COMPUTER TRADING AND ITS IMPACTS ON FINANCIAL MARKETS

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Abstract

This paper studies the impact of computer-based technology (CBT) on the financial markets. I examine to study the strategies utilized by HFTs, their profitability, and their relationship with characteristics of the overall market, including liquidity and volatility. According to my research, I find that CBT has several beneficial effects on market: (1) liquidity[1] has improved, (2) transaction costs have fallen for both retail and institutional traders, (3) market prices have become more efficient, which means CBTs add substantially to the price discovery process.

[1] Liquidity describes the degree to which an asset or security can be quickly bought or sold in the market without affecting the asset's price. http://www.investopedia.com/terms/l/liquidity.asp

Introduction

Financial markets are significant in economics and for everyone. They support business and growth across the world. In the United States, finance and insurance represented 7.0 percent (or $1.223 trillion) of U.S. gross domestic product in 2014. Financial markets are evolving ever faster by forces such as competition, globalization, and most importantly, technological developments. Technological developments are causing many new products and services, and have changed the way financial markets operate. Today, over one-third of the United Kingdom based equity trading volume is generated by high frequency automated computer trading. In the United States, the number was 61 percent[2] in 2009. High frequency trading has been implicated by some people as one of the contributory factor of the Flash Crash of May the 6th 2010, which over one trillion dollars evaporated within a few minutes. After the Flash Crash 2010, there have been repeated mini-flash crashes all over the world. Opposed to the specialists who blame HFT for causing the Flash Crash in 2010, computer-based trading has numerous positive effects on financial markets. First, HFT has made a positive contribution to liquidity, as measured by bid-ask spread. Second, it has reduced transaction costs for both retail and institutional traders. Third, through the price discovery process, HFT made market prices more efficient. Some opponents, including a few of policy makers, of HFT assert that it increased volatility or market abuse, but there is no certain evidence to support their idea. However, "in specific circumstances, self-reinforcing feedback loops can amplify risks and lead to financial instability". [3] Since some policies are needed to prevent computer based trading's market abuse, some policy makers proposed policies that could be helpful. The main purpose of this research paper is to analyze the

[2] http://www.theatlantic.com/business/archive/2014/04/everything-you-need-to-know-about-high-frequency-trading/360411/
[3] https://www.youtube.com/watch?time_continue=45&v=aJg10eiNQXw

evidence to support the idea that HFT has improved the efficiency of financial markets. However, just like policy makers' assertion about the effects of HFT on instability in financial market, this paper examines how HFT can be most efficient under new regulatory policies, while preserving any advantages that HFT may bring.

What Is High Frequency Trading?

Since HFT was unknown only ten years ago, there is no complete agreement on how to define some of these technological innovations. Even though HFT has short history, it is estimated that high frequency traders in the United States compose 60% or more of trades in equities and future markets. The US Securities and Exchange Commission (SEC) 2010 Concept Release on Equity Market Structure (SEC (2010)) describes HFT as employing technology and algorithms to capitalize on very short-lived information gleaned from publicly available data using sophisticated statistical, machine learning and other quantitative techniques. Yet, even within this general description, the SEC notes the difficulty in characterizing what HFT actually means:

> The term is relatively new and is not yet clearly defined. It typically is used to refer to professional traders acting in a proprietary capacity that engage in strategies that generate a large number of trades on a daily basis (…) Other characteristics often attributed to proprietary firms engaged in HFT are: (1) the use of extraordinarily high speed and sophisticated computer programs for generating, routing, and executing orders; (2) use of co-location services and individual data feeds offered by exchanges and others to minimize network and other types of latencies; (3) very short time-frames for establishing and liquidating positions; (4) the submission of numerous orders that are cancelled

shortly after submission; and (5) ending the trading day in as close to a flat position as possible (that is, not carrying significant, unhedged positions over night). [4]

By the definition, high frequency trading is a program trading platform that uses powerful computers to transact a large number of orders at very fast speeds. HFT uses complex algorithms to analyze multiple markets and execute orders based on market conditions. Typically, the traders with the fastest execution speeds will be more profitable than with slower execution speeds. HFT became most popular when exchanges began to offer incentives for companies to increase liquidity to the market. For example, the New York Stock Exchange (NYSE) has a group of liquidity providers called supplemental liquidly providers (SLPs), which attempt to add competition and liquidity for existing quotes on the exchange. As an incentive to the firm, the NYSE pays a fee or rebate for providing liquidity, and the rebate was $0.0015 in 2009. High frequency traders try to profit from the price movements caused by large institutional trades. For example, when a mutual fund decides to sell a million shares of a stock, the price falls, and HFTs buy the stock, wishing to be able to sell the shares a few minutes later at the normal price. When a pension fund buys two million shares, the HFTs short-sell [5]the stock, hoping to close their position at a profit. HFTs are buying when the price is below trend and selling when the price is above trend. Even though this kind of fast buy low and sell high strategy seems unfair for individual investors or other firms that have slower speed, it tends to reduce the price fluctuations.

[4] US Securities and Exchange Commission (2010).
[5] Short-selling refers to selling stock that a buyer doesn't own; the buyer borrow the shares from a stockbroker, sell them, and then later buy the stock to return the borrowed shares.

[6]

What is Flash Crash 2010?

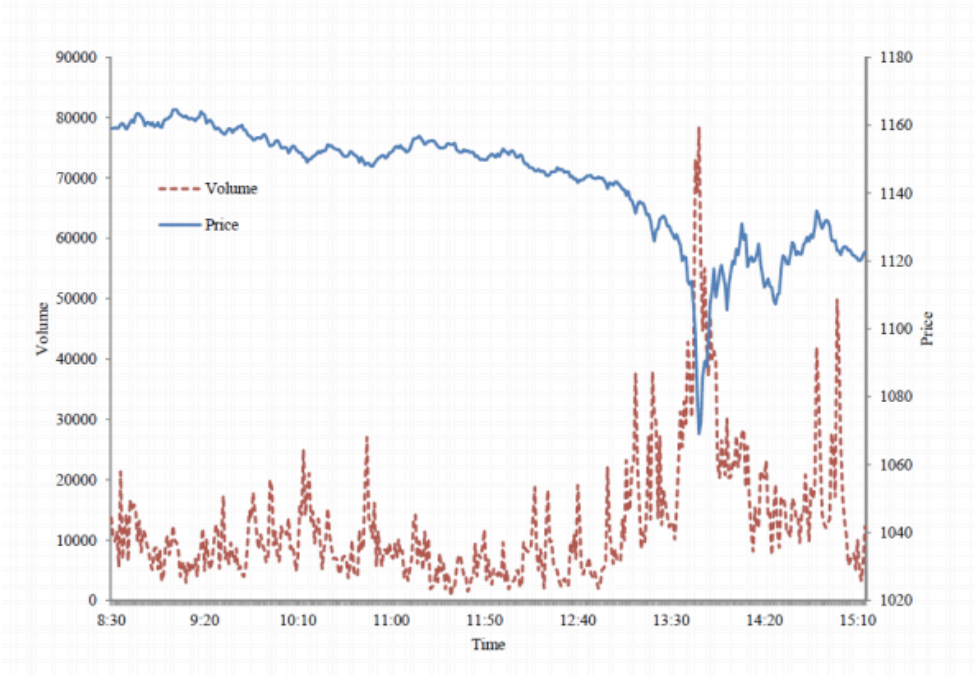
On May 6, 2010, U.S. financial markets experienced a systemic intraday event, known as the Flash Crash, when a large automated sell program was rapidly executed in the E-mini S&P 500 stock index futures market. The CFTC-SEC (2010b) joint report describes the Flash Crash as follows:

> "At 2:32 [CT] p.m., against [a] backdrop of unusually high volatility and thinning liquidity, a large fundamental trader (a mutual fund complex) initiated a sell program to sell a total of 75,000 E-mini [S&P 500 futures] contracts (valued at approximately $4.1 billion) as a hedge to an existing equity position. [. . .] This large fundamental trader chose to execute this sell program via an automated execution algorithm ("Sell Algorithm") that was programmed to feed orders into the June 2010 E-mini market to target an execution rate set to 9% of the trading volume calculated over the previous

[6] http://www.forbes.com/sites/billconerly/2014/04/14/high-frequency-trading-explained-simply/#18aa20b27dda

minute, but without regard to price or time. The execution of this sell program resulted in the largest net change in daily position of any trader in the E-mini since the beginning of the year (from January 1, 2010 through May 6, 2010). [. . .] This sell pressure was initially absorbed by: high frequency traders ("HFTs") and other intermediaries in the futures market; fundamental buyers in the futures market; and cross-market arbitrageurs who transferred this sell pressure to the equities markets by opportunistically buying E-mini contracts and simultaneously selling products like [the] SPY [(S&P 500 exchange-traded fund ("ETF"))], or selling individual equities in the S&P 500 Index. [. . .] Between 2:32 p.m. and 2:45 p.m., as prices of the E-mini rapidly declined, the Sell Algorithm sold about 35,000 E-mini contracts (valued at approximately $1.9 billion) of the 75,000 intended. [. . .] By 2:45:28 there were less than 1,050 contracts of buy-side resting orders in the E-mini, representing less than 1% of buy-side market depth observed at the beginning of the day. [. . .] At 2:45:28 p.m., trading on the E-mini was paused for five seconds when the Chicago Mercantile Exchange ("CME") Stop Logic Functionality was triggered in order to prevent a cascade of further price declines.1 [. . .] When trading resumed at 2:45:33 p.m., prices stabilized and shortly thereafter, the E-mini began to recover, followed by the SPY. [. . .] Even though after 2:45 p.m. prices in the E-mini and SPY were recovering from their severe declines, sell orders placed for some individual securities and ETFs (including many retail stop-loss orders, triggered by declines in prices of those securities) found reduced buying interest, which led to further price declines in those securities. [. . .] [B]etween 2:40 p.m. and 3:00 p.m., over 20,000 trades (many based on retail-customer orders) across more than 300 separate securities, including many ETFs, were executed at prices 60% or more away from their 2:40 p.m.

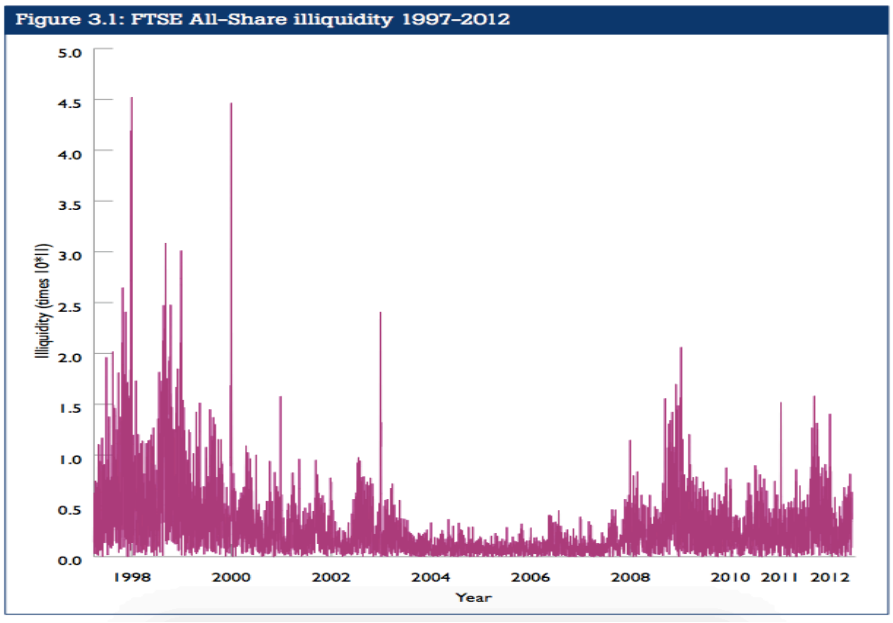
prices. [. . .] By 3:08 p.m., [. . .] the E-mini prices [were] back to nearly their pre-drop level [. . . and] most securities had reverted back to trading at prices reflecting true consensus values."



Benefits of HFT

1) Liquidity

As previously mentioned, liquidity describes degree to which an asset or security can be quickly bought or sold in the market without affecting the asset's price. Academics and market practitioners have developed a variety of approaches to measure liquidity, which is vital for well-functional financial market. Without liquidity, financial crisis may be caused. And liquidity is best measured by qualities such as tightness, resilience, and depth. Tightness (quoted bid-ask spreads) is the difference between trade price and original price. Resilience (price impact of trades) means speed with which the price returns to its original level after transactions. And Depth (order book) refers to the volume that can be traded at the current price level.



By looking at the chart from FTSE, the year in 2008 and 2009 had bad shocks to volume. This chart indicates that the macroeconomic crises had been the main driving force for liquidity and volatility of UK equity markets. It is hard to define that HFT had negative impact on liquidity.

2) Transaction Costs

Trading with using computer is cheaper than trading with humans, therefore transaction costs have fallen rapidly in recent 10 years as a result of the automation of markets. Menkvelv says that “new entry, often designed to accommodate HFT, had profound effects on transaction costs. For example, the entry of Chi-X into the market for Dutch index stocks had an immediate and substantial effect on trading fees for investors, first through the lower fees that Chi-X charged and then through the consequent reduction in fees that Euronext offered. The strongest effect, however, was a reduction in clearing fees. A new clearinghouse entered, EMCF, and this triggered a price war that ended up with a 50% reduction in clearing fees”. In summary, transaction costs have fallen because of changes in trading market structure by competition aroused from development of HFT.

3) Price Efficiency

Price efficiency is vital in well-functioning financial market. Hendershott describes the meaning of price efficiency in the context of high-speed markets, and pronounces the arguments why HFT may improve market efficiency by enabling price discovery through information dissemination. To measure the degree of market inefficiency, the usual method is through the predictability of prices based on past price information. Brogaard asserts that high frequency traders have a positive impact in price efficiency by "trading in the direction of permanent price changes and in the opposite direction of transitory pricing errors on average days and the days of highest volatility". However, some negative impacts might be occur if high frequency traders manipulate prices, such as by using front running, quote stuffing[7], and layering[8]. But those kinds of manipulating-price strategies are more difficult to use effectively if there are many firms following the same strategies. And to prevent complex and manipulating prices, policy makers should make some laws to improve trade transparency. Therefore, the more competitive the HFT industry, the more efficient will be the markets in which they work.

Conclusion

In recent ten years, computer-based trading, especially algorithmic trading and high frequency trading, has evolved significantly. Because of its short history, many people were not sure whether CBT has positive or negative impact on financial markets. As I mentioned above, there are many benefits, such as increasing liquidity, decreasing transaction costs, and making market price more efficient. However, by using the enormously fast speed, high frequency traders may

[7] quote stuffing refers to placing and then immediately cancelling orders.
[8] Layering means using hidden orders on one side and visible orders on the other.

use market-abuse strategies. Therefore, policy makers need to implement laws so that high frequency traders may not manipulate prices while preserving those benefits that HFT may bring.

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