

# High-frequency Trading, the silent financial revolution: Understanding its opportunities and issues.

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Markets have provided numerous examples of high volatility in the last two years. Even if some of the volatility crashes can be explained by macroeconomic and geopolitical events such as the Covid pandemic, the inflation rise, and, sadly, the war in Ukraine, some remain completely inexplicable from a macroeconomic event perspective.

Another phenomenon is taking place, with far-reaching implications for markets' efficiency: High-frequency trading (HFT). Despite not being covered by most of the headlines from top specialized newspapers, HFT revolutionized the finance industry. It was almost unknown in 2005 while in 2018 it represented 52% of the US Financial market share (Zaharudin et al 2022:72). New jobs appeared beside traditional traders, such as quantitative traders, mathematicians, bot developers, and financial engineers. HFT is one of the leading sectors in Fintech that drains billions of revenues to Hedge funds. At each second, hundreds of thousands of trades are

automatically executed without a human having ever set them. The newest technological progress in deep learning give encouraging opportunities for further breakthroughs in the sector. Meanwhile, the prodigious results of modern artificial intelligence bots like the infamous ChatGPT offer promising evolution in HFT's optimization. Independently from what we think about it, we have to admit that humans do not rule the market anymore (at least alone).

Nevertheless, HFT's supremacy may be harmful to the markets. HFT has been a hot topic in financial markets research for over a decade, with some arguing that it provides benefits such as improved market efficiency and liquidity. In contrast, others argue that it creates significant risks and harms the market due to excessive volatility. This could explain the insane volatility we have experienced over the last 2 years, even if no study has been conducted yet. HFT could have worsened the market's panic over the last months. Nevertheless, it is surprisingly not so much known among professionals and students. Hence, understanding its key features and the implications of HFT is a must for anyone who wants to stay long in the market.

## A prodigious revolution

The HFT is nothing else than the evolution of the machine learning techniques applied to the financial sector. HFT is a type of algorithmic trading that uses sophisticated computer programs to execute trades almost instantly. HFT is characterized by using advanced technologies, such as high-speed communication networks, powerful computers, and advanced algorithms, to analyze market data and ex-

ecute trades at extremely high speed. Technological progress allows trading bots to react in a time frame that was before unthinkable and that is beyond the human reaction time. The most modern exchange allows trade at the nanosecond scales, meaning 8 zeros after the comma for one second. Those time frames can be considered instant for our human understanding as it is almost infinitesimal. Those incredibly short periods allow the trained bots to use arbitrage between the stock markets. Therefore, the rentability is high as the risk is low due to the use of arbitrage.

Moreover, it allows trading without any emotional background that human traders face, such as FOMO or greed. Thus, the bots follow their trading plan exactly as expected. The algorithm is well programmed, and its accuracy is improved accuracy with help of historical data and unsupervised machine-learning strategies. This allows the trading bots to constantly apply the most efficient trading strategy, depending on the context. It's not a surprise if the Fintech sector has seen a spectacular increase.

HFT firms use these tools to gain a competitive advantage, often by making trades in fractions of a second before other market participants can react. These trades can involve large volumes of shares, bonds, currencies, or other financial instruments. In one way, the volume of trades may provide sufficient liquidity, which may be positive but can lead to market manipulation.

Therefore, it is surprising that mainstream and even professional media like Bloomberg do not speak more about the issues and trends of this topic as it is becoming the inevitable agent of markets. Moreover, this incredibly fast-moving revolution brings

not only opportunities but issues that are currently understated by many.

## Identifying key features

HFT remains controversial. Scholars find mixed results about its impact on the markets. This is due to the lack of a uniform identification, leading to difficulties in identifying it properly for empirical studies (Broggard et al. 2014:2270). The literature overview signals mixed results about how harmful the HFT is. One of the explanations may be that data sets are identifying HFT differently due to different methodologies. The professionals shall not understate this issue as it means true impacts may be overlooked.

However, The regulators and Scholars agree on a few basic features of HFT. According to the Security Exchange Commission (SEC), we can identify HFT when at least those features are present:

### SEC 2010 Characteristics list for identifying HFT

- Use of extraordinarily high-speed, sophisticated computer programs for generating, routing and executing orders.
- Use of colocation services and individuals data feeds offered by exchanges and others.
- Very short time frame for establishing and liquidating positions.
- Submission of numerous orders that are canceled shortly after submission.
- Ending the trading day in as close to a flat position as possible.

However, SEC does not consider that every point must be fulfilled to be considered HFT. This tends to make the identification even more difficult. As seen above, identification points on HFT are relatively large and vague. Thus, it remains difficult to truly separate it from algorithmic trading, which can be summarized as trading bots without faculty to set a trade independently.

## Harmful HFT strategies

HFT is a challenge for regulatory agencies like SEC or FCA. Instant automated trading allows news trading strategies that are harmful to other participants. Numerous strategies exist, like front running, order anticipation, quote matching, spoofing, and quote stuffing. As financial professionals or students, we need to understand at least the concept of those practices in order to manage risks efficiently.

### Front running

Front running is an illegal practice that consists of a massive scalping strategy to use the latency of more prominent traditional traders. The HFT bot will see it and will use this information in order to highjack a part of the potential gains of the traders by placing an order just below or above him. Moreover, the HFT algorithm can see top information like a FED announcement literally before anyone else and trade it with an enormous advantage as news has not yet been priced. The incredibly short time range and the high amount of orders this strategy implies, make it difficult for regulators to sanction HFT. Empiric suggests that until 50% of the potential gain of the traditional trader may be highjacked

by HFT front runners (Xu and Chen 2023). This shows the relevance of HFT to others participants.

### Order anticipation

Order anticipation is almost similar to Front running, but it is not considered illegal. In place to trade a piece of information, the bot predicts a trade from large institutional traders, and it will use it in the same way as with front running. The HFT bot will put a price The rapid progress in IA offers promising future development.

### Quote stuffing

Quote Stuffing is the most controversial strategy. It creates an illusion of liquidity by filling the order book with an enormous amount of trades and canceling them afterward. The goal is to manipulate the market by persuading other market participants that there is a high demand respectively offer. Thus, it is a type of market manipulation.

## Effects on the markets

In addition, HFT can have different effects on markets even when harmful strategies are not implemented. Those effects are very problematic as they distort the whole financial structure. In sum, we can summarize the effects in 3 aspects.

### Liquidity

Scholars find mixed results about liquidity as HFT may provide some type of liquidity to markets. However, this is only in the short run, and it is difficult to separate true liquidity from an illusion of liquidity due to the fragmentation of the market due to

the enormous amount of trades. The advantage is that it can provide short-term liquidity that allows a rapid price adjustment and, therefore, better market efficiency. Nevertheless, SEC argues that HFT may give toxic liquidity from distorted order flows. In clear, HFT can give an illusion of Liquidity, which is in fact not true as most orders are canceled before execution. This leads to a fragmentation of markets as HFT absorbs all the remaining liquidity markets, which kills any buyer or seller pressure. This phenomenon is valid in the really short term with average volatility. Orders from HFT's bots are executed by taking the existing liquidity, and the remaining are instantly deleted while regular traders believe the pressure is stronger. Therefore, the market movement goes slower or changes direction, and other participants accumulate a loss. In sum, other participants may be fooled by fake volatility generated by HFT. In 2015, the SEC fined two high-frequency trading firms, Latour Trading LLC and Tower Research Capital LLC, for violating the "market access rule," which is in place to prevent erroneous or manipulative trades. The firms were found guilty of having engaged in thousands of incidents of "layering," a form of market manipulation in which traders place and quickly cancel orders to create a false impression of supply and demand known as "layering". Layering is analog to Quote Stuffing seen before but in a more complex way. Some other harmful behaviors are difficult to identify due to the enormous amount of needed data. That's why such fines are relatively rare and reserved for extreme cases.

## Volatility

The main concerns are about excess volatility. HFT has a negative impact on volatility. This tends to higher the risks due to unexpected large movements. Scholars agree that HFT is positively correlated with intraday volatility (Zhang 2010). The main explanation is its insanely quick speed. HFT algorithms are the firsts to react to major headlines such as Fed's announcements or Macro news. Their transactions are often in sudden large amounts which can create instability and excessive pressure on the price (Jarrow & Protter 2012). A great example happened in 2010 and is known as the flash crash. The Dow Jones plummeted nearly 1,000 points in a few minutes, only to recover just as quickly when HFT traders were quicked out for 5 seconds by the Chicago Mercantile Exchange (Phillips 2010). It allowed algorithms to be reinitialized and it cut the toxic extra liquidity.

In this incident, a combination of market conditions and trading algorithms caused the sudden and dramatic drop, triggering further selling by other market participants like a snowball effect. While the market eventually recovered, the incident highlighted the potential for HFT to exacerbate sudden and unpredictable market movements, which can be especially damaging for individual investors and small firms that do not have the resources to keep up with the rapid pace. Moreover, derivatives traders suffered the most from the crash as leverages amplified the loss and margins realized the loss.

Even if the volatility is short-term and bonded to intraday, scholars found empirical evidence that this excessive volatility from HFT has long-run impacts on individual stock prices (Boehmer et al 2018). This is concerning not only for scalpers but for

value investors too.

## Adverse selection

HFT has fractionalized the market so that the risk perceived by informed investors has systematically risen. This means that in order to match the regulatory risk management such funds have the obligation to adapt their financial decisions. It results in fewer investments in markets with HFT transactions like stocks and bonds. Thus, this underinvestment leads to decreasing welfare (Zaharudin et al 2021) and harms the whole economy. Sadly, regulators lack measures in order to fight this phenomenon. Regulators have been more focalized on short-run effects even if long-run are way more detrimental for everybody even for those who are externs of the financial system.

## Key take away

Whether we are thrilled or frightened about it, we must admit that HFT is revolutionizing the markets forever. Like other revolutions, it comes with some issues for markets and regulators but with opportunities too. HFT enables new ways to perform in the very short term while reducing the risks for scalpers. Moreover, there are no emotional factors that drive irrational behaviors. Using arbitrage may lead to better efficiency of markets as the price adaption is quicker and safer than a traditional scalping strategy. Nevertheless, new technology has always two sides and regulators lack to adapt their policy to HFT issues. Identification of HFT as well as a common definition is missing. It is detrimental to the prosperity of markets. Regulators need to adapt at least as quickly as the technology evolves

in order to prevent some harmful players from using Quote Stuffing or Front Running. Most importantly, HFT may be harmful to the market's stability and long-run stability. Surprisingly, this issue is not enough stressed by branch media even if it is of the highest relevance for anyone in the industry. It is crucial even for value investors to quantify HFT risks in their analysis and to innovate for avoiding underinvestment risks.

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