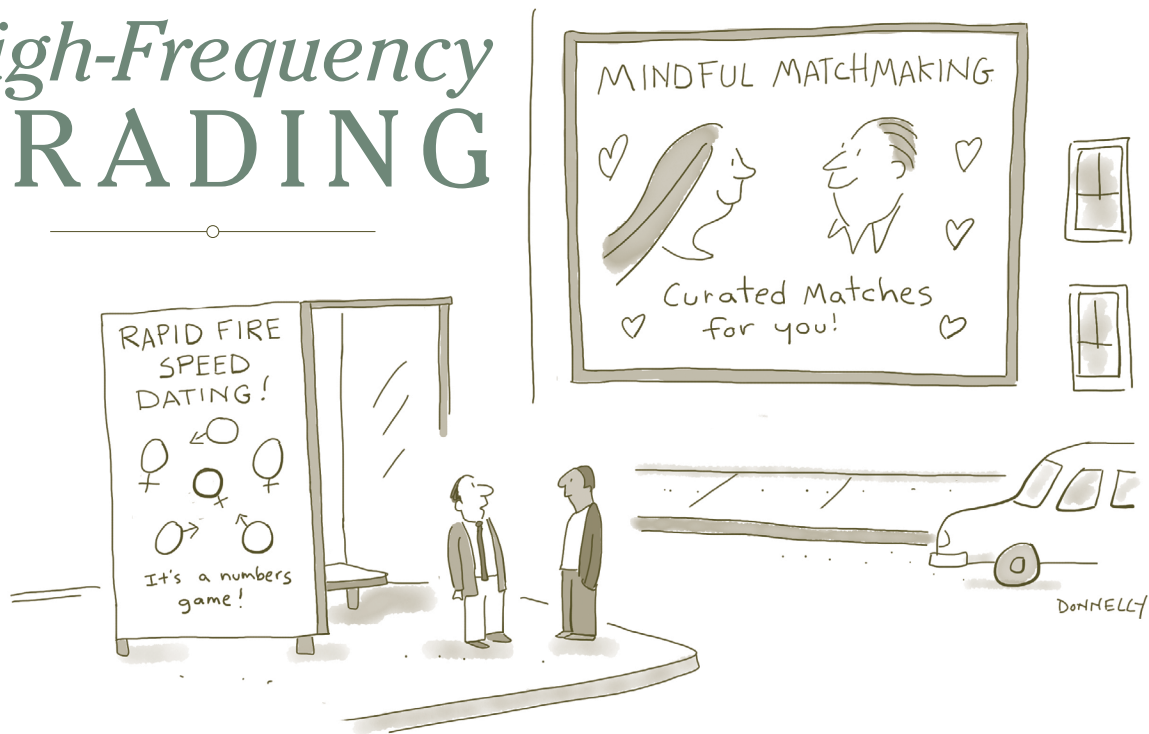


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AN OVERVIEW OF

High-Frequency TRADING



"You do it your way, and I'll do it mine."

High-frequency trading (HFT) has dominated the trading world in the last decade and today accounts for around 50% of U.S. trading. It has been criticized for the role it played in the Flash Crash of May 2010 but also praised for the liquidity it provides to the market. Public and regulatory pressures have led to massive consolidations in the industry, furthering its transformation. In this article, we will provide a description of the HFT landscape, review pros and cons of HFT, and discuss its role in the recent market drawdown.

HFT Overview

As a strategy, trading is a form of investing, albeit at the shorter end of an investor's time horizon. Career traders intend to make a profit in a shorter time frame, through

buying and selling. While the process of trading can span a broad time spectrum—from fractions of seconds to months—HFT refers to the shortest of time frames and is performed at the fastest of speeds. More specifically, HFT is a type of algorithmic trading approach involving fast speed, high turnover rates, and high order-to-trade ratios. It takes advantage of sophisticated algorithms and powerful computers to generate an enormous number of trades in a very short time period, ranging from seconds to milliseconds.

Another key component of HFT is high-frequency market data, which is time-series market data collected intraday at an extremely fine scale. For example, each stock's »

transaction data is collected whenever there is a trade, quote, or order. HFT executes automated moves in and out of securities over a miniscule time period in order to profit from slight price changes, which can accumulate enormous gains if those trades can be executed accurately and with superior speed. High-frequency traders typically liquidate their entire positions by the end of day, without taking any market exposure overnight.

The most common HFT strategies are market making and arbitrage.

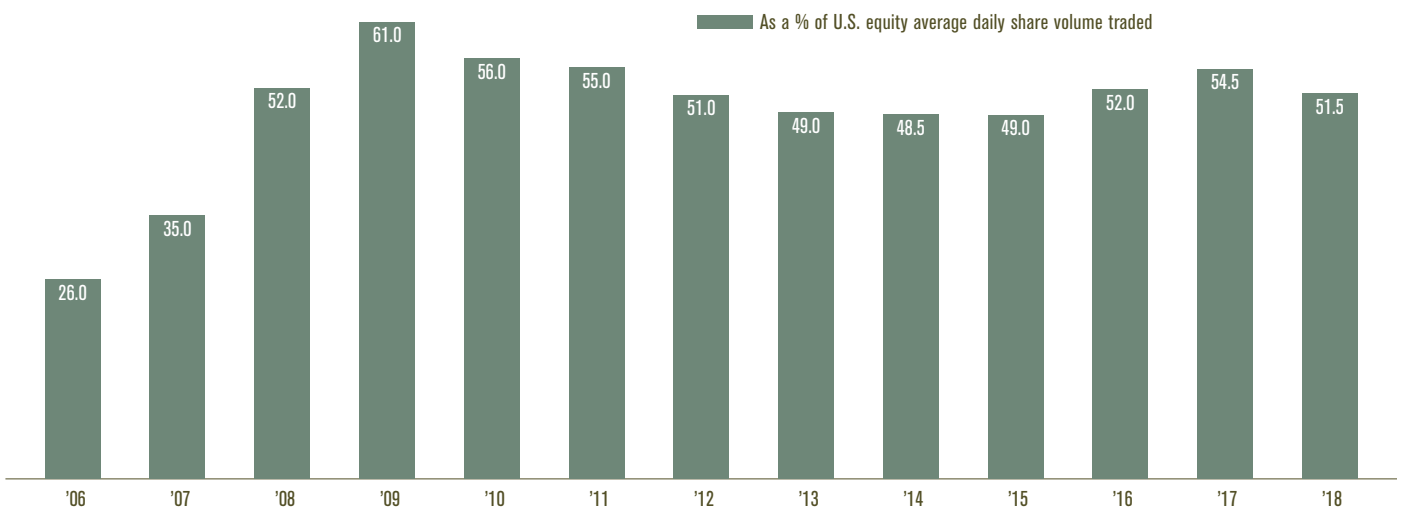
- According to the SEC, a market maker is essentially a firm standing ready to buy or sell a stock on a regular and continuous basis at a publicly quoted price. Market makers earn a profit on the difference between the bid prices buyers are willing to pay and the ask prices sellers are willing to accept. Given their high speed and frequent turnover, HFTs essentially provide liquidity in various markets.
- Arbitrage trading takes advantage of price differences for the same security traded on different exchanges, or the same security and its derivatives. One very popular arbitrage trade is between the S&P 500 E-mini futures traded on the Chicago Mercantile Exchange and the S&P 500 Index traded on the New York Stock Exchange.

Other HFT strategies include news-based trading and direction-based trading, where more sophisticated algorithms (machine learning, big data, etc.) are used to exploit information from other sources like Bloomberg, Twitter feeds, and news websites.

The HFT industry has grown rapidly since its inception in the early 2000s. Today, it represents about 50% of trading in U.S. equity markets, down from its 2009 peak of 60% (Exhibit 1). HFT market participants mainly include independent proprietary trading firms (such as Virtu Financial, DRW Holdings, and Tower Research Capital), proprietary trading desks of investment banks like Goldman Sachs, Morgan Stanley, and Deutsche Bank, and hedge funds like Citadel, D.E. Shaw, and Renaissance Technologies. The HFT industry is highly proprietary, which limits the participation of retail investors.

Despite the large presence in the market, the HFT industry has faced tremendous challenges in the past decade, partly due to the depressed level of market volatility after the 2008–2009 financial crisis, which hurt HFT firms’ ability to make profits. These firms also faced pressure from regulators as more rules and limits were designed to improve market transparency and reduce predatory activities in financial markets, both of which hurt HFT’s competitive advantages. »

EXHIBIT 1 HIGH-FREQUENCY TRADING: HALF OF U.S. STOCK MARKET TRADING VOLUME FOR PAST DECADE



Source: Tabb Group estimate. There is no assurance that any estimate, forecast, or projection will be realized.

Pros and Cons

Since the emergence of HFT in the 2000s, there have been vigorous debates on its positives and negatives among academics, market participants, and regulators.

Positive Impact

- **Increased Liquidity:** The large number of trades executed by HFT traders generally improve market liquidity by reducing tick sizes (the minimum price movement of a stock) and narrowing bid-ask spreads. The use of algorithms and computers in trading also facilitates more frequent and accurate pricing updates.
- **Improved Market Efficiency:** In an efficient market, security prices should reflect market information quickly

and accurately. HFT is believed by some to enable faster price discovery through its instantaneous processing of relevant market information.

Negative Impact

- **Amplified Systemic Risks:** Some research has shown that high-frequency trades tend to be highly correlated, which could intensify shocks that hit certain active high-frequency traders, and detrimentally affect the entire financial market. An example of this is the Flash Crash of May 2010, when the Dow Jones Industrial Average fell by 600 points (down ~6%), and then recovered within a few minutes—all a result of a faulty trading algorithm (Exhibit 2). »

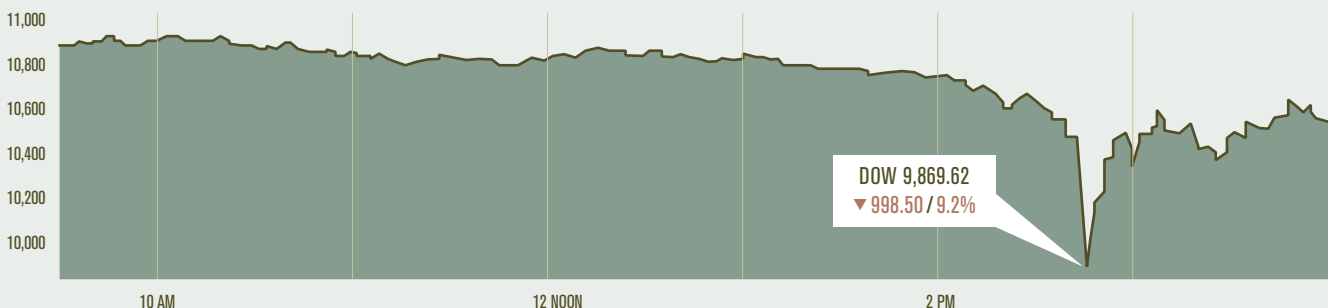
EXHIBIT 2 THE MAY 6, 2010, FLASH CRASH

On May 6, 2010, a trader at a large U.S. mutual fund firm entered an order to sell 75,000 E-mini futures contracts, which mimic movements in the S&P 500 Index using a trading algorithm that had specifications only for volume, but not price and time. A number of HFT firms that had bought a part of these contracts from the mutual fund firm soon started selling these themselves in addition to the mutual fund firm, which was still trying to sell its remaining futures contracts.

Soon, the HFT firms started trading these contracts among themselves, creating a loop that resulted in the price of these contracts falling rapidly within minutes.

Between 2:45:13 p.m. and 2:45:27 p.m., firms traded over 27,000 contracts, accounting for about 49% of the total trading volume, and resulting in a huge drop in the Dow Jones Industrial Average. At 2:45:28 p.m., trading had to be paused for five seconds as the falling prices had triggered a stop logic functionality. When trading resumed, prices stabilized and the contract started to recover rapidly.

Later, a SEC report on the May 6 Flash Crash clearly mentioned that aggressive selling by HFT traders accelerated the index decline on this date, and the event was instrumental in bringing the potential implications of HFT to the notice of regulators all over the world.



Source: Capgemini, "High Frequency Trading: Evolution and the Future," 2012.

- **Increased Volatility:** HFT executes intraday trades with large positions, typically within minutes or even just seconds. This trading pattern introduces very frequent price fluctuations and may increase overall market volatility given HFT's dominant share of total trading volumes.

- **Harm to Institutional and Retail Investors:**

There have been allegations from institutional investors that HFT strategies front-run their trades by detecting incoming order flow, buying the same security, and then selling the security to the institution at a slightly higher price. Such activities implicitly increase the transaction cost for institutional investors. Retail investors are indirectly impacted by those activities as many of them participate in the market via institutional investors such as mutual funds.

RMB's View

The recent extraordinary market drawdown due to COVID-19, at a pace even more rapid than during the 2008 Great Financial Crisis, was likely amplified by the prevalence of HFT. In March 2020, when markets were hit with waves of negative shocks (macro disruptions and changing firm fundamentals), the market quickly went into panic-selling mode. The HFT algorithms were triggered to execute

much more frequently due to the moves in the market. Meanwhile, HFT market makers were forced to reduce their trade sizes due to the volatility spike, which resulted in more trades but smaller order sizes. The combination of these circumstances essentially intensified the already increased volatility and reduced the liquidity. HFT firms took advantage of widening bid-ask spreads and fast-moving markets. Virtu Financial, one of the biggest HFT firms, said its trading income in Q1 more than doubled the previous year's income from the same period.

While the merits of HFT are debatable, the overall impact to RMB and our clients is relatively limited. If HFT is at one end of the investor time horizon, RMB's investment approach is at the other end. Our investment time horizon is measured in years, not months, days, hours, or nanoseconds. We're likely to come into contract with the HFT world when we're executing buys and sells for clients and within underlying active investing strategies, given HFT's 50% share of volume. However, given our long-term approach to investing and sensitivity around taxes, our portfolio turnover and trading volume are relatively limited. Consequently, less trading and portfolio turnover minimizes the impact HFT may have on RMB clients' portfolios. ■

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Index Descriptions

- The S&P 500® is widely regarded as the best single gauge of large-cap U.S. equities. There is over USD 7.8 trillion benchmarked to the index, with index assets composing approximately USD 2.2 trillion of this total. The index includes 500 leading companies and captures approximately 80% coverage of available market capitalization.

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