

The Impact of High-Frequency Trading on Markets

Before rushing to judge HFT, investors need to understand the empirical evidence

BY FRANK ZHANG AND STUART BADEN POWELL

The rise of high-frequency trading (HFT) has provoked a range of reactions, from highly supportive to highly negative, with few holding a neutral view. Before reaching any conclusions, market observers and participants should consider the findings of empirical, quantitative research supported by grounded and knowledgeable qualitative insight. A fundamental consideration is the impact of HFT on the primary purpose of financial markets—allocating capital to its most productive use.

In the United States, HFT now accounts for about 70 percent of consolidated volume. In Europe, the number is approaching 40 percent. In the United Kingdom, recent research from TABB Group has the percentage of HFT in continuous trading at 77 percent. Despite this marked shift in the liquidity dynamic, only recently have the two main regulators—the U.S. Securities and Exchange Commission (SEC) and the Committee of European Securities Regulators (CESR)—sought to look into the strategies, tactics, and operations of high-frequency traders. As a result of this lack of attention, HFT's impact on market integrity and efficiency is not well understood.

HFT is a subset of algorithmic (or automated) trading. Much “algo” trading consists of working client orders on an agency basis, but HFT is often practiced off a proprietary capital base. HFT is faster to the market, has a shortened holding period, rarely carries positions overnight, and uses a number of differing algorithmic trading techniques. The overall aim is to make small margins of profit on high trading volume. Speed is a relative condition. To put this into an HFT perspective, a recent study on the CAC-40 by the French regulator *Autorité des Marchés Financiers* (AMF), noted that “some operators (HFT) are able to modify messages less than 10 microseconds (μ s)¹ after sending them to the market and that orders can in some cases have life cycles of less than 7 μ s.”² Using high-powered computational technology, co-location,³ and forecasting stochastics (such as Ito calculus and generalized autoregressive conditional heteroskedasticity [GARCH] models⁴) has enabled HFT to attain unusually high risk-adjusted performance. Given that the blink of an eye is a “slow” ~300 milliseconds, an HFT application operating at 10 μ s could make multiple alterations to quotes or orders in line with information and signals that it views well ahead of most other participants. Thus, for some *non*-HFT houses, accurate pretrade execution prices have become more of a probability estimate than a deterministic event.

HFT being in front of *non*-HFT orders has to some extent been reflected in the “message-to-trade” ratios,

which are now running at extremely high levels. For example, according to the AMF surveillance department, three firms that accounted for 39.6 percent of orders on the CAC-40 in April 2010 cancelled 96.5 percent of these orders. This tactic of order cancellation, which can be used for aggressive or defensive purposes, has played a core role in the divergence of executable liquidity and net executed volume, an imbalance known as the concept of “disappearing liquidity.” For example, the joint Commodity Futures Trading Commission (CFTC)–SEC report on the 6 May “flash crash” (in discussing the 14-second “hot potato” period) notes that “high trading volume is not necessarily a reliable indicator of market liquidity.”⁵ On the European side, a recent study of Chi-X traded Dutch stocks stated that the introduction of a new HFT “middleman” “lowers bid–ask spreads but also lowers volume.”⁶

Although HFT firms would note that their strategies are modifications of such well-known trading strategies as directional trading, arbitrage trading, and market making, these headline techniques raise concerns. What matters is not so much the descriptive name of the strategy but rather how that strategy is implemented at the tactical and operational levels. For example, the “market-making strategy” is self-descriptive and crucially non-contractual,⁷ and, as a result, high-frequency traders have decision-making control over when to provide liquidity for stocks of their choosing and at a price that is suitable for them, as opposed to the formal regulatory obligations that we are familiar with under the banner of “market making.” Consequently, this particular topic is now the subject of much regulatory debate.

Because HFT accounts for the lion's share of trading volume, it naturally has some considerable impacts on the capital market. Some heavyweight buy-side firms, such as Principal Global Investors with more than US\$225 billion in assets under management, have recently voiced concern over the consequences of HFT for market trust, confidence, and efficiency. The major impact is on liquidity. HFT has led to a reduction in bid–ask spreads and an increase in trading volume in the definitive sense, and indeed, both institutional and retail investors can certainly benefit from lower bid–ask spreads. This benefit comes with a caveat, however. As already noted, trading volume is not necessarily a reliable indicator of market liquidity, especially in times of significant volatility. The automated execution of large orders by institutional investors, which often use trading volume as the proxy for liquidity, could help trigger excessive price movement and extraordinary losses, as evidenced in the 6 May flash crash.

The second key impact is on stock-return volatility. Although some would say HFT's market-making activities may reduce stock volatility, the more aggressive trading strategies could increase volatility. For example, HFT's liquidity-detection strategies detect and trade ahead of large institutional-sized orders. This practice pushes the stock price up (down) if institutional investors have large buy (sell) orders, thereby amplifying price swings and increasing stock-price volatility. As HFT is often based on short-term statistical correlations among stock returns, a large number of unidirectional trades can create price momentum and also attract other momentum traders to the stock, a practice that increases price return volatility. On the more passive side, HFT's market-making activities may adversely affect stock volatility if traditional investors do not adequately take into account HFT's free exit from the capital market.

In fact, Zhang (2010)⁸ notes that "HFT trading is positively correlated with stock price volatility." Crucially, this study controlled for fundamental volatility and other exogenous factors, giving a more realistic picture of the specific impact. Also, high-frequency traders tend to trade selected names, and the positive correlations tended to increase among the 3,000 U.S. stocks with the highest market capitalization included in the study.

The third impact is on price discovery—whether HFT helps stock prices reflect firms' fundamentals, thereby making capital markets more efficient. On the intraday basis, HFT, with its rapid execution speed, responds to news ahead of other investors and potentially makes stock prices reflect new information more quickly, but HFT's longer-term effect on price discovery is less clear. HFT strategies are often based on the statistical properties of both short-term stock returns and order imbalances between supply and demand. Thus, they are agnostic to a stock's price level and have no intrinsic interest in the fate of companies, leaving little room for a firm's fundamentals (e.g., earnings and cash flows) to play a direct role in its trading strategies. Zhang shows that HFT hinders longer-term price discovery. As the principal objective of the capital market is to allocate scarce capital resources to their most productive use, longer-term price efficiency is of greater importance. It is unclear how a price-discovery process delayed by 50 milliseconds or even two seconds would affect resource allocation efficiency in any meaningful way.

Finally, HFT has an impact on "market confidence." According to the Investment Company Institute (ICI), there have been five consecutive months of U.S. equity fund outflows since the flash crash, and we can understand the reservations of many institutional firms. Sophisticated technologies and the practice of co-location give high-frequency traders a large advantage over regular investors, creating a disincentive for individuals of more modest means to invest in the markets. At the same time, HFT makes it extremely difficult for regulators, who play

a critical role in maintaining a fair market, to monitor financial transactions—because high-frequency trading, by its very nature, leaves a limited paper trail and buries transactions in mountains of data, thus causing difficulties in the provision of transparency. The SEC, which has unlimited access to data, needed more than five months to determine what caused the 6 May flash crash. All of these issues tend to reduce the market's confidence.

Regardless of how we analyze an industry or firm, the profit line will always play a central role in assessment. The market-share gains of high-frequency trading have been remarkable, but HFT firms' net profit is also high, with well-respected consultancy firm TABB Group estimating the net profit at between US\$8 billion and US\$21 billion for 2008—a time when market share was lower than in 2009 and 2010. Many would say that this alpha component could—or perhaps should—be part of the return to the end institutional fund, as opposed to being "leaked" out of fund performance through transaction costs.

Whether regulatory action is needed to correct what an increasing number of longer-term investors regard as an uneven playing field is beyond the scope of this article. Certainly, however, the more traditional elements of the market need to be nimble and intelligent enough to build products and apply methods that counter such techniques as disappearing liquidity and help mitigate the negative impacts outlined by researchers. ▀

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NOTES

- 1 One microsecond is equal to one millionth of a second.
- 2 "Equity trading: A review of the economic literature for the use of market regulators" (June 2010).
- 3 The practice of locating the HFT computer servers as close as possible to the exchange "matching engine" to minimize the time to the market (referred to as "latency").
- 4 GARCH aims to forecast volatility on the premise that volatility goes through clustered periods of calm followed by periods of swings and so forth.
- 5 The report also states that, during this period, high-frequency traders traded 27,000 contracts (of the S&P 500 E-mini), which accounted for 49 percent of total traded volume but bought only 200 contracts net. "Findings Regarding the Market Events of May 6, 2010: Report of the Staffs of the CFTC and SEC to the Joint Advisory Committee on Emerging Regulatory Issues" (30 September 2010)—available at www.sec.gov.
- 6 Boyan Jovanovic and Albert Menkveld, "Middlemen in Limit-Order Markets," SSRN working paper (30 June 2010).
- 7 GETCO, one of the largest HFT houses in the world, recently became a designated market maker (DMM) on the NYSE. In considering HFT, it is important to remember that not only are the DMM obligations not particularly onerous against the bottom line (a DMM must maintain a bid and offer at the NBBO, or national best bid and offer, for an aggregate average time of only 10 percent during a calendar month as well as receiving 30 cents on 100 shares in rebate), but the DMM obligations do not extend to the full extent of the fragmented U.S. market.
- 8 "Frank Zhang, High Frequency Trading, Stock Volatility and Price Discovery," Yale University working paper (December 2010) Available at papers.ssrn.com.