



# High-Frequency Trading as an Impediment to Long-Term and Sustainable Finance: Identifying a Regulatory Gap that Can Put the Goals of the European Action Plan on Financing Sustainable Growth at Risk

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## Abstract

The EU Commission's Action Plan on Financing Sustainable Growth reflects a pivotal shift in policy priorities, spurred by a fast-moving international agenda, and specifically the adoption of the Paris Agreement and the UN Sustainable Development Goals. The ambitious goals of the Action Plan require private capital to be reoriented to more sustainable investment purposes. To this end, one key objective in the Action Plan is to foster transparency and long-termism in financial and economic activity, implemented among others through imposing new requirements on ESG-related disclosure on companies and financial market actors. This article investigates whether and how that policy objective is impacted by the ubiquitous market practice of high-frequency trading (HFT). Evidence suggests that HFT may have an inbuilt focus on short-term pricing signals. Furthermore, HFT can hamper the uptake of the new ESG-related disclosure requirements with negative effect for sustainable market outcomes. Neither the new regulatory initiatives nor the current regulatory measures in Directive 2014/65/EU (MiFID II) will alleviate these shortcomings. This constitutes a gap in the policy agenda relating to the institutional and organisational features of the current market structure. These issues should be given consideration in future policy-making assessments and efforts aiming to improve long-term sustainability in financial markets.

## Keywords

High-frequency trading, sustainable finance, long-termism, short-termism, ESG

## 1. Introduction

Over the past few years, sustainable finance has become a major policy priority within the European Union (EU),<sup>1</sup> as evidenced by the European Commission's Action Plan on Financing Sustainable Growth (the Action Plan)<sup>2</sup> and the launching of the European Commission's ambitious New Green Deal, among others.<sup>3</sup> Another, but unrelated, development in recent decades is the rise of high-frequency trading (HFT), a super-fast subgroup of algorithmic trading that has captured a large part of the trading activities taking place in the international financial markets. Concerns that HFT practices may challenge the longstand-

1. European Commission, 'Sustainable Finance' <[https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance\\_en](https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en)> (all hyperlinks have been accessed on 9 May 2020, unless stated otherwise).
2. European Commission, 'Action Plan: Financing Sustainable Growth' (Communication) COM(2018) 97 final (8 March 2018).
3. European Commission, 'The European Green Deal' (Communication) COM(2019) 640 final (11 December 2019).

ing regulatory objectives of orderly trading and market integrity<sup>4</sup> have led the EU to regulate the phenomenon in MiFID II.<sup>5</sup> Separate questions arise, however, about whether HFT is also detrimental to the goals and objectives set out in the Action Plan and, if so, whether MiFID II provides a sufficient regulatory response. The aim of this article is to provide some answers to these questions.

The EU initiatives relating to sustainable finance are spurred by high-level policy developments elsewhere, in particular the adoption of the Paris Agreement and the UN Sustainable Development Goals (the SDGs), both creating a demand for financing that goes beyond contributions from public finance. At the same time, there is growing acknowledgement that financial risks stemming from long-term sustainability-related factors – particularly associated with climate change, but also other social and environmental problems – may not be properly considered in today’s financial markets. In the longer run, a lack of attention to environmental, social and governance (ESG) issues<sup>6</sup> could challenge the overarching policy goals of financial stability and well-functioning capital markets.

In the Action Plan, the European Commission insists that public policies be adapted to new realities, noting the threat of increasingly catastrophic and unpredictable consequences due to climate change and resource depletion.<sup>7</sup> The Commission suggests that the financial system has a key role to play in this regard and notes that reorienting private capital to more sustainable investments requires a comprehensive shift in how the financial system works.<sup>8</sup> Consequently, the concrete policy actions put forward by the Action Plan mainly revolve around activities that take place within the realms of the financial system and its various actors, and its interaction with the corporate sector.

One major issue addressed by the Action Plan relates to concerns that current market practices favour investments producing high returns over a short timeframe, at the detriment of investments that represent longer-term objectives and consequences. Because sustainability-related risks tend to materialise over a longer period, the Action Plan takes the view that a short-term focus can result in unnecessary exposure to long-term sustainability risks.<sup>9</sup> Thus, the Action Plan adopts among its main objectives the aim to ‘foster transparency and long-termism in financial and economic activity’.<sup>10</sup> As a follow-up to this policy objective, the three European Supervisory Authorities (EBA, ESMA and EIOPA) were mandated to collect evidence of undue short-termism in capital markets, resulting in three reports being delivered to the Commission in December 2018.<sup>11</sup> During the preparation of the report delivered by ESMA,<sup>12</sup> the ESMA stakeholder group (SMSG)<sup>13</sup> raised concerns

4. For a discussion of these issues, see Trude Myklebust, ‘Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach’ (2020) 31(1) *European Business Law Review* 33 and Trude Myklebust, ‘High-Frequency Trading: Regulatory and Supervisory Challenges in the Pursuit of Orderly Markets’ in Iris H-Y Chiu and Gudula Deipenbrock (eds), *The Routledge Handbook of Financial Technology and Law – Regulatory, Supervisory, Policy and other Legal Challenges* (forthcoming).
5. Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (‘MiFID II’) [2014] OJ L173/349.
6. ESG is a broad concept which can encompass a large variety of more specific issues and concerns. The scope of the concept as used in the EU Action Plan is discussed in section 3.2 below.
7. COM(2018) 97 final (n 2) 1.
8. *Ibid.*
9. *Ibid.* 11.
10. *Ibid.* 2.
11. See section 3.2 below.
12. European Securities and Markets Authority, ‘Undue Short-Term Pressure on Corporations’ *ESMA30-22-762* (18 December 2019) <[www.esma.europa.eu/sites/default/files/library/esma30-22-762\\_report\\_on\\_undue\\_short-term\\_pressure\\_on\\_corporations\\_from\\_the\\_financial\\_sector.pdf](http://www.esma.europa.eu/sites/default/files/library/esma30-22-762_report_on_undue_short-term_pressure_on_corporations_from_the_financial_sector.pdf)>.
13. The Securities Markets and Stakeholder Group (SMSG) amongst others provide technical advice on ESMA’s policy developments, see <<https://www.esma.europa.eu/about-esma/governance/smsg>>.

that algorithmic trading (which includes high-frequency trading) had not been covered by the preceding survey and suggested that further analysis was necessary in order to understand its possible implications for short-termism.<sup>14</sup> However, in its report, ESMA did not expand on the topic, deferring instead to an upcoming assessment of the impact of the MiFID II requirements regarding algorithmic trading, including HFT, to be conducted in accordance with Article 90(1)(c) of MiFID II and published later.<sup>15</sup>

With this in mind, this study sets out to explore whether and to what extent the practice of algorithmic high-frequency trading can pose a challenge to the goals set out in the European agenda of sustainable finance, in particular with regards to the aim of counteracting undue short-termism in capital markets. A review of the literature on the effects of high-frequency trading on market quality suggests that HFT practices may exacerbate, rather than attenuate, financial market short-termism by relying on an extremely myopic time horizon. Furthermore, the presence of HFT in markets can cause other worrisome effects, inducing traders with long-term trading horizons to spend less resources on fundamental analysis or migrate to less transparent market venues ('dark pools') to avoid being disadvantaged by the superior speed and processing capacity of the HFT segment. This could have detrimental effects for price-formation, because the market actors are deprived of important pricing signals resulting from long-term, fundamental analyses, which can also comprise sustainability-related factors. Consequently, this could stop regulatory initiatives relating to enhanced disclosure of sustainability-related issues from having full effect. The article finds that adverse effects are unlikely to be alleviated by the current regulation of HFT in MiFID II, which focuses on other aspects of HFT activity. The article thus identifies a gap in the EU policy agenda on sustainable finance that could counteract the policy objective of fostering transparency and long-termism in financial and economic activity. Finally, suggestions that stock exchanges and other market venues will opt to decrease the level of participation of HFT on a voluntary basis should be regarded with caution. HFT activity is an important source of revenue for market venues and their policies take this and the competition they face from other market venues into account. Without regulatory intervention, the prospect of voluntary action seems uncertain. The article concludes with some policy recommendations that could potentially contribute to future policy-making in the field.

## 2. Setting the Scene – Tracing the Origins of the Sustainable Finance Agenda and the Concept of ESG

Within the EU, the objective of sustainable development is enshrined in several provisions of the EU treaties as well as embedded in secondary legislation governing various EU policy areas.<sup>16</sup> The EU sustainable finance agenda inserts sustainability as an objective in a regulatory area that until recently was not preoccupied with such issues. Financial regulation, under the auspices of the Commission's Directorate-General for Financial Stability, Financial Services and Capital Markets (DG FISMA),<sup>17</sup> is a vast body of policy measures, regulation and institutions, which cover the activities taking place within the sectors of insurance and

14. The SMSG's advice of 15 August 2019 is included in European Securities and Markets Authority (n 12) 151–164.

15. European Securities and Markets Authority (n 12) 100–101. The indicated time for publishing is December 2020.

16. For extensive discussions relating to the business sector, see for instance Beate Sjøfjell and Anja Wiesbrock (eds), *The Greening of European Business under EU Law: Taking Article 11 TFEU Seriously* (Routledge 2015).

17. The Directorate-General for Financial Stability, Financial Services and Capital Markets Union <[https://ec.europa.eu/info/departments/financial-stability-financial-services-and-capital-markets-union\\_en#responsibilities](https://ec.europa.eu/info/departments/financial-stability-financial-services-and-capital-markets-union_en#responsibilities)>.

occupational pensions, banking and the financial markets. Predominantly characterised as a public law domain, its overarching purpose closely adheres to the role the financial system plays in a market-based economy – that is, providing structures and functions that facilitate the allocation of resources over time and between investment purposes to the purported benefit of investors, companies and society. The overarching role of financial regulation is to improve the workings of the financial system<sup>18</sup> – and thus support it in carrying out its role – by correcting market failures that hamper the ideal functioning of the system.<sup>19</sup> The main legislative goals have traditionally been well-functioning markets and financial stability. These goals translate into more specific regulatory objectives for each of the three main sectors mentioned above (insurance and occupational pensions, banking, and the financial markets), none of which have previously taken sustainability-related issues into account.<sup>20</sup>

The recent shift towards sustainable finance within the EU is a result of a combination of drivers, amongst which are the Paris Agreement and the UN SDGs, the need to mobilise private finance to contribute to under-financed purposes, and the gradual acceptance of new ideas regarding the societal role and the workings of the financial system. Together these driving forces have paved the way for the change represented *inter alia* by the Action Plan. However, these ideas have not developed in a vacuum.<sup>21</sup> Preceding the EU policy agenda, the same circumstances have elicited attention and influential contributions from other policy-making bodies, practitioners, civil society and academia, forming an important background against which the EU agenda should be understood.<sup>22</sup>

The format of this article allows only a cursory glance at these developments, some of which will be further discussed in the following sections. However, of particular interest is the voluntary and practitioner-led agenda of *responsible investment*, in which the ESG terminology now adopted in the context of the EU sustainable finance agenda has been a core concept for more than a decade. The responsible investment agenda also contributed to the development of a particular focus and certain ideas that were later taken up by the EU policy agenda, not least the importance of instituting a long-term time horizon for investments.<sup>23</sup>

The ESG concept can be traced back to an UN-initiated report published in 2004,<sup>24</sup> looking into how environmental, social and governance issues could be better integrated

18. John Armour and others, *Principles of Financial Regulation* (1<sup>st</sup> edn, Oxford University Press 2016) 51.

19. For a discussion of the rationale underpinning financial regulation and its relation to economic theory, see Mads Andenas and Iris HY Chiu, *The Foundations and Future of Financial Regulation: Governance for Responsibility* (Routledge 2014) 4 and 17 et seq.

20. One earlier indicator of the new focus is the adoption of Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups ('Non-Financial Reporting Directive') [2014] OJ L 330/1.

21. There are important links between this body of thought and the substantial and well-developed practices and literature relating to corporate social responsibility. For a discussion of the relationship between these agendas, see for instance Céline Louche, 'Corporate Social Responsibility: The Investor's Perspective' in Samuel O Idowu and Walter Leal Filho (eds), *Professionals' Perspectives of Corporate Social Responsibility* (Springer 2010) 211–231.

22. This is acknowledged for instance by the High-Level Expert Group on Sustainable Finance, 'Financing a Sustainable European Economy: Interim Report' (12 July 2017) 3 <[https://ec.europa.eu/info/sites/info/files/170713-sustainable-finance-report\\_en.pdf](https://ec.europa.eu/info/sites/info/files/170713-sustainable-finance-report_en.pdf)>.

23. See among others Timo Busch, Rob Bauer and Marc Orlitzky, 'Sustainable Development and Financial Markets: Old Paths and New Avenues' (2016) 55 *Business & Society* 303 <<https://doi.org/10.1177/0007650315570701>>.

24. The Global Compact, 'Who Cares Wins – Connecting Financial Markets to a Changing World' (June 2004) <[https://www.unepfi.org/fileadmin/events/2004/stocks/who\\_cares\\_wins\\_global\\_compact\\_2004.pdf](https://www.unepfi.org/fileadmin/events/2004/stocks/who_cares_wins_global_compact_2004.pdf)>. See also the follow-up report IFC/FDFA/Global Compact, 'Future Proof? Outcomes of the Who Cares Wins Initiative 2004-2008' (January 2009) <<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/476811468158704493/future-proof-embedding-environmental-social-and-governance-issues-in-investment-markets-outcomes-of-the-who-cares-wins-initiative-2004-2008>>.

in analysis, asset management and securities brokerage as well as fiduciary duty and financial disclosure. Shortly after, the ESG terminology was taken up and disseminated by the UN-backed Principles for Responsible Investment (PRI), a global network of market actors active in the space of responsible investment. PRI has been an influential proponent of the responsible investing agenda, constantly expanding its remit and signatory base, while also taking part in various research and policy-making efforts within the area.<sup>25</sup> At its inception in 2006, the PRI had 51 signatories, while by the end of 2019, it had more than 2200.<sup>26</sup>

In its early days, proponents of responsible investment focused mainly on questions of ethics in finance, advocating divestment from holdings in companies that did not conform with the moral values of the shareholder.<sup>27</sup> While this perspective is still present in investor strategies, as evidenced *inter alia* by the Ethical Guidelines of the Norwegian Government Pension Fund,<sup>28</sup> the responsible investment agenda has also broadened substantially over the years. A common approach among investors that today label themselves as ‘responsible investors’ is to adhere to the voluntary framework provided by the PRI. The PRI defines responsible investment as a strategy and practice involving the incorporation of environmental, social and governance (ESG) factors in investment decisions and active ownership.<sup>29</sup> This can involve considering ESG issues when building a portfolio or engaging with portfolio companies to enhance their ESG performance.

Interest in the agenda of sustainable finance has also appeared in the ranks of policy-making institutions and international organisations with responsibility for economic and financial issues. This was particularly evident in the years after the 2008–2009 financial crisis.<sup>30</sup> Growing interest in these bodies is often triggered by challenges posed by the financial system in terms of delivering on the societal objectives embedded in their mandates or areas of responsibility. In the later years, the most obvious examples of that type of engagement relate to the impact of climate change on the economy.<sup>31</sup> Central banks and financial supervisory authorities have been particularly active when it comes to the effect of climate change on financial stability.<sup>32</sup> The Bank of England, for instance, has undertaken comprehensive efforts in this regard, stating that severe climate change could impact the economy

25. Among others, the PRI was represented in the High-Level Expert Group on Sustainable Finance appointed by the European Commission in 2016 (see section 3.1 below).

26. Principles for Responsible Investment, ‘Annual Report 2019’ (2020) <[https://d8g8t13e9vf2o.cloudfront.net/Uploads/t/j/z/priannualreport2019\\_901594.pdf](https://d8g8t13e9vf2o.cloudfront.net/Uploads/t/j/z/priannualreport2019_901594.pdf)>

27. For a discussion of the early development of the responsible investment agenda, see Trude Myklebust, ‘The Role of Stock Exchanges in Shaping More Sustainable Company and Market Practices’ (12 September 2013) University of Oslo Faculty of Law Research Paper No 2013-28 <<https://ssrn.com/abstract=2324743>>.

28. Government Pension Fund Global, ‘Guidelines for observation and exclusion from the Government Pension Fund Global’ (18 December 2014) <<https://nettsteder.regjeringen.no/etikkradet3/files/2019/12/guidelines-for-observation-and-exclusion-from-the-gpfg-01.09.2019.pdf>>.

29. Principles for Responsible Investment, ‘What is responsible investment?’ <[www.unpri.org/pri/an-introduction-to-responsible-investment/what-is-responsible-investment](http://www.unpri.org/pri/an-introduction-to-responsible-investment/what-is-responsible-investment)>.

30. See for example the comprehensive project *Inquiry into a Sustainable Financial System* led by the UN Environmental Program, resulting in a large range of reports on various topics of relevance for sustainable finance, available at <<https://unepinquiry.org/about-us/>>.

31. See among others A Group of the Advisory Scientific Committee of the European Systemic Risk Board, ‘Too Late, Too Sudden: Transition to a Low-Carbon Economy and Systemic Risk’, Reports of the Advisory Scientific Committee No 6 (February 2016); European Systemic Risk Board, ‘Positively Green: Measuring Climate Change Risks to Financial Stability’ (June 2020); International Association of Insurance Supervisors and The Sustainable Insurance Forum, ‘Issues Paper on Climate Change Risks to the Insurance Sector’ (July 2018) <<https://www.iaisweb.org/page/supervisory-material/issues-papers//file/76026/sif-iais-issues-paper-on-climate-changes-risk>>.

32. See for instance Emanuel Campiglio, Yannis Dafermos, Pierre Monnin and others, ‘Climate change challenges for central banks and financial regulators’ (2018) 8 *Nature Climate Change* 462–468 <<https://doi.org/10.1038/s41558-018-0175-0>>.



in various ways, whether it is affecting total economic activity, the productivity of the workforce, or the smooth functioning of financial markets.<sup>33</sup> One significant development has been the so-called TCFD principles developed in 2017 by an industry-led group established by the Financial Stability Board: the Task Force on Climate-related Financial Disclosure.<sup>34</sup> The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) is a group of Central Banks and Supervisors established to share best practices and contribute to the development of environment and climate risk management in the financial sector and to mobilize mainstream finance to support the transition towards a sustainable economy. The International Organization of Securities Commissions (IOSCO), has also engaged in the matter among others by establishing a Sustainable Finance Network (SFN) in 2018 and has issued a report on sustainable finance and the role of securities regulators and IOSCO.<sup>35</sup> Of interest to the topic of this paper is the Sustainable Stock Exchanges Initiative (SSE), which was established in 2008 by a UN Partnership Programme organised by UNCTAD, the UN Global Compact, UNEP FI and the PRI. The SSE states that its mission is to provide a global platform for exploring how exchanges, in collaboration with investors, companies (issuers), regulators, policy makers and relevant international organisations can enhance performance on environmental, social and corporate governance issues and encourage sustainable investment.<sup>36</sup>

This adoption of the concept of sustainable finance among policymakers resonates with an emerging body of thought within academia investigating the workings of the financial system, with an emphasis on how its societal role can better be fulfilled, particularly since the financial crisis.<sup>37</sup> Thus, policymakers are currently faced with a daunting task: how can the financial system be structured and regulated so that it contributes to investments that increase welfare and without jeopardising nature's limited resources, violating human rights or undermining social justice?<sup>38</sup> For these overarching aims to be fulfilled, the functions of the financial system need to be inspected more closely, including how they contribute to moving this agenda forward. This discussion will inevitably touch on intricate questions relating to market structure and market microstructure which will be discussed in section 4.

### 3. The EU Agenda on Sustainable Finance – Main Objectives, Action Points and Regulatory Initiatives

#### 3.1 Overview

The European agenda on sustainable finance is situated at the nexus of a number of larger and fast-paced initiatives within the EU. First, the EU has vast financing needs, particu-

33. Bank of England, 'Climate Change: Why it Matters to the Bank of England' <<https://www.bankofengland.co.uk/knowledgebank/climate-change-why-it-matters-to-the-bank-of-england>>; see also De Nederlandsche Bank, 'Waterproof: An Exploration of Climate-Related Risks for the Dutch Financial Sector' (2017).

34. Task Force on Climate-related Financial Disclosures, 'Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures' (June 2017).

35. IOSCO, 'Sustainable Finance and the Role of Securities Regulators and IOSCO: Final Report' FR04/2020 (April 2020) <<https://www.iosco.org/library/pubdocs/pdf/IOSCOPD652.pdf>>.

36. See for instance Sustainable Stock Exchanges and World Federation of Exchanges, 'How Exchanges Can Embed Sustainability within Their Operations: A Blueprint to Advance Action' (September 2019).

37. See for instance Viral V Acharya and others (eds), *The Social Value of the Financial Sector: Too Big To Fail Or Just Too Big?* (World Scientific 2014).

38. For extensive discussions with regards to considerations of environmental sustainability within the area of banking regulation, see Kern Alexander, 'Banking Regulation and Environmental Sustainability' (2015) 104 *Amicus Curiae Journal of the Society for Advanced Legal Studies* 2-9. See also Kern Alexander, *Principles of Banking Regulation* (Cambridge University Press 2019) chapter 13.

larly if it wants to achieve its 2030 climate and energy targets.<sup>39</sup> Other projects in the transport, energy and resource management sectors will also require large investments, creating a yearly investment gap described by the Commission as ‘astounding’.<sup>40</sup> Second, the agenda relates to concerns about the financial impact of emerging societal risks, especially those tied to the growing realisation of the magnitude of costs and losses that will be brought on by climate change, but also those arising from social issues like poor working conditions and growing inequalities.<sup>41</sup> These concerns tie in with the work on climate-related risk and financial stability as mentioned in section 2 above.

The momentum of the sustainable finance agenda has built up swiftly. The 2016 communication on the implementation of the SDGs, which heralded an ambition to better align the financial system with EU policies in support of sustainable growth and investments, was an important milestone in this respect.<sup>42</sup> It was followed by concrete plans for action put forward in the Mid-Term Review of the Capital Markets Union Action Plan in June 2017, where the Commission argued that a deep re-engineering of the financial system was necessary for investments to become more sustainable and for the system to promote truly sustainable development from an economic, social and environmental perspective. The Commission noted that this would imply ‘finding ways to integrate sustainability into the EU’s regulatory and financial policy framework and to mobilise and orient more private capital flows towards sustainable investments.’<sup>43</sup> Furthermore, in 2017 it was announced that the three supervisory authorities (EBA, ESMA and EIOPA) were mandated to promote sustainable finance, while ensuring financial stability, and to take account of environmental, social and governance-related factors and risks in all their tasks.<sup>44</sup>

An important element of the EU Sustainable Finance work stream has been the work of the EU High-Level Expert Group on Sustainable Finance (HLEG). The group delivered its interim report in July 2017<sup>45</sup> and its final report in January 2018.<sup>46</sup> The group’s deliberations and recommendations have been instrumental in guiding further work by the Commission in the area of finance and sustainability and the Action Plan explicitly states that it builds upon the HLEG’s recommendations.<sup>47</sup> The Action Plan, described in more detail below, was adopted in 2018 and sets out the specific policy actions and regulatory initiatives that comprise the sustainable finance agenda.

Since the adoption of the Action Plan, EU policy has increasingly focused on pushing its financial and economic systems towards more sustainability. In December 2019, the Commission presented the European Green Deal,<sup>48</sup> with ambitious targets to make Europe car-

39. COM(2018) 97 final (n 2) 2.

40. Ibid.

41. Ibid 3.

42. European Commission, ‘Next Steps for a Sustainable European Future – European Action for Sustainability’ (Communication) COM(2016) 739 final (22 November 2016).

43. European Commission, ‘Mid-Term Review of the Capital Markets Union Action Plan’ (Communication) COM(2017) 292 final (8 June 2017) 9.

44. European Commission, ‘Creating a stronger and more integrated European financial supervision for the Capital Markets Union’ (Press release) (20 September 2017) <[https://ec.europa.eu/commission/presscorner/detail/en/IP\\_17\\_3308](https://ec.europa.eu/commission/presscorner/detail/en/IP_17_3308)>.

45. High-Level Expert Group on Sustainable Finance, ‘Financing a Sustainable European Economy: Interim Report’ (n 22).

46. High-Level Expert Group on Sustainable Finance, ‘Financing a Sustainable European Economy: Final Report’ (31 January 2018) <[https://ec.europa.eu/info/sites/info/files/180131-sustainable-finance-final-report\\_en.pdf](https://ec.europa.eu/info/sites/info/files/180131-sustainable-finance-final-report_en.pdf)>.

47. COM(2018) 97 final (n 2) 1.

48. European Commission, ‘The European Green Deal’ (Communication) COM(2019) 640 final (11 December 2019).

bon-neutral by 2050, alongside a range of other sustainability-related goals.<sup>49</sup> In March 2020, in support of the Green Deal, and also taking the situation created by the Covid-19 pandemic into account, the Commission launched a consultation on a renewed sustainable finance strategy. The new strategy will build on the 10 actions put forward in the 2018 Action Plan.<sup>50</sup> The Commission has established a platform for sustainable finance to coordinate efforts on environmentally sustainable finance initiatives.<sup>51</sup>

### 3.2 The Objectives and Main Elements of the Action Plan

Closely following the lead of the HLEG's recommendations, the 2018 Action Plan<sup>52</sup> sets out three overarching policy goals:<sup>53</sup>

1. re-orient capital flows towards sustainable investments in order to achieve sustainable and inclusive growth;
2. manage financial risks stemming from climate change, resource depletion, environmental degradation and social issues;
3. foster transparency and long-termism in financial and economic activity.

The first two goals refer to the need of steering finance towards sustainable purposes and improved risk-management, as described in section 3.1 above. The third goal focuses less on an end result and more on how the functioning of the financial system should be conditioned to help realise the first and second goals.

The Action Plan refers to 'sustainable finance' as the process of taking due account of environmental and social considerations in investment decision-making, leading to increased investments in longer-term and sustainable activities. More specifically, the Action Plan states that *environmental* considerations concern climate change mitigation and adaptation, as well as the environment more broadly (eg air and water pollution, resource depletion and biodiversity loss) and related risks (eg natural disasters). *Social* considerations may refer to issues of inequality, inclusiveness, labour relations, investment in human capital and communities. The Action Plan emphasises the fundamental role of the *governance* of public and private institutions – including management structures, employee relations and executive remuneration – in ensuring that social and environmental considerations are considered in the decision-making process.<sup>54</sup>

The Action Plan also argues that this new focus may bring about a competitive advantage, with sustainability imperatives and the transition to a low-carbon, more resource-efficient and circular economy<sup>55</sup> as key to ensuring the long-term competitiveness of the EU

49. European Commission (n 1).

50. European Commission, 'Consultation on the Renewed Sustainable Finance Strategy' 4 <[https://ec.europa.eu/info/sites/info/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/2020-sustainable-finance-strategy-consultation-document\\_en.pdf](https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/2020-sustainable-finance-strategy-consultation-document_en.pdf)>.

51. International platform on sustainable finance, 'Factsheet' <[https://ec.europa.eu/info/sites/info/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/200325-international-platform-sustainable-finance-factsheet\\_en.pdf](https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200325-international-platform-sustainable-finance-factsheet_en.pdf)>.

52. For an in-depth description of the Action Plan and its various elements, see Michele Siri and Shanshan Zhu, 'Will the EU Commission Successfully Integrate Sustainability Risks and Factors in the Investor Protection Regime? A Research Agenda' (2019) 11 *Sustainability* 6292.

53. COM(2018) 97 final (n 2) 2.

54. *Ibid.*

55. The European Commission has adopted an action plan for circular economy: European Commission, 'A New Circular Economy Action Plan for a cleaner and more competitive Europe' (Communication) COM(2020) 98 final (11 March 2020).



economy.<sup>56</sup> While alluding to the Brundtland Commission's concept of sustainable development by stating that the EU is committed to a form of development that meets the needs of present and future generations, the plan does not abandon the growth paradigm, which is present in the title as well as throughout the text of the Action Plan.<sup>57</sup> The Plan stresses that taking longer-term sustainability interests into account makes economic sense and does not necessarily lead to lower returns on investment.<sup>58</sup> The Action Plan contains 10 concrete points of action, whereof several entail regulatory measures.<sup>59</sup>

One strong underlying assumption of the Action Plan relates to *short-termism*, which is considered to hinder the realisation of financing needs and prevent proper risk assessments from taking place within the current configuration of the financial system. The Action Plan notes that investment decisions are typically based on several factors, but that environmental and social considerations are often not sufficiently taken into account since such risks are likely to materialise over a longer time horizon.<sup>60</sup> The Action Plan states that 'sustainability and long-termism go hand in hand' and describes long-termism as the practice of making decisions that have long-term objectives and consequences.<sup>61</sup> The Action Plan suggests that current market practices often focus on producing high returns over a short timeframe, and goes on: 'Therefore, a central focus of the sustainability agenda is to reduce the undue pressure for short-term performance in financial and economic decision-making, notably by increased transparency, so that investors, whether corporate or retail, can take better informed and more responsible investment decisions.'<sup>62</sup>

Thus, the Commission evidently associates the problem of short-termism with a presumed lack of information about such factors in the financial markets. However, market practices<sup>63</sup> and regulatory issues<sup>64</sup> are also mentioned as possible barriers to long-term financial decision-making.

Discussions involving the relationship between time horizons and finance have a long history.<sup>65</sup> The question has engaged policymakers<sup>66</sup> and researchers<sup>67</sup> and has been an area of priority in the analytical framework underpinning the voluntary responsible investment agenda.<sup>68</sup> There is a recurring assertion that finance contributes to an overly short-term focus among financial and economic decision-makers, to the detriment of long-term sus-

56. COM(2018) 97 final (n 2) 1.

57. Ibid.

58. Ibid 2.

59. See the table of proposed implementing measures COM(2018) 97 final (n 2) 16. See Siri and Zhu (n 52) 3 et seq. for a description of the various implementing measures.

60. COM(2018) 97 final (n 2) 2.

61. Ibid 3.

62. Ibid 3–4.

63. Ibid 3.

64. Ibid 10, particularly focusing on reporting and accounting rules.

65. An overview of literature is given in Richard Davies and others, 'Measuring the Costs of Short-Termism' (2014) 12 *Journal of Financial Stability* 16, section 2. A weakness of the discourse on short-termism vs long-termism is that a clear definition of both concepts is lacking, and seems to vary both when it comes to content, reasons and effects. The way it is used in the Action Plan points to a relative way of understanding the concepts, seen in relation to the societal purposes the European Commission wants to further.

66. For example, the government-appointed Kay Commission in the UK resulting in the report 'The Kay Review of UK Equity Markets and Long-Term Decision Making: Final Report' (July 2012) <[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/253454/bis-12-917-kay-review-of-equity-markets-final-report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/253454/bis-12-917-kay-review-of-equity-markets-final-report.pdf)>.

67. An extensive list of literature is included in European Securities and Markets Authority (n 12) 107–123.

68. For a comprehensive discussion of time horizons, see Dirk Schoenmaker and Willem Schramade, *Principles of Sustainable Finance* (1st edn, Oxford University Press 2019) chs 3.4 and 7. See also Louche (n 21) section 11.7.3 and PRI Academic Network, 'Long-termism in financial markets' (April 2014) *PRI Academic Network RI Quarterly* vol 3 <[www.unpri.org/Uploads/t/q/k/RI-QUARTERLYvol3.pdf](http://www.unpri.org/Uploads/t/q/k/RI-QUARTERLYvol3.pdf)>.

tainability-related goals. In 2015, the then-Governor of the Bank of England, Mark Carney, moved the issue to the forefront of the agenda of financial policy-making in his now-famous speech at Lloyd's in London, when he used the expression a 'tragedy of horizons' to explain how climate-related financial risk may be disregarded because impacts materialise outside the normal decision-making timeframes of public and private organisations.<sup>69</sup> In the HLEG's reports, there is a strong emphasis throughout on the need to encourage a long-term orientation and integration of ESG issues at the time of investment as a prerequisite of sustainability.

The Action Plan contains several concrete action points which aim to attenuate short-termism in the context of financial markets. In line with the causality attributed to the lack of transparency about environmental and social factors, much emphasis is placed on increasing company disclosure of non-financial information (Action 9 of the Action Plan). The motivation is to foster transparency and long-termism by enabling issuers and stakeholders to properly assess the long-term value creation of companies and their management of sustainability risks, and also to help steer companies in a more sustainable and long-term direction.<sup>70</sup> The Non-Financial Reporting Directive<sup>71</sup> was filled out with new non-binding guidelines in 2017,<sup>72</sup> and additional non-binding guidelines on reporting climate-related information were published in June 2019, integrating the recommendations of the FSB Task Force on Climate-related Financial Disclosures (TCFD).<sup>73</sup> Further amendments to the Directive were proposed as a result of the European Green Deal.<sup>74</sup> Changes to the requirements on company reporting also require consideration of the relevant accounting standards.<sup>75</sup>

To the extent that increased transparency and more clarity about what types of activities are deemed 'sustainable' will help foster long-termism, also other initiatives set in motion by the Action Plan could contribute towards that objective. In particular, Action 9 of the Action Plan refers to the proposal in Action 7 of the Action Plan to increase the disclosure required by asset managers and institutional investors.<sup>76</sup> Without being specifically attributed to the objective of fostering long-termism, arguably other regulatory developments under the workstream of Sustainable Finance that increases transparency and clarity could also contribute to that end.<sup>77</sup>

69. Mark Carney, 'Breaking the Tragedy of the Horizon—Climate Change and Financial Stability', Speech (29 September 2015) <<https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability.pdf?la=en&hash=7C67E785651862457D99511147C7424FF5EAOC1A>>.

70. COM(2018) 97 final (n 2) 3.

71. Non-Financial Reporting Directive (n 20).

72. European Commission, 'Guidelines on non-financial reporting (methodology for reporting non-financial information)' (Communication) [2017] OJ C 215/1.

73. European Commission, 'Guidelines on non-financial reporting: Supplement on reporting climate-related information' (Communication) [2019] OJ C 209/1.

74. European Commission, 'Public consultation 20 February 2020 on Non-financial reporting by large companies (updated rules)' <<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12129-Revision-of-Non-Financial-Reporting-Directive/public-consultation>>.

75. COM(2018) 97 final (n 2) 10.

76. Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector [2019] OJ L317/1. The Regulation places new sustainability-related disclosure requirements on a host of financial market service providers towards end investors.

77. Key actions include a classification system for sustainable activities (the 'taxonomy'), the creation of standards and labels for sustainable financial products, better integration of sustainability in ratings and market research and the development of sustainability benchmarks. Several legislative implementing measures have been put forward by the European Commission, based on recommendations from a Technical Expert Group

As part of the goal to foster transparency and long-termism, the Action Plan furthermore highlighted a corporate governance perspective (see in particular Action 10 of the Action Plan) and observed that undue short-term market pressures could make it difficult to lengthen the time horizon in corporate decision-making.<sup>78</sup> Corporate managers could become overly focused on short-term financial reporting and disregard opportunities and risks stemming from environmental and social sustainability considerations. As a consequence, the Action Plan raised the possibility that interactions between capital market pressure and corporate incentives could lead to ‘unnecessary exposure’ to sustainability risks in the long-term.<sup>79</sup> In accordance with Action 10 of the Action Plan, the three European Supervisory Authorities (EBA, ESMA and EIOPA) were therefore mandated to collect evidence of undue short-term pressure from the financial sector on corporations and to advise on possible further policy.<sup>80</sup> All three delivered comprehensive reports discussing several issues of interest for gauging the existence of short-term pressure in financial markets and companies.<sup>81</sup> However, much as in the HLEG’s reports and the Action Plan, issues relating to high-frequency trading and the associated phenomenon of market structure were barely touched upon. The next section will delve into what these particular features of modern financial markets mean for the goals of the EU strategy for sustainable finance.

## 4. Investigating the Effects of High-Frequency Trading in Relation to the Goals of the EU Action Plan on Sustainable Finance

### 4.1 Introduction

This section will discuss whether and to what extent the aims of the Action Plan, and in particular the stated goal to foster transparency and long-termism in financial and economic activity, may be negatively affected by the practice of high-frequency trading – a practice that has become a pervasive feature of financial markets over recent decades. The question is timely because it has been raised, though little discussed, in the various reports and fact-finding exercises carried out by the EU work stream on sustainable finance. In its final report, the HLEG noted that the average holding period for market-traded assets was getting shorter and pointed to HFT as one of several factors that may have contributed to this development. The HLEG did not conclude on the matter; it simply stated that a shorter holding period could have implications for sustainability and suggested a number of policy initiatives that might be taken in response. The group did, however, stress that this would be an important matter for future research.<sup>82</sup> In its advice given in connection with the preparation of the

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on Sustainable Finance (TEG), see Siri and Zhu (n 52) 3. For an overview of the various regulatory initiatives underway or adopted under the various categories, see for instance ESMA, ‘Sustainable Finance’ <<https://www.esma.europa.eu/policy-activities/sustainable-finance>> accessed 13 July 2020.

78. COM(2018) 97 final (n 2) 11.

79. *Ibid.*

80. DG FISMA, ‘Call for Advice to the European Supervisory Authorities to collect evidence of undue short-term pressure from the financial sector on corporations’ (1 February 2019) <[https://ec.europa.eu/info/publications/190201-call-for-advice-to-esas-short-term-pressure\\_en](https://ec.europa.eu/info/publications/190201-call-for-advice-to-esas-short-term-pressure_en)>.

81. European Securities and Markets Authority (n 12), European Banking Authority, ‘EBA Report on Undue Short-Term Pressure from the Financial Sector on Corporations’ (18 December 2019) <[https://eba.europa.eu/sites/default/documents/files/document\\_library/Final%20EBA%20report%20on%20undue%20short-term%20pressures%20from%20the%20financial%20sector%20v2\\_0.pdf](https://eba.europa.eu/sites/default/documents/files/document_library/Final%20EBA%20report%20on%20undue%20short-term%20pressures%20from%20the%20financial%20sector%20v2_0.pdf)>; European Insurance and Occupational Pensions Authority, ‘Potential Undue Short-Term Pressure From Financial Markets on Corporates: Investigation on European Insurance and Occupational Pensions Sectors’ *EIOPA-BOS-19-537* (18 December 2019) <[https://www.eiopa.europa.eu/content/potential-undue-short-term-pressure-financial-markets\\_en](https://www.eiopa.europa.eu/content/potential-undue-short-term-pressure-financial-markets_en)>.

82. High-Level Expert Group on Sustainable Finance, ‘Financing a Sustainable European Economy: Final Report’ (n 46) 46.

ESMA report on undue short-term pressure on corporations, the SMSG called for further analysis regarding algorithmic trading strategies, including HFT, in order to better understand the extent to which short-termism is present and potentially problematic.<sup>83</sup> However, in the said report, ESMA touched only briefly on the issue of HFT and algorithmic trading, and provided no concrete suggestions for action. Instead, the question was deferred to the forthcoming ESMA report on the impact of MiFID II requirements regarding algorithmic trading, including HFT, which is to be conducted in accordance with Article 90(1)(c) of MiFID II and is planned for delivery in December 2020.<sup>84</sup>

Since the question is open for the moment, it seems an appropriate time to consider the practices and effects of HFT in the context of sustainable finance. After introducing the phenomenon of algorithmic HFT and the effect it has on its trading environment, this section goes on to discuss how HFT could impact the goals and priorities of the EU Action Plan (as described in section 3.2 above). The findings suggest that there may indeed be reasons for concern, in particular with regards to the effects that HFT has on time horizons and the effects of disclosure of ESG issues in financial markets – both of which are major priorities under the Action Plan. Given that the regulatory changes set in motion under the Action Plan do not address HFT, and in anticipation of the assessment of the impact of the MiFID II requirements on algorithmic trading planned for late 2020, the findings in this section are briefly discussed in relation to the current regulation of HFT in MiFID II.

With regards to the methodology of this section it should be noted that the relationship between sustainable finance and HFT has as yet been little explored in scholarly work.<sup>85</sup> However, the practice of HFT and its effects are the subject of burgeoning research efforts within different disciplines.<sup>86</sup> This literature can usefully inform the question at hand. Hence, the assessments in this section draw on contributions from several disciplines.

#### 4.2 High-frequency Trading and its Effects: An Overview

HFT is a particular form of financial trading that takes place on stock exchanges and other trading venues that facilitate organised trading in financial assets.<sup>87</sup> It is a subgroup of algorithmic trading, which is a concept used to describe a set of computer-based and automated trading techniques in which decisions about where, when and how to trade are made both according to pre-programmed rules and without human intervention.<sup>88</sup> The most remarkable characteristic that sets HFT apart from other types of algorithmic trading is the extreme speed with which trading activities are conducted. High-frequency traders are in

83. European Securities and Markets Authority (n 12) 156.

84. *Ibid* 100–101.

85. See, however, Thomas Skou Grindsted, 'Algorithms and the Anthropocene' (2018) *Financial Geography Working Paper Series* 21.

86. In legal scholarship, HFT has in particular been discussed in relation to core concepts of securities law such as market integrity, market abuse, and fair and orderly trading. Within financial economics, a large bulk of HFT-related research comes from the branch of market microstructure theory, which has focused on the effects of HFT with regards to important elements of market quality, such as efficiency, liquidity, price-formation and transaction costs. Furthermore, its effect on systemic risk within the financial sector has been the subject of research in computer science, physics and network-theory. Also, policy-making organisations have produced comprehensive research relating to the nature and effects of HFT. For a compilation of research into the effects of HFT, see for instance Myklebust, 'Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach' (n 4) section B.V with further references.

87. For an in-depth description of the properties and strategies of HFT from a legal perspective, see Myklebust 'Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach' (n 4) section B.III.

88. All HFT is performed using algorithms, but not all algorithmic trading is HFT.

command of sophisticated and powerful trading systems that can place, update and cancel large numbers of orders in the blink of an eye. They operate with a ‘latency’, or speed of communication with the trading systems in which they are active, that is measured in milliseconds, microseconds or even nanoseconds.<sup>89</sup> High-frequency trading has captured a large share of the trading activities in international financial markets: between 25 and 70 percent according to estimates in a recent IMF report.<sup>90</sup> In the EU, the estimated level in 2013 was between 24 and 43 percent, depending on the method of measuring.<sup>91</sup> Although both algorithmic trading and HFT are defined in MiFID II for legal purposes,<sup>92</sup> these definitions are wide enough to fit a variety of different practices with potentially very different effects on markets.<sup>93</sup>

High-frequency traders differ from other traders in that their trading activities are not generally motivated by a desire to hold or maintain a portfolio of financial assets. On the contrary, often they will have no holdings at the end of the trading day.<sup>94</sup> This is because the HFT business model is based on the trading activities themselves rather than accrued returns from a portfolio. Biais and Foucault describe five main HFT strategies: market making, directional trading, arbitrage, structural strategies and (illegal, but hard to detect) manipulative strategies.<sup>95</sup> A common trait of all these categories is the use of data tools to analyse large amounts of data, which in turn generate a response in the form of orders or changes to orders placed on the trading systems of market venues. Because each transaction can only generate a small return, high-frequency traders operate with very large volumes in order to have a chance of achieving a satisfactory profit. Their systems therefore generate very large numbers of orders. However, a high proportion of these orders are also cancelled, as the high-frequency traders’ purpose is not necessarily to trade on the submitted orders.<sup>96</sup> Instead, the orders and cancellations may serve as a means of gleaning information about the positions of other market participants based on how they respond to the changes in the electronic order book. To the extent that high-frequency traders succeed in their endeavours, this essentially means that they capture trading gains at the expense of other traders, who lose out to their superior speed and computing capacities.

The business model of HFT has developed in a market environment that has undergone fundamental changes over recent decades.<sup>97</sup> The keyword here is market *fragmentation*. Emerging from a context in which securities trading was concentrated on the physical trading floors of the national incumbent stock exchanges, trading now takes place electronically across a multitude of venues for trading in financial instruments. The changes in the landscape of trading venues have resulted from technological developments as well as regu-

89. Walter Mattli, *Darkness by Design: The Hidden Power in Global Capital Markets* (Princeton University Press 2019) 1.

90. International Monetary Fund, ‘Global Financial Stability Report: Vulnerabilities in a Maturing Credit Cycle’ (April 2019) 51.

91. ESMA, ‘High-Frequency Trading Activity in EU Equity Markets – Economic Report No 1’ (2014) 4 <[https://www.esma.europa.eu/sites/default/files/library/2015/11/esma20141\\_hft\\_activity\\_in\\_eu\\_equity\\_markets.pdf](https://www.esma.europa.eu/sites/default/files/library/2015/11/esma20141_hft_activity_in_eu_equity_markets.pdf)>.

92. MiFID II (n 5), Arts 4(1)(39) and 4(1)(40).

93. The definitional challenges are discussed in Myklebust, ‘High-Frequency Trading: Regulatory and Supervisory Challenges in the Pursuit of Orderly Markets’ (n 4) section 4.2.

94. ESMA (n 91) 5.

95. Bruno Biais and Thierry Foucault, ‘HFT and Market Quality’ (2014) 128 *Bankers, Markets & Investors* 5.

96. Andrew G Haldane, ‘Financial Arms Races’, Bank of England Speech (2012) <<https://www.ineteconomics.org/uploads/papers/haldane-andy-berlin-paper.pdf>> accessed 5 April 2017.

97. For an in-depth description of these developments, see Myklebust ‘Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach’ (n 4) section B.II.



latory and institutional changes.<sup>98</sup> In Europe, the adoption of MiFID I had a profound effect by removing the concentration rule and authorising the trading of listed securities on alternative market venues.<sup>99</sup> This has left a highly competitive landscape where market venues with different characteristics and regulatory status compete for order flow and liquidity.<sup>100</sup> One noteworthy development with regards to the discussion of the topic at hand is the existence of so-called *dark pools*. Dark pools are trading platforms that in accordance with certain waivers instituted in the MiFID II framework operate with lower levels of pre-trade transparency than what follows from the requirements otherwise applying to the transparent ('lit') order books operated by regulated markets, multilateral trading facilities or organised trading facilities.<sup>101</sup> This characteristic has attracted non-HFT traders to such platforms because they want to shield themselves from being taken advantage of by the HFT segment of traders.<sup>102</sup>

The changes just described in the *macrostructure* as well as the *microstructure* of markets have created a trading environment which is conducive to HFT as a business model. When the same (or related)<sup>103</sup> asset is simultaneously traded at different venues, price differences occur that can be exploited through arbitrage<sup>104</sup> – simply put, by buying low and selling high. This creates a business environment in which HFT traders are well positioned to utilise their superior speed and processing capacity to successfully engage in arbitrage activities across markets and national borders. These opportunities are dependent on stock exchanges and other market venues adapting their trading systems so they conform to the needs of high-frequency traders. This means, for instance, facilitating high-speed connections (ie 'co-location'),<sup>105</sup> special access to data,<sup>106</sup> and rebates and fee structures that differ from those of other investors. The trading venues, still largely in control of their own market microstructure,<sup>107</sup> respond to such needs because they value the increase in liquidity as well as the increased trading fees that result from the activity of high-frequency traders.<sup>108</sup>

Financial-market researchers have identified both positive and negative effects resulting from HFT activity.<sup>109</sup> Initially, such activity was viewed as mainly positive for market quality

98. Extensively described elsewhere, for instance by Randal Michie, 'Exchanges in Historical and Global Context' in Larry Harris (ed), *Regulated Exchanges: Dynamic Agents of Economic Growth* (Oxford University Press 2010).

99. Guido Ferrarini and Niamh Moloney, 'Reshaping Order Execution in the EU and the Role of Interest Groups: From MiFID I to MiFID II' (2012) 13 *European Business Organization Law Review* 557.

100. In addition, trades can be executed through systematic internalisers which facilitate trade on a bilateral basis. For a description, see Ferrarini and Moloney (n 99) 557, 570.

101. MiFID II (n 5), arts 19, 20 and Title III respectively. For a description of the waivers, see Peter Gomber and Ilya Gvozdevskiy, 'Dark Trading under MiFID II' in Danny Busch and Guido Ferrarini (eds), *Regulation of the EU Financial Markets* (Oxford University Press 2017) 379 et seq.

102. Monica Petrescu and Michael Wedow, 'Dark Pools in European Equity Markets: Emergence, Competition and Implications' (July 2017) *ECB Occasional Paper Series No 193* 4.

103. Thierry Foucault, Marco Pagano and Ailsa Röell, *Market Liquidity: Theory, Evidence, and Policy* (Oxford University Press 2013) 39.

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

105. Co-location is a practice in which market venues sell to traders the opportunity to locate their computer system in close physical proximity to that of the trading venue in order to reduce latency (the time it takes for the electronic communication to reach its destination).

106. See discussion in Giovanni Cespa and Thierry Foucault, 'Sale of Price Information by Exchanges: Does It Promote Price Discovery?' (2014) 60 *Management Science* 148.

107. John Armour and others (n 18) 148.

108. This special relationship has even been described as 'co-dependent': see Larry Harris, 'Trading and Electronic Markets: What Investment Professionals Need to Know' (2015) *CFA Research Foundation Publications* 36.

109. For a comprehensive discussion of various effects of HFT, see Myklebust 'Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach' (n 4) section B.V. with further references.

because of observed improvements in liquidity, which in turn lead to decreased spreads, improved market efficiency, decreased transaction costs, improved price formation and cross-venue price alignment. Over time this view has become more nuanced as the research agenda has broadened and deepened,<sup>110</sup> and the effects of HFT on fairness and integrity in financial markets has become a subject of investigation.<sup>111</sup> Yadav, for instance, explains that fast traders can place other traders at a persistent informational disadvantage, thereby eroding their profits, in a way that is similar to those regulated under conventional theories of insider trading.<sup>112</sup> Furthermore, the positive effects on traditional measures of market quality have been called into question, based on observations that HFT-induced liquidity is transitory and may evaporate in volatile market conditions.<sup>113</sup> Furthermore, the reduced transaction costs can be offset by a general rise in costs associated with listing, membership and trading as result of an ‘electronic arms race’ that drives large investments in electronic development and equipment to accommodate the need for volume, speed and connectivity necessitated by the complex HFT systems.<sup>114</sup>

A main concern, which also has been an important motivating factor for the adoption of regulation of HFT in MiFID II, is the observation that HFT may cause disorderly trading conditions. ‘Rogue’ algorithms have caused so-called flash crashes several times, making share prices plummet or rise uncontrollably in a matter of minutes and thereby causing damage to all traders.<sup>115</sup>

There are two effects that have been pointed out by researchers that warrant particular consideration with regards to the Action Plan. The first relates to allegations that HFT can lead the price-formation process in financial markets to become decoupled from fundamental information. The second concerns the effects on the dissemination and uptake of long-term fundamental price signals in financial markets resulting from non-high frequency traders lowering their research efforts or migrating to dark pools to avoid trading against HFT in lit markets. Both these effects will be further discussed in the following section.

#### 4.3 How HFT and Associated Features of Market Structure can Impact the Level of Transparency and Long-termism in Capital Markets

The European Commission’s Action Plan on Financing Sustainable Growth addresses a wide variety of issues, with the aim of furthering the prospects of a successful transition to a low-carbon, more resource-efficient and circular economy.<sup>116</sup> While some of these initiatives relate solely to the financial sector<sup>117</sup> or public funding,<sup>118</sup> the objective of fostering trans-

110. See for instance Johannes Breckenfelder, ‘Competition among High-Frequency Traders, and Market Quality’ (2019) *ECB Working Paper Series No 2290*; Álvaro Cartea and others, ‘Ultra-Fast Activity and Intraday Market Quality’ (2019) 99 *Journal of Banking and Finance* 157.

111. See a seminal paper by O’Hara (n 104); discussed among others by Myklebust ‘Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach’ (n 4).

112. Yesha Yadav, ‘Insider Trading and Market Structure’ (2016) 63 *UCLA Law Review* 968.

113. Didier Sornette and Susanne von der Becke, ‘Crashes and High Frequency Trading’ (August 2011), *Swiss Finance Institute Research Paper No 11-63* <<https://ssrn.com/abstract=1976249>> (noting that volume must not be mistaken for liquidity).

114. Larry Harris, ‘Stop the High-Frequency Trader Arms Race’ *Financial Times* (27 December 2012) <<https://www.ft.com/content/618c60de-4b80-11e2-88b5-00144feab49a>>.

115. For a discussion of these issues, see Myklebust, ‘High-Frequency Trading: Regulatory and Supervisory Challenges in the Pursuit of Orderly Markets’ (n 4) section 2.2.

116. COM(2018) 97 final (n 2) 1.

117. For instance consideration of incorporation of sustainability in prudential requirements as discussed in COM(2018) 97 final (n 2) section 3.3.

118. *Ibid* section 2.3.

parency and long-termism in financial and economic activities (goal no. 3 in the Action Plan) concerns also the interaction between the financial sector and the corporate sector more broadly. This is made evident by the focus on corporate reporting, accounting rules and the pressure capital markets may exert on corporate governance, as discussed in section 4 of the Action Plan. The close relationship that exists between the financial sector and investee companies is clearly recognised by the Action Plan, thus adding to the complexity of its brief. More specifically, the Action Plan is obliged to deal with two different spheres of subjects (companies and financial market actors),<sup>119</sup> each with its separate and comprehensive set of regulatory environments, codes of conduct, and incentive structures.

Financial market actors influence companies directly (through voting and other ownership activities related to their shareholding) and indirectly (through the valuation of the company that takes place through the process of price formation in the financial markets, and the obvious effects on the cost of capital for the company). The first dimension – the corporate governance aspect of the Action Plan – will only be touched upon briefly here, but is extensively discussed elsewhere (eg by Möslein and Ensig Sørensen).<sup>120</sup>

With regards to the issue of price formation, researchers have expressed concerns that the presence of HFT can result in market prices that are less reflective of fundamental information. This is an interesting point to examine, given the emphasis in the Action Plan on increasing transparency regarding long-term ESG-related risks and opportunities, in order to help investors assess companies' long-term value creation and their sustainability risk exposure.<sup>121</sup> What should first be mentioned here is the longstanding debate within legal scholarship about the effectiveness of disclosure as a regulatory tool in financial markets.<sup>122</sup> Commentators have drawn attention to the fact that increased disclosure does not necessarily lead to changed market behaviour, pointing out that little consideration has been 'given to other very important issues, such as the question whether market actors used all of the disclosed information and if so what kind of decisions they took on the basis of abundant supplies of information.'<sup>123</sup> Adding to this, there are arguably specific features relating to HFT that could further challenge the effectiveness of disclosure-based regulatory techniques.

The fact that high-frequency traders do not generally trade to hold a portfolio, but instead trade with the objective of profiting from arbitrage or other trading-related gains, suggests that their focus is the very near-term, intra-day changes in supply and demand, as displayed in the electronic order books, and not information that reflects a company's long-term risk-return profile. Lerch, for instance, contends that HFT strategies are independent from the fundamental value of a given financial instrument, so fundamentals are usually not significant with respect to their decisions. Therefore, HFT orders do not necessarily transform new information into prices.<sup>124</sup> This resonates with the findings of Balp and Strampelli: 'There-

119. On this distinction, see also Florian Möslein and Karsten Ensig Sørensen, 'The Commission's Action Plan for Financing Sustainable Growth and Its Corporate Governance Implications' (2018) *Nordic & European Company Law Working Paper* No 18-17 <<https://www.ssrn.com/abstract=3251731>>.

120. Ibid.

121. COM(2018) 97 final (n 2) 9.

122. See for instance Niamh Moloney, 'Financial Services and Markets' in Robert Baldwin, Martin Cave and Martin Lodge (eds), *The Oxford Handbook of Regulation* (Oxford University Press 2010) 442–444.

123. Emiliós Avgouleas, 'The Global Financial Crisis and the Disclosure Paradigm in European Financial Regulation: The Case for Reform' (2009) 6(4) *European Company and Financial Law Review* 440, 443 <<https://doi.org/10.1515/ECFR.2009.440>>.

124. Marcus P Lerch, 'Algorithmic Trading and High-Frequency Trading' in Rüdiger Veil (ed), *European Capital Markets Law* (2nd edn, Hart Publishing 2017) 492.

fore, automated software-based orders cannot provide any active informative contribution as regards the fundamentals of securities. Whilst programmed to react quickly to immediate news, it remains doubtful whether algorithms are also modelled to absorb information concerning longer-term fundamentals, since HFTs' trades are clearly focused on the very short term.<sup>125</sup>

This would suggest that increased information regarding the long-term sustainability performance of a company, as advocated by the Action Plan, is unlikely to be given much consideration by this segment of traders. Thus, there is a risk that this information will be less clearly reflected in the prices that form in the market, depending on the level of HFT participation.

This argument finds support in one of the reports from the UNEP Inquiry into a sustainable financial system, where it is noted that the greater the presence of short-term investors or traders, the greater the pressure on all market participants to shorten investment horizons, thus reducing 'the likelihood of the incorporation of even material ESG issues<sup>126</sup> into investment decisions and associated market valuations.'<sup>127</sup> According to this report, markets will consequently value only short-term performance, to the detriment not only of companies themselves but also of economies and society more broadly. Furthermore, the report contends that markets that are focused primarily on the short term will almost certainly excessively discount even price-relevant ESG information, further limiting the role that markets are able to play in encouraging sustainable behaviour.<sup>128</sup>

Another argument relates to the decrease in fundamental analyses that may follow if fast traders can exploit price changes following from that information at the expense of the one who obtained it. This is pointed out by Stiglitz, who explains that if the returns on investing in information decrease, the market will become less informative.<sup>129</sup> In his view, better 'nanosecond' price discovery comes at the expense of a market in which prices reflect underlying fundamentals. As a result, resources will not be allocated as efficiently as they otherwise would.<sup>130</sup> Yadav echoes that view and construes this as a free-rider problem.<sup>131</sup> Mattli likewise points to the practices of co-location and proprietary data feeds catering to high-frequency traders and points out that this may disincentivise investors from conducting fundamental research if it enables high-frequency traders to 'piggyback' on the costly acquisition of information by investors engaged in fundamental research.<sup>132</sup>

Yet another argument relates to the possibility that traders who have spent resources on obtaining fundamental information will choose to trade in dark pools to avoid being taken advantage of by high-frequency traders who can exploit the information inherent in pre-

125. Gaia Balp and Giovanni Strampelli, 'Preserving Capital Markets Efficiency in the High-Frequency Trading Era' (2018) 2 *Journal of Law, Technology and Policy* 349, 387.

126. By 'material', is meant issues that have an actual impact on the profitability of an investment.

127. Siobhan Cleary, 'Stock Exchanges and Sustainability' *Inquiry Working Paper 15/13* (United Nations Environmental Programme 2015) 17 <[http://unepinquiry.org/wp-content/uploads/2015/12/Stock\\_Exchanges\\_and\\_Sustainability.pdf](http://unepinquiry.org/wp-content/uploads/2015/12/Stock_Exchanges_and_Sustainability.pdf)>.

128. *Ibid* 23.

129. Joseph E Stiglitz, 'Tapping the Brakes: Are Less Active Markets Safer and Better for the Economy?' *Federal Reserve Bank of Atlanta 2014 Financial Markets Conference* (15 April 2014) 7 <[https://www8.gsb.columbia.edu/faculty/jstiglitz/sites/jstiglitz/files/2014\\_Tapping\\_Brakes\\_pub.pdf](https://www8.gsb.columbia.edu/faculty/jstiglitz/sites/jstiglitz/files/2014_Tapping_Brakes_pub.pdf)> accessed 22 May 2017.

130. *Ibid*.

131. Yesha Yadav, 'How Algorithmic Trading Undermines Efficiency in Capital Markets' (2015) 68 *Vanderbilt Law Review* 1607, 1615.

132. Mattli (n 89) 118; see also Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money And Information* (Harvard University Press 2015) 130.

trade disclosure of orders in the electronic order book.<sup>133</sup> As explained in section 4.2 above, to the extent that high-frequency traders succeed in gaining a profit from their trading, they do so at the expense of other, slower traders (such as institutional investors).<sup>134</sup> Successful HFT thus exerts a systematic and distributive effect by channelling trading gains from non-HFT (fundamental traders) to high-frequency traders.<sup>135</sup> Fundamental traders who wish to avoid that risk may choose to trade in market environments with no HFT presence and/or in environments where the rules of the market protect them from being exploited by high-speed traders. Both of these characteristics are found in dark pools. In this case, information that would otherwise follow from pre-trade disclosure (including ESG disclosure) will no longer benefit market participants in their price-discovery process and may therefore to a less extent be reflected in the price. From a regulatory perspective, IOSCO relates a concern that market participants that cannot make the necessary technological investments, will (for market confidence reasons) be less willing to trade and less willing to display their trading interest. This could result in less liquid markets and a ‘compromised price formation process’.<sup>136</sup> The arguments just related may be particularly detrimental if the investors that exit the lit market or lower their research efforts are those who would otherwise be inclined to spend resources on research into the long-term price impact of ESG factors (eg large institutional investors or sovereign wealth funds with a widely diversified and long-term investment strategy – sometimes referred to as ‘universal owners’<sup>137</sup> – and those mandated to adopt responsible investment strategies).

To sum up this discussion, findings in the research suggest that high-frequency trading, in combination with other features of the current structure of the financial markets (eg dark pools), affects the process of price formation. This may undermine the objective of improving the valuation of long-term, ESG-related factors in financial markets. The widespread use of indices and passive investment strategies based on market weights and market prices can amplify such impacts,<sup>138</sup> with effects for passive investors that do not engage in fundamental analyses themselves. This suggests that on top of the problem of the availability and quality of ESG information espoused by the Action Plan, there remains a structural problem. The structural configuration of the financial market may pose an unacknowledged risk to the effectiveness of the new disclosure requirements and thus the ability to achieve a more sustainable financial sector. As shown in this discussion, both the microstructure (the organisation and trading rules at the level of the individual market venue) and the macrostructure (ie the existence of multiple market venues competing with each other, some of which operate under a laxer regulatory regime) are important.

Finally, a brief remark will be made regarding the relationship between market structure and the ability to promote sustainable corporate governance measures as mentioned

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133. Petrescu and Wedow (n 102) 4.

134. Harris (n 108) section 3 explains the zero-sum game of trading activities.

135. According to Yadav, in algorithmic markets informed traders are giving away some of their first-mover gains to ‘derivatively’ informed HFT traders, see Yadav (n 131) 1663.

136. IOSCO, ‘Regulatory Issues Raised by the Impact of Technological Changes on Market Integrity and Efficiency: Final Report’ (2011) FR09/11 30.

137. James Hawley and Andrew Williams, ‘Universal Owners: Challenges and Opportunities’ (2007) 15 *Corporate Governance: An International Review* 415 <<https://doi.org/10.1111/j.1467-8683.2007.00574.x>>. See also Ellen Quigley, ‘Universal Ownership in the Anthropocene’ (13 May 2019) *SSRN Electronic Journal* <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3457205](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3457205)>.

138. See for instance Robert C Hockett and Saule T Omarova, ‘Systemically Significant Prices’ (2016) 2 *Journal of Financial Regulation* 1, 8 <<https://doi.org/10.1093/jfr/fjw007>>.



in action point 10.1 of the Action Plan. As described in section 2 above, the role of stock exchanges in facilitating a market environment conducive to sustainable investing has been emphasised by investment professionals and sustainable investment organisations as well as the stock exchanges themselves.<sup>139</sup> Exchanges and other regulated markets could arguably take over or coordinate to facilitate some of the ESG-related efforts otherwise undertaken individually by shareholders. Stock exchanges can contribute to more sustainable company and market practices through different means.<sup>140</sup> Much attention has been devoted to improving the quality and uniformity of company reporting on ESG-related issues. Other possible routes are through the normative function of exchanges, for instance by setting listing requirements that are sensitive to companies' CSR performance and by exchanges constructing products and services (ie indices) that respond to the needs of responsible investors.<sup>141</sup>

The extent to which stock exchanges can be expected to undertake and further such initiatives on a voluntary basis will depend partly on the incentives available, bearing in mind that most stock exchanges are now private profit-maximising companies.<sup>142</sup> HFT has contributed to changing the revenue structure of exchanges such that an increased share of the profits now derives from volumes and transactions rather than listing fees. This shift may lead to a 'race to the bottom' regarding listing requirements and company reporting on issues that are important from a sustainability point of view, because there will be low demand for such services from the HFT segment. The coordinating and controlling roles that stock exchanges and other regulated markets could play in facilitating a market environment that favours good corporate governance practices and sustainable investing may be diminished by this development.

#### 4.4 Will the Action Plan or Existing Regulatory Frameworks Alleviate the Structural Concerns raised by the Action Plan on Financing Sustainable Growth?

The proposed policy actions and regulatory initiatives of the Action Plan described above in section 3.2 do not contain changes that would affect HFT and the fragmented market structure discussed in section 4.3. Moreover, the regulation of HFT already in place under MiFID II is clearly motivated by reasons other than considerations of sustainability. Specifically, MiFID II's regulation of HFT is driven by the need to deter risks to the safe and orderly operation of the trading systems (including so-called flash crashes) and to ensure market integrity, among others by counteracting manipulative practices.<sup>143</sup> The Directive introduces a definition of HFT<sup>144</sup> and bases its regulatory approach on three main features.<sup>145</sup>

139. See for instance the Sustainable Stock Exchange Initiative <<http://www.sseinitiative.org>> and the World Federation of Exchanges' Sustainability Working Group.

140. For several possible options, see Myklebust (n 27) 90 et seq.

141. For a broader description of these different approaches, see Myklebust (n 27) 92 et seq.

142. Bengt Rydén, 'Demutualization and Self-Listing' in Larry Harris (ed), *Regulated Exchanges: Dynamic Agents of Economic Growth* (Oxford University Press 2010) 237–251.

143. For an in-depth description of the relevant regulation, see Myklebust 'Fairness and Integrity in High-Frequency Markets – A Critical Assessment of the European Regulatory Approach' (n 4) section C.

144. The definition in Art 4(40) of MiFID II is built around technical specifications, which are a common feature of HFT, but does not distinguish between different HFT strategies. This means that the definition will cover both strategies that are referred to as 'predatory' or 'manipulative' in the literature and those that are perceived as more benign in terms of market quality, for instance strategies that have more in common with traditional market-making activities. See discussion in Myklebust, 'High-Frequency Trading: Regulatory and Supervisory Challenges in the Pursuit of Orderly Markets' (n 4) section 4.2.

145. See Niamh Moloney, *EU Securities and Financial Markets Regulation* (3rd edn, Oxford University Press 2014) 528.

First, it requires HFT firms that are not already authorised as investment firms to obtain such authorisation<sup>146</sup> (which will also render HFT firms subject to supervisory oversight). Second, it imposes a set of operational requirements on HFT firms<sup>147</sup> and another set of operational requirements on trading venues<sup>148</sup> that provide HFTs with access to their electronic trading systems. In both cases, the operational requirements mostly concern the configuration and technical requirements of the systems necessary to perform/enable HFT. Both high-frequency traders and market venues must ensure that their systems are resilient, have sufficient capacity, and are fully tested and properly monitored. The requirements include circuit breakers and the ability to temporarily halt or constrain trading in situations with severe volatility. Although improving the operational stability of the systems, these provisions will have little effect on the problems discussed in relation to the agenda of sustainable financial markets. One regulatory development that could possibly have a certain effect is the so-called double volume cap mechanism in Article 5 of the MiFIR Regulation, which limits trading in dark pools to a certain percentage of each listed financial instrument across the EU over the previous twelve months. However, it is difficult to gauge the real impact of this provision on the concerns related to dark-pool trading raised in section 4.3 above.<sup>149</sup>

Examination of the current regulation of HFT leaves us with the impression that it is perhaps not so well-attuned to the priorities contained in the agenda for sustainable finance. At the same time, structural considerations seem to play a more important role in this context than hitherto acknowledged by policy makers. The lack of attention in this respect could perhaps be attributed to an adherence to the standard tenets within financial theory that efficient markets objectively reflect all available information,<sup>150</sup> abstracted from the configuration of the actual trading process.<sup>151</sup> However, the importance of the actual transaction process, the effects of market structure and trading rules on the transaction process, and the transaction process's implications for fundamental economic decisions are all highlighted as important to the final outcome of trading processes within the market microstructure literature.<sup>152</sup>

The preceding discussion has uncovered a possible gap in the EU Action Plan in relation to HFT and fragmented market structures. This oversight may have potentially negative consequences on the achievability of the Action Plan's objectives. The implication is that institutional, organisational and structural aspects of market functionality are all important perspectives that should be given more emphasis in the upcoming assessments of the impact of high-frequency trading on the goals of sustainable finance.

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146. MiFID II (n 5) Art 2(1)(d)(iii).

147. MiFID II (n 5) Art 17.

148. MiFID II (n 5) Art 48.

149. However, recent assessments seem to indicate that the share of on venue trading is declining also after the adoption of the double volume cap. See European Commission, 'Public Consultation on the Review of the MiFID II/MiFIR Regulatory Framework' (17 February 2020) 83 <[https://ec.europa.eu/info/sites/info/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/2020-mifid-2-mifir-review-consultation-document\\_en.pdf](https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/2020-mifid-2-mifir-review-consultation-document_en.pdf)>.

150. See discussion in Yadav (n 131) 1631 et seq.

151. Randi Næs and Johannes Skjeltorp, 'Is the market microstructure of stock markets important?' (2006) 77 *Norges Bank Economic Bulletin* 123 <<https://www.norges-bank.no/globalassets/upload/english/publications/economic-bulletin/2006-03/naes.pdf>>.

152. Ibid.

## 5. Conclusion

The European Commission's Action Plan for Financing Sustainable Growth sets an ambitious agenda that aims to shift the workings of the financial system in order to reorient private capital towards more sustainable investments. One of the Action Plan's main objectives is to foster transparency and long-termism in financial and economic activity. Environmental and social impacts materialise over a longer time horizon and may, according to the Action Plan, be discounted in a market environment that favours short-term returns over long-term value creation and sensitivity to risk. The response to this concern includes various measures directed at increasing ESG-related disclosure, specifically through corporate reporting and by financial market service providers to end-investors. This approach relies heavily on the longstanding preference in financial regulation for disclosure as a means of changing financial market behaviour. However, legal scholars have explained that the effectiveness of disclosure as a regulatory technique requires critical consideration. Its application must be carefully adapted to actual market conditions, as it is not just the availability of information but also the extent to which it is used that determines how information influences actual decisions.<sup>153</sup> This article has expanded on that argument by investigating how the effectiveness of the disclosure-related measures initiated by the Action Plan is undermined by current structural features in the financial markets, and in particular by the proliferation of HFT and the existence of dark pools. The findings suggest that, depending on the level of HFT participation in markets, there is a risk that long-term ESG issues will not be sufficiently reflected in prices because of the inherent myopic time horizon of HFT models. Furthermore, the risk of HFT free-riding on other investors' fundamental analyses can decrease the incentives of other investors to perform such analyses, including that of ESG-related disclosures, something that could decrease the uptake of such information in the process of price formation. Moreover, the incentives for other traders to avoid trading on venues with an HFT presence can lead them to resort to dark pools. The decreased level of pre-trade transparency following from that could also affect the uptake of ESG-related disclosures. Finally, the revenue structure of stock exchanges and other market venues may lead them to pay more attention to the needs of high-frequency traders than working towards facilitating solutions that could help long-term investors realise their strategies within sustainable investing. Current regulatory measures in MiFID II do little to alleviate these shortcomings. The regulatory gap uncovered by this article suggests that the institutional and organisational features of the current market structure – both at the micro-level and the market-wide level – should be given due consideration in future policy-making geared at improving long-term sustainability in financial markets.

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153. Avgouleas (n 123) 474.