent of damage done* should, on its own, only have positive effects, by limiting the impact of behaviour found harmful. In case the functions were to be used to clean up after incidents wrongly classified as destructive the opposite is, however, true. Some caution is therefore advised.

²⁵⁸ Cf. Gerding, *Law, Bubbles, and Financial Regulation* (Routledge 2013), p. 353 ff.

²⁵⁹ Cf. section 3.3.6.2.1.

4.2.6 Potential Effects of the Measures Meant to Facilitate Supervision

4.2.6.1 Authorisation and Registration of HFTs

Conditioning the participation in market activities of any trader on registration or authorisation could be presumed to massively facilitate supervision, partly by preventing unwanted traders from entering the markets before they have even had an opportunity to harm others, partly by making those registered or authorised subject to continuous reviews of compliance.²⁶⁰ However accurate this might be, there is, possibly, another side to the matter.

Requiring only some to register should, theoretically, give those not subject to the same scrutiny a competitive advantage – spelled lower compliance costs. Regardless of how bad this might appear at a glance, the changes brought about ought in practice to be rather insignificant. As was said in section 4.2.4, most HFTs already run risk controls, which is the perhaps most notable change following the new system. *No significant compliance costs, otherwise absent, should thus arise by virtue of the obligations to register present and suggested in both jurisdictions.* Even more vital is, though, the fact – also brought into view earlier – that the absence of such requirements constitutes something of an exception.

Within the EU, where proprietary traders currently do not need to register, HFTs, who mainly invest own funds, are not subject to controls as rigorous as those faced by others having a matching degree of influence on overall market performance. The inclusion of HFTs in the group of registered investment firms consequently makes the *conditions for competition more even*, rather than imposing an additional burden on HFTs. On top of that, the *costs for the authorities to monitor compliance should fall* when they are made aware of which participants to review more closely and which not to.²⁶¹ That should, in turn, enable the authorities to lower any fees and taxes meant to cover their expenses, hopefully resulting in lower transaction costs.

Harder to justify are the US rules demanding that not only HFTs, but also those involved in the creation and maintenance of the trading systems, are authorised. Obligating the registration of

²⁶⁰ Cf. art. 5 MiFID II; NASD Rule 1032(f); 17 CFR § 1.3.

²⁶¹ The very reason why there are at all requirements for registration and authorisation is the higher efficiency of monitoring associated with knowing which participants to observe more closely on beforehand. Those aimed at are, naturally, the participants having an influence large enough to motivate the additional burden caused – that is those having a more positive impact on overall market efficiency when registered than when not.

programmers and others involved in the operation of HFT systems would be comparable to requiring those educating traders to register. As no such obligations exist, HFTs are in fact imposed an additional burden, constituting a competitive disadvantage, for which they will have to compensate. This could be acceptable if the overall efficiency of allocation was improved by the authorisation. As the requirements faced by HFTs still force them to prevent any system flaws, it is hard to see how additional obligations would be of any use.²⁶² The legislature would consequently be better off not intervening in the choices of programmers.

4.2.6.2 *Recordkeeping and Monitoring*

The outcome of ATs and markets in both the EU and the US being coerced to keep records on their arrangements to ensure compliance; on orders and transactions; and, in the case of ATs, on their source codes, depends on the relative value of those records – in the pursuit of compliance – compared to the cost of maintaining them. While the value is determined by the demand for such information in the monitoring and sanctioning, the cost is a product of storage prices. The obligation to stack up data can be costly – especially for HFTs, who are very capable of producing it – but should still be defensible on the same grounds as the requirements for registration. ATs are indeed able to affect the performance of markets and, as a result, *need to be as meticulously surveyed as other participants trading similar volumes*. If the storage of additional data is necessary for the monitoring, ATs should therefore be required to keep records of it. Moreover, public confidence in the soundness of markets ought to be improved if there is specific data to review, whenever that might be called for.

4.2.6.3 *Making Source Code Available*

In view of code repositories being of no use if the information stored in them cannot be accessed by the supervisory authorities, the EU and US rules allowing copies and descriptions, of the algorithms used, to be requested, could be presumed not to cause any hassle.²⁶³ Unluckily, it probably is not possible to be much more mistaken than so. Source codes are the holy grail of automated

²⁶² No additional incentives to hire only the best are needed.

²⁶³ Cf. art. 17.2 MiFID II; proposed 17 CFR § 1.84.

trading, worth staggering amounts of money and protected dearly.²⁶⁴ If they were to be made available to others than their owners, who are not prohibited from using them, they would soon become pointless.²⁶⁵ For that reason, their proposed accessibility *has had many concerned*. The general trust in the ability of authorities to keep trade secrets out of public is rather low and, in particular, the proposed right of the CFIC to request information on codes used by a special call has therefore caused some turmoil, which might be worsened by the realisation that easily accessible information is likely to be regarded as less sensitive than that more heavily protected.²⁶⁶

To tell whether or not any harm will actually come is, if not impossible, then at least quite difficult. Thereby not said that a prediction of effects would be out of reach. A general fear of requests could be met with attempts to falsify records and the hiring of lawyers, as well as other compensatory measures in preparation for the worst possible outcome – a leak of code. It could, however, also lead to a zealous adherence to rules, which ought in most cases to be good. What decides the definitive result ought, as always, to be the relative costs and benefits associated with each option.

4.2.6.4 *Sanctions and Withdrawal of Authorisation*

Being more reliant on the interpretation of other provisions than any other rules, the possibilities to sanction both natural and legal persons and to withdraw authorisations will exaggerate, or bring into existence, the effects already stated above, partly by *discouraging particular activities*, partly by *preventing the continued participation in market activities* and by *making other effects more palpable*.²⁶⁷ To exemplify, a HFT knowing that market abuse can lead to sanctions and a loss of authorisation will be more likely to follow the rules than one knowing that such penalties are absent. If such an

²⁶⁴ Cf. Dolmetsch, *Flash Boys' Programmer in Goldman Case Prevails Second Time* (Bloomberg 2016), <<https://www.bloomberg.com/news/articles/2015-07-06/-flash-boys-programmer-in-goldman-theft-has-charges-tossed-out-ibrz5tyj>>, accessed December 6, 2016.

²⁶⁵ All trading strategies are dependent on some momentum of surprise. If the coded strategy of someone is known, others can predict its every movement and act accordingly, to impose it additional costs without necessarily improving efficiency. Furthermore, any incentives to try optimising the code used, and thereby making allocation more efficient, would vanish, to the detriment of society at large in its quest for economic growth.

²⁶⁶ See Levine, *Source Code and Chicken Indexes* (Bloomberg View 2016), <<https://www.bloomberg.com/view/articles/2016-11-07/source-code-and-chicken-indexes>>, accessed December 6, 2016.

²⁶⁷ Cf. art. 8, 22, 44, 70 and 71 MiFID II; 7 U.S.C. § 13-13c; 15 U.S.C. § 78u and 78ff.

entity were to harm others by disobeying some rule, it could also be prevented from causing further losses in the future.

4.2.7 Potential Effects of the Measures Intended to Affect the Behaviour of Others

4.2.7.1 Transparent Terms for Co-location, Market Making and Execution

To anyone living in a democracy, at all debating the effects and value of transparency might seem pointless. Recalling what was said of the requested availability of algorithms, it should, however, be clear that appearances may deceive. Market operators, who happen to be the subjects of the rules – within the EU requiring that the terms of co-location and market making are transparent and fair, and within the US demanding that market making and the rules guarding execution are fair and made public – do not have that many features in common with governmental institutions.²⁶⁸ Assuming, without further, that markets would, at large, function better when forced to uncover particular aspects of their operations would, for that reason, be methodologically incorrect.

When determining the effects of all provisions on transparency, the value of secrecy must be compared to that of knowledge. At the core of the comparison is the *need for protection of ideas* and the *need for a complete decision support*. Market operators cannot be expected to invest their time and money in research and development of products that do, at their height, amount to ideas, if they cannot make certain that those ideas will not be borrowed by others, pocketing portions of the potential proceeds that would have made the whole process profitable. At the same time, potential market participants cannot make the right decisions without correct and complete information. There are of course plenty of occasions where the interests do not collide. Some information sensitive to markets may be considered irrelevant to participants, or only cause confusion, while markets may indeed be eager to make information that speaks to their advantage known by all potential benefactors, who obviously require it in their decision-making processes. Even so, there is a massive grey area, where it is unclear whether the end result, measured in efficiency of allocation, will be positive or negative. Determining where the proposed changes fall requires further investigation.

First, as regards co-location, the foremost benefits would come to participants who are not using the services, as those who do can be presumed already to have insight into the terms of the

²⁶⁸ Cf. 48.8 MiFID II; 17 CFR § 242.1002(c); proposed 17 CFR § 38.401(a)(1) and § 40.25.

different markets – albeit not into the terms of other contractors. For the wider, unknowing, collective of potential market participants, the value would lay in an understanding of the conditions for HFT, necessary for an evaluation of the available exchanges. Due to the common hatred of HFT, such knowledge could prove particularly important in the efforts to combat the misconceptions seemingly rife amongst participants suspecting that HFTs, and other ATs, are given unfair advantages.²⁶⁹ Besides, as the terms *ought not to be considered a competitive advantage – or disadvantage – for any market, if they are no known*, it is hard to see how any sort of harm, at the end impairing market efficiency, would arise from transparency, provided that there is no material risk for misunderstandings. Accordingly, the calls for transparency should be considered to conform with the superior objectives and thus be of benefit to the whole market system.

The same conclusion may be drawn with respect to market making. Unless the market operators intend to deceive their clients, and thus the whole society, they should not be harmed by transparency, wherefore the increased openness ought to be considered positive. Rather unsurprisingly, also public insight into the mechanisms for execution should be of significance to those trying to choose between venues. If, for instance, one market offers order types permitting some to gain an advantage over others, those at risk of being wronged would likely be better off knowing that in advance. Cumulatively, the measures seeking to bring transparency discussed in this section should therefore be deemed highly suitable, if not else, then at least by reason of their purported ability to increase confidence.

4.2.7.2 *Limits to the Use of Dark Pools*

Bearing in mind the critiques of and fear for dark pools, as well as the potentially positive net effects of their use, the difficulties of establishing the effects of the new EU provisions, limiting the volume of instruments traded in dark pools, should be evident.²⁷⁰ What needs to be considered in the calculation of consequences is both the importance of protecting those at risk of being

²⁶⁹ Regardless of how unfair terms might once have been, abuse of the kind should, under the stricter laws both in place and to come, no longer occur, to any material extent. Cf. Hope, *Lawsuit Against Exchanges Over 'Unfair Advantage' for High-Frequency Traders Dismissed* (The Wall Street Journal 2015), <<http://www.wsj.com/articles/lawsuit-against-exchanges-over-unfair-advantage-for-high-frequency-traders-dismissed-1430326045>>, accessed December 16, 2016; Rubenstein, *This High-Speed Trader Says Thanks, Regulators* (The Wall Street Journal 2015), <<http://www.wsj.com/articles/this-high-speed-trader-says-thanks-regulators-1429832042>>, accessed December 16, 2016.

²⁷⁰ Referring to art. 3-11 MiFIR.

preyed on and the value of accurate data on supply and demand for other participants. The element ultimately deciding the preferable outcome of the unavoidable balance act, between secrecy and publicity, will, most likely, be the extent to which each interest influences the aggregate efficiency of allocation. This, in turn, varies with the value of the instruments optimally allocated by virtue of the specific order chosen, and what the outcome of every alternative order would be. Expressed differently, if the value of the instruments being optimally allocated when traded on dark pools exceeds the value of the instruments temporarily held or traded inefficiently, and no more effective alternative scheme exists, then the limits adopted should be considered ideal – and otherwise not. For the calculation necessary to be executable, insight into the relative values of secrecy and openness would be needed. Due to such data being absent, it is, in this context, not possible to do more than to indicate what to consider when assessing the rules, meaning that no definite judgment may be presented without further research into the matter.

4.2.7.3 Best Execution

Since the EU and the US rules on best execution have yet to be altered in any material respect, there is not much to add to the description presented in section 3.4.2, on the first generation legislation.²⁷¹ Maintaining an order as strict as the US one, which enables HFTs to engage in predatory arbitrage, obviously will only lead to a continued use of such techniques, while the more flexible solution of the EU still should not be expected to father any systematic incentives for HFTs to employ predatory arbitrage trading strategies. Translated into metrics, the EU approach should thus lower transaction costs for larger traders, allowing them to contribute to an increased depth and a lower volatility, while the US solution will most likely contribute to a decreased confidence within the same group, resulting in a smaller depth and an increased volatility.

4.3 The Cumulative Effects for Individual Participants

Given the variance in effects and suitability of the measures, as well as their sheer number, seeing how the function of exchanging money at one point in time for money and benefits at another could be perceived difficult. As a matter of fact, it is, however, rather simple. The availability of lending and investment opportunities depends on the willingness of potential investors, which is, in turn, contingent on the efficiency of the markets, measured in metrics. In other words, when

²⁷¹ Cf. art. 27 MiFID II; 17 CFR § 242.600-612.

the metrics are improved, the quality of the functions sought after by individual investors will rise, leading to an increased use of the markets.

Of the measures dealing with HFT, positive effects should, primarily, follow the requirements for registration; the prohibition of abuse; the obligations to keep certain records; and the demand for transparency, faced by markets. As explained above, when abusive behaviour becomes easier to identify and prevent, confidence and liquidity on secondary markets rise, as the general willingness to invest increases and the need for margins drop, causing volatility to fall. For individual participants in primary markets, this *makes the acquisition of capital less expensive due to lending or investing being associated with lower risks.*²⁷²

The main issues with the new legislation, countering the positive effects, are the forced market making agreements, to be implemented in the EU; the fee structures likely to raise the costs for most HFTs; the, perhaps, excessively detailed rules on risk controls; the proposed rules making source code too easily available; and, potentially, the limits to dark trading. Seeing that aspects of HFT found to have a positive impact on total market quality are counteracted by the increased direct and indirect costs faced by such traders, and that the development of markets is hindered by the limitations to venue competition, the rules aimed at should cause liquidity to fall and volatility to rise on secondary markets, by compelling HFTs to increase their margins/spreads and to change beneficial strategies for disadvantageous ones, not forcing them to enter into agreements. When the decay spreads to primary markets, the *cost of capital will rise, because of the increasing risks related to investing and lending.* Whether or not the negative effects will outweigh the positive is, at this point, not possible to tell, since it would require data on the relative value of the advantages and disadvantages to be expected, not available in a form suitable for this thesis. As has been explained before and will be elaborated further in the following section, it should, however, be sufficient to conclude that the solutions chosen are not the best ones available. The legislatures ought, in other words, not to avoid critique only because the net value is positive if alternatives have not been accounted for.²⁷³

²⁷² See section 3.1.7.3, on how primary and secondary markets interrelate.

²⁷³ As always, a positive NPV (Net Present Value), with opportunity costs included, is the only acceptable predictor of suitability. All decisions have alternatives, which can – regardless of it, at times, involving rather complex conversions – be valued according to some common unit of measurement.

4.4 The Overall Suitability of the Regulatory Response

4.4.1 The Core Objective

Examining the findings of the hitherto conducted analysis, at what ought to resemble a macro level, requires, yet another, brief reminder of the objectives. For markets to function optimally, *participants need to be provided with all tools necessary to freely act in a manner mirroring that of an informed individual sharing their preferences.* Said objective, which translates into a focus only on making the allocation process better represent the believed interests of market participants, stands in contrast to any sort of intervention not intended to allow more informed decisions to be executed in a predictable manner. When applied to the regulations adopted in response to HFT, the criterion helps separate between rules that are, and rules that are not, suitable. It does not exclude all legislation that is not directly aimed at increasing the information value of market data or at facilitating execution, as some rules seemingly distant, in fact, have a rather great significance for the efficiency of allocation. Such are, for instance, those requiring that records of certain kinds be kept, which do not have an immediate effect on the efficiency of allocation, but indirectly improves it by allowing authorities to keep fraudsters off the market. For those, indirectly relevant provisions, to be justified, *the net effect on the efficiency of allocation needs, as with directly relevant provisions, to be positive.* To understand what this means, and how informed individuals act, a repetition of what was said of the actual functions of markets is needed.

4.4.2 The Danger of Mixing Capitalism with Distributive Justice

As stated in sections 3.1.7.1 and 3.1.7.2, and more recently, section 4.3, individuals turn to the markets with an intent to satisfy their preferences. When deciding with whom to contract and with regards to what they compare all aspects of the available offers deemed relevant. This, evidently, does not always result in complete success, as the available data can be difficult to interpret or even incomplete – and indeed be may be hard to put to use. On the contrary, it does at times result in an allocation less optimal than the best imaginable. Regardless of that, trying to support the decision making of any participant, by steering it in any direction, will always be wrong, even if it were to prove successful in some particular case. It is, with the technology currently obtainable, not possible to read the thoughts of every market participant and to simply decide for them. Instead, traders will have to be presumed to better know how best to satisfy their own preferences than others. The rules affecting HFT therefore should, as stated above, *only ensure that participants are not inflicted harm by being misled or being hindered from acting as they see fit and never*

alter the ultimate outcome of the trading process. There is no predetermined distributive pattern for markets to generate, wherefore *the competitive advantages of HFTs, or others, should not be impeded in a quest for fairness* – or whatever other concept, lacking relevance, might be put forward. Instead, it should be respected that those who are, by means not causing others harm, most successful in their attempts to accumulate capital on the financial markets, have been of greatest service to others, who have freely chosen them as their counterparties.²⁷⁴

4.4.3 The Impact HFTs Can Actually Have on Overall Market Performance

Bearing the explanation of functions and incentives in mind, it is possible to decide which types of rules can, and which types cannot, be expected to have positive net effects on allocation. For the account to be fully comprehensible, some additional clarifications of the actual impact of HFT must, however, be made. Firstly, it should be remembered that *HFTs nearly only affect the performance of secondary markets* and thus should, as was concluded in section 4.3, not have any greater impact on the actual issuance of securities, other than by prompting the parties on the primary markets to alter their risk margins. Secondly, as HFTs *only engage in trading*, they can only impact the actual allocation either by making, or inducing others to make, more or less informed decisions to trade or by somehow hindering the efficient execution of orders. As explained before, their own decisions can be both informed and uninformed, although the greater part are very well informed, while the effects on others, both as regards the making and the execution of decisions, depends on the strategies used. If an HFT decides to spoof the market, it will, like any other participant sending false signals, reduce the information value of quotes – leading the prevailing market status further away from the efficient market hypothesis²⁷⁵ – and possibly lower the stability of order matching systems – resulting in a less predictable execution – whereby it makes it harder,

²⁷⁴ It could be argued that there is no opportunity to decide whether or not to contract with an HFT acting before there has been any real opportunity to consider how to handle a quote after some change in circumstances. That is, however, untrue. The existence of HFTs is no secret and anyone participating in the trade in financial markets is aware of the risks. Therefore, a decision has indeed been made, albeit at an earlier stage. This obviously does not render the allocation process flawed as there is always a risk of being subject to adverse selection or, for that matter, to invest in an instrument that does not live up to the expectations.

²⁷⁵ A theory stating that the price of an asset traded on a competitive market should reflect all relevant information available. See Berk et al., (n. 88), p. 294-300.

primarily for less talented participants, to act on an informed basis. The rules on HFT thus should only prevent HFTs from such behaviour as may deceive or hinder others.²⁷⁶

4.4.4 What to Make of the Law Reviewed

Against the rather extensive backdrop, and those provided by sections 4.2 and 4.3, seeing which rules should, and which should not, be presumed to forward the objectives of the markets ought to be far easier. The first category obviously includes the provisions prohibiting abuse, provided that they are not interpreted so as to cover healthy quote flickering; the rules demanding that traders are not presented with any incentives to misbehave, under the same conditions; the flexible measures obligating ATs to have in places risk controls; the correlating risk-mitigating rules for markets; the rules requiring registration of ATs; the provisions demanding that records, allowing abusive traders, sending misleading orders, to be identified and prevented from further impairing market performance, be kept; the measures presenting authorities with means to sanction those disobeying the provisions; and the rules requiring that information not sensitive to publicity be exposed. What unites all of the measures listed is the pursuit of an, either directly or indirectly, *increased value of market data and a more stable execution process*. They seek to ensure that orders not representing an honest intent to trade are not sent and that – if they were to be omitted regardless – their impact on market performance is limited.

Leftover for the second category, of unsuitable rules, are the provisions having some function not justifiable under the current market order. More precisely, the group includes the provisions forcing certain HFTs to enter into seemingly undesired agreements, regarding market making, or to otherwise trade under conditions not coveted; the rules on risk controls only adding an extra layer of unnecessary obligations; possibly the rules limiting the dark trading found beneficial; probably the requirements that source code be described and made available; and potentially a majority of the rules only just deemed suitable, if an improper definition of orderly markets were to be implemented. If they were to be described using some other common denominator than only their fairly vague incompatibility with the market objectives, then they should probably be depicted as a collection of measures intending to bring the end result of trading closer to an imaginary state of distributive fairness. They seek to protect manual traders and, seemingly, to make HFT less attractive.

²⁷⁶ HFTs should not be hindered from 'making decisions that harm themselves so long as those do not also harm others.

In conclusion, *the decisive factor in the assessment of aptness is the impact rules have on resource allocation.* Given that HFTs are, in the end, like all other traders, almost exclusively capable of affecting the information value of intraday messages; the results of the allocative process; and the stability of execution, it is rather obvious that any rules not likely to bring about more informed and accurate decisions are not called for. Thus, concluding that the measures seeking to minimise the competitive advantages and presence of HFTs, rather than increasing efficiency, are but an insult even to legal positivism,²⁷⁷ and that those with the opposite function ought to make anyone of service to other market participants better off, ought, all things considered, to be uncontroversial.

²⁷⁷ They do not seem to be compatible with superior sources of law and, thus, should cause some bitterness even amongst the strictest of legal positivists. Cf. Agell (n. 15), p. 37 ff.; Hellner (n. 12), p. 359 ff.

5 Concluding Remarks

5.1 The Verdict

On account of everything said up to this point, it can be concluded that the legal responses to the proliferation of HFT are not optimal. Some provisions should be expected to forward the pursuit of economic growth by improving the efficiency of allocation, as they respond to actual issues – such as abusive behaviour, found by research to impair market performance. Far too many others do, however, appear to conflict with reality, since they are at risk of countering positive effects of HFT, like the partially increased liquidity and decreased volatility.

Regardless of how vague the legislatures have been in their efforts to formulate explicit market purposes, it can, with some certainty, be concluded that only rules allowing individuals to more easily choose for themselves how to satisfy their needs for financing, at different points in time, are acceptable. Any attempts to include ulterior objectives are only likely to steer the end results away from said target, even if they can, with absolute certainty, be concluded to increase the efficiency and output of some particular sector of industry, or the wealth of certain market participants. This is due to the definition of economic growth – *in liberal jurisdictions like the EU and the US* – having its origin in the liberal concept of freedom as a minimisation of restrictions/invasions of privacy, which happens to be *incompatible with any form of intervention²⁷⁸ in the allocative process*, regardless of its purpose. However morally superior the legislatures might consider themselves when they adopted the measures “protecting” manual traders, they have, consequently, counteracted the greater aim of allocative efficiency and economic growth, by acting as redundant guardians, preventing individuals from making the most autonomous/free decisions possible and from distributing wealth *according to their preferences*. This reality is by no means altered by the need to ensure confidence in the markets, as those who speak the loudest often have nothing to say.

Confidence is, of course, extremely important, since it is the only factor – apart from a supply and a demand – that must exist for voluntary transfers of capital to occur. If, however, the level of confidence does not reflect the actual efficiency of markets, and it only exists amongst *relatively* unimportant market participants with limited assets, it is utterly worthless. This is, firstly, because

²⁷⁸ To be read as “an action making it harder for an individual to act autonomously, which seeks to achieve a pre-defined end result”.

those transferring the largest volumes have the greatest impact on the ultimate distribution and, secondly, because any transfers occurring on a market that is not efficient will – provided that there is a better alternative – only lead to a less optimal allocation and a lower total value of benefits produced/preferences satisfied than that which would follow the best possible solution. Put another way, listening to the voices of those either not having any insight into the actual serviceability of markets or seeing their own wealth decrease due to HFTs outcompeting them – by being more efficient and, thus, capable of bringing their counterparties greater benefits – is only likely to impair market aptness. The newly adopted and proposed rules that will solely produce joyful feelings amongst ignorant persons and outcompeted manual traders consequently should not be considered appropriate and most likely will not improve market efficiency. Determining, with absolute certainty, what has caused the uncanny state would necessitate the authoring of another thesis. If the requirement for precision is lowered slightly, some highly qualified approximations may, though, be made.

5.2 A Possible Explanation

To begin with, it should be recognised that both legislatures have been forced to act under extremely difficult circumstances. When, at the turn of the decade, regulators began realising the significance of HFT, the world was still recovering from, and affected by, the global financial crisis.²⁷⁹ Fearing further disruptions and starting to realise how legislation had, in fact, spurred the development, the lawmakers faced possibly the worst scenario imaginable. The crisis had lowered the market confidence significantly and reports that HFTs were abusing their competitive advantages only made things worse. Then came the May 6, 2010, flash crash, draining whatever confidence was left and prompting a hasty response.

At the start of the rulemaking process, there was not much research available. HFT was, to researchers, still a rather novel and complex phenomenon, into which few had any real insight. When incidents for which HFT was partly to blame then continued to occur, it would have seemed natural to try countering its growth. The new regulation was therefore deemed to fail before it had even been introduced, not necessarily because it was, at the time, based on a flawed perception of reality, but because the increased scrutiny of HFT made the trading technique develop into the rather pleasant, perhaps unforeseen, element it constitutes today. In sum, it can therefore be concluded that not all the blame should not be put on the legislator. A great portion

²⁷⁹ Cf. Grant, *High-frequency trading: Up against a bandsaw* (Financial Times 2010), <<https://www.ft.com/content/b2373a36-b6c2-11df-b3dd-00144feabdc0>>, accessed December 10, 2016.

of the rules adopted are, in spite of the unfavourable conditions, quite suitable, and only a few can be considered greatly inappropriate. Nevertheless, it should be remembered that some of the unsuitable rules were not brought into being until after a great number of papers had dispelled many of the suspicions of harmful effects, and that there are most likely more undesirable rules to come. Simply postponing the implementation of directives or regulation will not fix this.

5.3 What There is to Learn

5.3.1 The Importance of a Proper Comprehension When Forming Law

As always, there is quite a lot to learn from the mistakes made. Most importantly, any regulatory process should be preceded by due research and reflection. In conformity with the method chosen for this thesis, it is absolutely mandatory to know the nature of the regulatory system, the objectives of any relevant superior law and the nature of the phenomenon to be regulated before any measures are even contemplated.²⁸⁰ If, for example, it is not known how the phenomenon affects some other invention and, thus, whether the consequences should at all be dealt with, no rules should be written. Along the same lines, caution is advised when the impact of some provision cannot be estimated. If possible, it is then better to wait for enlightenment than to be rash.²⁸¹

5.3.2 The Importance of Meticulousness When Creating Law

Beyond noting that a proper method is a must, it is essential to indicate just how thoroughly it must be followed. When it comes to more significant areas of law, such as financial markets law – which provides the very means for individuals to fund all their choices – it is not sufficient merely to follow all steps indicated in some negligent fashion. On the contrary, it is necessary also to go into rather extreme detail as one seemingly immaterial uncertainty can render whole acts, like Regulation NMS, counterproductive. This is particularly true when a rule has to try controlling highly intellectual individuals seeking means to avoid or abuse it.

²⁸⁰ Cf. Pan, ‘Organizing Regional Systems: The US Example’ in Moloney et al., *The Oxford Handbook of Financial Regulation* (Oxford University Press 2015), p. 189 ff.

²⁸¹ As it is never possible to be completely certain, there is obviously only one large grey zone, where a major need for legislation can motivate action in spite of uncertainty.

5.3.3 The Danger of Populism

If it was not clear from the previous section exactly what is meant by meticulousness, then perhaps an indication of how the legislature should not proceed might help bring certainty. What such a process starts with is the formation of a public opinion – like that supposedly borne by unknowing people and those having something to win from misleading others – which is given too much attention. Instead of methodically following the common regulatory scheme, the legislature will, in response to the idea brought forward, then, without performing a proper analysis, adopt some flawed rule only seeking to quiet the masses. As noted in section 5.1, this appears to have been, and still is, particularly troublesome in the regulatory process preceding the rules dealing with HFT, as numerous complaints were, and still are, publicly forwarded by individuals and entities both having a great power to influence the common opinion and having a great stake at play. In other words, although the confidence of potential and existing market participants has to be accounted for, it is essential to *separate valid concerns from propaganda*. It is after all not impossible to sponsor investigative reports, to air unfounded opinions or to write a one-sided book seeking to get attention.

5.4 What to Expect in the Future

Only time can tell exactly what will happen to HFT and what direction future rules will take. A few things are, however, certain. Firstly, there will be a lot of additional material to review once MiFID II has been fully implemented and Regulation AT, potentially, adopted. Secondly, the rapid evolution of HFT is rather likely to continue in the forthcoming years, wherefore many more regulatory changes should come.²⁸² Thirdly, unless a miracle was to occur, future rules probably will not be flawless. In reality, if the era of populism – spurred by decadent societies that provide their citizens with the means necessary for a life in denial – does not suddenly end, the prospects of prudent rulemaking seem bleak.

²⁸² Telling if HFT will continue to grow is harder as it appears to have reached a point where the competition nearly makes it unprofitable. Cf. Broogard et al., *High-Frequency Trading Competition* (2016), p. 20, <https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2809894_code1751574.pdf?abstractid=2435999&mirid=1>, accessed December 10, 2016.

5.5 What the Thesis Adds to Existing Research

By merging the results of existing research on the effects of HFT with the regulatory response to its proliferation, the thesis provides a more comprehensive picture than most other existing writings. It does, however, not include any experiments or the like, wherefore it is more of an exercise in systemising existing information than one in producing data. Nevertheless, the analysis and the conclusions drawn should be fairly unique, as most existing pieces tend to move only within the boundaries of one scientific field and to examine only the effects at one level of society.

Beyond its material substance, the thesis could be claimed to contribute to a better understanding of how the method used in legal research can be modified to suit the research objective. This might prove particularly valuable for anyone seeking to perform an impact assessment dealing with financial markets law, but should also be of service to others, intending to research any sort of norm in any context.

6 Suggestions for Further Research

Apart from the obvious need for more exhaustive legal reviews, there is a constant need to continue studying every aspect of AT and HFT, as it evolves. Relying on outdated findings when creating law is out of the question. Perhaps more pressing is, though, the need for analyses of the effects investor confidence has on the regulation of HFT, and other technological innovations.²⁸³ On the same topic, a dignified quest could, perhaps, also be to examine exactly why both media and common people tend to be particularly suspicious of inventions bringing market participants large profits. Lastly, exploring the consequences of HFT for the technological development at large could be an intriguing task, since the investments in technology are often claimed to be wasteful.

²⁸³ As people tend to be overly prone to adopt critical opinions on topics out of reach for their intellects or interests, the negative coverage of HFT is at risk of inducing the enactment of additional unsuitable rules.

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