Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach

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Abstract

Over the past decades, financial markets have been fundamentally transformed by technological advances in combination with regulatory and institutional change. This has produced highly competitive and fragmented financial markets. It is in this market environment that the ultra-fast segment of high-frequency trading (HFT) has materialised. European regulators have addressed the potential adverse market impact of HFT in terms of increased systemic risk (e.g. 'flash crashes') and market abuse through provisions in MiFID II and in the MAR. But there is also an additional concern that so far has received less regulatory attention – the question of whether HFT is fair. This article explores whether and how HFT raises fairness-related concerns against the backdrop of the overarching policy goal of maintaining confidence in the financial markets. Finding that HFT does indeed raise such concerns, it then asks whether the newly instituted provisions on algorithmic trading and HFT in MiFID II and MAR do anything to alleviate this problem. The answer is to a certain extent yes. However, significant concerns remain unaddressed by the new regulatory context. The article suggests other provisions in MiFID II that in the author's view should be assessed with a view to target fairness-related concerns raised by HFT.

Keywords

High-frequency trading, algorithmic trading, fairness, market microstructure, MiFID II, unfair market practices, market confidence, market integrity, conflict of interest, systemic risk

* Trude Myklebust is a PhD candidate in the Faculty of Law, Oslo University. The author gave a talk on selected aspects of a preliminary version of this paper at a seminar organised by Professor Gudula Deipenbrock at HTW Berlin, University of Applied Sciences, Germany, on 16 November 2018. I am grateful to Professor Gudula Deipenbrock for convening the conference and for the opportunity to present the topic on that occasion, and for the suggestions and feedback from the conference participants. I would also like to thank my supervisor, Professor Mads Andenæs, for his guidance, and Professor Inger Johanne Sand and Assistant Professor Marte Eidsand Kjørven for many inspiring discussions. All errors remain mine.

Myklebust, Trude. 'Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach'. *European Business Law Review* 31, no. 1 (2020): 33-76.

A. Introduction

High-frequency trading (HFT), a hyperactive and extremely rapid subgroup of algorithmic trading, has become pervasive in global financial markets in recent decades. Current literature has identified the positive effects of this novel implementation in the securities market, while other studies have focused on its negative impact. One concern raised is related to fairness in HFT markets. In a 2015 article in the Journal of Financial Economics, renowned financial market expert Maureen O'Hara wrote that there is increasing concern that although markets are faster, they are not fairer. She pointed out that fairness is not an issue typically considered in the literature on market microstructure theory, where the focus has been on market properties, such as liquidity and price efficiency. She explained why it should be considered: 'the greater complexity, lower transparency, and higher uncertainty of high frequency markets all contribute to a sense that markets can be more fair for some than for others'. As she admits though 'how, exactly, to investigate this hypothesis is complicated because fairness is hard to define and even harder to measure.'[1]

Professor O'Hara writes about the challenge to financial scholarship. The question of fairness is also a pressing legal issue, as fairness is a core concept in securities regulation. The regulatory emphasis on fairness is closely connected to sets of rules that aim to uphold important properties, such as market integrity, market efficiency and a level playing field for trading. The objectives behind regulatory intervention are, among others, to encourage market participation and attract the deployment of capital via the mechanisms of financial markets, thereby contributing to the realisation of the allocative properties envisaged for the financial system in a modern market economy. Suspicions related to the unfair outcomes resulting from HFT practices may lead to deteriorating trust in financial markets, contrary to one of the most important overarching goals of financial regulation – maintaining market confidence. A decrease in confidence might deter market participation, but it could also, as a matter of principle, lead to serious detrimental effects on systemic stability, something that should be taken into consideration. The article explores in depth the nature and impact of HFT-practices and considers how these can impact the perceptions of market integrity and fairness among other traders. It also analyses how the concepts of fairness and integrity are closely connected to the goal of market confidence, and shows how HFT practices can lead to decreased market confidence along several dimensions.

The effects of unfair outcomes in HFT markets motivate the two main questions dealt with in this article: First, to what extent can HFT be considered fair, based on an assessment of the context-specific circumstances and regulatory objectives of securities markets? And second, situating the discussion in a European perspective, to what extent can the regulatory approach – newly instituted in the 2014 Markets in

[1] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 269 (2015).

Financial Instruments Directive (MiFID II)[2] and the Market Abuse Regulation (MAR)[3] – be expected to successfully address any of the relevant concerns raised here?

These issues are timely given the significant role HFT plays in modern financial markets. In Europe, as in many other regions, HFT represents a large share of the value traded on financial markets and an even larger share of the number of submitted orders.[4] The emergence of HFT is a market-led development, with a potentially large impact on market functioning in an increasingly complex and globalised market environment. It is important from a policy perspective to understand both how the phenomenon fits into the existing regulatory framework and how it should be dealt with in future policy developments.

Much of the academic research on the effects of HFT has so far centred on the core characteristics of market quality, as this concept has been developed in economic theory, and particularly within the branch of market microstructure theory.[5] The main focus of that research is on market properties of importance for the price discovery process,[6] with the emphasis on measures of liquidity, efficiency, transaction costs and volatility. Another impact that has received much attention, including among supervisors and policy-makers, is the effects HFT may have on systemic risk. In this instance, research suggests that HFT can exacerbate the conditions of volatility and illiquidity in times of market stress, in the worst case leading to a so-called flash crash.[7]

As pointed out by O'Hara, fairness-related issues have not been a core concern of market microstructure theory and as such have received relatively little attention in the early academic literature that has informed policy debates.[8] However, interest in

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[2] 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, OJ EU L 173/349 (12 June 2014) (MiFID II).

[3] 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, OJ EU L173/1 (12 June 2014) (MAR).

[4] See ESMA, *High Frequency Trading Activity in the EU Equity Markets* 1 Economic Report, 4 (2014).

[5] For a description of the recent research agenda, see Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, Section 3 (2015).

[6] For instance, Thierry Foucault, Marco Pagano, and Ailsa Röell, *Market Liquidity: Theory, Evidence, and Policy,* 2 (Oxford; New York: Oxford University Press, 2013).

[7] Systemic risk in HFT markets is among others a focus in 2012 UK Foresight project 'Future of Computer Trading'. For a summary of the findings, see The Government Office for Science, *Foresight: The Future of Computer Trading in Financial Markets, Final Project Report* (London, 2012).

[8] A review of academic evidence that influenced the regulatory approach can be found as Annex IV to ESMA's consultation report that preceded the first European regulatory intervention targeting automated trading environments; the ESMA Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities, ESMA/2012/122 (24 February 2012) (described in Section C.I. below). See ESMA, Consultation Paper, Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment

this aspect of HFT has developed over the last few years. Popular literature, and in particular Michael Lewis' book *Flash Boys*[9] and Scott Patterson's book *Dark Pools*[10] have played a role in this regard. Recently, there has been an increase in focus on the fairness-related concerns associated with HFT activities from academics as well as market participants and policy-makers. This debate is still relatively new, and there is no common understanding of the problems or solutions: arguments diverge on both accounts.

The article proceeds as follows: the properties and effects of high-frequency markets are investigated in Section B, with particular emphasis on features of importance in relation to fairness and market integrity. Section C gives an account of the regulatory provisions of relevance for algorithmic trading and HFT that have been instituted by MiFID II and MAR. Section D discusses different ways of understanding the concept of fairness and relates these to the specific circumstances of financial market regulation. The various regulatory measures in MiFID II are discussed so as to assess whether they can alleviate the fairness-related concerns highlighted in the preceding sections. Section E concludes.

B. What is High-Frequency Trading? Some Features of High-Frequency Markets Explained

I. Notes on Methodology, and Caveats

In this section, I conduct an in-depth investigation of the core features of HFT markets. It is important to note from the outset that in order to understand how HFT functions it is necessary to consider not only high-frequency traders as such, but also their institutional surroundings and their relationships with other market actors. This warrants a close description of the role of the different market platforms through which high-frequency traders conduct their operations. This description will help accentuate the important transformations that securities markets have been through in the last decades, as highlighted by O'Hara:

> Markets are different now in fundamental ways. High-frequency trading (HFT) has clearly made things faster, but viewing the advent of HFT as being only about

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Firms and Competent Authorities, ESMA/2011/224, 61 (20 July 2011). The deliberations in Annex IV refer to the developments within research in microstructure and go on to discuss the issues of transaction costs, dimensions of liquidity, price formation, volatility and financial stability. It is noted that there is little research on algorithmic trading and high-frequency trading externalities, particularly regarding market integrity and more generally, on social welfare, however, it is acknowledged that there may be possible concerns relating to abusive practices.

[9] Michael Lewis, *Flash Boys: Cracking the Money Code* (London: Penguin Group, 2014).

[10] Scott Patterson, *Dark Pools: High-Speed Traders, A.I. Bandits, and the Threat to the Global Financial System* (1st ed, New York: Crown Business, 2012).

> speed misses the revolution that has happened in markets. From the way traders trade, to the way markets are structured, to the way liquidity and price discovery arise – all are now different in the high frequency world.[11]

From the perspective of legal scholarship, issues at the intersection of technology and regulation pose particular challenges in terms of methodology, as stated by Brummer:

> One of the difficulties of theorizing the scope of the impact of technological disruption and securities regulation is that it involves assessing both regulatory and market infrastructures across diverse issue areas and contexts. As such, a multidisciplinary approach is required that employs broad-based regulatory history, market theory and practice, and rigorous institutional analytics.[12]

With this in mind, this article refers not only to legal literature on the topic, but also takes into account the economic literature, in particular within the field of market microstructure theory. Market microstructure theory is a sub-discipline of financial economics that is particularly concerned with how markets work at the level of individual transactions.[13]

Furthermore, a general challenge when discussing policy issues related to HFT is the problem of capturing the concept itself with sufficient clarity to make well-informed assessments. First, the practices associated with HFT are many and diverse, as the next section will show. Second, the specific details concerning each practice is as a rule proprietary information, and as such not readily accessible to researchers.[14] Third, the speed of innovation in this area is very high, so the practices and methods in question are constantly changing, thus complicating any investigation. Fourth, as each market operator has significant discretion to design its own microstructure, findings that relate to one specific trading platform may not necessarily be applicable to activity elsewhere. Finally, it is difficult to have full knowledge of how high-frequency traders' relationships with regulators and supervisors play out. That can for instance mean that some of the predatory practices typically associated with HFT in the literature may be more efficiently deterred as supervisory agencies build capacity

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[11] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257 (2015).

[12] Chris Brummer, *Disruptive Technology and Securities Regulation* 84 Fordham Law Review 982 (2015).

[13] For a seminal work, see Maureen O'Hara, *Market Microstructure Theory* (Cambridge Massachusetts, Blackwell Publishers Inc., 1995). See also Ananth Madhavan, *Market Microstructure: A Survey* 3 Journal of Financial Markets 205 (2000) and Larry Harris, *Trading & Exchanges: Market Microstructure for Practitioners,* chapter 8.1 (New York: Oxford University Press 2003).

[14] This lack of data and the variety of strategies are emphasized by the Deutsche Bundesbank as a problem when it comes to researching the extent of HFT activity and its impact, see Bundesbank, *Significance and Impact of High-Frequency Trading in the German Capital Market,* Deutsche Bundesbank Monthly Report, 39 (October 2016). <https://www.bundesbank.de/resource/blob/707606/2231b11bf81f848041be6341195e214b/mL/2016-10-high-frequency-trading-data.pdf> (Call-off date for all hyperlinks, unless stated otherwise: 19 June 2019).

and become more effective in detecting breaches and in enforcing existing rules (for instance on market manipulation). The following description should therefore be read with these caveats in mind.

II. Setting the Scene – How Changes in Market Structure Enabled High-Frequency Trading as a Business Model

HFT is a concept used to describe a variety of computer-based automated trading techniques, which share a set of defining characteristics.[15] Being a subset of algorithmic trading, their most conspicuous feature is the extreme speed with which they communicate with the electronic trading systems of the trading venues. The time it takes for the electronic orders to reach the trading system has been reduced to milliseconds, microseconds and in some instances even nanoseconds.[16] As a rule, HFT is proprietary trading,[17] performed by employing superior computer power to generate large volumes of orders and cancellations that are fed into the electronic trading systems of the market venues.[18] High-frequency traders are active in markets for several different types of financial instruments – securities, bonds and derivatives – as well as in markets for foreign exchange.[19] High-frequency traders are described as being latency sensitive or, in other words, highly sensitive to the speed of transmission. This means that they rely on certain forms of infrastructure provided by the market venues where they are active in order to employ their strategies and exploit their speed advantages.[20] HFT has become a very significant feature of stock exchanges in global markets. In the EU, it is estimated that the 2013 level was between 24 and 43 per cent.[21] In the US, the share of HFT at the same time was around 50 per cent on the New York Stock Exchange.[22] Countries outside Europe and the US feature high-frequency traders as well, although the level of HFT participation varies between regions and markets. There are signs that high-frequency trading has declined in more recent years.

The rise of HFT must be understood against the backdrop of the fundamental changes financial markets have undergone in recent times, driven by both techno-

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[15] The legal definition in MiFID II is discussed in Section C.II.2 below.

[16] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 259 (2015).

[17] ESMA, *High Frequency Trading Activity in the EU Equity Markets* 1 Economic Report 5 (2014).

[18] Regulated markets, other market venues and trading systems for trading in financial instruments. See below in Section B.IV.

[19] Laura Cardella et al., *Computerization of the Equity, Foreign Exchange, Derivatives, and Fixed-Income Markets* 49 The Financial Review 231 (2014); Bank for International Settlements, *High-Frequency Trading in the Foreign Exchange Market* (2011).

[20] See Section B.IV. for further discussion of this aspect.

[21] ESMA, *High Frequency Trading Activity in the EU Equity Markets* 1 Economic Report 5 (2014).

[22] U.S. Securities and Exchange Commission, *Equity Market Structure Literature Review*, 4 (2014).

logical developments and regulatory and institutional changes.[23] The traditional picture, where trading in a listed security was confined to the stock exchange on which it was listed, has given way to a highly dispersed trading environment. As technological developments have made it possible to separate the order execution and matching function from the physical trading floors of the stock exchanges, trading activities have migrated towards a plethora of emerging alternative trading platforms. The US markets were early movers in this respect, while in Europe the national incumbent stock exchanges were protected by the 'concentration rule', which allowed national regulators to require trading to take place on the stock exchange where the security was listed.[24] However, European markets soon moved in the same direction as their US counterparts.[25] The 1996 Investment Services Directive[26] required stock exchanges to facilitate remote membership for European investment services firms through screen-based participation. Subsequently, the Markets in Financial Instruments Directive I (MiFID I)[27] abolished the concentration rule and made possible alternative market venues referred to as Multilateral Trading Facilities (MTFs).[28] This led to the rapid proliferation of new market venues offering electronic order execution within Europe.[29]

In parallel, important changes took place in the stock exchanges' organisation model through the process of 'demutualization'.[30] Starting with the Stockholm stock exchange in 1993, stock exchanges in many parts of the world were transformed from mutual or member-owned institutions into joint stock companies with a dispersed ownership structure and a profit-maximising purpose, in many cases the organisations themselves becoming listed public companies.[31]

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[23] Thierry Foucault, *Algorithmic Trading* in Frédéric Abergel et al (eds), *Market Microstructure: Confronting Many Viewpoints,* 12 (The Wiley Finance Series, Hoboken, N.J: Wiley, 2012).

[24] See Niamh Moloney, *EU Securities and Financial Markets Regulation*, 436 (3rd ed, Oxford: Oxford University Press, 2014).

[25] For an account of the evolution of the European trading venue regime, see Niamh Moloney, *EU Securities and Financial Markets Regulation*, chapter V.2. (3rd ed, Oxford: Oxford University Press, 2014).

[26] Council Directive 93/22/EEC of 10 May 1993 on investment services in the securities field, OJ EU L 141 (11 June 1993) 27-46 (ISD).

[27] 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, OJ EU L 145 (30 April 2004) 1-44 (MiFID I).

[28] Dariusz Wójcik, *The Global Stock Market: Issuers, Investors, and Intermediaries in an Uneven World,* 129 (Oxford: Oxford University Press, 2011).

[29] Among them CHI-X, BATS and Turqoise, see Dariusz Wójcik, *The Global Stock Market: Issuers, Investors, and Intermediaries in an Uneven World,* 140 (Oxford: Oxford University Press, 2011).

[30] This development is discussed in IOSCO Technical Committee, Issues Paper on Exchange Demutualization (June 2001).

[31] The evolving role of stock exchanges is extensively described elsewhere, see for instance Ranald Michie, *Exchanges in Historical and Global Context* in Larry Harris (ed), *Regulated Exchanges: Dynamic Agents of Economic Growth,* 3 (Oxford: Oxford University Press, 2010).

The new characteristics of the securities markets had several significant implications. One was a wave of consolidation of stock exchanges and other market venues into groups or conglomerates,[32] often also encompassing specialised entities within various services such as information handling or post-trade processing.[33] Revenue distribution shifted as well, increasing the relative share of stock exchanges' earnings from traded volumes and decreasing the share flowing from listing fees.[34] The for-profit motive in the new business model accentuated potential conflicts of interests, challenging the long-standing public interest-oriented role[35] previously played by stock exchanges in ensuring well-functioning financial markets. This led to a reconsideration (and partial reversal) of the role of stock exchanges as co-regulators[36] of their own markets.[37]

The emergence of new types of venues for order execution has since continued, a development that is reflected in MiFID II, in which there are now provisions for three alternative forms of multilateral market venues for order execution: regulated markets, multilateral trading facilities and organised trading facilities. In addition, there are provisions for so-called systematic internalisers, which facilitate trade on a bilateral basis. Trading can also be conducted in systems not covered by the European trading regulation regime, often denoted as OTC (over-the-counter). Such systems may be provided by investment firms offering bilateral, discretionary execution services to clients and are often associated with lower degrees of transparency and investor protection ('dark pools' or 'dark trading').[38]

The result of this particular development is that securities trading in Europe now involves fierce competition among a multitude of platforms, each exhibiting wide variation in terms of their configuration, their trading protocols and the degree of

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[32] For an account of this development, see Guido Ferrarini and Paolo Saguato, *Governance and Organization of Trading Venues: The Role of Financial Markets Infrastructure Groups* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 285 (Oxford: Oxford University Press 2017).

[33] Dariusz Wójcik, *The Global Stock Market: Issuers, Investors, and Intermediaries in an Uneven World,* 132 et seq. (Oxford: Oxford University Press, 2011).

[34] Trude Myklebust, *The Role of Stock Exchanges in Shaping More Sustainable Company and Market Practices* University of Oslo Faculty of Law Research Paper No. 2013-28; Nordic & European Company Law Working Paper No. 10-41, 87 (2013), <https://ssrn.com/abstract=2324743>.

[35] E.g., as stated by IOSCO: 'The fair and efficient functioning of an exchange is of significant benefit to the public. The efficiency of the secondary market in providing liquidity and accurate price discovery facilitates the efficient raising of capital for commercial enterprises, benefiting both the wider corporate sector and the economy as a whole.' [IOSCO Technical Committee, Issues Paper on Exchange Demutualization, 10 (June 2001)].

[36] See Paul G Mahoney, *The Exchange as Regulator* 83 Virginia Law Review 1453 (October 1997).

[37] These aspects are discussed in IOSCO Technical Committee, *Issues Paper on Exchange Demutualization*, 5 et seq. (June 2001).

[38] For a more detailed description, see Niamh Moloney, *EU Securities and Financial Markets Regulation*, 428 (3rd ed, Oxford: Oxford University Press, 2014). See also Section C.II.3 below.

regulatory intensity and supervisory attention to which they are exposed, and characterised by high levels of competition in a quest for liquidity and revenues.[39]

The changes just described have been instrumental in the development of the trading techniques that are the focus of this article. When the same security could be traded in several venues simultaneously due to fragmentation, new challenges and opportunities arose for market participants. With the old monopolistic structure gone, investors and traders were tasked with determining which venue was best suited to conducting their transactions.[40] This required complex consideration of a wide variety of parameters,[41] and depended on being able to access, process and respond to massive amounts of information from the different market venues' electronic trading and information systems.[42] Thus, the use of highly advanced computer systems became widespread. Mimicking the developments in US markets,[43] sophisticated computer programs harnessing the power of algorithms have also become an indispensable tool for processing questions of where, when and how to execute orders in the European context. Such programs have made it possible to seek out the most suitable venue for each trade as well as structuring the orders, for example by slicing large orders into smaller 'child orders' and timing their execution so as to minimise market impact.[44]

The speed with which traders communicate with the trading systems has several important implications. For instance, Biais et al. explain that, in fragmented markets, investors must search for quotes across markets, which can result in delayed or partial execution, which is costly.'[45] However, although speed can be important for all traders, for high-frequency traders, speed is integral to their business model.

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[39] It is important to note that not all markets have been affected by the transformation just described. In some parts of the world, the stock exchanges retain the role of traditional incumbents, in different degrees.

[40] In particular in order to fulfil the best execution obligations of investment firms towards customers. Thierry Foucault, *Algorithmic Trading* in Frédéric Abergel et al (eds), *Market Microstructure: Confronting Many Viewpoints,* 14 (The Wiley Finance Series, Hoboken, N.J: Wiley, 2012).

[41] 'e.g. price, liquidity, costs, speed and likelihood of execution or any combination of these dimensions.' [Peter Gomber and Markus Gsell, *Catching up with Technology – The Impact of Regulatory Changes on ECNs/MTFs and the Trading Venue Landscape in Europe* 1 Competition and Regulation in Network Industries 535 (2006)].

[42] In particular, through so-called Smart Routing Systems (SOR).

[43] As noted above, the fragmentation of trade due to the emergence of alternative trading systems had an earlier start in the US.

[44] Peter Gomber and Markus Gsell, *Catching up with Technology – The Impact of Regulatory Changes on ECNs/MTFs and the Trading Venue Landscape in Europe* 1 Competition and Regulation in Network Industries 535 (2006).

[45] Bruno Biais, Thierry Foucault, and Sophie Moinas, *Equilibrium Fast Trading* 116 Journal of Financial Economics 292 (2015), referring to research showing that delays in execution account for about one-third of the total costs for institutional investors, due (for example) to worsening price conditions between an order's arrival and its completion and opportunity costs due to partial execution.

III. Properties and Strategies of High-Frequency Trading

Commentators tend to agree that describing HFT is difficult as there are so many varieties[46] and that no single definition exists.[47] O'Hara contends that high frequency trading is a "misnomer", a seemingly precise term used to describe a large and diverse set of activities and behaviours.[48] The European Securities and Markets Authority (ESMA) also points to the lack of precision in the definition and identification of HFT activity.[49] The approach often used is to describe HFT by referring to a set of common denominators that are typically present. The International Organisation of Securities Commissions (IOSCO), for example, offers the following compilation of characteristics related to HFT:[50]

- It involves the use of sophisticated technological tools for pursuing a number of different strategies, ranging from market making to arbitrage;
- It is a highly quantitative tool that employs algorithms along the whole investment chain: analysis of market data, deployment of appropriate trading strategies, minimisation of trading costs and execution of trades;
- It is characterized by a high daily portfolio turnover and order to trade ratio (i.e. a large number of orders are cancelled in comparison to the trades executed);
- It usually involves flat or near flat positions at the end of the trading day, meaning that little or no risk is carried overnight, with obvious savings on the cost of capital associated with margined positions. Positions are often held for as little as seconds or even fractions of a second;
- It is mostly employed by proprietary trading firms or desks; and
- It is latency sensitive. The implementation and execution of successful high frequency trading strategies depend crucially on the ability to be faster than competitors and to take advantage of services such as DEA[51] and co-location.

A legal definition of HFT is adopted in Art. 4(1)(40) of MiFID II.[52]

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[46] Marcus P Lerch, *Algorithmic Trading and High-Frequency Trading* in Rüdiger Veil (ed), *European Capital Markets Law*, 485, fn 61 (2nd ed, Oxford; Portland: Hart Publishing, 2017).

[47] IOSCO points to the additional complexity in seeking to define HFT in that it encompasses many players, different organisational and legal arrangements and, most importantly, a wide number of diverse strategies. IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11, 22 (October 2011).

[48] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 258 (2015).

[49] ESMA, *High-Frequency Trading Activity in EU Equity Markets* 1 Economic Report 5 (2014).

[50] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11, 22 et seq. (October 2011).

[51] DEA is an abbreviation for Direct Electronic Access. See the definition in Art. 4(1)(41) of MiFID II.

[52] The legal definition is described in Section C.II.2. below.

When it comes to the different strategies employed by HFT, they diverge greatly, but there seems to be consensus about a basic classification into the following broad types of HFT strategies: market making, arbitrage and directional trading.[53] HFT also employs various strategies that have been referred to as abusive or manipulative,[54] and are often described as 'predatory' in the literature.[55] This large diversity in strategies is important to note, as the different categories raise different concerns from a regulatory perspective, as well as from a fairness perspective.[56] Common to all strategies is the fact that they are enacted by placing orders and cancellations in the electronic trading systems of market venues, where the limit order book (LOB) is a central element. The limit order book is where all orders are entered, and where the actual matching of orders takes place continuously while the market venue is open.[57]

Market making is a form of trading activity that precedes HFT and market makers have traditionally been a common presence on stock exchanges. The role of market makers is to supply liquidity to the market by offering quotes for buying or selling securities on a continuous basis. Market makers quote two prices: the bid price, at which they will buy securities, and the ask price, at which they will sell. The difference between the bid and the ask price, the spread, is the market maker's profit.[58] The spread is a measure of market liquidity; the smaller the spread, the more liquid the market. For the market venue, the presence of markets makers is beneficial for their trading environment because traders are attracted by the enhanced level of liquidity. Market operators have therefore traditionally entered into agreements with market

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[53] See among others, Thierry Foucault, Marco Pagano, and Ailsa Röell, *Market Liquidity: Theory, Evidence, and Policy,* 38 (Oxford; New York: Oxford University Press, 2013); Diego Leis, *High Frequency Trading: Market Manipulation and Systemic Risks from an EU Perspective*, 21 et seq. (SSRN Electronic Journal 2012); Bruno Biais and Thierry Foucault, *HFT and Market Quality* 128 Bankers, Markets & Investors 5, 6 et seq. (2014); Norges Bank Investment Management, *High Frequency Trading – An Asset Manager's Perspective* NBIM Discussion Note #1-2013, 9 (30 August 2013). <https://www.nbim.no/globalassets/documents/dicussion-paper/2013/discussionnote_1-13.pdf>.

[54] Bruno Biais and Thierry Foucault, *HFT and Market Quality* 128 Bankers, Markets & Investors 5, 8 (2014).

[55] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 260 (2015).

[56] For example, Biais and Foucault state: 'Fast access to markets can be used both to (i) reduce intermediation costs and (ii) obtain information in advance of other market participants. A reduction in intermediation costs can benefit all market participants if competition among intermediaries is strong so that the cost reduction is passed to final investors. In contrast, trading on advance information is a source of adverse selection, which hinders the efficiency of risk-sharing in financial markets.' Bruno Biais and Thierry Foucault, *HFT and Market Quality* 128 Bankers, Markets & Investors 5 (2014). See also, IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11, 24 (October 2011).

[57] For a description of limit order markets and their general functioning, see Thierry Foucault, Marco Pagano, and Ailsa Röell, *Market Liquidity: Theory, Evidence, and Policy,* 17 (Oxford; New York: Oxford University Press, 2013).

[58] See David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in R Buckley et al (eds) *Reconceptualising Global Finance and Its Regulation*, 223 (Cambridge: Cambridge University Press, 2016).

makers, obliging them to stay in the market and compensating them for the risk that follows from that obligation. The HFT variety of market making benefits from being able to adjust their quotes quickly when market conditions change. This increases their ability to capture a larger fraction of the profit opportunities, helps them avoid being 'picked of' and reduces their inventory risk.[59] In this process, high-frequency market makers will operate with very rapid updates of their quotes, including a high cancellation rate and a high order to trade ratio in order to minimise market risk.[60]

High-frequency market makers have so far been subject to fewer formalised contractual market maker obligations, but have been incentivised by market operators to post orders on their venues through the offer of liquidity rebates and other special fee arrangements.

Arbitrage is an age-old trading concept based on the idea of buying low and selling high in order to pocket the difference. Fragmented markets increase the opportunity for arbitrage.[61] When trading in the same or related securities takes place on several platforms simultaneously, the order flow on each platform can result in diverging prices, as explained by Foucault et al.:

> (…) For instance, suppose that a sell order imbalance on Euronext pushes the price downward on this platform while at the same time a buy order imbalance pushes the price upward on Chi-X. A dealer operating on both platforms can take advantage of these opposite price pressures by buying stock on Euronext and reselling it at a higher price on Chi-X.[62]

Another form of arbitrage is statistical arbitrage, that is, arbitrage opportunities arising from statistical deviations from long term, historical statistical relationships (e.g. correlations) among securities.[63] Assuming reversion to the mean, significant deviations from these relationships offer profitable trading opportunities.[64] Other forms of arbitrage opportunities arise because the adjustment of prices to information is not perfectly synchronised between related assets, among others derivatives and their

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[59] Bruno Biais and Thierry Foucault, *HFT and Market Quality* 128 Bankers, Markets & Investors, 5 (2014).

[60] *IOSCO, Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report,* FR09/11*,* 24 (October 2011).

[61] 'Multiple venues executing trades also means that prices need not always be the same, opening the door for arbitrage across markets.' [Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 258 (2015)].

[62] Thierry Foucault, *Algorithmic Trading* in Frédéric Abergel et al (eds), *Market Microstructure: Confronting Many Viewpoints,* 14 (The Wiley Finance Series, Hoboken, N.J: Wiley, 2012).

[63] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11, 25 (October 2011).

[64] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report,* FR09/11, 25 (October 2011).

underlying assets.[65] Foucault explains that these arbitrage opportunities are extremely short-lived: they disappear as soon as market makers update their quotes or an arbitrageur exploits the opportunity: 'Thus, a trader can exploit these small but frequent fleeting opportunities only if he is very fast. This has been another major impetus for the development of high frequency trading.'[66]

Directional trading is a term that seems to encompass widely different approaches that all have in common the fact that the high-frequency trader adopts a position in an asset in expectation of a future price movement with the aim to gain profit from this position if and when the expected price movement materialises. Directional strategies can involve using the superior speed and data processing capacity possessed by HFT to analyse and react to macroeconomic and company-specific announcements before other, and slower traders.[67] Furthermore, as pointed out by Foucault: 'market data (quotes, trades, order submissions etc.) themselves constitute a piece of information about future price movements. Having access to these data faster is another way to anticipate price movements in the short run.'[68] Some of the strategies under this category seem to be less benign than others. Leis notes that some could be seen as abusive, however, as the strategies are proprietary they are kept secret and there is little direct knowledge of them.[69]

Order anticipation is one example of directional trading that has been referred to as predatory.[70] HFT's sophisticated systems are able to detect 'footprints' left by other traders when the latter execute large orders, as explained by Foucault: 'such large orders are often split in a chain of smaller orders (called "child orders") to reduce their impact on prices. The detection of early child orders in this chain might then be useful to forecast the arrival of later child orders.' If successful, the consequence is that HFT competes away informed traders' profits. Another example is when HFT encounters signs of a distressed trader that needs to liquidate a large position and then reinforces the downward price movement by initially trading in the same direction as the distressed trader and eventually buying the asset at a steeply discounted price.[71]

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[65] Thierry Foucault, *Where Are the Risks in High Frequency Trading?* 20 Banque de France Financial Stability Review 53, 56 (2016).

[66] Thierry Foucault, *Where Are the Risks in High Frequency Trading?* 20 Banque de France Financial Stability Review 53, 56 (2016).

[67] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Repor*t, FR09/11*,* 24 (October 2011).

[68] Thierry Foucault, *Where Are the Risks in High Frequency Trading?* 20 Banque de France Financial Stability Review 53, 57 (2016).

[69] Diego Leis, *High Frequency Trading: Market Manipulation and Systemic Risks from an EU Perspective*, 23 (SSRN Electronic Journal 2012).

[70] Norges Bank Investment Management, *High Frequency Trading – An Asset Manager's Perspective* NBIM Discussion Note #1-2013, 10 (30 August 2013). <https://www.nbim.no/globalassets/documents/dicussion-paper/2013/discussionnote_1-13.pdf>. Some other examples will be given below, in context with the description of manipulative practices later in this section.

[71] Thierry Foucault, *Where Are the Risks in High Frequency Trading?* 20 Banque de France Financial Stability Review 53, 58 (2016).

Yet another directional strategy is liquidity detection,[72] which involves an HFT searching for large orders that are not visible in the order book.[73] This can be achieved via a variety of techniques, among others through so-called 'pinging', whereby the HFT sends a host of small orders into the system to elicit information about the order picture.[74] Leis shows that when a HFT detects a large order it can rapidly trade ahead to capture the price movement, in that way take out the available liquidity on the market and eventually ending up being the counterparty for the large trade at a slightly higher price, thus capturing the price movement.[75]

As mentioned, high-frequency traders have been known to use their electronic systems for abusive practices. In addition to the practice of pinging described directly above, ESMA mentions quote stuffing, momentum ignition and layering and spoofing to illustrate HFT practices that can be considered abusive market practice techniques.[76] Quote stuffing is an example of structural arbitrage, which seeks to 'exploit structural inefficiencies either in market structure or in the strategies of certain participants.'[77] By overwhelming the market with orders, other traders are slowed down and HFT can profit from stale prices.[78] High-frequency traders can also act to reinforce each other's strategies (referred to by O'Hara as 'pack hunters') to the detriment of low-frequency traders.[79]

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[72] Thierry Foucault, Marco Pagano, and Ailsa Röell, *Market Liquidity: Theory, Evidence, and Policy,* 39 (Oxford; New York: Oxford University Press, 2013).

[73] Not all liquidity is necessarily displayed in the order book. Some order types allow parts to be hidden, for instance so-called iceberg-orders. This depends on the rules and order types of each market venue. See Peter Gomber and Markus Gsell, *Catching up with Technology – The Impact of Regulatory Changes on ECNs/MTFs and the Trading Venue Landscape in Europe* 1 Competition and Regulation in Network Industries, 549 (December 2006).

[74] Pierre–Henri Conac, *Algorithmic Trading and High-Frequency Trading* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 483 (Oxford: Oxford University Press 2017).

[75] Diego Leis, *High Frequency Trading: Market Manipulation and Systemic Risks from an EU Perspective,* 24 (SSRN Electronic Journal 2012).

[76] ESMA describes quote stuffing as entry of small variations of the position in the order book so as to create uncertainty for other participants, slow down their process and hide their own strategy. Momentum ignition is described by ESMA as entry of aggressive orders so as to start or exacerbate a trend hoping for other trend followers to bring the trend further and offer an opportunity to unwind the position. Layering and spoofing is described by ESMA as submitting multiple orders at different prices on one side of the order book slightly away from the touch, submitting an order to the other side of the order book (which reflects the true intention to trade) and, following the execution of the latter, rapidly removing the multiple initial orders from the book. See ESMA, *Consultation Paper, Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities,* ESMA/2011/224, 27 (20 July 2011).

[77] Norges Bank Investment Management, *High Frequency Trading – An Asset Manager's Perspective* NBIM Discussion Note #1-2013, 9 (30 August 2013). <https://www.nbim.no/globalassets/documents/dicussion-paper/2013/discussionnote_1-13.pdf>.

[78] Norges Bank Investment Management, *High Frequency Trading – An Asset Manager's Perspective* NBIM Discussion Note #1-2013, 8 (30 August 2013). <https://www.nbim.no/globalassets/documents/dicussion-paper/2013/discussionnote_1-13.pdf>.

[79] 'Several HFTs independently become aware of each other's activities and then form a pack to

It is important to note that as far as the aforementioned practices fall within the scope of market manipulation in MAR, they can be deemed illegal and sanctioned by regulators. However, such practices pose significant challenges to supervisory bodies.[80] As pointed out by ESMA, when thousands of order messages a second are flowing to individual trading platforms, it increases the challenge of spotting potentially abusive behaviour.[81] Furthermore, it can be very difficult to draw the line between behaviour that is within and outside of the remit of legal practices.[82]

IV. The Role of Market Venues and Market Microstructure

The needs of algorithmic traders, and in particular high-frequency traders, have led to a new dimension in their relationship with trading system operators. The traders seek market environments that increase the effectiveness of their electronic strategies, while the market operators are responsive to such demands in order to increase their market share of volumes, liquidity and trading revenues that follow from the high order activity associated with electronic trading. Norges Bank Investment Management (NBIM) describes how the venues compete with each other along various dimensions such as pricing structures, speed (lower latency on data feeds and execution) and order types, all of which are intended to attract more volume from market participants, whether they are high-frequency traders or not.[83]

The competition between venues takes place through the market operators' design of their market microstructure. The concept of market microstructure denotes the elements of a trading environment that determine how individual orders and transactions will be processed. This encompasses the configuration of the trading system and the various protocols that determine the rules for trading activities. These elements are to a large extent under the market operators' control:[84] first, because the electronic infrastructure (the trading system) belongs to them, and second, because they set the

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maximize the chance of triggering a cascading effect.' [Maureen O'Hara, *High-Frequency Trading and Its Impact on Markets* 70 Financial Analysts Journal 20 (2014)].

[80] Harry McVea, *Supporting Market Integrity* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds.), *The Oxford Handbook of Financial Regulation*, 636 (Oxford, United Kingdom: Oxford University Press, 2015).

[81] ESMA, *Consultation Paper, Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/224, 27 (20 July 2011).

[82] As noted by Foucault, it is difficult to distinguish trading strategies that undermine both price informativeness and liquidity from trading strategies that might look manipulative, but which just consist in rational exploitation of market power and private information. Thierry Foucault, *Where Are the Risks in High Frequency Trading?* 20 Banque de France Financial Stability Review 53, 58 (2016).

[83] Norges Bank Investment Management, *High Frequency Trading – An Asset Manager's Perspective* NBIM Discussion Note #1-2013, 5 (30 August 2013). <https://www.nbim.no/globalassets/documents/dicussion-paper/2013/discussionnote_1-13.pdf>.

[84] Though subject to overarching regulatory requirements, see for instance Art. 47(1)(d) of MiFID II. Art. 48 of MiFID II introduces stricter requirements regarding the safe operation of trading systems, see below in Section C.II.

rules for the trading process. These rules fix the structure and priority of orders and how orders are matched and trades executed via the limit order book, thereby 'creating a standard contract between market participants'.[85] As noted by Armour et al., the most important rules that remain designed and implemented by the exchanges are those governing market microstructure – in other words, the rules governing the trading activities of buyers and sellers in the market place.[86]

An obvious indication of market operators' willingness to accommodate the needs of high-frequency traders is the provision of so-called co-location. Co-location means that high-frequency traders are offered physical space to locate their servers in close proximity to that of the market operator in order to secure the highest possible speed of connectivity and thereby reduce latency.[87] Other arrangements that cover a similar purpose are so-called proximity-hosting and direct electronic access (DEA).[88] Market operators have also catered for the needs of high-frequency traders by offering access to information and order types in a way that is well adapted to the high-frequency traders' systems.[89] When it comes to pricing structures, as mentioned by Norges Bank Investment Management, market operators often offer rebates to traders posting orders that are perceived to increase the liquidity of the market,[90] often represented by high-frequency traders posting limit orders.[91] The competition among trading

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[85] Armour et al., *Principles of Financial Regulation,* 148 (Oxford: Oxford University Press, 2016).

[86] Armour et al., *Principles of Financial Regulation,* 148 (Oxford: Oxford University Press, 2016).

[87] 'Co-location services exist to house trading systems used by market participants (and potentially other parties, such as data vendors) in a location close to trading venue servers. Such services are generally provided by a trading venue, whether within its data centre or in a location of close physical proximity. By providing co-located firms with the shortest available physical distance to the trading venue's systems, co-location offers the advantage of extremely low latency, an essential ingredient in certain trading strategies typically used by high frequency traders and other firms wanting high speed access to the markets. Trading platforms seeking to attract this type of business, which may generate large transaction volumes (and, more generally, to attract market participants who want extremely low latency), have a commercial interest in offering this service. Its provision has increased considerably in recent years, in part with the building of sometimes massive out-of-town data centres.' [IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Consultation Report*, CR02/11, 16 (July 2011)].

[88] Art. 4(1)(40)(a) of MiFID II.

[89] See Giovanni Cespa and Thierry Foucault, *Sale of Price Information by Exchanges: Does It Promote Price Discovery?* 60 Management Science, 148 (January 2014). See also Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 377 (2018), explaining how exchanges sell data feeds that deliver detailed trade information directly to the HFT's co-located facilities.

[90] Foucault explains that attracting limit orders is a prerequisite to generate trades on these platforms since trades happen when a market order hits a limit order. Thierry Foucault, *Algorithmic Trading* in Frédéric Abergel et al (eds), *Market Microstructure: Confronting Many Viewpoints*, 14 (The Wiley Finance Series, Hoboken, N.J: Wiley, 2012).

[91] According to Foucault, rebates are awarded to those who increase liquidity by posting limit orders. He explains that each time a limit order executes, trading platforms often rebate, to the investor holding this limit order, a fraction of the fee charged to the market order triggering the transaction. This rebate contributes to the earnings of electronic market makers and incentivizes them to post more aggressive limit orders to earn the rebate. [Thierry Foucault, *Algorithmic Trading* in Frédéric Abergel et al (eds),

platforms to attract orders and liquidity has also led to a reduction in the so-called tick size, which is the smallest incremental change in price that a trading system allows when entering a new order.[92] The tick size is important in relation to the structuring of orders. Because most electronic systems operate under the rule of price-time priority, a large tick size makes it more difficult to step to the front of the queue by offering a fractionally better price.[93] Smaller tick sizes therefore benefit the super-fast high-frequency traders. Market operators can also attract high-frequency trading through order types that facilitate the strategies of high-frequency traders. Fleckner points out that exchanges have introduced:

> odd order types that traders would not have dreamt of only a few years ago. For instance, 'book-or-cancel' orders will be rejected without entry in the order book if immediate execution is possible – an order type that will upset all those who naïvely believed that orders were placed to get executed rather than placed not to get executed.[94]

Market operators' systems and algorithmic traders have evolved in parallel, and so their systems are conditioned to provide mutual benefits. Harris describes the two systems as being co-dependent and states:

> Traders need high-speed order processing and communication systems to implement their electronic trading strategies, and the exchanges need electronic exchange systems to process the huge numbers of orders that these electronic traders produce. The adoption of electronic exchange systems led to huge growth in automated order creation and submission systems.[95]

To sum up, a common denominator among high-frequency traders is the use of very advanced data tools to analyse large amounts of data, which then generate a response in the form of orders or changes in orders entered into the trading systems of marketplaces. Because the gain per trade is small, high-frequency traders are required to trade in very large volumes in order to achieve a satisfactory return. Their systems therefore generate very large amounts of orders. However, a very high proportion of

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Market Microstructure: Confronting Many Viewpoints, 14 (The Wiley Finance Series, Hoboken, N.J: Wiley, 2012)].

[92] See Tom Grimstvedt Meling and Bernt Arne Ødegaard, *Tick Size Wars, High Frequency Trading, and Market Quality,* Working Papers in Economics 5/17, University of Bergen, Department of Economics (June 2017).

[93] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR 09/11, 18 (2011).

[94] Andreas Martin Fleckner, *Regulating Trading Practices* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation*, 621 (Oxford: Oxford University Press, 2015).

[95] Larry Harris, *Trading and Electronic Markets: What Investment Professionals Need to Know* 36 (Charlottesville VA: CFA Research Foundation Publications, 2015).

the orders are cancelled.[96] High-frequency traders do not necessarily wish to trade on the orders they submit. Instead, the orders and cancellations may serve as a strategic means to achieve objectives such as extracting information about the positions of other market participants by observing and interpreting the response to their orders. Hence, the business idea of HFT firms is to profit from the trading activities as such, rather than to trade in securities with the purpose of holding a portfolio of financial assets.[97] In this, they diverge from other traders.

The characteristics presented above distinguish high-frequency traders from other investors (called, for instance, 'utilitarian'[98], 'final'[99] or 'everyone else'[100]) due to the systems they own, the strategies they apply and the purpose of their activities. Yet another characteristic that differentiates them from other investors is their relationship with the stock exchanges and other market venues on which they operate. These will often give high-frequency traders a preferential position by offering high-speed connections (i.e. 'co-location'), special access to data information,[101] specially-structured order types and rebates and fee structures that differ from those of other investors.[102] This special relationship has been described as 'symbiotic'.[103]

V. The Impact of High-Frequency Trading

The question of how HFT impacts the functioning of the financial markets is the subject of a large body of research. An important focal point of much of this research is the concept of market quality, as this is developed in economic theory and particularly within the sub-field of market microstructure theory.[104] Scholarly discussion

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[96] Andrew G Haldane notes that the ratio can be as small as one trade per 60 orders, Andrew G Haldane, *Financial Arms Races,* Bank of England Speech, delivered at the Institute for New Economic Thinking, Berlin (2012) <https://www.bankofengland.co.uk/news/2012/april/financial-arms-races-remarks-by-andy-haldane>.

[97] They often aim for to hold no open position overnight. IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11, 23 (October 2011). Taking very little risk does not seem to preclude them from earning large, persistence profits as noted in Andrei A Kirilenko and Andrew W Lo, *Moore's Law versus Murphy's Law: Algorithmic Trading and Its Discontents,* Journal of Economic Perspectives 51, 60 (2013).

[98] Larry Harris, *Trading & Exchanges: Market Microstructure for Practitioners,* chapter 8.1 (New York: Oxford University Press 2003).

[99] Charles-Albert Lehalle and Sophie Laruelle (eds), *Market Microstructure in Practice,* 13 (New Jersey, USA: World Scientific, 2014).

[100] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 260 (2015).

[101] Giovanni Cespa and Thierry Foucault, *Sale of Price Information by Exchanges* 60 Management Sciences, 148 (January 2014).

[102] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 261 (2015).

[103] J Doyne Farmer and Spyros Skouras, *An Ecological Perspective on the Future of Computer Trading* 13 Quantitative Finance 325, 337 (March 2013).

[104] For a discussion of the concept of market quality, see David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in R Buckley et al (eds) *Reconceptualising Global Finance*

within this field has often focused on the features of efficiency, liquidity, volatility and price formation and researchers have identified both positive and negative effects of HFT activity when assessed according to these parameters. On the one hand, research has identified improvements in liquidity, which in turn have led to decreased spreads, improved market efficiency, decreased transaction costs and improved price formation and cross-venue price alignment. Others, however, contest such positive opinions on the grounds that improvements in liquidity are fleeting as high-frequency traders tend to exit markets first in situations where markets come under stress (or in other circumstances) and this can be detrimental to market quality.[105]

One effect that has received significant attention from academics as well as supervisors and regulators is the role HFT can play in the development of disruptive market conditions. One defining event in this regard took place on 6 May 2010, when the US stock market experienced what later became known as a 'flash crash'. During the dramatic developments in the afternoon of that day, the prices in the US equity market experienced an extraordinarily rapid decline and recovery. Within about half an hour, prices dropped and rebounded, some trading more than 60% away from the values just moments before. Trades were executed at prices of a penny or less, or at prices as high as $100,000, before returning to the 'pre-crash' levels.[106] Although not conclusive, the evidence clearly suggested that HFT strategies had played a role, at least in how the crash developed.[107] The May 2010 flash crash is perhaps the best known of such incidents, but several other episodes have occurred.[108] Flash events may have severe detrimental effects on market functionality in the short and long run,[109] and have been an important impetus for regulatory intervention.

Concerns relating to the fairness and integrity of HFT practices have been discussed in the literature from several different perspectives, both in terms of the types of HFT practices that may pose a problem in relation to fairness and integrity, but also in terms of whose interests may be negatively affected by such practices (including other individual investors, investors in the aggregate and society at large).

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and Its Regulation, 220 (Cambridge: Cambridge University Press, 2016).

[105] A survey of research can be found in Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, Section II.B (2018).

[106] Staff of the Commodity Futures Trading Commission and the 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*, 1 (2010).

[107] For an account of this and several other disruptive incidents, see Andrei A Kirilenko and Andrew W Lo, *Moore's Law versus Murphy's Law: Algorithmic Trading and Its Discontents* 27 Journal of Economic Perspectives 51(2), 60 et seq. (Spring 2013).

[108] Giovanni Cespa and Xavier Vives, *High-frequency Trading and Fragility,* 2 European Central Bank Working Paper Series No 2020 (February 2017) <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp2020.en.pdf?f0853c8630ef920d9429e31ff85b2682>.

[109] Ananth Madhavan, *Exchange-Traded Funds, Market Structure, and the Flash Crash* 68 Financial Analysts Journal 20 (2012).

When it comes to the detrimental effects HFT practices may have on other investors, a dividing line can be drawn between activities that already are prohibited as market abuse[110] on the one hand and, on the other, activities that have not been deemed illegal but which may nevertheless be perceived as unfair or as otherwise harmful to market integrity.

As shown in Section B.III. above, there are several practices associated with HFT that can be subsumed under the definition of market manipulation. However, the complexity and volume of HFT messaging pose a significant challenge to the authorities charged with detecting and reacting to abusive practices.[111] As noted by Balp and Strampelli, there is a risk that traditional investors may end up dealing with counterparties that, due to their superior technology, are capable of unfairly overwhelming them.[112]

Aside from the risk of manipulative practices, arguments that HFT is unfair have also been linked to the structural characteristics of the current market environment.[113] Market arrangements that give high-frequency traders a speed advantage over others, either in terms of receiving information more quickly than others or through a faster processing capacity, have raised concern.[114] The shorter response time of the fast trader allows the trader to exploit the quotes of slower traders, which have not yet been updated according to new value-relevant information.[115] A necessary prerequisite for high-frequency traders to exploit their speed advantage to 'pick off' the quotes of slower traders is the infrastructure provided by market venues through arrangements such as co-location and access to customized information and order types. Some have posed the question of whether such services can be seen as fair. As a matter of principle, for instance O'Hara raises the question of whether stock exchanges should be allowed to offer high-frequency traders specialized order types, co-location for a fee or certain information before it is available to others.[116]

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[110] Under the previous regulatory regime, the French Autorité des Marchés Financiers (AMF) in a decision dated 4 December 2015 sanctioned a market venue for market manipulation for exempting a HFT from its Order to Trade fee without public disclosure. See an account in Pierre–Henri Conac, *Algorithmic Trading and High-Frequency Trading* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 484-485 (Oxford: Oxford University Press 2017).

[111] For a discussion of such challenges, see *IOSCO, Technological Challenges to Effective Market Surveillance: Issues and Regulatory Tools, Final Report,* FR04/13 (April 2013).

[112] Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 364 (2018).

[113] See David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in R Buckley et al (eds) *Reconceptualising Global Finance and Its Regulation*, 225 (Cambridge: Cambridge University Press, 2016).

[114] Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 371 (2018).

[115] Peter Hoffmann, *A Dynamic Limit Order Market with Fast and Slow Traders* 113 Journal of Financial Economics 156, 157 (July 2014).

[116] Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 269 (2015).

Moreover, conflicts of interest on the part of market venues are pointed out as possible sources of unfairness.[117] The profit incentive may lead market operators to design markets that prioritise some traders at the expense of others, leading to a deterioration in confidence.[118] Ownership structures, where HFT firms have partial ownership of new forms of trading platforms have also been emphasised as a source of conflict of interest.[119] Furthermore, the need for non-HFT traders to enter into an 'arms race' by acquiring costly technology in order to protect themselves against losses induced by high-frequency traders can be perceived as an unfair disadvantage.[120]

Yadav has made a powerful argument that the structural information advantage available to high-frequency traders in fact amounts to a situation that is comparable to insider trading in a traditional sense. She coins the phrase 'structural insider trading' and contends:

> […] structural insider trading exhibits harms that are substantially similar to those regulated under conventional theories of corporate insider trading. Structural insiders place other investors at a persistent informational disadvantage. Through their first sight of market-moving data, structural insiders can capture the best trades and erode the profits of informed traders, reducing their incentives to participate in the marketplace.[121]

Balp and Strampelli show how the current market context results in a two-tier system of information dissemination and argue that this is hard to reconcile with the principle of equal access to information underlying financial regulation.[122]

Fairness-related concerns have also been pointed out in contexts other than those experienced by individual traders encountering HFT activity in trading systems. In a 2016 report by the Canadian *Commission de l'éthique en science et en technologie*, focusing at an overarching level on questions of 'fairness in the distribution of risk, costs and benefits of high-frequency trading', several potentially detrimental effects to what they refer to as the 'collective utility' are pointed out. The Canadian Commission report shows, among other things, that the high level of cancellations may create a false impression of liquidity and that there is a risk that markets may be

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[117] For a comprehensive legal and ethical analyses of many aspects of High-Frequency Trading, see Steven R McNamara, *The Law and Ethics of High-Frequency Trading* 17 Minnesota Journal of Law Science & Technology 71 (2016).

[118] See David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in Buckley et al (eds) *Reconceptualising Global Finance and Its Regulation*, 225 (Cambridge: Cambridge University Press, 2016).

[119] Commission de l'éthique en science et en technologie, *Ethical Issues of High-Frequency Trading,* 13 (2016). <http://www.ethique.gouv.qc.ca/en/assets/documents/THF/CEST-THF_EN%20vf_A.pdf>.

[120] This arms race has been described as socially wasteful, see Eric Budish, Peter Cramton and John Shim, *The High-Frequency Arms Race: Frequent Batch Auctions as a Market Design Response* 130 The Quarterly Journal of Economics 1547 (2015).

[121] Yesha Yadav, *Insider Trading and Market Structure* 63 UCLA Law Review 968 (2016).

[122] Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 403 (2018).

destabilised by HFT activity and that institutional investors may experience negative effects in terms of market impact cost. The Canadian Commission notes that there is a potential conflict of interest in the industrial organisation of markets, as stock exchanges benefit from HFT in different ways, particularly in terms of the trade volumes that high-frequency traders bring to exchanges. On the other hand, the fees they charge these traders generate significant revenues (e.g. co-location, sale of data feeds).[123]

In addition to the theoretical arguments set out above, recent factual developments may be explained by reference to HFT-markets being regarded as less fair. One such example is the migration of trade to 'dark pools',[124] where the level of pre-trade transparency is lower, and particularly those where HFT is barred. Another example is the establishment of the Investors Exchange (IEX) in the US, which operates with a delay in the trading system that reduces the advantages of high-frequency traders. This has led to other exchanges also introducing 'speed bumps' in their systems. Furthermore, in the US, several market venues (among them the New York Stock Exchange) are facing a class action suit from investors, claiming compensation on the grounds that advantages afforded HFT and concealed from ordinary investors are in breach of securities law.[125]

To sum up, it is clear that commentators observe a range of different effects of HFT that can potentially be seen as unfair in relation to investors as well as society at large. The various groups can be negatively affected by the same inherent properties in high-frequency markets. In particular, if HFT activity leads to a general decrease in market confidence, investors can choose to retreat to 'dark' venues which offer less transparency and less protection for investors. Such developments can be detrimental to investor protection and investor confidence and may also distort prices on lit trading venues.[126] A distorted price discovery process can have detrimental effects on investors, on issuers of securities, and on the wider economy.

An important takeaway from this section is the focus on what might be termed 'structural unfairness', that is, the fairness-related concerns that emanate from the design, configuration and rules that govern the market microstructure of trading ven-

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[123] Commission de l'éthique en science et en technologie, *Ethical Issues of High-Frequency Trading,* 13 (2016).

http://www.ethique.gouv.qc.ca/en/assets/documents/THF/CEST-THF_EN%20vf_A.pdf.

[124] For a description of dark trading, see Peter Gomber and Ilya Gvozdevskiy, *Dark Trading under MiFID II,* D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* chapter 14 (Oxford: Oxford University Press 2017).

[125] Reuters, *U.S. Exchanges Must Face Renewed High-Frequency Trading Claims: Judge* (29 May 2019). <https://www.reuters.com/article/us-usa-high-frequency-trading-lawsuit/u-s-exchanges-must-face-renewed-high-frequency-trading-claims-judge-idUSKCN1SZ1XO>.

[126] Yadav explains how HFT, by free-riding on the intelligence of others, save themselves time and money while reaping a share of the winnings. When informed actors see their gains systematically reduced or wiped out by faster traders, investing in good quality information makes little business sense. She points out that investment in acquiring a long-term picture of the market can suffer as result, and, that this is problematic given the great importance attached to the prices as a proxy for value-relevant information about companies and their governance, in many different contexts. Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets* 68 Vanderbilt Law Review 1607, 1615 (2015).

ues. It is obvious that therein lies a substantial source of power and control that lends itself to misuse from a fairness perspective, if not properly handled, not least in terms of conflicts of interest that may arise as a result of the prevailing incentive structures. Because of the proprietary character, complexity and opacity of such structures, other stakeholders may not have access to a satisfactorily complete vision of the trading environment. This means that the overall perception of market trustworthiness may be hampered, which can be problematic from the overarching policy perspective of securities regulation. This will be further discussed in Section D below.

C. The European Regulatory Response to High-Frequency Trading

I. The Regulatory Backdrop

The turn towards automated trading in fragmented markets described in Section B above has implied a substantial shift in the workings of financial markets that in turn triggered interest and concern from policy-making institutions, regulators and supervisors.[127] IOSCO has discussed the regulatory issues raised by technological change and electronic trading on several occasions.[128] Within the European context, the European Commission in the 2010 Review of MiFID put forward several amendments that would imply stricter regulation of automated activities.[129] However, before the adoption of MiFID II could take place, ESMA[130] had already undertaken a separate consultation[131] and proposed to establish guidelines for automated trading environments under the existing legal framework of MiFID and the Market Abuse Directive

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[127] For an overview of other regulatory initiatives in several parts of the world (among others in Europe), see Kee. H Chung and Albert J Lee, *High Frequency Trading: Review of the Literature and Regulatory Initiatives Around the World* 45 Asia Pacific Journal of Financial Studies 7 (2016).

[128] See IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR09/11 (October 2011); IOSCO, *Technological Challenges to Effective Market Surveillance, Issues and Regulatory Tools, Final Report*, FR04/13 (April 2013), IOSCO, *Mechanisms for Trading Venues to Effectively Manage Electronic Trading Risks and Plans for Business Continuity*, FR31/15 (December 2015).

[129] European Commission, Directorate General Internal Market and Services, Public Consultation, Review of The Markets In Financial Instruments Directive (MIFID) (8 December 2010). The content of the report was among others built on groundwork by ESMA's predecessor CESR, among others CESR, *Technical Advice to the European Commission in the Context of the MiFID Review – Equity Markets*, CESR/10-802 (29 July 2010). See in particular Ch. 7. <https://www.esma.europa.eu/sites/default/files/library/2015/11/10_802_technical_advice_mifid_review_equity_markets.pdf>.

[130] For an account of ESMA's organisational and operational design, tasks, powers and governance, with emphasis on its regulatory role, see Gudula Deipenbrock, *The European Securities and Markets Authority and Its Regulatory Mission: A Plea for Steering a Middle Course* in Mads Andenas and Gudula Deipenbrock (eds), *Regulating and Supervising European Financial Markets,* 13 (Switzerland: Springer, 2016).

[131] ESMA, *Consultation Paper, Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities,* ESMA/2011/224, 8 (20 July 2011).

(MAD).[132] As grounds for its swift action, ESMA cited the importance of the issues raised by automated trading, the regulatory developments outside the EU and the fact that the competent authorities across the EEA were already seeking to deal with the issues within the existing legal frameworks.

The outcome of the consultation was summed up in a Final Report in December 2011.[133] ESMA stated, with reference to the academic literature, that the effects of algorithmic trading were mixed. On the one hand, positive effects in the form of improved liquidity and price discovery were noted. On the other hand, other types of liquidity could decrease (increase in realised spreads, reduction in traded volumes and market depth), especially in times of market stress.[134] ESMA here made reference to the 2010 New York 'flash crash', which was a dramatic event that gave rise to much public attention and supervisory scrutiny, including a comprehensive report by the U.S. Securities and Exchange Commission (SEC) and the U.S. Commodity Futures Trading Commission (CFTC).[135] The report stated that the interaction between automated execution programs and algorithmic trading strategies quickly can erode liquidity and result in disorderly markets.[136] Overall, it was clear from the structure and content of the Final Report that ESMA was to a large degree preoccupied with risks related to the sound workings of electronic trading systems, from a stability perspective. ESMA noted that the increase in message traffic sent to trading platforms could disrupt electronic trading systems if operators did not have adequate systems and controls in place to deal with capacity constraints.[137] The collective costs (negative externalities) generated by such incidents would have to be borne not only by the firms using algorithms, but by all market participants, thus increasing uncertainty and reducing financial stability.[138] Furthermore, ESMA noted that the increasing complexity of algorithms reduced the capacity of all market participants to assess the impact

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[132] Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation (market abuse), OJ EU L 96/16 (12 April 2003) (MAD).

[133] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/456 (21 December 2011).

[134] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities,* ESMA/2011/456, 59 (21 December 2011).

[135] Staff of the Commodity Futures Trading Commission and the 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). The New York 'flash crash' is described above in Section B.V.

[136] Staff of the Commodity Futures Trading Commission and the 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*, 9 (2010).

[137] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/456, 60 (21 December 2011).

[138] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities,* ESMA/2011/456, 60 (21 December 2011).

of their implementation in the market, creating uncertainties, especially in times of stressed market conditions.[139] The volume and complexity of algorithmic trading could also create information asymmetries, making it harder for competent authorities to promote market integrity (including by detecting market abuse) due to the costs and the time needed to process the massive amounts of information produced by the volume and complexity of algorithmic messaging.[140] When discussing whether a policy response was warranted or not, ESMA pointed out that incentive structures were such that market participants would not necessarily mitigate the above-mentioned market failures. Thus, the related short-comings were considered to be market failures that justified some form of regulatory intervention. In considering whether to instate guidelines or not, ESMA placed emphasis on the benefits of regulation for investor protection, fair and orderly markets, market integrity and financial stability, linked to more robust and resilient markets and, furthermore, a decreased risk of market manipulation.[141]

In February 2012, the ESMA Board of Supervisors issued the Guidelines.[142] The Guidelines had two main addressees: operators of electronic trading systems (regulated markets or MTFs) and investment firms either using electronic trading systems or providing direct market access (DEA) or sponsored access to clients. The Guidelines laid down organisational requirements for the electronic trading systems for both categories of subjects,[143] in addition to organisational requirements for both categories 'to promote fair and orderly trading in an automated trading environment'. When it came to such provisions, the Guidelines stressed that systems should be robust enough to ensure continuity and regularity.[144] In support of this overarching objective, the

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[139] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/456, 60 (21 December 2011).

[140] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities,* ESMA/2011/456, 60 (21 December 2011).

[141] ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/456, 61 et seq. (21 December 2011).

[142] ESMA, *Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2012/122 (24 February 2012). The Guidelines were issued under Art. 16 of Regulation (EU) No 1095/2010 of the European Parliament and of the Council establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC, OJ EU L 331/84 (15 December 2010) (ESMA Regulation).

[143] Number 1 and 2 of the Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities, ESMA/2012/122 (24 February 2012).

[144] Upon laying down the Guidelines, ESMA underlined that the provisions of the guidelines were in line with MiFID I and the Market Abuse Directive (MAD), and merely provided for a correct application of the new trading techniques. Cf. 'III Purpose' of the Guidelines, which states that the purpose of guidelines is to ensure common, uniform and consistent application of MiFID and MAD as they apply to the systems and controls required of trading platforms and investment firms in an automated trading environment and in relation to the provision of direct market access or sponsored access.

Guidelines laid down a host of organisational requirements for HFT firms as well. These were aimed at ensuring the technical resilience and robustness of electronic trading systems. The Guidelines also contained requirements related to the provision of direct market access or sponsored access.[145] Finally, investment firms were subjected to organisational requirements to prevent market abuse in automated environments.[146] The Guidelines where withdrawn by the ESMA Board of Supervisors on the 26 September 2018 based on the subject matter being incorporated into MiFID II, MAR, and relevant delegated acts.[147]

II. The Provisions on Algorithmic Trading and High-Frequency Trading in MiFID II and MAR

1. Background, Purpose and Objectives of the Provisions in MiFID II

From the adoption of MiFID II in 2014, provisions aimed directly at algorithmic trading and HFT were included in the directive. The content of several of the provisions in MiFID II can be traced back to the ESMA Guidelines described above. The provisions on algorithmic trading and HFT constitute a comprehensive and detailed body of regulation.[148]

MiFID II introduces legal definitions of the central concepts, such as algorithmic trading and HFT, and incorporates such activities into the scope of the directive. MiFID II does not prohibit or directly restrict either algorithmic trading or the extent to which market venues can offer access to such trading in their systems. While accepting the presence of such trading strategies in European securities markets, the directive instead aims to reduce the ensuing risks by imposing several targeted measures.[149]

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[145] Number 3, 4, 7 and 8 of the Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities, ESMA/2012/122 (24 February 2012).

[146] Number 6 of the Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities, ESMA/2012/122 (24 February 2012).

[147] Decision of the Board of Supervisors, Withdrawal of MiFID guidelines on 'Systems and controls in an automated trading environment for trading platforms, investments firms and competent authorities', ESMA70-154-803 (26 September 2018).

[148] For a general overview of the regulation of HFT and algorithmic trading in MiFID II, see Danny Busch, *MiFID II: Regulating High Frequency Trading, Other Forms of Algorithmic Trading and Direct Electronic Market Access* 10 Law and Financial Markets Review 72 (2 April 2016). See also Niamh Moloney, *EU Securities and Financial Markets Regulation*, chapter VI.2.3 and V.7.3 (3rd ed, Oxford: Oxford University Press, 2014); Andreas Martin Fleckner, *Regulating Trading Practices* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation,* 596-630 (Oxford: Oxford University Press, 2015); and Marcus P Lerch, *Algorithmic Trading and High-Frequency Trading* in *European Capital Markets,* 477-520 (Hart Publishing, 2017); Pierre–Henri Conac, *Algorithmic Trading and High-Frequency Trading* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 483 (Oxford: Oxford University Press 2017).

[149] Danny Busch, *MiFID II: Regulating High Frequency Trading, Other Forms of Algorithmic Trading and Direct Electronic Market Access* 10 Law and Financial Markets Review 72, 73 (2 April 2016).

A core element of the MiFID II-approach is operational requirements directed at investment firms and market venues, whereby obligations are laid down with respect to the properties and functions of the electronic systems of such entities. This comprehensive and detailed regulation of the configuration of trading systems is a novelty in European legislation, as the EU regulatory regime has traditionally dealt with the operation of trading systems only in a very overarching manner.

It is clear from the preamble of MiFID II that the risk of disorderly trading conditions, which played an important role in the decision to draft the ESMA Guidelines, also explained the resolve to increase regulatory intervention to the level of a binding directive. Recital 62 of MiFID II states that trading technology gives rise to a number of risks, including an increased risk of overloading trading venues' systems due to large volumes of orders and the risk of algorithmic trading generating duplicative or erroneous orders or otherwise malfunctioning in a way that may create a disorderly market. It was further noted that there is a risk of algorithmic trading systems overreacting to other market events which can exacerbate volatility if there is a pre-existing market problem. Moreover, the risk of market abuse was noted as a regulatory concern in so far as algorithmic trading and high-frequency trading could lend itself to behaviour prohibited under MAR.

Of special relevance for our fairness-related discussion, Recital 62 of MiFID II states that because of the information advantage provided to high-frequency traders, high-frequency trading may also prompt investors to choose to execute trades in venues where they can avoid interaction with high-frequency traders.

The emphasis on systems resilience, and the connection with the preceding ESMA Guidelines, is evident in Recital 63 of MiFID II, which states that in order to strengthen the resilience of markets in light of technological developments, the measures should reflect and build on the ESMA guidelines.

That the risks of disorderly markets, on the one hand, and market abuse, on the other hand, were the main regulatory concerns is also evident in Recital 64 of MiFID II which states that both investment firms and trading venues should ensure robust measures are in place to ensure that algorithmic trading or high-frequency algorithmic trading techniques do not create a disorderly market and cannot be used for abusive purposes.

Issues related directly to fairness were raised in two different contexts. Recital 62 of MiFID II notes that in order to ensure orderly and fair trading conditions, it is essential to require trading venues to provide co-location services on a non-discriminatory, fair and transparent basis. And Recital 65 of MiFID II states that it is also necessary to ensure that the fee structures of trading venues are transparent, non-discriminatory and fair and that they are not structured in such a way as to promote disorderly market conditions. This was followed up by a declaration suggesting that it was appropriate to allow trading venues to adjust their fees for cancelled orders according to the length of time for which the order was maintained and also that they be allowed to impose higher fees for cancellation on participants with a high order-to-trade ratio. This however was in order 'to reflect the additional burden on system

capacity without necessarily benefitting other market participants' and thus seems more related to system concerns than to concerns about how fair such practices are.

2. Scope and Definition

While the ESMA Guidelines provided no formal definition of algorithmic trading or HFT, this was introduced in MiFID II. Art. 4(1)(40) of MiFID II defines 'high frequency algorithmic trading technique[s]' as a specific type of algorithmic trading, conforming to certain characteristics as mentioned in Art. 4(1)(40) (a)-(c) of MiFID II. The distinction drawn between algorithmic trading and HFT is important because classification as a high-frequency trader leads to additional requirements being imposed under the directive. The term 'Algorithmic trading' is defined in Art. 4(1)(39) of MiFID II as '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, […]'.[150]

The specific characteristics set out in Art. 4(1)(40)(a)-(c) of MiFID II for determining whether an algorithmic trading technique is to be defined as 'high frequency' appear to be cumulative. Sub-paragraph (a) requires both a specific *intention* and *certain properties* of the technique to fall under the definition. The technique needs to include 'infrastructure intended to minimize network and other types of latencies'. When it comes to properties, litra (a) requires the presence of at least one of the following facilities for algorithmic order entry: co-location, proximity hosting or high-speed direct electronic access (DEA). The three alternatives underline the time-sensitive quality of high-frequency trading, all of them being tools that facilitate high-speed connectivity. Furthermore, they all point to high-frequency traders' reliance on having access to a trading system – without a trading system in which their strategies can be enacted, HFT is not viable. Sub-paragraph (b) requires use of 'system-determination of order initiation, generation, routing or execution without human intervention for individual trades or orders.' The final characteristic in the definition follows from sub-paragraph (c), which requires 'high message intraday rates which constitute orders, quotes or cancellations'.[151]

As discussed in Sections B.I. and B.III. above, many commentators have pointed to the challenges of defining high-frequency trading in a precise manner. Moloney

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[150] The provision states that the definition of algorithmic trading will not include 'any system that is only used for the purpose of routing orders to one or more trading venues [so-called automated order routers (AOR)] 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.' What is meant by 'limited or no human intervention' is explained in Danny Busch, *MiFID II: Regulating High Frequency Trading, Other Forms of Algorithmic Trading and Direct Electronic Market Access* 10 Law and Financial Markets Review 72, 74 (2 April 2016).

[151] What constitutes 'high message intraday rates' is explained in Danny Busch, *MiFID II: Regulating High Frequency Trading, Other Forms of Algorithmic Trading and Direct Electronic Market Access* 10 Law and Financial Markets Review 72, 74 (2 April 2016).

argues that the regulatory design challenges are considerable, not least with respect to how best to capture HFT and algorithmic trading within robust regulatory definitions.[152] In the context of this article, it is worth noting that the legal definition hinges on relatively few criteria, mostly related to technical properties that characterise HFT activity. As such, the definition does not distinguish between the different HFT strategies discussed in Section B.II. above and will thus apply to all strategies, whether benign or 'predatory', to the extent that they are covered by the technical criteria. However, falling under the definition of HFT does not preclude a strategy from being deemed in breach of the prohibition on market manipulation under Art. 12(2)(C) of the MAR. MAR makes use of the same definition of HFT as MiFID II does, according to Art. 3(1)(33) of the MAR.

3. The Three-Pronged Approach of MiFID II

MiFID II builds its regulatory approach on three main elements:[153] (1) an obligation for high-frequency firms to obtain authorisation as investment firms, thus ensuring supervisory oversight;[154] (2) a set of operational requirements directed at HFT firms set forth in Art. 17 of MiFID II; and (3) a set of operational requirements directed at the trading venues that give HFT firms access to their electronic trading systems set forth in Art. 48 of MiFID II. The operational requirements for both HFT firms and trading venues address the configuration of and technical requirements for the systems necessary to perform/allow HFT. Both sets of provisions focus on the systems and routines that must be established to prevent disruptive market incidents caused by the specific characteristics of algorithmic trading.

HFT firms must according to Art. 17 of MiFID II set up effective systems and risk controls to ensure that their trading systems are resilient, have sufficient capacity, are subject to appropriate trading thresholds and limits, and prevent the sending of erroneous orders.[155] They must ensure that their systems function in a way that precludes creating or contributing to a disorderly market. There are also requirements for effective business continuity arrangements to address any failures in HFT systems and ensure that the systems are resilient, have sufficient capacity and are fully tested and properly monitored. HFT firms are required to notify National Competent Authorities (NCAs) and the relevant trading venues on which they engage in algorithmic trading and are subject to further disclosure requirements regarding the nature and detail of

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[152] See Niamh Moloney, *EU Securities and Financial Markets Regulation*, 527 (3rd ed, Oxford: Oxford University Press, 2014).

[153] Niamh Moloney, *EU Securities and Financial Markets Regulation*, 528 (3rd ed, Oxford: Oxford University Press, 2014).

[154] Under MiFID I, high-frequency traders operating only in the capacity of proprietary traders were exempt from the scope of the directive.

[155] Detailed measures operationalising these provisions are adopted in Commission Delegated Regulation (EU) 2017/589 of 19 July 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council with regard to regulatory technical standards specifying the organisational requirements of investment firms engaged in algorithmic trading, OJ EU L 87/417 (31 March 2017).

their strategies. They must record and store information about their activities and be prepared to share it with competent authorities upon request. A high-frequency trader carrying out a market making strategy must continue to do so during specified hours in order to provide regular and predictable liquidity, except under exceptional circumstances.[156] An investment firm that provides direct electronic access (DEA) is responsible for ensuring that its clients comply with the requirements of the directive and the rules of the trading venue. The investment firm must monitor transactions in order to identify possible infringements, disorderly trading conditions and conduct that may involve market abuse and that is to be reported to the competent authority.

The degree to which the operators of trading platforms are subject to HFT-related requirements will depend on which, if any, authorisation they operate under. MiFID II differentiates, as previously mentioned, between three categories of multilateral market venues: regulated markets, multilateral trading facilities and organised trading facilities. The operational requirements for regulated markets relevant for algorithmic trading and HFT that follows from Art. 48 of MiFID II also apply to multilateral trading facilities and organised trading facilities according to Art. 18(5) of MiFID II. Systematic internalisers,[157] operate bilateral systems while dealing on their own account. Systematic internalisers operate under authorisation as investment firms and will as such have to comply with the regulation for investment firms.[158] In addition, MiFID II still allows trading to take place in the OTC space, which have lighter regulation and supervision than pertains to market venues and systematic internalisers in accordance with MiFID II.[159] Such trading, which according to regulatory-granted waivers,[160] publish no or limited pre-trade information,[161] is often referred to as 'dark trading' or 'dark pools'.[162] High-frequency traders are active in this space.[163]

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[156] Requirements on the market making agreements and schemes are set forth in Commission Delegated Regulation (EU) 2017/578 of 13 June 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, OJ EU L 87/183 (31 March 2017).

[157] Art. 4(1)(20) of MiFID II.

[158] Regarding the distinctions between the different categories, see Niamh Moloney, *EU Securities and Financial Markets Regulation*, Chs V.6 and V.10 (3rd ed, Oxford: Oxford University Press, 2014).

[159] Peter Gomber and Ilya Gvozdevskiy, *Dark Trading under MiFID II* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 364 (Oxford: Oxford University Press 2017).

[160] Art. 4 of 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, OJ EU L 173 (12 June 2014) (MiFIR).

[161] Peter Gomber and Ilya Gvozdevskiy, *Dark Trading under MiFID II* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 364 (Oxford: Oxford University Press 2017).

[162] Art. 5 of MiFIR introduces a new regulatory measure that puts limitations on the trading of listed assets on dark pools through limitations on the volumes that can be traded under the waivers. This is termed the 'double volume cap' (DVC). Trading on dark pools have since fallen, but apparently has for a large part moved to systematic internalisers instead.

[163] Dark pools have often been marketed as providing other investors protection from HFT, because the lower level of pre-trade transparency reduces the likelihood of being exploited by HFT. However, there have been multiple instances when operators have allowed HFT to take part in the trade in spite

For regulated markets, multilateral trading facilities and organised trading facilities, Art. 48 of MiFID II introduces provisions specifically aimed at the operation of electronic trading systems. An important purpose is making sure certain risks that can arise in the electronic trading system, including from HFT activity, are addressed. Markets must, according to Art. 48(1) of MiFID II, ensure that their trading systems are resilient, have sufficient capacity to deal with peak order and message volumes, and are able to ensure orderly trading under conditions of severe market stress – and their systems must be fully tested to ensure such conditions are met. They must be able to ensure continuity of services if there is any failure in the trading systems. Article 48(2) of MiFID II requires market venues to have in place written market maker agreements with all investment firms pursuing a market maker strategy on the regulated market according to specifications set forth in Art. 48(3) of MiFID II. Furthermore, member states shall in line with Art. 48 (4) of MiFID II require a market venue to have in place effective systems, procedures and arrangements to reject orders that exceed pre-determined volume and price thresholds or are clearly erroneous. The market venues must in line with the requirement in Art. 48(5) of MiFID II have *circuit breakers* in place and be able to *temporarily halt or constrain trading* in situations with severe volatility, and even cancel or correct orders in exceptional situations. They must in line with Art. 48(6) of MiFID II provide testing facilities for algorithms to ensure that algorithmic trading systems cannot create or contribute to disorderly trading conditions on the market. If disorderly trading conditions do arise, they must be able to manage them, including having systems which limit the ratio of unexecuted orders to transactions,[164] and they must be able to slow down the flow of orders if their system capacity is at risk of being reached. The venues must according to Art. 48(10) of MiFID II require algorithmic (including HFT) orders to be flagged. They must also ensure that their fee structures do not create 'disorderly trading conditions or market abuse' in accordance with Art. 48(9) of MiFID II. The venues are responsible for following up on the market-maker obligations imposed on algorithmic firms;[165] for overseeing market participation based in direct electronic access (DEA); and for facilitating the flagging of algorithmic orders. The venues must upon request

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of this being in breach of the terms that were agreed. See Monica Petrescu and Michael Wedow, *Dark Pools in European Equity Markets: Emergence, Competition and Implications* 193 The European Central Bank Occasional Paper Series 11 (July 2017) <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op193.en.pdf?0c043c702ae95020d9003e632e3deaac>.

[164] See also Commission Delegated Regulation (EU) 2017/566 of 18 May 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 for the ratio of unexecuted orders to transactions in order to prevent disorderly trading conditions, OJ EU L 87/84 (31 March 2017).

[165] The obligations for trading venues in this regard are detailed in Commission Delegated Regulation (EU) 2017/578 of 13 June 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, OJ EU L 87/183 (31 March 2017).

share information relating to the order book with competent authorities so that they can monitor the trade.

According to Art. 48(8) and (9) of MiFID II, member states must ensure that national markets' rules on co-location services and their fee structures (including execution fees, ancillary fees and any rebates) are transparent, fair and non-discriminatory. The fee structure must not create incentives to place, modify or cancel orders or to execute transactions in a way which contributes to disorderly trading conditions or market abuse.[166] Article 48(9) of MiFID II sets forth that markets are required to impose market making obligations in individual shares or a suitable basket of shares in exchange for any rebates that are granted. Markets shall in line with Art. 48(9) of MiFID II be allowed to apply differential fees based on cancellation rates and the length of time the order was maintained. According to Art. 49 of MiFID II, markets must adopt a tick size regime.[167]

4. The Definition of Market Manipulation in the MAR

As described above in Section B.III., high-frequency traders have been known to perform practices that can be considered as market manipulation according to the regime on market manipulation in the MAR. Upon the adoption of the MAR, a change was made to the definition of market manipulation in Art. 12 of the MAR by adding examples in Art. 12(2)(c) of how algorithmic trading and high-frequency trading can constitute market manipulation. However, it is stated in Recital 38 of the MAR that these are examples that are neither intended to be exhaustive nor suggest that the same strategies carried out by other means would not also be abusive. Such practices could also before the change of the definition be considered as abusive.[168]

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[166] Detailed measures operationalising these provisions are adopted in Commission Delegated Regulation (EU) 2017/573 of 6 June 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 on requirements to ensure fair and non-discriminatory co-location services and fee structures, OJ EU L 87/145 (31 March 2017).

[167] Art. 49(2) of MiFID II requires that the tick size regime shall be calibrated to reflect the liquidity profile of the financial instrument in different markets and the average bid-ask spread, taking into account the desirability of enabling reasonably stable prices without unduly constraining further narrowing of spreads and furthermore, adapt the tick size for each financial instrument appropriately. The requirements are detailed in Commission Delegated Regulation (EU) 2017/588 of 14 July 2016 supplementing Directive 2014/65/EU of the European Parliament and of the Council with regard to regulatory technical standards on the tick size regime for shares, depositary receipts and exchange-traded funds, OJ EU L 87/411 (31 March 2017).

[168] See Niamh Moloney, *EU Securities and Financial Markets Regulation*, 744 (3rd ed, Oxford: Oxford University Press, 2014).

D. Evaluating the European Regulatory Response in Light of Concerns Relating to Market Integrity and Fairness in High-Frequency Markets

As the discussion in Section B.II. shows, there are HFT practices and effects that have been negatively associated with fair market conditions, or related concepts, in the academic literature and in other commentary. This chapter will discuss the extent to which European regulatory efforts concerning HFT and algorithmic trading alleviate such concerns.

Fairness is a pivotal concept in many realms of law, within the spheres of both public and private law. This reflects a universal emphasis in law on conditions or solutions that are equitable, reasonable, moral or just, in some sense of the word.[169] However, fairness may have widely different meanings, depending on the area of law in question.[170] For instance, within accounting law, fair value denotes an estimate of the market value of a good, while discussions of what constitutes fair punishment in the context of criminal law will typically refer to principles of reciprocity or proportionality. Proportionality can also be the measuring rod when discussing fair use of state power, but in other contexts, the notion of fairness takes equality as its point of departure, for instance when settling an inheritance dispute between heirs of the same legal status. Distributive fairness is an important consideration in some areas, such as tax law. Other formalised ways of thinking about fairness include the distinction between procedural fairness and outcome-based fairness,[171] where procedural fairness considers the characteristics of decision-making or the allocation of rights, obligations or resources, while outcome-based fairness considers the result in substantive terms.

Achieving fairness may be an important end goal in itself. Nevertheless, fair processes or outcomes may also support other objectives. For example, fair processes may persuade people to accept judicial conflict resolution (rather than relying on vigilante justice); provide legitimacy for public decisions (including among those adversely affected by the decision); or increase market participation due to confidence in fair market conditions. From this, one can infer that fairness is a multifaceted concept and that what may be considered fair in a certain area of law is a matter of interpretation. As a result, the context-specific factual circumstances of the regulated area in question must be considered in light of the goals and objectives behind the regulatory effort and other available legal sources.

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[169] A vast literature within legal philosophy and legal theory, exemplified by the writings of scholars such as Rawls, Hart and Dworkin, discusses the concept of fairness at great length and in much detail. However, the scope of this article precludes a more detailed discussion of the concept.

[170] For a discussion of the concept of fairness, including within other disciplines, see for example Janis Pearl Sarra, (ed.), *An Exploration of Fairness: Interdisciplinary Inquiries in Law, Science and the Humanities* (Toronto: Carswell, 2013).

[171] For one example, see Stefan T Trautmann and Gijs van de Kuilen, *Process Fairness, Outcome Fairness, and Dynamic Consistency: Experimental Evidence for Risk and Ambiguity* 53 Journal of Risk and Uncertainty 75 (2016).

I. Notions of Fairness and Integrity in the Context of Financial Regulation

In the regulation of financial markets, fairness is considered an overarching regulatory objective, as manifested not only in concrete regulatory acts but also in the declarations of intention and purposes of regulatory and supervisory authorities. For example, in the By-laws of IOSCO, the participating securities administrators resolve to cooperate in order to protect investors and maintain fair, efficient and transparent markets.[172] The European Commission states on its website that the comprehensive set of rules on investment services and activities aims to promote financial markets that are 'fair'.[173] The SEC describes its mission as that of protecting investors and maintaining a fair, orderly and efficient market.[174] The Australian supervisory body, ASIC, makes similar statements.[175]

Policy-makers' emphasis on fairness in financial markets, which is an area of society marked by extreme competition and with an implied understanding among participants, as well as observers, that losses and gains can be large and unevenly distributed, invites further consideration. One explanation can be inferred by looking at the overarching policy purposes at the core of financial regulation as such: that is, to foster trust and confidence in the workings of financial markets. This regulatory focus must be seen against the backdrop of the important role financial markets play in the wider economy.[176] In 1995, Robert C. Merton wrote that the *primary* function of any financial system is to facilitate the allocation and deployment of economic resources, both spatially and temporally, in an uncertain environment.[177] The importance of a well-functioning financial system is underscored by the salient findings in the economic literature, that financial development is associated with economic growth.[178] The role just described has had a profound impact on the goals and objectives of financial regulation, as expressed for instance by Armour et al, who state that

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[172] IOSCO, *By-Laws of IOSCO* at <https://www.iosco.org/library/by_laws/pdf/IOSCO-By-Laws-Section-1-English.pdf>.

[173] In addition, it is listed that markets should be transparent, efficient and integrated. The European Commission, Policies, Information and Services, Investment Services and Regulated Markets – Markets in Financial Instruments Directive (MiFID). <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/financial-markets/securities-markets/investment-services-and-regulated-markets-markets-financial-instruments-directive-mifid_en>.

[174] U.S. Securities and Exchange Commission, *About the SEC,* <https://www.sec.gov/about.shtml>.

[175] 'As the markets regulator, we assess how effectively authorised financial markets are complying with their legal obligations to operate fair, orderly and transparent markets.' Australian Securities & Investments Commission, *Investing and Financial Advice,* <https://asic.gov.au/for-consumers/investing-and-financial-advice/>.

[176] See, among others, Emilios Avgouleas, *Governance of Global Financial Markets: The Law, the Economics, the Politics*, 23 (Cambridge: Cambridge University Press, 2012).

[177] Robert C Merton, *A Functional Perspective of Financial Intermediation* 24 Financial Management 23 (1995).

[178] For a recent review of the literature, see Alexander Popov, *Evidence on Finance and Economic Growth* European Central Bank Working Paper Series No 2115 (December 2017).

the primary purpose of financial regulation is to improve the functioning of the financial system.[179]

An important prerequisite for the fulfilment of the objectives of a well-functioning financial system is a high level of market confidence.[180] This has to do with the willingness initially to commit surplus capital to be deployed throughout the system. Loss of market confidence can set off disorderly withdrawal of capital from the financial system, which can cause difficulties at the systemic level, for instance, in the form of bank runs or sharp downward moves in the stock market. Fostering trust and confidence has been a particularly important goal in banking regulation, due to the close relationship between loss of confidence and increased systemic risk in that sector.[181] However, there is no doubt that market confidence is also a prominent regulatory concern in the regulation of the market-based part of the financial system. The importance of reinforcing confidence is stressed from the outset in the preamble to MiFID II,[182] and in Art. 2 of the ESMA Regulation, which states that one of the main objectives of the European System of Financial Supervision is to ensure confidence in the financial system as a whole.

Within securities law, there is a close connection between the regulatory objectives of confidence, fairness and market integrity, and these concepts are often used interchangeably or in close connection with each other. For instance, IOSCO states that market integrity is the extent to which a market operates in a manner that is, and is perceived to be, fair and orderly and where effective rules are in place and enforced by regulators so that confidence and participation in the market is fostered.[183] Comparing approaches among several international securities regulators, Austin notes that while some regulators see the goal as being market fairness, for others the goal is market integrity or even market confidence.[184] Furthermore, she notes that regulators view the goals as being similar and the concepts of market fairness, market integrity and market confidence as being intertwined.[185]

In the European catalogue of securities regulation, considerations of fairness and integrity motivate several important sets of rules.[186] Here too, the notions of fairness,

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[179] See Armour et al., *Principles of Financial Regulation,* 51 (Oxford: Oxford University Press, 2016).

[180] For an explanation of the rationale and goals of financial regulation, see for instance Armour et al., *Principles of Financial Regulation*, chapter 3.2 (Oxford: Oxford University Press, 2016).

[181] See Frank Partnoy, *Financial Systems, Crises and Regulation* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation,* 81 (Oxford: Oxford University Press, 2015).

[182] Recital 4 of MiFID II.

[183] IOSCO, Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report, FR 09/11, 9 (2011).

[184] Janet Austin, *What Exactly is Market Integrity? An Analysis of One of the Core Objectives of Securities Regulation* 8 William. & Mary Business Law Review 215, 229 (2017).

[185] Janet Austin, *What Exactly is Market Integrity? An Analysis of One of the Core Objectives of Securities Regulation* 8 William. & Mary Business Law Review 215, 230 (2017).

[186] For instance, according to Art. 24 of MiFID II, investments firms have an obligation to act honestly, fairly and professionally when providing investment services to clients.

integrity and market confidence are closely connected. For the activities taking place on secondary markets – the focal area of this article – the concept of market integrity is often associated with rules concerning market abuse, a common denominator for insider trading and market manipulation.[187] The objective of these rules is to instil market confidence, both by acting as a deterrent against fraudulent and manipulative practices and by ensuring equality of access to information in the marketplace.[188] Market integrity is also emphasised as an important prerequisite for market efficiency,[189] a goal routinely highlighted as paramount in financial regulation.[190] For instance, Fleckner notes that the price formation process under ideal circumstances will work to establish equilibrium prices that accurately reflect market supply and demand in a manner that is transparent and fair, providing equal treatment of traders.[191] The extensive sets of rules governing the disclosure and handling of information[192] and determining the design of the market structure play an important role in the price formation process and the concrete outcomes of each transaction.[193] If informed investors shy away from market participation because they perceive the market to be structured to their disadvantage, price formation will suffer and market prices less informative, something which is detrimental also in a societal perspective.[194]

The objectives and nature of the main types of regulation mentioned point in the direction of a process-oriented, rather than an outcome-based, concept of fairness, thus underscoring the importance of regulatory intervention to encourage a level playing field in secondary markets. This corresponds to Principle no 34 of IOSCO's Objectives and Principles of Securities Regulation, pertaining to secondary and other

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[187] See for instance Armour et al., *Principles of Financial Regulation,* chapter 9 (Oxford: Oxford University Press, 2016).

[188] The underlying rationale for prohibiting insider dealing and market manipulation in the EU is described in Niamh Moloney, *EU Securities and Financial Markets Regulation*, chapter VIII.2 (3rd ed, Oxford: Oxford University Press, 2014).

[189] Fleckner, for instance, states that the main focus of securities regulators is typically on another factor that makes trading more efficient: market integrity. Andreas Martin Fleckner, *Regulating Trading Practices* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation,* 600 (Oxford: Oxford University Press, 2015).

[190] See for instance Armour et al., *Principles of Financial Regulation,* 71 (Oxford: Oxford University Press, 2016).

[191] Andreas Martin Fleckner, *Regulating Trading Practices* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation,* 600 (Oxford: Oxford University Press, 2015).

[192] See among others Luca Enriques and Sergio Gilotta, *Disclosure and Financial Market Regulation* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation*, chapter 17 (Oxford: Oxford University Press, 2015).

[193] The relationship between price formation and market design is discussed by Fleckner. Andreas Martin Fleckner, *Regulating Trading Practices* in Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation,* 600 (Oxford: Oxford University Press, 2015).

[194] According to Balp and Strampelli, HFT can in this way negatively affect price accuracy, real resource allocation and equity markets' allocative efficiency. Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349 (2018).

markets, which states that regulatory supervision should aim to ensure that the integrity of trading is maintained through fair and equitable rules that strike an appropriate balance between the demands of different market participants.[195]

Furthermore, an important observation is that market integrity is not only about the market being fair; it must also be perceived to be fair, in order to foster market confidence. This is emphasised by IOSCO,[196] as already mentioned, and Lerch also insists that the perception of a rigged market may lead market participants to reduce or quit their own market activities.[197] Confidence is not a static quality, dependent only on the objective characteristics of the market in question; it also embodies a subjective element that can be affected by circumstances that it may not be possible to determine exhaustively *ex ante*.[198] Here, a parallel can be drawn with other areas of regulation in which the confidence of observers is also important (e.g. public confidence in the work of auditors and civil servants based on the notion of 'independence in appearance').

II. Is the European Regulatory Response Likely to Alleviate Concerns Related to Fairness and Integrity in High-Frequency Markets?

The discussion in Section B.II. of the nature and effects of HFT practices highlighted various concerns relating to fairness and market integrity. Many of the objections arise from HFT's advantages in terms of being able to access, process and respond to value-relevant information faster than other, slower traders.[199] Such advantages stem from a combination of the superior speed and processing capacity of their electronic systems and the special arrangements granted by market venues, such as co-location, special order types and subscription to market data services.[200]

From the description of the European regulatory regime concerning algorithmic trading and HFT in Section C above, it is clear that the regulatory objectives and the ensuing regulatory approach have concentrated on the risks to well-functioning markets that arise from the disruptive effect HFT may have on markets in terms of systemic dysfunction and the potential of abusive practices. These findings align with those of Balp and Strampelli, who come to the same conclusion following an inves-

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[195] IOSCO, Objectives and Principles of Securities Regulation (May 2017). <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD561.pdf>.

[196] IOSCO, *Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency, Final Report*, FR 09/11, 9 (2011).

[197] Marcus P Lerch, *Algorithmic Trading and High-Frequency Trading* in Rüdiger Veil (ed), *European Capital Markets Law*, 494 (2nd ed, Oxford; Portland: Hart Publishing, 2017).

[198] For instance, the effects of investors' perceived probability of being cheated are discussed in Luigi Guiso, Paola Sapienza, and Luigi Zingales, *Trusting the Stock Market* LXIII, No 6 The Journal of Finance 2557 (2008).

[199] Peter Hoffmann, *A Dynamic Limit Order Market with Fast and Slow Traders* 113 Journal of Financial Economics 156, 157 (July 2014).

[200] Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 377 (2018).

tigation of the regulatory regime from the perspective of HFT-related effects on market efficiency.[201] While a decrease in the systemic risk associated with HFT may in itself may have positive effects on market confidence, this type of provision has little effect on perceptions of a fair market in terms of a level playing field. Similarly, bringing high-frequency trading firms within the scope of MiFID II – and thus subjecting them to authorisation and supervision – may have a positive effect on market integrity from the perspective of deterring abusive practices. The process of seeking authorisation, the organisational requirements, the prospects of supervision and the requirements to keep and share data[202] with supervisors could well be effective in terms of decreasing the potential for HFT-induced market abuse in European markets. However, what neither of these two main building blocks of the regulation can be expected to address is the perception of an unfair, or rigged, market that may result from the structural advantages that HFT enjoys through their special arrangements with market venues. A number of commentators have called attention to this aspect,[203] but there are no concrete responses in regulation. On the contrary, some of these elements (e.g. co-location, the ability to use high message order types), which clearly set those who are willing and able to pay for such arrangements apart from other traders,[204] have now been instituted as part of the definition of HFT in Art. 4(1)(40) of MiFID II. Although a definition does not itself determine what constitutes legal practice, it is hardly surprising if, as a result, both market participants and supervisors assume that the elements that form an integral part of the legal definition do not breach the regulation and, hence, will not be targeted by supervisors.

The provision in Art. 48(8) of MiFID II, requiring a regulated market to ensure that its co-location services are transparent, fair and non-discriminatory, will not be of any comfort to other traders either, as this provision only focuses on fair conditions between the high-frequency traders and has no impact on the relationship between HFT and other traders.[205]

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[201] Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 403 (2018).

[202] This obligation follows from Art. 17(2), fifth paragraph of the MiFID II.

[203] See, for instance, Yesha Yadav, *Insider Trading and Market Structure* 63 UCLA Law Review 968 (2016). See also Jacob Adrian, *Informational inequality: How High Frequency Traders Use Premier Access to Information to Prey on Institutional Investors* 14 Duke Law & Technology Review 256 (2016) and Gaia Balp and Giovanni Strampelli, *Preserving Capital Markets Efficiency in the High-Frequency Trading Era* 2 Journal of Law, Technology and Policy 349, 371 (2018).

[204] See Adrian, referring to a 'two-tiered system of 'haves' and 'have nots'. Jacob Adrian, *Informational Inequality: How High Frequency Traders Use Premier Access to Information to Prey on Institutional Investors* 14 Duke Law & Technology Review 256, 268 (2016).

[205] Some authors argue that there is little concern associated with the fairness of HFT practices as long as for instance co-location services are available to all. In this vein, see James J Angel and Douglas McCabe, *Fairness in Financial Markets: The Case of High Frequency Trading* 112 Journal of Business Ethics 585, 594 (2013). This, however, would entail a very narrow concept of fairness that does not seem well aligned with the need to ensure confidence among the market participants on a broad basis as discussed above in Section D.I.

This means that the effects of HFT on other traders (described in Section B.V.), including diverted trading gains, missed trading opportunities, costly investments in protective measures ('electronic arms race'), less informative prices, etc., which can all be viewed as detrimental from a fairness perspective, have not been countered by regulatory efforts so far. One can assume that, on balance, this has a negative effect on market confidence, an assumption that is supported by the reactions observed among other investors: namely, migration to dark venues, complaints brought before the courts, and a preference for venues that operate with 'speed bumps' as described in Section B.V.

The question then remains whether these (arguably serious) consequences for market quality, in a broader sense, remain without a remedy in European securities law. This question can be answered from the perspective of the regulation of investment firms as well as from the perspective of the regulation of market venues. Investment firms are subject to fairness-related requirements. Among these, Art. 30 of MiFID II requires investment firms to act honestly, fairly and professionally, and to communicate in a way that is fair, clear and not misleading in their dealings with eligible counterparties. Some HFT practices, while not crossing the threshold of market abuse, could arguably be discussed under the norms and expectations of this provision – for instance, HFT strategies that involve high rates of order cancellations.

However, it seems even more relevant to discuss the institutional and organisational provisions pertaining to market venues, given the pivotal role they play in financial markets and the importance of the market microstructure they control for the viability of HFT practices.[206] Even though market venues have assumed the status of profit-maximizing companies, their ancestry as entities with public utility-like functions is still clearly visible in regulation pertaining to them.[207] For instance, according to Art. 47(1)(d) of MiFID II, member states must require regulated markets to have transparent and non-discretionary rules and procedures that ensure fair and orderly trading and establish objective criteria for the efficient execution of orders.[208] Moreover, regulated markets must, in accordance with Art. 47(1)(a) of MiFID II, have arrangements to clearly identify and manage the potentially adverse consequences, for the operation of regulated markets or for its members or participants, of any conflict of interest between the regulated market, its owner or its market operator and the sound functioning of the regulated market. This applies in particular where such conflicts of interest might prove prejudicial to the accomplishment of a function del-

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[206] As mentioned in Section B.V. above, O'Hara raises questions about the practices of the market venues in this regard. Maureen O'Hara, *High Frequency Market Microstructure* 116 Journal of Financial Economics 257, 269 (2015).

[207] Moloney states that these venues have a strong public quality, which is reflected in how they are regulated. Niamh Moloney, *EU Securities and Financial Markets Regulation*, 427 (3rd ed, Oxford: Oxford University Press, 2014).

[208] Also Multilateral Trading Facilities (MTF) and Organized Trading Facilities (OTF) must establish rules for fair and orderly trading and establish objective criteria for the efficient execution of orders according to Art. 18(1) of MiFID II.

egated to the regulated market by the competent authority. Furthermore, the strict and comprehensive institutional requirements that Arts 45 and 46 of MiFID II place on regulated markets, show the important role the regulated markets are still expected to play in the financial markets. For instance, Art. 45(6) of MiFID II requires that the management body of a market operator take responsibility for its governance arrangements, so as to prevent conflicts of interest and promote the integrity of the market.[209] The strong emphasis on managing conflicts of interest and market integrity (still very present in the regulation of regulated markets) underscores the relevance of examining the relationship between regulated markets and HFT, so as to determine whether elements of this relationship may be in breach of the requirement to provide fair and orderly trading according to non-discretionary rules. Given the alignment of interests that seems to exist between market venues and HFT in terms of increased liquidity, volumes, fees and revenues, the relationship could warrant scrutiny from a conflict-of-interest perspective, particularly with regard to the ways in which this may impact other investors. When thinking in these terms, it is also worth recalling what was said above in Section D.I.: the perception of fairness is important in fostering market confidence. Because of the complexity and opacity of HFT practices, as well as their relationship with market venues, it is difficult for other traders to know to what extent they are affected by HFT in their trading activities. Thus, the suspicion of a conflict of interest, along with the difficulties encountered in assessing the full impact of HFT, may accentuate the perception that the market is 'rigged' to the detriment of other traders. These questions could be an interesting avenue for further research.

III. Some Considerations for Future Policy-Making – Fairness of High-Frequency Trading from a Societal Perspective

Apart from questions about how current regulation is, or should be, interpreted that have so far been central to the discussion, it is also important to discuss HFT from the perspective of future policy-making. What considerations should be brought to bear in policy makers' deliberations about future amendments? A first consideration relates to the distribution of benefits and risks between HFT and other investors at the aggregate level. It has been pointed out[210] that HFT practices increase institutional

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[209] In connection with this provision, Ferrarini and Saguato notes that regulated markets are a particular type of institution, creating risks of a special type which are mainly connected with the need to ensure fair and orderly trading and the integrity of markets, and furthermore that this explains the focus on conflicts of interest, which can arise out of the multiplicity of parties involved in the organised trading and on the resilience of trading systems. Moreover, they note that both conflicts of interest and and trading systems' failure may not only jeopardize market integrity, but also threaten the financial system as a whole. Guido Ferrarini and Paolo Saguato, *Governance and Organization of Trading Venues: The Role of Financial Markets Infrastructure Groups* in D Busch and G Ferrarini (eds), *Regulation of the EU Financial Markets,* 293 (Oxford: Oxford University Press 2017).

[210] See for instance Canadian Commission de l'éthique en science et en technologie, *Ethical Issues of High-Frequency Trading*, 11 (2016) <http://www.ethique.gouv.qc.ca/en/assets/documents/THF/CEST-THF_EN%20vf_A.pdf>.

investors' transaction costs, which decreases the rate of return for the ultimate owners of the capital managed by such investors (e.g. pensioners and retirees). When thinking about which interests should be accommodated by regulation when it comes to the distribution of trading gains across different groups of market actors, policy makers would be well advised not to let high-frequency traders reap larger gains from their trading practices than it balances the benefits they provide to the markets in terms of improved market quality. The discussion about the pros et cons of HFT has so far been inconclusive. Nevertheless, as shown in Section B.V., assessing the advantages and disadvantages of HFT from a broader perspective on market quality[211] gives a more nuanced and critical picture. From a fairness perspective, one could certainly argue that the investors that manage capital on behalf of groups that have little say in the financial markets on an individual basis, and furthermore actually provide the market with capital for investment purposes as well as information based on fundamental analyses,[212] should have priority over proprietary arbitrageurs like HFT.

The second consideration to bear in mind relates to the distribution of risks and rewards between HFT and society at large, as viewed through the lens of systemic risk. It is generally acknowledged that HFT can entail systemic risk, often materialising in the form of flash crashes.[213] Even though system requirements are an important part of the new regulatory regime under MiFID II, the concept of systemic risk is elusive and it is not possible to say with certainty that the new regime will fully extinguish systemic risk due to HFT.[214] Systemic risk in financial markets has a tendency to entail large societal consequences if and when it materialises. Donald contends that algorithmic trading represents a fundamental risk to society, a risk that is rarely assessed in terms of market quality. In his opinion, decisions that affect public safety should be made by a qualified and duly licensed person, not an insentient being or

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[211] A broad view on market quality is advocated by David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in R Buckley et al (eds) *Reconceptualising Global Finance and Its Regulation*, 220 (Cambridge: Cambridge University Press, 2016).

[212] Joseph E Stiglitz, *Tapping the Brakes: Are Less Active Markets Safer and Better for the Economy?* Paper presented at the Federal Reserve Bank of Atlanta, 2014 Financial Markets Conference, Tuning Financial Regulation for Stability and Efficiency, Atlanta, Georgia, 7 (15 April 2014).

[213] Systemic risk in HFT markets is extensively discussed in many of the reports commissioned under the 2012 UK Foresight project 'Future of Computer Trading'. For a summary of the findings, see The Government Office for Science, *Foresight: The Future of Computer Trading in Financial Markets, Final Project Report* (London, 2012).

[214] In its response to the ESMA, Consultation Paper, *Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/224 (20 July 2011), the European Systemic Risk Board voiced the following concern: 'The ESRB would also like to draw the attention of the ESMA to the risk that HFT would amplify the transmission of shocks across markets, potentially contributing to one or more financial shocks becoming systemic.' [ESRB, *ESRB Response to the ESMA Consultation paper on "Guidelines on Systems and Controls in a Highly Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*" (ESRB letter dated 21 September 2011)].

someone incapable of prudent reflection.[215] This is an important point to consider, as one cannot expect individual market actors active in HFT markets to have sufficient incentives to internalise the negative externalities they impose on society in terms of systemic risk.[216] Hence, this is a task for regulators. When regulators indirectly determine the risk level by imposing more or less strict regulations, they should assess the risk imposed by algorithmic trading on society against the benefits. Here, it seems that the balance is not necessarily fair from a societal perspective, as any benefits accruing to society from HFT are indirect, diffuse and hard to measure. A worst-case scenario of systemic risk on the other hand could prove dramatic in a societal sense.

Finally, one might question whether the total resource expenditure necessitated by HFT practices is fair from a societal perspective. Because of the complexity and opacity of HFT, it is costly and difficult to supervise and, furthermore, leads to a general ramping up of trading infrastructure to accommodate HFT needs and wishes[217] – all of which represents resources that could have found an alternative use.

E. Conclusions

This article has explored in depth the properties and different strategies of HFT and has considered how HFT affects other traders from a fairness perspective. It has found that other traders have reason to be concerned about the HFT presence in their market environment for several reasons. One is that HFT can encourage unfair practices like market manipulation that are both difficult to detect and to control. Another concern is the potential for structural and systematic disadvantage that follows from various arrangements like co-location, data feeds and special order types. Third, HFT can impact long-term price formation to the detriment of traders with a longer time horizon than themselves. All these effects can result in the overarching regulatory objective of market confidence being challenged. This may impact not only the individual traders that encounter HFT in the trading systems, but can be detrimental to the economic and societal gains a well-functioning financial system ideally could provide. At present, these concerns are not fully dealt with by the legal mechanisms designed to regulate HFT in MiFID II and MAR. On the other hand, this article has identified other provisions in MiFID II (designed to ensure fairness, market integrity and market

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[215] David C Donald, '*Market Quality' and Moral Hazard in Financial Market Design* in R Buckley et al (eds) *Reconceptualising Global Finance and Its Regulation*, 234 (Cambridge: Cambridge University Press, 2016).

[216] See ESMA, *Final Report, Guidelines on Systems and Controls in an Automated Trading Environment for Trading Platforms, Investment Firms and Competent Authorities*, ESMA/2011/456, 61 et seq. (21 December 2011).

[217] Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets* 68 Vanderbilt Law Review 1607, 1661 (2015). The electronic arms race has been denoted as socially wasteful, see among others Steven R McNamara, *The Law and Ethics of High-Frequency Trading* 17 Minnesota Journal of Law, Science & Technology 71, 131 (2016).

confidence), which could in certain circumstances be applied to HFT or to the market venues on which high-frequency traders are active. The article argues that this particular regulatory application should be of interest to both supervisors/regulators and academics. Lastly, the article raises some questions in relation to future policy-making and contends that HFT can arguably be seen as unfair even in this broader perspective.