NEW TECHNOLOGIES AND INFRASTRUCTURES OF FINANCIAL SERVICES

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Abstract
This paper presents a view over recent developments in the underlying infrastructure of the financial system, more specifically electronic trading and how computers have taken over classic trading mechanisms. While some of the benefits are easy to agree upon, evidence shows that technical discrepancies have made the order book unequal fighting ground for traders. The findings of the paper suggests that in practice, high frequency trading is actually detrimental to order book health and degrades liquidity and overall quality of execution of regular trades.

Key words: *high frequency trading, financial infrastructure, electronic trading*

JEL Classification: *D47, D53*

I. INTRODUCTION

In the past, when orders to trade on Wall Street were run by men, a financial crisis or even a single incident of sudden drop and unexplained stock market, some brokers refused, risking discrediting to respond to telephone customers who wanted to place sell orders. In time the authorities began to respond by introducing new rules that transferred responsibility for the operation of the people by automated systems controlled by computers. Moreover, the whole financial industry has evolved with technology and most operations on markets are being achieved using IT facilities. More and more aspects of investment transactions on securities, including financial derivatives and even new financial instruments depend on the operation of computers and algorithms, most often intellectual Private property, and individuals that are operating in the market, either individually or as representatives of financial institutions have as counterpart a computer program. Of course the incident on 6 May 2010 - "Flash crash" that in about half an hour market fell sharply, at first glance inexplicable, about 9%, then recovered, is a testament to the imperfection and vulnerability of the system. It took several years for the authorities and economists to understand what happened or identify tools market manipulation or fraudulent techniques. Trading at high frequency (HFT), and other forms of electronic trading raise new challenges in the financial system, even if the research after the crash of 2010 suggests that these practices are not the cause, but they have generated volatility further. The issue of new dynamics on electronic transactions generated controversy points among economists and researchers with dissenting views on the risks and benefits introduced in the financial system. Books like "Flash Boys" by Michael Lewis argues that new practices of electronic trading harms many investors and expose internal and unseen mechanisms of the market that is increasingly more complex, without this complexity to be a benefit to the economy, but only additional revenue intermediaries. Other articles in publications such as Forbes, have the opinion that the problem was solved by the market, and that new technologies are ultimately beneficial to investors, but system complexity and the limited nature of understanding and research cover a potential systemic risk with substantial implications on the health of financial systems.

II. HIGH FREQUENCY TRADING - HFT

High frequency trading - HFT uses sophisticated technological equipment and algorithms to open and close positions on the market in fractions of a second. These positions on a short term accumulate very small profits on each transaction, which is why trading volumes are very high. It is estimated that over 50% of volumes on US exchanges are performed by such traders, with a higher percentage on derivative markets. Investment decisions are generated by algorithms that rely on quantitative models and the success is attributed to the processing capacity of a large volume of information. Operations of this kind are usually based on a strategy of arbitration, the competition taking place between HFT traders and less with the traditional investors, but have identified a number of illegal practices, including involving market manipulation. Some commonly used HFT strategies are:

- Rapid recovery access to information - communications solutions with low latency. In this case, computers are used to identify price discrepancies for assets traded on various markets and arbitrate these differences using rapid communication technologies. The transition from the optical fiber networks (where the light undergoes a decrease in velocity of more than 30% compared to a vacuum) to microwave technologies (a decrease of less than 1% as compared to the speed of light in vacuum) allows reducing the time of transfer of the information.

- Processes and algorithms that interpret the news. Using news feeds, computers can identify company names and keywords more efficient to any human operator.

- Market making. These techniques involve placing a limit order to buy or sell by forming a part against the orders of investors in the market, generating the spread between bid and ask. A number of empirical studies [CITATION Hen11 \ l 1048] suggest that these technologies and competition between operators has resulted in a decrease in the spread, an increase in liquidity and a reduction in indirect costs for end investors.

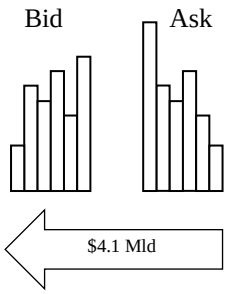
- Algorithms detection information from live quotation of the exchange, such as ultrashort-term trends, increases or decreases by the volumes of orders generated by large investment fund or other market events.

- Statistical arbitrage. Transactions exploiting temporary deviations and predictable statistical relationships between different titles. An example is the interest rate parity on forex markets, developments or differences between spot and futures of an asset.

- Driven by the properties brought to market orders, such as the age of an order (indicating the possibility that that order can be placed at a price sub-optimal compared to the market).

Effects of high speed trading based on algorithms is not only a matter of debate, but one of research because some benefits supported by members of the financial industry as well as better liquidity, tighter spread between bid and ask, less volatility and smaller costs for end investors, were not being tested in different contexts on the market, such as turbulence or declining markets. Most of the debate relates to matters related to the frequency and volume of transactions and not to the logic behind the investment decision, which is usually a secret of the operating companies. Italy, for example, covered a fee of 0.02% for transactions that takes less than half a second. Another point of concern is the effect on savings and pension solutions that rely on mutual funds investing in shares. Many of these funds pursuing an index and must regularly balance the portfolio, which allows traders to anticipate and trade before price movements caused by these operations. The result is the transfer of profits from investors to short-term traders with a significant impact on the yields of long-term saving instruments.

Analyzing SEC reports ("Securities and Exchange Commission") and CFTC ("Commodity Futures Trading Commission") on the incident in May 2010, it can be concluded that traders HFT had a positive effect on the impact of sales positions (from which is suspected a sale of $ 4.1 Waddell & Reed fund mdl Financial), which generated a spiral of decline on a background of high volatility in the markets. The incident reflects a fragmented market and unstable situations that trigger chain events dictated behaviors of trading algorithms. The transmission mechanism identified in the report is described in the scheme below:



An algorithm trading of fund issue orders to sell E-mini S&P futures contracts in a volume to cover a position (hedging).

In a context of high volatility and unusually small liquidity, the order determines a sharp drop in buyers' market. Companies specialized in HFT senses the entry of a large institutional player and sell aggressively contracts, by competing with each other. In just 3 minutes E-mini contract price falls by more than 3%.

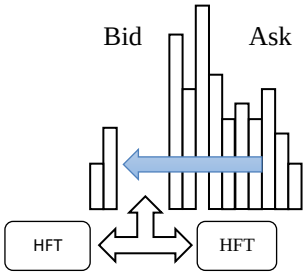
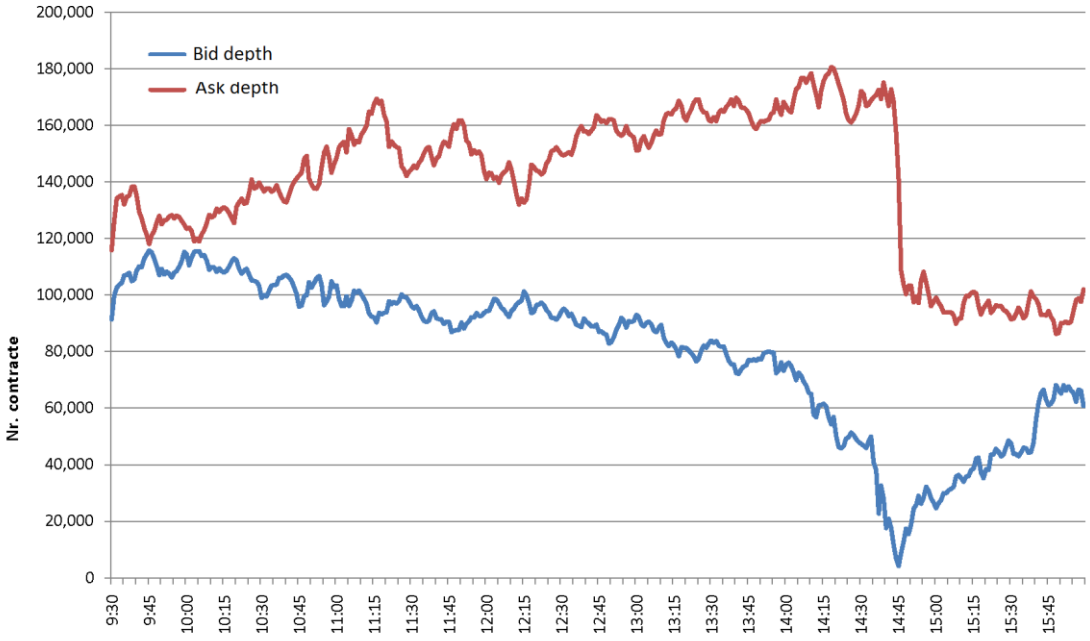


Figure no.2 shows the market depth, the number of contracts between 9:30 and 15:45 on 6 May 2010 for E-mini contracts, showing sharp drop in supply. Figure no. 3 shows the spot price index S&P 500 (SPY symbol) correlated with market depth.

HFT trader's aggressive activity and falling prices generate automatic decision to exit for some and higher sales for others which led to a reduction of available liquidity and price drop. The decline in futures markets made the arbitrage firms to react and decreases were transferred on spot markets. Because of the algorithms that drew systematically institutional actors in the market, lack of liquidity generated situations în

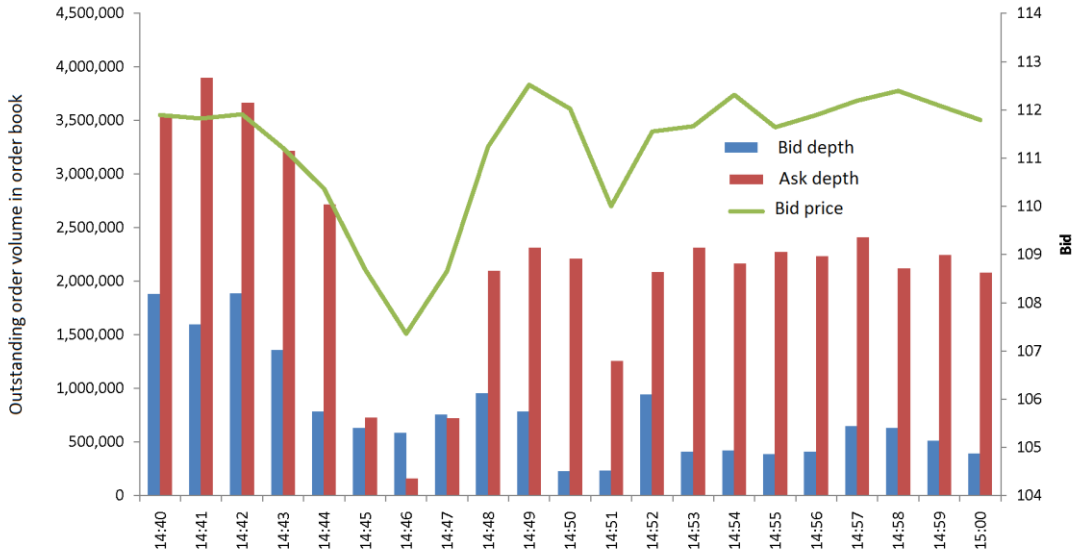
which for a few seconds the shares of large companies jumped to $ 100,000 or felt to a cent. Closing of these transactions was possible due to technical errors in price reporting systems. Some participants wanted to get out of the market by displaying purchase orders at very low prices and selling at very high prices, and HFT trader's algorithms closed their positions in order to market, thus accepting prices. To prevent a chain reaction and a cascade of declines, Chicago Mercantile Exchange stopped trading for five seconds, allowing prices to stabilize.

Fig.1: E-mini market depth



Source: Retrieved from The Commodity Futures Trading Commission, U.S. Securities & Exchange Commission, 30 Sept 2010

Fig 2 : SPT price and market depth (500 basis points from mid quote)



Source: Retrieved from The Commodity Futures Trading Commission, U.S. Securities & Exchange Commission, 30 Sept 2010

The report was criticized by many financial analysts, inclusive the representatives of Chicago Mercantile Exchange issued a press release in which argues against various issues such as the situation by triggering a single trading order. Authors such as Michael Lewis claim that authorities had no tools and no real understanding of the reality of trading mechanisms and causes of the event. Other academic and research authorities identified a number of problems, and there counts of unlawful practices and market manipulation. All the mechanisms that generated the event are a problem of financial infrastructure with systemic implications. One of the mechanisms

is the accumulation of an imbalance measured by order flow toxicity [CITATION Eas11 \ l 1048]. This concept measures the probability that informed traders to select the uninformed ones thus creating imbalance. As the level of toxicity increases, Market Makers get out of the market and this leads to a greater concentration of toxic order flow. As institutional actors retire market liquidity disappears which generates short-term crash sites. There are situations in which the action very traded, make the price to fall by 25% even for a split second. Finally, the event from May 2010 was a statement of complexity, because you cannot draw one to blame, but a number of culprits. One of these factors with a large share is a form of market manipulation by a technique for generating large sales orders to push the price down, only to be canceled and action to buy at the lower price. Called "spoofing" (translated to imitate in order to outflank) technique became illegal, but in March 2015 HTG Capital Partners, a company specializing in HFT has sued another company accusing practice and having thousands of case studies on record, proving that it is still practiced.

Infrastructure itself trading, one of the proposed regulations to stabilize the market situation described above is the placement of switches automated Circuit trading for a few seconds when the action goes to a predefined threshold in a given unit of time. Although not addressed the matter foundation, allows institutional players to "reset" algorithms and stabilize the market.

Relevant on the financial stage became the pricing schemes practiced scholarships, patterns that add complexity to the system and generates what some can describe as a conflict of interest. The old model of charges for each transaction with a fixed percentage - "Pro rata" - was replaced by a system based on grid tariffs and rebates (in English "Kickbacks" a term synonymous with bribery) called 'Taker - maker ". This model is based on the principle that participants who remove liquidity from the market, those that spread to accept cross-party transaction counter (Taker) pay a price. While those who wait for someone to accept their transaction, bringing liquidity in the market (Maker), are paid a smaller rebate, the difference is profit Exchange. Some scholarships reverse payment model which further complicates forwarding systems orders, which will obviously follow the best price. Conflict of interest occurs when the broker direct order to take advantage of the biggest advantages of this system of rebate data, sometimes to the detriment of execution of the order and the customer's cost. This targeting is another element that increases relevancy execution speed or latency of communication between exchanges and brokers. Controversies regarding algorithmic trading and HFT relies on other mechanisms that favor unevenly certain market participants, many of them undetected and unregulated. For example, some markets have introduced exotic order placing unnecessary complexity in the market and favor certain trading techniques instructed by nature. Some orders (Post-only) are executed at a price (which may be the limit) but only from passive position to collect the fee. This order can be further complicated in an apparently counter-intuitive order Hide Not Slide, in which the trader concealed its intention to buy at a higher price than the market. The intention must remain hidden because otherwise the rules for execution at the best available price immediately determines the execution of the transaction. Thus, when the price reaches the level set in order, it becomes visible and is being executed before the other spot orders placed. This practice, although at first glance seems disadvantageous for the trader because it means a higher price paid compared to the time it was placed the order, provides valuable information such as the existence of a buyer at a higher price in a market where the amount can be limited and arises the arbitrage opportunity to other markets, and also offers the possibility of execution order before the other participants are using standard orders. Such orders that provide an information advantage to certain categories of market participants explain why about half of the volume is assigned to algorithmic traders, but 99% of the order. Some of these orders are explained unequally to the market participants.

In terms of how we can formulate trading strategies, HFT firms can achieve three categories of activities:

1. *Front – running*, is a practice of scanning scholarships to identify orders that propagate through brokers routing systems and their interception. HFT traders place small orders in each market for each share traded and when a big order reaches one of the scholarships, availability traders buy or sell the other to move the price. This erodes traditional price execution for investors who pay more or receive less in each transaction. These revenues are no risk of stripping the market because buying or selling orders in the system is certain. It is estimated that each year billions of dollars are made from such transactions, usually at the expense of institutional investors such as mutual funds or pension. One way to eliminate these opportunities is the delay of an order by an algorithm or physical infrastructure projected in this regard for the order to reach the market at the same time. The following figure illustrates the process of scalping and market mechanism to equalize the induced latency.

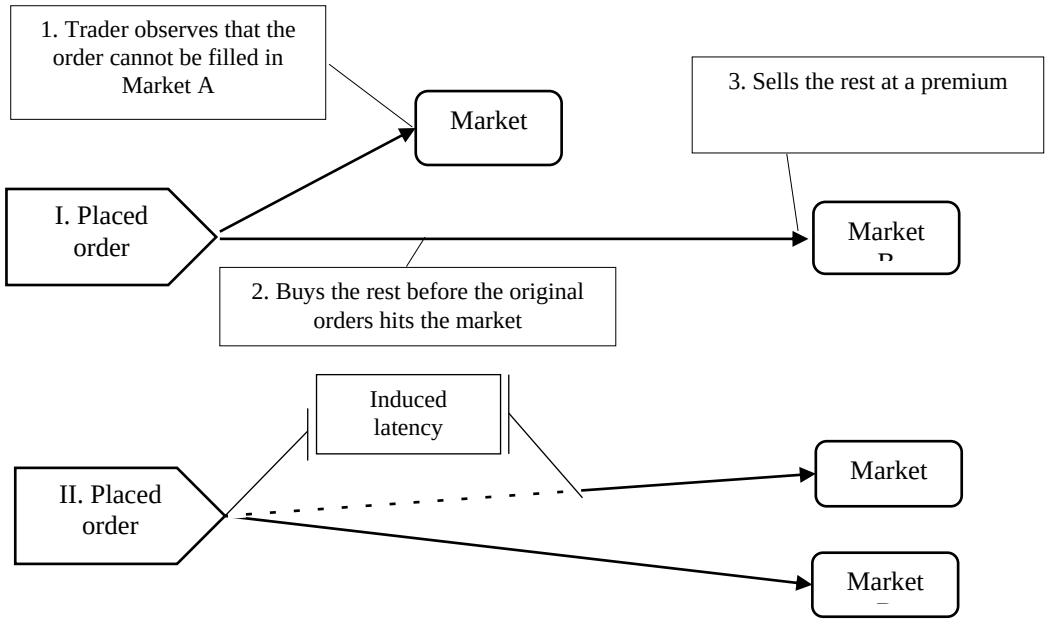


Figure no. 3: Scalping done by HFT
Source: Processing on Arnuk and Saluzzi 2012

The legality of this practice is questionable. They are possible because of unequal market access with advantages of milliseconds. The practice is illegal when brokers trade on their own accounts prior to honor an order from the customer, or when insiders place orders before certain large transactions (eg: short order before anyone from management board to sell a stake).

2. Arbitration tariff pricing refers to differences in system maker - taker occurring between different exchanges, traders making transactions simultaneously opposing on different exchanges when identifying a profit opportunity of the positive differences between rates paid and received.

3. The arbitration latency, or markets slowed refers to the arbitration of price differences between different markets which trade the same title in the spectrum for an order on one of the markets that adjusts the price until the moment when other markets change official price. This mechanism is the reason why the physical infrastructure is important, that every microsecond is the ability to mark a profit.

All this opportunity has generated an entire race for speed, with traders paying for private lines or fiber optics for space closer to the physical location of the computers scholarship. One of the most important causes of the spread of these opportunities is the fragmentation of markets. Introducing regulations that allow open scholarship alternatives to eliminate the monopoly of big players such as the New York Stock Exchange and to provide open access to markets, and thus higher efficiency, it had the side effect of generating unequal access and introduce inefficiency. The detection of such practices would be illegal even if it is very difficult because the algorithms break scholarships orders in smaller chunks that are sent by transparent rules. The only restrictions are usually given execution at the best price available on the market, but as BATS exchanges made public that due to technical errors, it was possible to regulate transactions at a price other than the best available. System errors and unpredictable behavior of the markets are not anomalies, but symptoms of an imperfect system.

III. CONCLUSIONS

Many of the arguments of representatives of the financial industry in favor of high-frequency transactions, such as improving liquidity and reducing the spread between bid and ask are questionable. Liquidity is the ability of markets to enable rapid sale or purchase of an asset with significant price influence. By their actions traders move the price and erode quality of execution classical orders, and thus reduce market liquidity. We make a clear distinction between liquidity and trading volume obviously increases, but this does not benefit intermediaries and investors. Regarding the spread between bid and ask, the reduction is primarily due to the execution of electronic orders allowing all participants to increase or reduce the bid-ask therefore is questionable contribution of high frequency traders. Without these arguments, trading of high frequency becomes an additional fee paid for additional capital and intermediate profits from a legal vacuum and technology.

Of course, some functions of the exchange became more efficient, for example adjustment quicker certain relationships statistics for different prices, interest rates, stock freight or macro-economic indicators, but a legal framework and technical limit to the opportunities for exploiting financial markets is necessary.

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