A law and economic analysis of trading through dark pools

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Abstract

Purpose – The purpose of this paper is to assess the latest directives of the European Parliament and the Council – MiFID II and MiFIR – on markets in financial instruments in response to the growth of dark pools in European equity markets.

Design/methodology/approach – This paper examines the impact of the new regulatory packages on European equity markets by identifying areas where the legislation is effective and comparing these changes in EU legislation with US legislation on dark pools.

Findings – This paper find that the MiFID II and MiFIR directives, implemented by the European Securities and Markets Authority to address these concerns, have reduced information asymmetry between market participants, thereby increasing competition between regulated markets and alternative trading facilities.

Research limitations/implications – Increased competition can improve market quality, which has practical implications for financial market regulation and policy formulation.

Originality/value – These findings are novel in the existing literature on high frequency trading through dark pools. They improve the understanding of dark trading and its impact on competition and market efficiency. In addition, this research can assist policymakers in designing effective financial market regulation. The economic analysis of legislation also helps regulators assess the impact of new legal provisions on the functioning of capital markets.

Keywords High frequency trading, Dark pools, Dark trading, Competition, Liquidity, Efficiency, Deregulation

Paper type Research paper

1. Introduction

Financial innovation is directly related to changes in trading practices and market operations. Moreover, the free market hypothesis promotes financial deregulation and restricts government intervention to correct market failures (Malkiel, 2011). These trends are based on the view that rational and informed market participants, equipped with advanced quantitative methods and novel financial instruments, can efficiently manage risk. However, the financial crisis of 2007–2009 demonstrated that the market efficiency hypothesis is fragile and that financial theories overall failed to anticipate the implications of complex

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financial engineering in a global financial system, particularly in deregulated markets like dark pools. Consider, for example, the role of securitization and collateralized debt obligations in the global financial crisis of 2007–2009, and particularly in the Greek debt crisis in the early days of May 2010, which was characterized by high levels of uncertainty in the equity markets that affected the entire European trading session (Jansen, 2019). In addition, consider the impact of automated execution algorithms and exchange traded funds (ETFs) on the events of May 6, 2010 – known as the Flash Crash – characterized by the deviation of asset prices away from their fundamental values (Dalko, 2016; CFTC and SEC, 2010).

Virgilio (2019) provides an overview of algorithmic trading and describes several mini flash crashes that affected European markets, such as the eightfold increase in oil futures volatility on February 2, 2011, and the 98% decline in Morningstar ETFs in March 2011. These events occurred in the aftermath of the Flash Crash and were caused by the rapid execution of large orders. On the afternoon of May 6, 2010, the prices of equities and financial derivatives fell nearly 1,000 basis points in minutes, marking the largest decline in US financial market history in recent decades. While some markets recovered quickly, empirical evidence shows that nearly 8,000 stocks and ETFs were more permanently affected by the unexpected price volatility shock. For example, the share price of Sotheby's (the prestigious British auction house) immediately increased from $34 to $99,999.99, while the prices of other securities that declined by 5% to 20% returned to their initial levels shortly thereafter (Patterson, 2012). In total, more than 20,000 trading transactions were executed in the USA, involving 300 different equity stocks, ETFs, alternative funds, and financial options, at prices significantly diverging from their pre-crash values. The sequence of events related to the crash occurred in just 20 min – a remarkably short period – triggering a cascade of automated transactions by algorithmic trading groups that resulted in nearly a billion dollars in losses in the US equity markets alone (Phillips, 2010).

The Federal Bureau of Investigation (FBI) and financial market regulators spent years investigating and analyzing the key events that disrupted the smooth operation of the financial markets and led to the Flash Crash. The investigation concluded that the primary factors were the presence of numerous unregulated investment markets, such as dark pools, and extensive high frequency trading (HFT). Financial regulation focuses on enforcing private property rights necessary to encourage risk-taking, resulting in the implementation of capital adequacy standards in accordance with micro-prudential regulation. While these standards improve investor protection and competition, they cannot be effectively implemented in all markets. This, in turn, is associated with the emergence of the financial crisis and global account imbalances [1]. Given the global impact of HFT and the expansion of dark pools in European markets, it is important to assess the EU's new directives and regulatory packages designed to protect investors from such extreme events and to compare them with US legislation (Carrie, 2008). The purpose of this paper is to assess the latest directives of the European Parliament and the Council – MiFID II and MiFIR – on markets in financial instruments in response to the growth of dark pools in European equity markets.

The EU regulatory framework, which aims to develop an integrated, competitive and transparent European financial market, implemented the MiFID regulatory package [2]. This directive has been essential for financial market regulation in the EU since 2007. It aims to improve market competitiveness by creating a single investment market, thereby enhancing harmonized investor protection. In addition, the emergence of dark pools in the EU and the increasing demand for improved investor protection and market transparency in the aftermath of the financial crisis, led to a new legislative proposal to revise MiFID. The revised directive, MiFID II [3], and a new regulation commonly referred to as MiFIR

[4], have had a significant impact on trading practices in European equity markets. Specifically, MiFID II and MiFIR aim to consolidate market harmonization, reduce the negative impact of algorithmic trading and increase financial disclosure of dark trading platforms. However, since the implementation of MiFID II on January 3, 2018, the development process has been continuously evolving, implying that the final outcome of the new legislation is yet to be determined.

We examine the impact of the new regulatory packages on European equity markets by identifying areas where the legislation is effective and comparing these changes in EU legislation with US legislation on dark pools. Dark pools disclose limited information about the identity of market participants, the content of their trades and the size of other contingent claims on these trades. These trading platforms are therefore characterized by opacity. The growth of dark pools and their opacity highlight the need for supplementary regulations to respond to the new developments in financial innovation and the evolving technology of emerging trading platforms (Mills, 2014). The legal framework of the EU's financial services sector should recognize the dynamism of the current high frequency era and pursue more radical regulation with the aim of reducing opacity, improving transparency and increasing competition (Awrey, 2012).

The challenges posed by the 2007–2009 financial crisis, the Flash Crash, and the subsequent mini flash crashes in Europe have led to a reconsideration of financial concepts and the role of intermediaries in facilitating price discovery (Zhu, 2014), identifying market misconduct and implementing best practices to ensure the fairness and integrity of financial markets. Typically, policymakers make efforts over time to enforce norms that promote disclosure, transparency and fairness. However, it appears that the progress of innovation and technology is constantly diminishing the effectiveness of these norms (Aguilar, 2015). These concerns are particularly important for policymakers, as dark pools attract the attention of large institutional investors engaging in substantial financial transactions. The opaque nature of dark pools, the importance of market participants operating within these platforms, and the unpredictable influence of algorithmic trading strategies indicate that dark trading has introduced new systemic risk concerns in financial markets. Traditional solutions alone are not sufficient to address the critical threats posed by systemic risk. Therefore, shedding light on dark markets requires a more rigorous regulatory approach, and the consistent application of this framework across European equity markets for the benefit of all market participants (Panagopoulos, 2021).

The primary objective of the new regulatory packages is to enhance competition and efficiency in European financial markets. Key changes within the packages include the introduction of near real-time post-trade disclosure requirements aimed at reducing dark trading, as well as stricter rules on high frequency trading. We find that the opaque environment of dark pools and the liberalization of market entry after the implementation of the MiFID directive initially increased competition among rival trading platforms. However, this was also associated with market segmentation in liquidity between visible and dark trading (Madhavan, 1995), as well as concerns about financial disclosure and transparency. Thus, the increased competition led to market fragmentation and pre-trade transparency waivers, creating an uneven playing field between competing trading platforms (Zaza, 2013). Only after the implementation of the new directives, MiFID II and MiFIR, has the information asymmetry between market participants been reduced due to the increased competition between regulated markets and alternative trading venues. This has the potential to improve market quality in terms of liquidity and information transparency.

These findings are novel in the existing literature on HFT through dark pools. They improve our understanding of dark trading and its impact on competition and market

efficiency. In addition, this research can assist policymakers in designing effective financial market regulation. The economic analysis of legislation also helps regulators assess the impact of new legal provisions on the functioning of capital markets [5].

In conclusion, it is important to note that while the crash has unquestionably exposed deficiencies in the regulation and operation of financial markets, the regulatory challenges arising from rapid technological and financial innovation existed prior to and independent of the events leading up to the financial crisis or the Flash Crash. The new regulations and changes in financial conduct are likely to influence current trends in economic development, especially the future role of dark pools.

This paper is organized as follows. Section 2 focuses on the emergence and impact of dark trading in financial instrument markets, while Section 3 analyzes the impact of the EU regulatory framework on dark pools. Section 4 concludes.

2. Dark trading in markets of financial instruments

Dark pools are private trading venues for financial securities that, unlike conventional trading venues such as the London Stock Exchange, allow market participants to trade large volumes of securities with delayed public disclosure (Baxter, 2017). Such trading activity can increase market liquidity, especially for institutional investors aiming to trade large blocks of stock, such as 100,000 shares of stock at a time. Liquidity is often defined as the ease with which a financial instrument can be converted into cash. In this context, liquidity primarily reflects the degree to which an asset can be traded without significantly affecting the price of the asset class. Typically, the main indicator of liquidity for a particular asset class is the trading volume, represented here by the depth of the order book. Like any other trading venue, dark pools are required to disclose information about executed trades or quotes (e.g. volume, price and date). However, because dark trading is often considered an over-the-counter (OTC) practice, the information disclosed is restricted to protect certain institutional investors. Such restrictive contractual clauses can hinder market transparency [6]. More specifically, the growth of dark pools in Europe is associated with a transitional period of regulatory and technological change (Boulton and Braga-Alves, 2020). Although opaque trading was not new to European equity markets, it was the first time that trading venues characterized by a lack of transparency and compliance with regulatory requirements attracted such a significant volume of trading activity (Petrescu and Wedow, 2017).

Dark market participants trade anonymously, concealing their strategies, and are not required to publicly disclose information in real time. Consequently, when an order is filled, the prices of securities should not, at least theoretically, fluctuate significantly. Dark trading can actually contribute to efficient market pricing (Brogaard, 2010; Brogaard *et al.*, 2014). For example, by placing numerous small-volume buy and sell orders at the best current prices and profiting from the difference in bid-ask spreads, dark market operators act as electronic market makers and provide market liquidity (Noss *et al.*, 2017). In addition, these traders can use speed advantages to engage in financial arbitrage – targeting temporary price differences between the same products on different platforms – which theoretically represents a form of market pricing failure that should disappear instantly, preventing many traders from benefiting from it (Hasbrouck, 1995; Kaya and Schildbach, 2016). With the increasing reliance on trading through technologically advanced systems, automated limit orders create nearly continuous fluctuating liquidity (Kraa, 2011). Consequently, the need for conventional market makers to guarantee liquidity has diminished over time. In today's financial markets, continuous trading is typically facilitated by a limit order book system. However, dark pools do not display quotes and lack market makers or visible limit order books, necessitating alternative means of providing liquidity. Dark trading can also create

negative externalities, such as reduced transparency and increased transaction costs for trades executed outside of dark platforms (Mercurio, 2013) [7].

In general, there are three primary methods for creating and maintaining liquidity through dark pools. First, when dark pool operators act as systemic internalizers (see Section 3), liquidity is enhanced by leveraging retail flow. Second, brokers direct public liquidity to dark platforms, thereby removing liquidity from public markets that could affect price discovery. Third, a significant amount of liquidity is provided by linking dark pools to other alternative venues. Additionally, a potential fourth method, is resident flow as described in the dark order book. Acknowledging that in the EU dark pools are subject to the MiFID regulatory package, they are also required to ensure best pricing practices to achieve the best possible outcomes for clients. To oversee all platforms where specific stocks of interest are traded, smart order routing algorithms have been developed. However, these technological advances are currently under investigation by the US Securities and Exchange Commission (SEC). One of the main criticisms of dark pools in the US is the lack of a uniform reporting standard, which directly impacts the quality of liquidity reporting (Hatch, 2010). This reporting is made public to attract more investors. The new regulatory packages in Europe aim to establish a uniform reporting standard to support fair competition between different trading venues.

Critics of dark trading argue that dark pools reduce market transparency and price efficiency, and create conflicts of interest between brokers and dark pool providers. In addition, fairness concerns dominate recent regulatory actions and are frequently highlighted in the press. For example, dark pool trading can be manipulated to favor front-running institutional investors heavily reliant on HFT in exchange for large lump-sum payments (Lewis, 2015; Vaananen, 2015). The rise of dark trading is closely linked to the unprecedented growth of HFT, as technological advances have accelerated the speed of new information discovery and reduced trading latency. The systematic use of such automated trading practices by some market participants may increase transaction costs for others (Cohen *et al.*, 1981). One HFT strategy is to use high-speed algorithms to gain an information edge, allowing traders to execute orders ahead of queued or pending orders, essentially front-running orders (Lattemann *et al.*, 2012). This practice increases the trading costs for investors placing initial orders, particularly those with large orders. As a result, high frequency traders frequently pay a premium to obtain detailed information and data before it is accessible to other investors. The advantage gained from this information asymmetry to achieve better returns on investments may be challenged on competitive grounds (Clarke, 2014). In addition, because HFT strategies rely on a series of small trades with low latency, their presence on a trading venue can lead to frequent price fluctuations. Such fluctuations can cause prices to change between the time a non-HFT market participant places an order and the time it is executed, increasing uncertainty and risk for investors. This mismatch between expected and actual execution prices impairs market efficiency.

The notion that complete information makes markets efficient is essential for informational reporting requirements. However, there is no scientific evidence that complete information actually exists. Therefore, it is even more uncertain whether complete information can lead to market efficiency. A market is considered efficient when the market price of an asset fully reflects all available relevant information (Fama, 1965, 1970; Fama and French, 2010). In other words, the market reflects prices unaffected by the disclosure of information to market participants because the price already reflects all relevant information. According to the efficient market hypothesis, it is theoretically impossible to beat the market by trading on current information because this information should already be fully reflected in asset market prices (Jensen, 1978; Fama and French, 2010). Dark trading does not

facilitate transparent market transactions and may even hinder price discovery. Moreover, dark trading leads to partial segmentation of informed and uninformed traders. Orders executed in the dark tend to be less informed than orders executed in the lit market (Comerton-Forde and Putnins, 2015). This is consistent with the observation that informed traders face lower execution probabilities in the dark relative to uninformed traders. By disproportionately reducing the number of uninformed trades in the lit market, high levels of dark trading could increase adverse selection risk in the lit market, leading to wider bid-ask spreads. The reduction in the number of uninformed traders in the lit market, coupled with wider spreads, reduces the incentives for costly information acquisition because informed traders are less able to trade in the dark than uninformed traders. As a result, dark trading may reduce the overall amount of information produced about fundamental values.

In conclusion, the demand for dark pools has increased because, by avoiding real time information disclosure in the order book, dark pools increase the likelihood that active traders can profit from the delayed disclosure of such information. This gives dark pools a competitive advantage over conventional trading platforms, weakening the role of securities exchanges and clearinghouses and challenging their quasi-monopolistic market power (Garvey *et al.*, 2016). In addition, the costs associated with HFT and preferred proprietary information services may deter small investors from entering such trading venues, leading to market fragmentation. Taken together, these concerns may significantly weaken competition in financial markets and lead to high information asymmetries and agency costs, justifying more extensive regulatory intervention in the financial system. Events such as the financial crisis of 2007–2009 and the Flash Crash have reinforced the need for regulators to create a robust regulatory environment.

3. The effect of the EU regulatory framework on dark trading

The Flash Crash highlights two notable concerns. First, the extensive use of sophisticated, innovative trading technologies can lead to a liquidity shock. The execution of financial transactions in fractions of nanoseconds, contributing to an unprecedented economic rise and growth of trading venues, may increase market fragmentation (Buti *et al.*, 2011). If these new trading venues are unregulated, competition among them may intensify in ways that are unorthodox from the perspective of regulated trading platforms (Harris, 2003). Second, a change in the ecosystem of trading venues may leave markets exposed during periods of extreme volatility, with severe consequences for market functioning and economic stability.

The MiFID regulatory package focuses on enhancing the healthy competitiveness of financial markets and harmonizing investor rights by increasing the legal disclosure requirements for both trading venues and investment firms in the EU (Casey and Lannoo, 2009). It places more emphasis on promoting market efficiency rather than enhancing market integration (Yeoh, 2019). The framework emphasizes pre- and post-trade transparency requirements for equity transactions across all platforms (Panagopoulos, 2021). Importantly, MiFID enables conventional exchanges to face competition from other venues across all Member States, thereby reducing barriers to entry for new trading venues. With the ability to compete for volume across a broader range of instruments, new venues have more opportunities to participate in the market. Additionally, to encourage competition between established and new trading venues, MiFID has introduced a regulatory framework for the main types of order execution arrangements in the European financial marketplace. This includes the introduction of a new category of multilateral trading facilities (MTFs), which includes all other organized multi-party trading facilities with non-discretionary execution that have not yet been registered as regulated markets [8]. MTFs may be registered and

operated by investment firms or other operators, thereby narrowing the gap in requirements between regulated markets and MTFs [9].

With the removal of barriers to competition, new trading venues emerged and grew rapidly, leading to significant fragmentation in the European stock trading market. MTFs such as BATS, Chi-X and Turquoise began to offer equity trading in several European countries (Ready, 2014). The incentive to participate in such platforms lies in the benefits of economies of scale and network effects. For large investors with diversified portfolios, MTFs could meet all their trading needs. The share of equities traded on MTFs in Europe increased rapidly from a negligible percentage of turnover in 2008 to around 20% in 2011 (Fioravanti and Gentile, 2011). While the largest MTFs in Europe operate lit order books similar to conventional exchanges, dark pools have also emerged as new venues following the liberalization of competition after the implementation of the MiFID directive. Prior research shows that the relationship between fragmentation and liquidity depends on the source of fragmentation, whether it is visible or dark (Degryse *et al.*, 2015).

Fragmentation is particularly important for pre-trade transparency. Specifically, liquidity improves with competition for order flow in the case of visible fragmentation, while it deteriorates in the case of dark trading. The positive relationship between visible fragmentation and liquidity is driven by competition among liquidity providers. Conversely, the negative effect of dark trading is consistent with a "cream-skimming" effect, where dark markets primarily attract uninformed order flow, thereby increasing adverse selection costs on visible markets. The nature of the trading venue determines the overall costs and benefits of venue competition. Visible fragmentation increases aggregated liquidity across all visible trading venues but reduces liquidity in traditional markets. This means that the benefits of fragmentation are realized by those who engage in more secretive trading behavior, rather than by investors who send orders exclusively to traditional markets.

As increased competition facilitated the emergence of dark pools (Kaya and Schildbach, 2016), further regulatory changes were deemed necessary to harmonize the segmented financial trading market. Following the financial crisis, the European Securities Markets Authority (ESMA), an independent EU regulatory institution, and the European Commission proposed a revision and amendment of the MiFID regulatory package. The Directive on Markets in Financial Instruments, repealing Directive 2004/39/EC of the European Parliament and of the Council, and the Regulation on Markets in Financial Instruments, adopted MiFID II and MiFIR. The main objective of the new regulatory packages is to enhance the efficiency, durability and transparency of financial markets by implementing a series of definitional tests, regulatory benchmarks, and registration requirements. For example, introducing real-time post-trade disclosure to reduce both OTC and dark trading and demanding stricter compliance rules on HFT, directly impacts financial technology firms and investment banks. In addition, MiFID II facilitates access to capital for small and medium-sized firms by balancing investor protection with reduced administrative requirements (Busch, 2017). It also adds organized trading facilities (OTFs) to increase transparency and efficiency, leveling the playing field between various trading venues (Busch, 2017). OTFs can handle all types of organized trading that do not fit the regulatory specifications of regulated markets and MTFs, thus ensuring proper regulation of all trading in financial instruments. Furthermore, MiFID II introduced the data reporting service providers to ensure high quality market information on completed transactions, which benefits all market participants, especially national regulators and ESMA, who can use this mechanism to effectively monitor the financial markets (Yeoh, 2019). Overall, MiFID II focuses on market integrity to increase investor protection by introducing rules on short

selling, stricter regulation of derivative products, reducing the risk of disorderly markets and lowering transaction costs for market participants (Prorokowski, 2015; Lannoo, 2017).

Finally, MiFID II aims to improve business resilience and support liquidity provision, accompanied by enhanced disclosure, including algorithmic trading and HFT[3]. However, these transparency requirements have caused discussions around data consolidation needs and the treatment of dark pools (Busch, 2017; Katsaiti, 2019). The MiFID II technical standards specify various requirements relevant to HFT and the treatment of dark pools (Woodward, 2017), considering enforcement developments in the USA, particularly a 2015 civil suit by the New York Attorney General against Barclays. The MiFID II standards are similar to those adopted by the US SEC following these events.

3.1 The Barclays case

In 2015, Celment ranked Barclay's alternative trading systems (ATS) or dark trading as third among all leading electronic order books for best price, third for best overall price, and first for best speed among designated market makers (Jaswal, 2015). Barclay's performance is comparable to that of major exchanges such as NASDAQ MC and BX, as well as IMC-Chicago, demonstrating excellent standards of best execution [10]. Best execution requires that orders be executed on the most favorable terms reasonably available, with prompt execution, settlement of any order size and efficient consideration of all other transaction costs (Benvegna, 2017).

Law enforcement did not take sufficient legal action against firms profiting from HFT techniques until June 2015, when the New York Attorney General Eric Schneiderman filed a civil suit under the scope of a 1920s Martin Act (Shorter and Miller, 2014). The act empowers the Attorney General to regulate and investigate economic fraud. Schneiderman aimed to protect and enhance investor confidence and ensure market effectiveness for the general public by preventing the substantially unfair situations created by HFT trading techniques. In January 2016, Barclays settled for $70m with the SEC for misconduct, as customers were misled about the management of their dark pool orders. According to the complaint, the investment bank altered "material purporting to show the extent and type of high frequency trading in its dark pool", and the proportion of aggressive HFT activity in its dark pools [11]. Additionally, it was alleged that Barclays "routed a disproportionately high percentage of client orders to its own dark pools marketing its institutional investors as providers of protection from high frequency traders", while secretly providing HFT firms with information about clients involved in its dark pools.

Under the US regulatory framework, dark pools are regulated as broker-dealers and are required to be registered with the SEC and the Financial Industry Regulatory Authority. The legal framework regulating algorithmic trading and dark trading has been revised as a result of several events, including the Barclays case. The court's verdict stated that materiality can only be viewed from the perspective of an institutional investor and not a non-expert (People v. Barclays Capital, 2015). Materiality, a critical factor in a Martin Act claim [12], renders immaterial representations that impact investment decisions non-actionable. The investment bank unsuccessfully argued that the scope of the Martin Act is restricted to misrepresentations that affect investment decisions in transactions of a specific security. In contrast, the court held that the selection of a trading platform to execute a trade is an investment decision because "trading decisions can be inexorably linked to the venue in which the trade occurs" due to the venue's impact on "the profitability of a trade based on timing and counterparty". In conclusion, the investors' selection of Barclay's ATS to execute their orders was regarded as an investment decision because these investors, including mutual and pension funds, tried to "minimize their exposure to HFT" by relying on this alternative trading system.

3.2 Other dark pool settlement cases

Along with Barclays Capital Inc., Credit Suisse Securities (USA) LLC was fined for violating federal securities laws in its operation of dark pools. While Barclays admitted wrongdoing and agreed to pay $70m in penalties, Credit Suisse did not admit to any misconduct but agreed to pay a total of $84.3m. The SEC found that Credit Suisse violated several rules and required the firm to cease and desist from these violations and to pay penalties, disgorgement and interest [13]. Credit Suisse misrepresented the functionality and transparency of its Alpha Scoring feature and allowed opportunistic trading despite claims to the contrary. Additionally, Credit Suisse executed more than 117 million illegal sub-penny orders and failed to maintain the confidentiality of subscriber information, disclose routing priorities and inform subscribers about the Crosslink technology that alerted high-frequency trading firms to their orders.

Following the settlements with Barclays and Credit Suisse, another European bank operating in the USA, a unit of Deutsche Bank AG, misled investors and violated securities laws, agreeing to pay more than $40m to settle charges related to its routing of orders to dark pools (Lynch, 2016). The bank admitted that its marketing materials misrepresented how it routed orders to dark pools, attributing the problem to a computer coding error involving deficient disclosures by its dark pool trading platform. This settlement was reached without Deutsche Bank admitting wrongdoing. Unlike the previous cases involving misleading investors in the banks' own dark pools, Deutsche Bank's case focused on its order router, Super X+. Due to a coding error from January 2012 to February 2014, the router used outdated data, leading to inflated rankings for certain dark pools. This resulted in millions of orders being misrouted.

The misconduct and violations described here involve European banks operating in the USA, investigated and fined by US regulatory authorities, particularly the SEC and the New York Attorney General. Overall, these issues may have arisen due to the uncontrolled growth of high-frequency trading (HFT), the unexpected consequences of opaque transactions in dark pools, and intentional misreporting to serve individual goals. These factors may have also magnified the implications of the 2007–2009 financial crisis, highlighting the need for stronger regulation. In response to global reforms like the 2010 Dodd-Frank Act in the USA, revising MiFID was necessary since it failed to meet its objectives, specifically regarding market stability and investor safety. As a result, MiFID II and MiFIR were introduced in 2014, significantly overhauling European securities legislation.

3.3 The challenges faced by the new regulatory package

The MiFID II directive, focusing on the harmonization of pre-trade transparency, introduced the "double volume cap". This constraint stems from the utilization of a reference price and a negotiated price waiver on trading systems, without any restriction applicable to the large-in-scale waiver. According to the new rules, within a 12-month period, only 4% of the total trading in a particular stock can occur in the same operation of dark pools. Simultaneously, the trading of any stock across all dark pools is restricted to 8% of the total trading volume (Stafford, 2018). A breach of either of these thresholds results in the prohibition of transactions on that security for the next six months, either from an individual dark trading operation that violated the cap or from all dark pools [14]. However, these caps do not apply to OTC transactions. Additionally, the new directive adjusts the minimum size thresholds for transactions using the large-in-scale waiver. Specifically, the restrictions regarding size are lowered for low-volume securities but expanded for the most active securities in the market.

Policymakers would be concerned if MiFID II offers banks and HFT companies the option of operating their own unregulated venues, also known as systematic internalizers (SIs), which share

many elements with dark pools. Some trade volumes have already shifted to SIs markets, accounting for 10% of the European equity market according to Fidessa, a trading technology group. However, there are concerns about the continuous growth in the popularity of SIs, closely following the trend set by dark pools, indicating the need for additional rules to be implemented. Regulators are sufficiently uneasy with the possibility that large volumes may mitigate to SIs, which would necessitate rewriting the rules. Whether investors will redirect their trading activities to conventional exchanges, as intended by the new regulations, or if new infrastructure will emerge in the market to bypass the barriers imposed by MiFID II, remains uncertain.

There have already been developments to circumvent the new regulation, including the use of SIs, where firms execute trades for in-house clients against their own book, rather than against other firms. This is essentially running their own private exchanges, exempting them from most of MiFID II's requirements. Empirical evidence suggests that liquidity appears to be shifting into periodic auctions, where investors regularly auction shares throughout the day (Besson *et al.*, 2019). If the result of the trading caps is to divert trading from dark pools to periodic auctions, then policymakers and regulators have not really achieved their goals.

The market share of dark pools has stabilized around the 8% volume cap, making it unlikely that new MiFID II restrictions will significantly reduce their overall presence (Olesky, 2018). However, the impact on trading in certain securities, particularly those where dark pools are more active, may be more significant as trading levels may exceed the cap. The regulation's effect will vary across dark pools, with those handling large orders potentially continuing to offer dark trading through large-in-scale waivers. This situation raises important questions about the appropriate regulatory approach.

The new regulation under MiFID II and MiFIR is likely to affect dark pools directly by setting limits on trading volumes and indirectly by regulating predatory practices, especially those of algorithmic trading or HFT. Other countries have already enacted legislation that addresses algorithmic trading in various ways (Eng *et al.*, 2013). MiFID II and MiFIR aim to regulate algorithmic trading and HFT, primarily through measures to prevent crashes when liquidity for this type of trading disappears [15]. MiFID II and MiFIR include requirements for system controls of algorithms and storing sequenced records of the actions of algorithmic trading systems, as well as obligations that algorithms engaged in market making do so on a continuous basis [16]. The purpose of these requirements is to ensure the resilience of trading systems, avoid sending erroneous orders, and provide monitoring entities with information on the activities of algorithmic trading.

4. Conclusions

Researchers, regulators, investors and trading institutions have long been fascinated by the impact of dark trading and the fragmentation of visible order books [17]. In addition, dark pools have developed and increased exponentially in economic prominence over the past decade. The events that have facilitated their emergence range from technological innovations to regulatory changes. Specifically, dark pools are private trading platforms that operate similarly to conventional exchanges and clearinghouses, but they are subject to less strict regulatory framework. They still benefit from reduced regulation and compliance. More importantly, they prevent the leakage of valuable information, enabling institutional investors to execute large volumes of trades without allowing imitators to easily replicate or others to prey on their trades. This has weakened the role of conventional trading venues and has redefined the bargaining share in this ecosystem (Johnson, 2017). These events have prompted a reassessment of financial concepts and the role of intermediaries in ensuring fair and transparent financial markets. While norms promoting disclosure and fairness have been enforced, technological advances have challenged their effectiveness. Dark pools, which

attract large institutional investors, raise new systemic risk concerns due to their opaque nature and the influence of algorithmic trading. Addressing these risks requires a more rigorous regulatory approach that goes beyond traditional solutions.

The EU regulatory environment has undergone significant changes with the adoption of MiFID II and MiFIR directives, driven by the challenges of the 2007–2009 financial crisis and the Flash Crash events. The main objective of these directives is to increase competition and efficiency in European financial markets. They introduce near real-time post-trade disclosure requirements and impose stricter regulations on high frequency trading. However, we find that increased competition has initially led to market fragmentation and pre-trade transparency waivers, creating an uneven playing field among trading platforms. Only after implementing the new regulations did the information gap between market participants narrow, thereby improving market quality. These findings have practical implications for regulation and compliance. For example, they can help policymakers design effective regulations that promote competition. More importantly, the economic analysis of legislation can help regulators assess the impact of new regulatory changes in the current era of high frequency trading.

In conclusion, we suggest that while the new regulation is comprehensive and all - encompassing, its revised solutions may prove insufficient if they do not effectively adapt to the evolving trends in financial markets. This is particularly crucial given the increasing influence of high frequency trading on the safety of European equity markets and the divergence of dark trading on alternative platforms such as systematic internalizers. Future research should address potential regulatory reforms to strengthen both market efficiency and market integration, with the aim of protecting investors and fostering competition by improving communication between EU supervisors.

Notes

1. According to the ill-fated Consolidated Supervised Entity (CSE) Program administered by the US Securities and Exchange Commission. See, SEC and Exch. Comm. Office of the Inspector Gen. (2008)
2. Directive 2004/39/EC of the European Parliament and of the Council of April 21, 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC, (MiFID I) (OJ 2004 L 145/1).
3. Directive 2014/65/EU of the European Parliament and of the Council of May 15, 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU (MiFID II), (OJ 2006 L 241/26).
4. Regulation (EU) No 600/2014 of the European Parliament and of the Council of May 15, 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012 (MiFIR) (OJ 2006 L 241/1).
5. We would like to thank an anonymous reviewer for highlighting the value of this paper's findings.
6. Liquidnet is a type of dark pool that offers greater transparency compared to others, although it also has a restricted entrance policy.
7. Transaction costs may include monitoring costs, fees and commissions, systemic risk, front-running and withdrawal during troubled times (Virgilio, 2019).
8. Article 4, Directive 2004/39/EC.
9. Title II in Directive 2004/39/EC.
10. The rewards for Barclay's best execution continued for two more years, to name just a few: Select ISA Provider of the Year and Best Execution Only Stockbroker by ADVFN International

Financial Awards 2016, Best Execution Only Stockbroker by Share Awards 2015, and Best Execution Only Stockbroker by ADVFN International Financial Awards 2015.

11. Complaint for Petitioner at 2-4, *People* v. *Barclays Capital, Inc.*, 1 N.Y.S.3d. 910, 912, Sup. Ct., N.Y. 2015. Available at: https://ag.ny.gov/pdfs/Barclays_complaint_as_filed_June_25_2014.pdf.
12. *Quoting People* v. *Bank of NY Melon Corp.*, 977 N.Y.S.2d 668 at 13. The test for materiality under New York law "is whether defendant's representations, taken together and in context, would have misled a reasonable investor about the nature of the investment".
13. See, https://www.sec.gov/news/press-release/2016-16.
14. Article 5, Regulation (EU) No 600/2014 (MiFIR).
15. For example, the High-Frequency Trading Act in Germany, passed in 2013, defines authorization and organizational requirements for investment firms using HFT, and outlines obligations regarding trading on alternative venues (Lattemann *et al.*, 2012).
16. Article 17, Directive 2014/65/EU.
17. In 2010, the SEC conducted a broad review of current equity markets, and it was particularly interested in the effect of dark trading on execution quality. See, Securities and Exchange Commission (2010)

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Further reading

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