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Introduction

Extensive technological developments have undoubtedly had far reaching effects on markets and economies alike. Therefore, to understand why these developments have occurred at such a large scale and why markets today operate in the way that they do, it seems imperative to understand how these developments impacted markets. Technological advancements fundamentally changed almost all aspects of markets: from the smallest possible scale in how signals are transmitted within computers, to how changing prices of commodities affect the lives of people across the world. Among the most consequential developments in trading has been the rise of High-Frequency Trading (hereon referred to as HFT). The rise of HFT within the trading industry – which itself has extremely far-reaching effects – has transformed trading strategy, market efficiency and regulation of markets. In combination with developments in Algorithmic Trading (AT), these automated trading strategies have mostly replaced human trading activity, accounting for almost half of all volume in the US stock market (Jain, et al., 2021).

These autonomous trading strategies usually fall under two broader categories: market-making and liquidity-taking algorithms. Both algorithms operate at speeds much faster than those of human traders and can place a much greater number of quotes. The structure of the markets in which these algorithms operate, most commonly financial markets, incentivise both speed and accuracy of quotes – therefore it is clear how these algorithms came to dominate these markets. This increased HFT activity was naturally followed by increased competition between HFT firms and led to the rapid development of various strategies and technologies to gain an advantage in the market. There is, however, a clear distinction between how these two strategies operate and their impact on markets – a key point of evaluation when considering the overall impact of the rise of HFT on markets.

Firstly, this essay explores the effects of the rise of HFT through a ‘bottom-up’ approach, this allows the links between areas of markets to be more easily made and therefore revealing in more detail how markets have been transformed. The first step in this analysis considers the activity of participants in their respective markets by examining trading strategy, exploring how the changes in technology have changed the behaviour of traders. Understanding this tackles the broader question at the most microeconomic level by analysing transactions between traders to provide a background for the other changes that follow from these interactions.

Secondly, having outlined the practices within these markets, this essay takes the next logical step in exploring markets: stepping up in size and looking at the changes to how separate groups of participants interact with information in the market. By considering both the speed with which they act upon this information and the accuracy of these interactions, this section primarily focusses on the effects of the rise of HFT on market efficiency and the understanding of these effects is greatly aided by the preceding section.

Finally, to understand changes to markets most comprehensively, the rules under which all these markets and their participants act should be established. Here, market regulators are considered as the next step in the hierarchy of trading, such as the SEC, FCA and the European Commission. These regulators have great responsibilities when it comes to protecting markets from the effects of trading. The speed at which regulation becomes effective is naturally slower than the innovation in these markets. Consequently, early HFT developments worried many and posed issues for regulators due to the need to draw up regulation for an entirely new method of trading. As with any regulation, problems were encountered when finding a balance, but the general aims of regulators remained clear: protection of markets and promotion of efficiency.

1 Effects of HFT on Trading Strategy

The rise of HFT has had a far-reaching impact on trading strategy, its superior execution speed and incorporation of information have resulted in innovation and adaptation of strategies in many markets. Trading strategies are essential in understanding the impact of the rise of HFT on markets. Exploring how the rise of HFT has impacted the ways in which traders act allows for an understanding of how traders interact with the market. In this section, I explore how the rise of HFT has highlighted certain strategies as more profitable or efficient, while also allowing for development of entirely new strategies. Competition in these markets means strategies most often found to be profitable are those that are most likely to continue to develop. Therefore, should the rise in HFT provide a new opportunity for increased profit, this will almost certainly lead to a change or development in strategy.

1.1 Changes in incentives and signals for trading

Firstly, the shift towards extreme speed-based competition represents the changing incentives for trading. These changes, such as the use of new signals and parameters by algorithms to enter trades, result in changes to how a market reacts to added information. Often, institutional investors find that their profits are being eroded by the increased competition and speed of execution in financial markets. In capital markets, this erosion of profits for traders who prioritise research reduces their incentive to trade and instead promotes speed of trading as a contributing factor to profitability (Yadav, 2015).

The skew of incentives towards speed and predation becomes increasingly apparent as simulations of HFT activity show that profitability can be more effectively achieved by prioritising speed of execution over accuracy of quotes (Manahov, 2016). Such a move away from the traditional signals for trading activity, including developing models based on market information and applying them to an asset, highlights issues with HFT. It is clear how the changes in incentives and signals for trading impact trading strategies – algorithms consider different pieces of information when placing trades and therefore will place different trades, a clear change in trading strategy.

The movement away from using available information about an asset but instead trading based more heavily on the actions of others may be considered a distortion of information in a market. Although beneficial for competition, it is counterproductive for the purposes of regulation, which aims to promote informational efficiency.

1.2 Changes to market-making strategies

Secondly, market-making has been less transformed but instead developed by the rise of HFT. Market-making algorithms are far superior to human traders in this role entirely due to the breadth of information that they can incorporate and the volumes of trades that they can place, in a fraction of the time. The competition during the rise of HFT (the 'speed race' or 'arms race') has resulted in algorithms which are extremely efficient in finding prices across exchanges. The nature of market-making algorithms closely ties their profits to their spread and ability to avoid being 'picked-off', placing a focus on the accuracy and speed of these algorithms. While liquidity-taking algorithms could make profits from 'picking off' a few stale quotes, market-making algorithms needed to continue to update and cancel orders to avoid losing on trades – and therefore developed to be far more complex (MacKenzie, 2021). Their resulting efficiency and size changed the scope of information incorporated into these algorithms, incentivising market-making algorithms to act across many new exchanges (Banerjee & Roy, 2023), a clear change to a key component of trading strategy.

However, this notion finds some disagreement in literature, especially as regulation begins to shape strategy with fees on surpassing order submission thresholds, potentially leading to a move of algorithms away from market-making strategies as profitability becomes harder to achieve. Despite this, it nonetheless can be concluded that, from the perspective of market-making, the rise of HFT has greatly developed the range of information upon which these algorithms act, the number of exchanges they provide their services to, and therefore transformed the practice of market-making.

1.3 Changes in tick-size constraints

In addition to the changes and developments of existing strategies, HFT has led to various new strategies which play to its strengths. While the transformation of markets to digital platforms gave rise to these algorithms, a pivotal step in this process was decimalisation. This reduction of minimum price increments from 1/8ths of a dollar to \$0.01 for stocks over \$1 (MacKenzie, 2021) became instrumental in differentiating between liquidity provision of HFTs and non-HFTs: the first display of the significance of tick-size constraints.

Who Quotes the Best Price?

	Relative Tick Size	(1) HFT Only	(2) Non-HFT Only	(3) HFT & Non-HFT	(4) Ratio
Large Cap	Large (Low Price)	1.60%	2.50%	95.90%	1.55
	Medium (Medium Price)	11.90%	18.60%	69.60%	1.57
	Small (High Price)	16.80%	37.70%	45.50%	2.25
Middle Cap	Large (Low Price)	18.00%	15.20%	66.80%	0.84
	Medium (Medium Price)	20.00%	56.60%	23.40%	2.83
	Small (High Price)	20.70%	63.70%	15.70%	3.08
Small Cap	Large (Low Price)	11.30%	54.70%	34.10%	4.86
	Medium (Medium Price)	20.20%	55.80%	24.00%	2.77
	Small (High Price)	18.60%	70.70%	10.70%	3.8
Total		15.40%	41.70%	42.90%	2.62

(Ye, 2014), Figure 1

Looking at Column (3) of Figure 1, where tick-sizes are relatively larger, across all caps, HFT and non-HFT traders are more likely to quote the same best price. This scenario presents HFT with an advantage, as HFT now has a way of 'jumping the queue' on trades and hence gaining an advantage (Ye, 2014), further incentivising speed of execution over traditional trading signals.

This structure draws HFT towards these markets in which it can find this advantage. As relative tick-sizes decrease, low-frequency traders are found to be increasingly likely to provide a better price of liquidity than HFT, allowing them to compete on price. These findings are particularly useful as they explain the differences in levels of HFT activity in various markets – the markets chosen for trading being a key component of trading strategy. An example of this includes the twin ETFs which track the S&P 500 index: SPY and iShares. Both funds track the same index and should therefore act in the same way, as the underlying information is the same, and therefore have similar expected levels of HFT. Problems arise however, as the differences in price do not result in a proportional difference in tick size; one has a higher relative tick-size and experiences a greater order book depth due to more HFT activity. Therefore, the rise in HFT activity in these markets has caused non-HFTs to change their strategy by operating in different markets.

1.4 Strategies unique to HFT

Potentially the most notorious development in trading strategy is quote-stuffing or spoofing, characterised by its influence on markets. Spoofing strategies place a large volume of quotes on an exchange or multiple exchanges, typically without intention of filling these orders to influence prices to their advantage. It is clear how this strategy may have been difficult or seemingly impossible prior to the developments of HFT, due to the need for placing large volumes of quotes while maintaining anonymity.

Such a strategy was labelled as one of the most significant contributors of the May 2010 flash crash (Busch, 2016). The most telling 'symptom' of spoofing is the abnormally large order-to-trade ratio (Khomyn, 2021). The strategy contributes to the more widespread issue of ghost-liquidity in the most severe way via a sudden injection of liquidity without the intention of filling most of these orders. The events of the 2010 crash are a clear display of the extent to which the developing technology of HFT, has led to new manipulative strategies with negative impacts on market, while also inciting major changes in regulation. Spoofing has since been outlawed (U.S. Congress, 2010), with similar activities constituting chargeable offenses (European Commission, 2014).

1.5 Development of older HFT strategies

Algorithmic trading strategies existed before widespread HFT adoption, but the resulting developments impacted their complexity. HFT has called for the continued development of its algorithms to maintain profits, the rise of dynamic strategies such as VWAP and TWAP are examples of this effort. However, as dynamic strategies incorporate larger amounts of data, this may lead to a larger margin of error that is detrimental to their performance (Mitchell, 2020). Counterintuitively, complex strategies can be outperformed by simpler, static strategies. Therefore, in some cases, the changes to strategy because of HFT have exposed certain strategies as invalid.

Alternatively, the complexity of algorithms is beneficial in other strategies, especially statistical arbitrage. For example, machine learning integrated HFT, when compared to the industry-standard 'CRISP' framework, outperformed the baseline: improving profits and reducing transactions by 9.25pp and 15pp respectively (Bayram, 2020). The study highlights how the exclusive use of quantitative data which increased transactions (the most common 'symptom' of HFT) can be improved through increased complexity in the form of machine learning integration. As a result, incorporation of developing technologies into HFT strategies can lead to changes in trading strategies: sometimes improving them, while highlighting issues with others.

2 Effects of HFT on Market Efficiency

The rise of HFT has transformed the ways in which market participants interact with information and has had significant effects on market efficiency. Market efficiency, or informational efficiency, occurs if prices at each moment incorporate all available information about the price of an asset (Fama, 1970). Therefore, should there be evidence to suggest that HFT has an impact on information incorporation, then it could be concluded that, indeed, the rise of HFT has influenced market efficiency, whatever effect this may be.

2.1 Liquidity as a condition for market efficiency

Firstly, HFT's impact on market liquidity can be used as an indirect measure of market efficiency, as it provides more opportunities for arbitrage algorithms to correct inefficiencies. Increased HFT activity, as human market-makers are replaced by HFT (Courdent & McClelland, 2022), after an exogenous shock, such as the introduction of digital trading, leads to improved speeds of information incorporation or efficiency (Madhavan, 2020) and (Yeferova, 2024). Market-making algorithms have been proven to dominate human traders by volume in this method of trading, thus becoming the standard providers of liquidity in most markets (Banerjee & Roy, 2023). As described in *1 Effects on Trading Strategy*, algorithms are best suited to this role due to their ability to scan information channels and manage thousands of quotes. Therefore, should the resulting development of more efficient price discovery systems, or increased speed of transactions allow for a reduction of wasted resources, it is an increase in economic efficiency in the market (Chen & Webster, 2012).

To investigate the effects of improved liquidity on market efficiency, we must look toward strategies that act on top of the improved liquidity provision. The liquidity-taking HFT algorithms described in *1 Trading Strategy* are the means of influencing efficiency. Statistical arbitrage strategies most closely improve market efficiency as defined in (Fama, 1970). These algorithms seek to, for their own benefit, exploit price discrepancies and thus remove them across exchanges. Their strategy provides signals to the market that an inefficiency exists, acting as a signal to other traders and improving the speed with which it is removed. This process of price discovery clearly contributes to the betterment of information incorporation, at great speed, therefore it can be concluded that this is beneficial to efficiency in markets.

2.2 Effects of spoofing on market efficiency

The effects of trading strategy on market efficiency, however, are highly dependent on the type of strategy employed. Spoofing strategies, commonly through quote-stuffing, distort the signals used by traders, including those of futures lead, order book dynamics, fragmentation, and related shares (MacKenzie, 2021). Quote-stuffing distorts the perception of genuine, available information with ghost-liquidity on either side of the order book. These quotes enter and exit so rapidly that other traders cannot interact with them, causing informational inefficiency as the price signals are influenced by 'intangible' trades.

Not only do misleading quotes impact efficiency, but the anticipation of spoofing also builds upon pre-existing inefficiencies. Understanding that unregulated spoofing practices were present in a market, it became far less likely that non-autonomous traders will react the same way to price movements, and therefore were less likely themselves to react to genuine price signals – further damaging efficiency in markets (MacKenzie, 2021). Another way in which spoofing can influence efficiency includes directly spreading misinformation about an asset, such as falsifying an SEC report to distort available information (Wellman & Rajan, 2017).

2.3 Adverse effects of complex algorithms

Algorithms are most restrained by their parameters, as they cannot themselves judge the validity of a price movement in a market. Adjusting for this weakness often requires human intervention, and the speed at which these algorithms perform greatly limits the extent to which human intervention can prevent huge losses if uncertain market conditions lead to the loss of profitability (Fourmou, 2024). Therefore, when executing trades as a shock hits the market and causes unaccounted-for volatility, HFT may lead to a reduction in informational efficiency (Yadav, 2015).

Furthermore, considering that many of these benefits to market efficiency stem from extensive liquidity provision, these too are impacted by uncertain market conditions. As ATs and HFTs withdraw from an uncertain market, they remove significant amounts of liquidity when markets need them most (Alexis, 2019). These events occur due to the self-reinforcing nature of liquidity (MacKenzie, 2021), as illiquid markets are likely to become more illiquid. The reduced liquidity that follows, as mentioned in *2.1 Liquidity as a condition for market efficiency*, will likely lead to reduced market efficiency.

2.4 Pricing and costs as measures of market efficiency

In line with (Liu, 2010), a reduction in transaction costs ought to indicate that informational efficiency in a market has improved (Bell, 2013): prices better reflect all available information in the market. Traders protect their profits in uncertain conditions by considering transaction costs and, when these are reduced, quotes are closer to the fair value of the underlying asset. Considering that HFTs are less likely to increase market volatility than human traders (Courdent & McClelland, 2022), the likely cause of reduced transaction costs because of HFT may come from the combination of reduced volatility and improved liquidity provision, as traders post more quotes that make less concessions for market volatility (Bhar, et al., 2004). The result of these effects is a greater number of accurate prices, concluding that HFT activity improves market efficiency.

Similarly, narrower bid-ask spreads can indicate improved efficiency because of HFT. However, issues can be encountered when evaluating the ways in which HFT impacts bid-ask spreads. In this case, the nature of the HFT algorithm is a determinant of the market impact. While the efficiency of market-making algorithms can allow them to reduce bid-ask spreads, the presence of aggressive HFT in the form of liquidity-taking can widen the bid-ask spread. By driving out liquidity providers through introducing the threat of 'picking off' stale quotes, these algorithms cause providers to account for this risk when quoting prices, reducing efficiency by increasing the bid-ask spread (Nimalendran, et al., 2024). The general sentiment across stock exchanges is that bid-ask spreads have fallen (Worstall, 2014) and, in line with the reasoning above, have improved market efficiency.

3 Effects of HFT on Regulation

The introduction of both Algorithmic and High-Frequency Trading, just as any other trading practice, decisively constitutes adequate changes to existing regulation. In this section, the effects of the rise of HFT on regulation are examined mostly via the same criteria across different areas. Due to the unique risks associated with HFT, regulation should aim to account for these explicitly to provide the most comprehensive guidance. However, having recognised the benefits that these strategies bring to markets, as seen with those to market efficiency, effective regulation should find a balance between reducing risks and promoting efficiencies.

3.1 Current approaches to regulation

One of the most comprehensive regulatory frameworks encompassing HFT today is MiFID II (Markets in Financial Instruments Directive 2014). The act, along with supplementary legislation, provides a legal framework in response to the developments of HFT and other forms of automated trading across European securities markets.

Firstly, having outlined the dangers of a high order-to-trade ratio (OTR) that are common with HFT when looking at trading strategy, how regulatory bodies have dealt with these risks can be used as a perspective into how the rise of HFT has shaped regulation. Measures to manage an excessive OTR have been especially prominent in these European markets, the most common measure being a guarantee of an appropriate ratio (Deutsche Borse Xetra, 2024) or close monitoring of these ratios (European Commission, 2016). This attention to excessive order-to-trade ratios, while not always applicable (in times of uncertainty as defined in MiFID II), clearly aims to reduce the effects of predatory HFT activity.

The most dangerous activity which the OTR-careful approach relates to, which the regulation mentions specifically, is spoofing. This method of market manipulation and its dangers are evident following the events of the May 2010 flash crash, where a great part of the cause of the crash is attributed to orders being placed without intention of being executed by ATs. This aggressive HFT strategy and its effects constituted great amendments to the regulatory frameworks to address the specific risks through supervision (Busch, 2016).

3.2 Regulation of tick-size constraints

Another concern for regulatory bodies with regards to HFT specifically has been tick-size constraints. Contrary to the reasoning of (Ye, 2014), regulators in both the US and Europe have discussed and implemented specific regulation for the purposes of reducing the advantage of HFT through managing tick-sizes. Within MiFID II, Article 49 along with the supplementary RTS-11 outline guidance for the minimum tick-size at which financial instruments trade, varying for different markets and some being exempt from this regulation. These constraints are particularly important for the price discovery process, where tick-sizes which are too small are likely to result in negligible price improvements that simply flood the order book with 'noise' and harm price discovery (Glowacki, 2017), but this reasoning finds issue with those who propose a reduction in tick-size.

The reduced relative tick-sizes and their incentivisation of price competition have positive effects on the 'level playing field' for traders of both high and low frequencies, reducing opportunities that are exclusively available to the fastest participants (Budish, et al., 2015). It can be argued that the main benefit of an increase in tick-size in a pilot program in small cap stocks (SEC, 2014) would be to prove that tick-sizes should be reduced to achieve the aims of equality of market participants (Ye, 2014). The relationship between HFT and relative tick-size introduces an interesting dynamic between trading activity and regulation. The reaction of traders to regulation provides an alternate view to the standard approach, where trading activity causes or influences changes in regulation, as regulation also influences trading activity. Therefore, this 'standard' relationship between new methods in a market such as the rise of HFT leading to changes in regulation, does not entirely describe the relationship between the two. Nonetheless, the concerns which arise when HFT activity enters markets are clearly a great contributing factor and are heavily considered in modern regulatory frameworks.

3.3 Changes to information requirements

Perhaps the greatest impact of HFT on regulation is that on information disclosure between HFT firms, regulators and exchanges. Information disclosure from HFT firms comes with difficulties due to the nature of HFT. The success of liquidity-taking algorithms is highly dependent on their ability to predict future order flows (MacKenzie, 2021). Thus, the success of an algorithm is closely related to how well it can predict other algorithms, while itself being unpredictable. Regulators may demand information about an algorithm and its trades on an *ad hoc* basis, so issues arise around the protection of this information. In addition to this, the sheer size and complexity of both liquidity-taking and market-making algorithms poses further challenges for regulators who invariably are unable to entirely understand the algorithms which they are regulating.

Further problems arise in certain areas of MiFID II, as it not only regulates HFTs, but also places additional emphasis on Direct Electronic Access (DEA) providers – should they be involved in DEA provision for AT or HFT (Busch, 2016). Considering the issues surrounding information requests and the regulator's understanding of algorithms, regulation ensures that trading venues employ staff 'with sufficient knowledge of: a) the relevant trading systems and algorithms; … c) the types of trading undertaken by the members, participants or clients of the trading venue' (European Commission, 2016). In addition to a sufficient understanding of algorithms, the European Commission ensures that 'Algorithmic Trading Systems' – venues which allow AT on their platforms – and their employees are subject to 'data privacy' and other confidentiality agreements, commonly with third party auditors. This clear display of an understanding of the unique risks that AT and certain HFT algorithms present can be used to conclude that increasing HFT activity has drawn the attention of regulators and led to amendments to existing regulation.

3.4 The impact of HFT on enforcement of regulation

The rise of HFT already has presented several issues for regulators of financial industries in which they operate. Much of this regulation seems straightforward: a problem arises, and safeguards are put in place to prevent further damage. However, many of the risks discussed pose specific issues for regulators when it comes to effective enforcement. One of these issues, concerns itself with how effectively fault for a breach of regulation can be found (Wellman & Rajan, 2017). Considering the use of machine learning in the development of strategies such as the 'Fuzzy' method (Bayram, 2020) and other systems, autonomous traders (especially AI and machine learning integrated ones) are increasingly free to initiate trades and determine signals while also being less predictable (Kearns & Nevmyvaka, 2010). Here, the continued development of the decision-making ability of these algorithms, which may be able to design their own decision-making frameworks, calls for clarification of regulation, both through ethical and legal boundaries.

Additionally, market regulation pays a great deal of attention to reducing manipulative activity, outlined in its definition as 'the expression of intent to distort others' perceptions of market conditions', harming informational efficiencies. Issues already arise with defining such intent, especially as the decision-making of algorithms develops, potentially not in line with the intent of the programmer. The investigation into determining intent finds other issues, firstly in identifying harmful activity. A major characteristic of predatory strategies is a high order cancellation rate, which is also key in market-making strategies. The distinguishment between these two being so vague, at times, allows manipulation to be disguised by mimicking the characteristics of liquidity-providing strategy. Perhaps most importantly, these distinguishments and boundaries ought to be clarified in regulation concerning itself specifically with HFT, with the aims of correctly identifying predatory strategy for the purpose of improving both market efficiency and the welfare of its participants.

Conclusion

The impact of HFT on these distinct aspects of markets, is widespread and clear. Within market efficiency, trading strategy and regulation, there is rarely a decisive and unique effect on the market, instead it is more common that the market impact varies either due to conflicting evidence and opinions, or it varies depending on the market and strategy involved. Nevertheless, the overarching conclusion is that HFT has strongly influenced change in these aspects of markets.

Firstly, the rise of HFT strategies provides the most basic understanding of the market – necessary for understanding the overarching impact on markets. The rise of HFT provided the foundation for the refinement of existing strategies, while creating opportunities for entirely new strategies. Just as with market efficiency, the impact on the market is highly reliant on which strategies are considered, and which markets they are employed in. Certainly, the rise of HFT strategies has changed the activities of traders: it has developed the practice of market-making and provided countless new methods for liquidity-taking. While not all methods, as described in *2 Effects of HFT on Market Efficiency*, may have positive impacts or even be profitable, it is difficult to find a trading strategy that has remained entirely the same following the widespread adoption of HFT.

Secondly, the impact of the rise of HFT on market efficiency, where there is a clear divide of positive and negative impacts, is largely dependent on the HFT strategy involved. The improvements to efficiency in markets resulting from HFT are extremely well documented and acknowledged by regulators and participants alike. It is clear to see why such a trading strategy could thrive in market-making and provide the liquidity for other traders who may contribute further to efficiency. However, the same technology that allows this efficiency creates an opportunity for aggressive and inefficient liquidity-taking strategies. There have been many examples of how such strategies can reduce informational efficiency via their influence on the perception of the market. Overall, both outcomes can undoubtably be considered significant changes to efficiency in markets – a key component when considering the overall impact on markets.

Finally, it is impossible to deny that regulation has not changed because of the rise of High-Frequency Trading. Reducing the risks from HFT has been a priority of financial regulators, evident from the extensive changes to, and creation of regulatory frameworks in the US and Europe. The consequences of these changes, however, are far more important in understanding why markets have developed in the way that they have, along with how they may continue to develop. Described throughout *3 Effects of HFT on Regulation*, not only has the interaction between traders and regulators been integral in making changes to regulation, but also in how these changes influence behaviour within the market. This is most useful when considering overall market impact. Looking at the changes resulting from HFT allows a deeper understanding of why regulation changes, and provides an insight into how HFT may adapt to an unfamiliar environment – and then likely result in future amendments to regulation. This cycle represents how the market shapes itself; understanding how the rules of the market change may be the most significant factor when considering how the market itself changes.

Overall, the changes to markets stemming from the rise of HFT are clear. In all scales and scopes of markets, in some way or another, the activity, efficiency and regulation of markets have changed either as a direct and obvious result of HFT – or in a more indirect and obscure way. These changes are described here in detail and the interactions between all these areas best describe the great extent to which markets have been transformed by the rise of High-Frequency Trading.

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