An objective look at high-frequency trading and dark pools

May 6, 2015

pwc

An objective look at high-frequency trading and dark pools

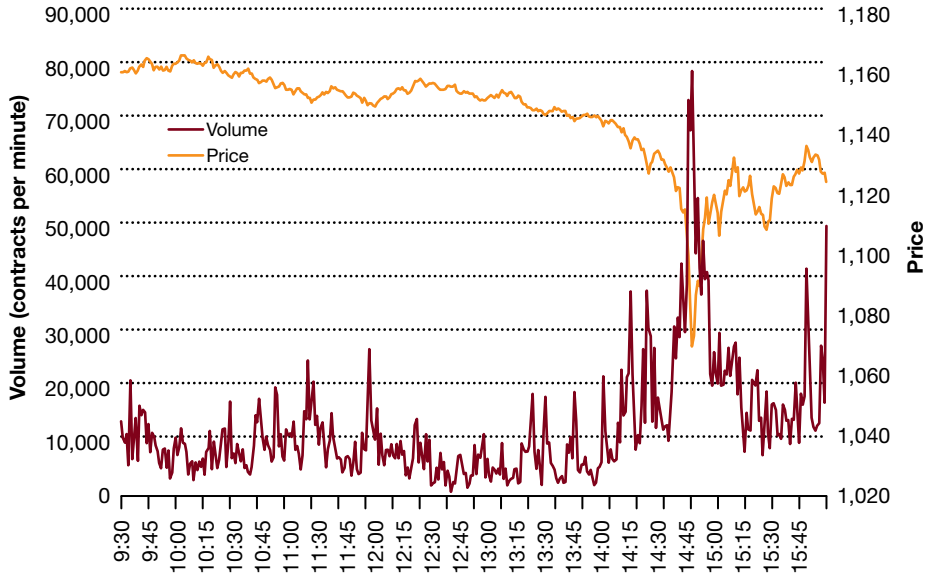
High-frequency trading has been in the news a lot over the past few years. The "Flash Crash" of 2010—when the Dow Jones Industrial Average experienced one of its biggest one-day point declines (of almost 1,000 points) in its history—was followed by the 2014 publication of Michael Lewis's bestselling nonfiction book, *Flash Boys*. As a corollary to this story, and equally controversial, dark pools have been sought by investors who are looking to avoid interacting with aggressive liquidity, usually from high frequency trading firms. What's the big deal?

1 "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, September 30, 2010.

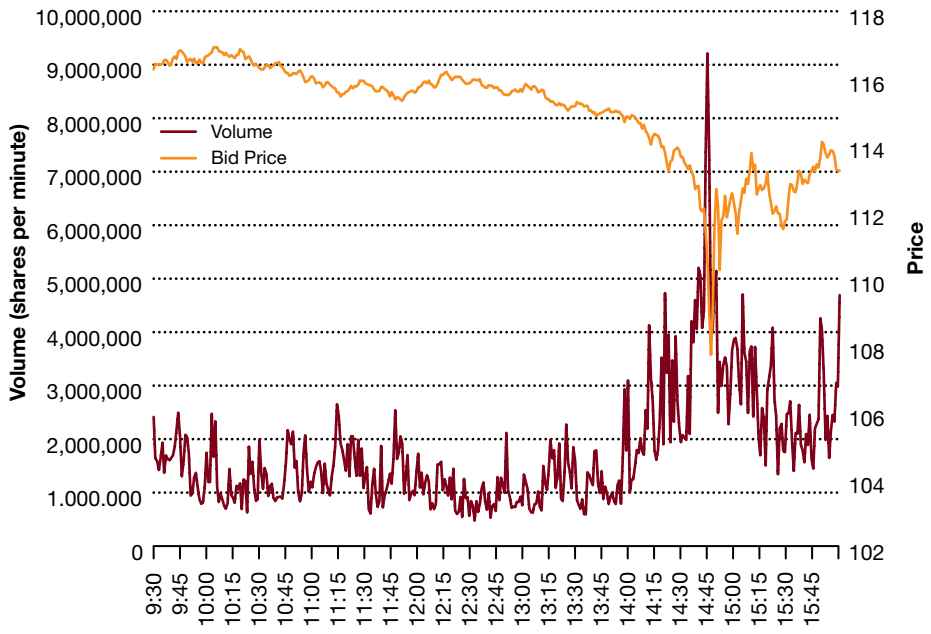
The two most active stock index instruments traded in electronic futures and equity markets, the E-Mini S&P 500 futures contracts (E-Mini) and the S&P 500 SPDR exchange traded fund (SPY), suffered steep declines during the May 6, 2010 "Flash Crash." The E-Mini dropped to $2.65 billion from nearly $6 billion—55%—and the SPY fell to $220 million from $275 million, a 20% decline.[1]

The "flash crash" selloff

E-Mini volume and price



SPY volume and price



Source: "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, September 30, 2010.

What do you know about high-frequency trading?

By trading with information that is milliseconds away from being disclosed in a stock's public price, high-frequency traders violate US insider trading laws.

False: Current insider trading laws apply to trading on information that is confidential and has been obtained through some violation of a duty to protect the information. While high-frequency traders are able to access (and then trade on) various forms of data more quickly than other investors, most legal scholars agree that this does not represent "insider trading."

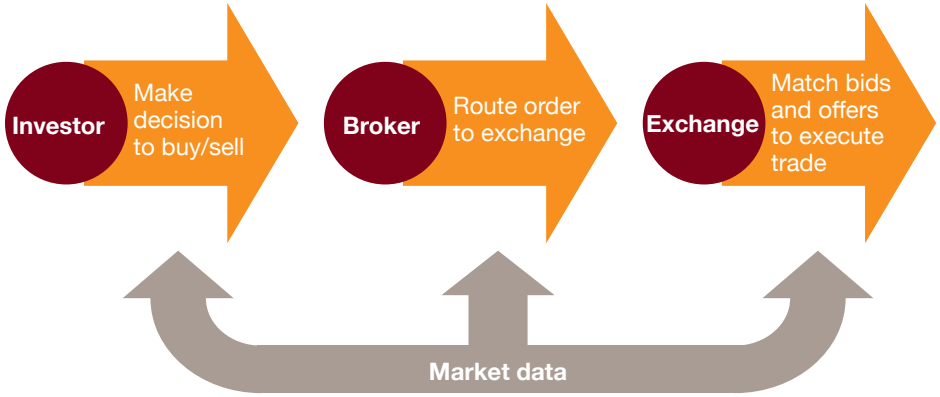
Just the facts

Background

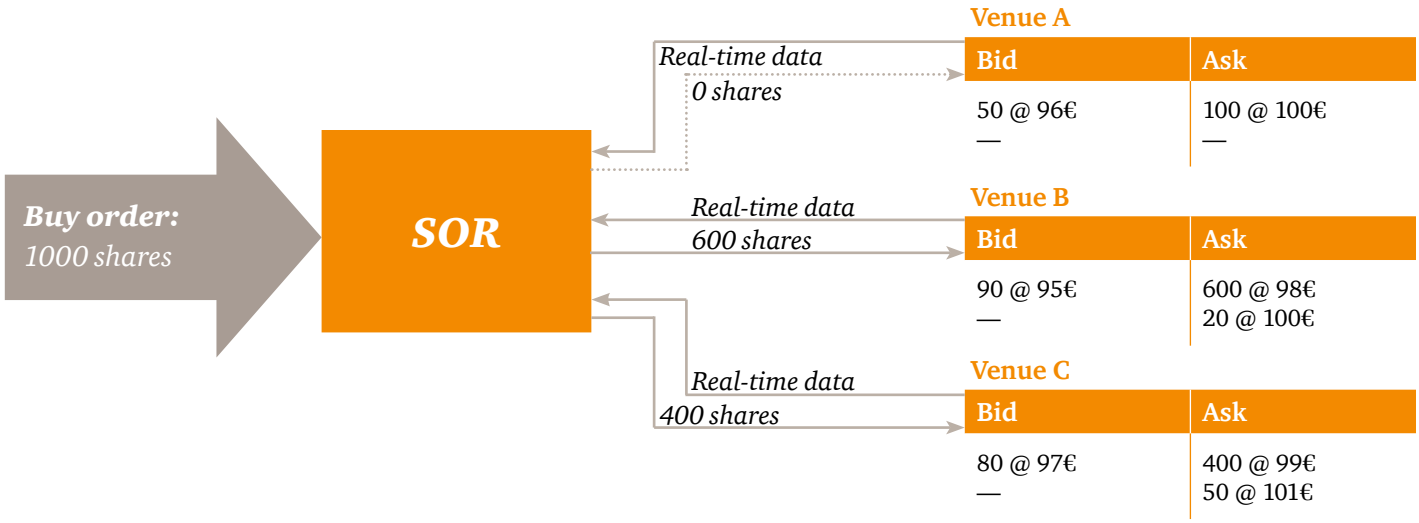
Prior to the 1990s, the manner in which stocks were traded in the US was relatively simple: an investor made a decision to buy or sell and conveyed this information to a broker, who then routed the order to an exchange, where bids and offers were matched and a trade was executed. All parties had access to the same information about a stock's bid-ask spread.

Today's trading is a lot more complex and frequently involves little human intervention. Most importantly, trading is done in microseconds—less than a blink of an eye. The dramatic increase in the number of available trading platforms, along with significant technological advancements, makes the process by which orders are handled, routed, and executed much more complex. Broker-dealers use algorithms to route different portions of an order to different venues in various sequences, taking into account many factors (including minimization of market impact, minimization of information leakage, immediacy of execution, and cost of execution).

Traditional/simple stock transaction flow



Principles of today's Smart Order Routing (SOR)



In this example, each line out of SOR (Smart Order Routing) represents orders to different venues/markets: The SOR is routing 0 shares to Venue A, 600 shares to Venue B, and 400 shares to Venue C.

Source: High Frequency Trading, Gomber, Arndt, Lutat, Uhle Goethe University.

With these innovations came changes to the accessibility of information among all market participants. Requests for more liquidity in the markets and the Securities and Exchange Commission's (SEC) adoption of a number of regulations aimed at modernizing the market structure—including decimalization, regulation of alternative trading systems, and Regulation National Market System (Reg NMS)—further set the stage for high-frequency trading (HFT) and dark pools.

What is high-frequency trading?

There's no definition for HFT in the securities laws or regulations. So what is it? HFT is not a trading strategy as such but applies the latest technological advances in market access, market data access, and order routing to maximize the returns of established trading strategies.

What do you know about high-frequency trading?

High-frequency trading provides essential liquidity to the equity markets.

Sometimes: This is a key area of disagreement between those who support and those who oppose high-frequency trading. In our view, while some liquidity provided by high-frequency trading is illusory (when based on, for example, pinging, layering, or spoofing techniques), other strategies (e.g., passive market making) create valuable liquidity to our markets.

What do you know about high-frequency trading?

High-frequency trading represents a growing share of US securities trading volume.

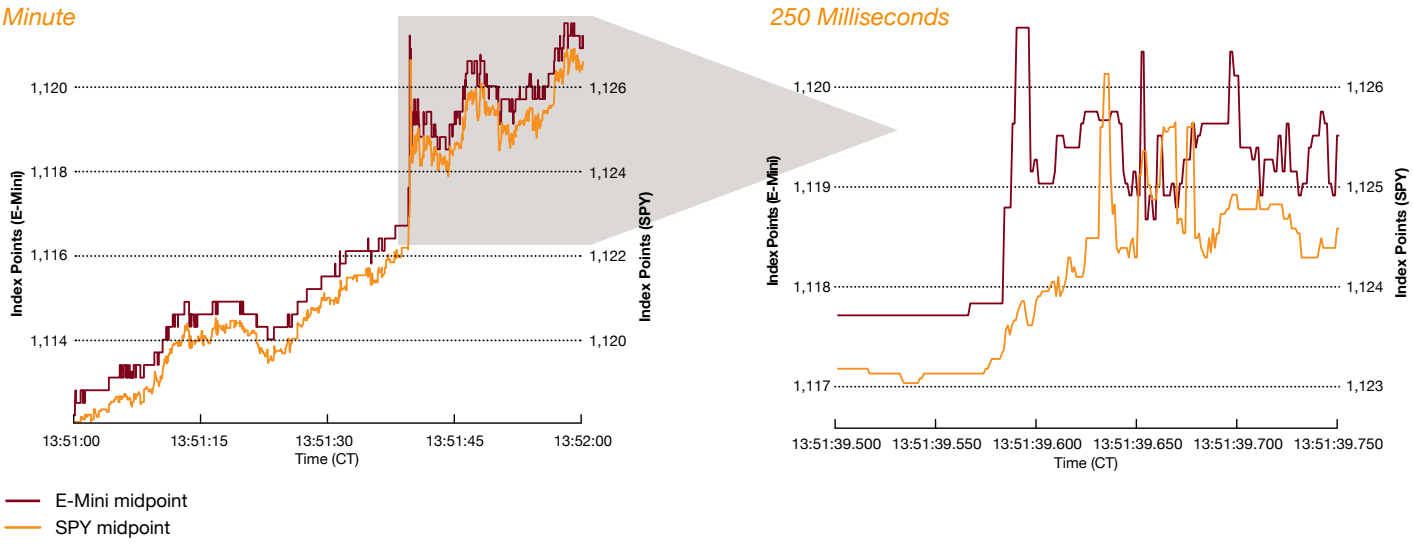
False: While high-frequency trading volume increased significantly up until 2009, since then levels have decreased. Even so, some estimate that more than half of every day's volume of transactions is represented by high-frequency transactions.[2]

Attributes of HFT often include the following:

- use of extraordinarily high-speed programs for generating, routing, and executing orders
- use of "co-location" services and individual data feeds offered by exchanges and others to minimize network and other types of latencies
  - *What is "co-location?"* A co-location service is an arrangement with trading centers (or third parties that host trading centers' matching engines) to rent space to market participants so that these participants can physically locate their servers in close proximity to a trading center's matching engine. This close proximity saves microseconds of latency.
- very short time frames for establishing and liquidating positions
- submission of numerous orders that are canceled shortly thereafter
- ending the trading day in as close to a flat position as possible

Gone in 250 milliseconds

Bid-ask midpoints of the E-Mini and SPY over the course of trading on August 9, 2011, at one minute and 250 milliseconds



Source: Budish, Eric, Cramton, Peter, and Shim, John, "The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response," February 17, 2015.

2 "Equity Market Structure Literature Review Part II: High Frequency Trading," Staff of the Division of Trading and Markets1 U.S. Securities and Exchange Commission, March 18, 2015; accessed on April 16, 2015 https://www.sec.gov/marketstructure/research/hft_lit_review_march_2014.pdf.

"Traders using algorithms employ a variety of low-latency tools, including (1) co-located servers in exchange data facilities and (2) direct data feeds from exchanges rather than the consolidated data feeds. Much of the recent public focus has been on high-frequency trading firms, but it is important to remember that the exchanges are required to make these low-latency tools available on terms that are equitable and not unfairly discriminatory, and that agency brokers are as likely to use these tools on behalf of their customers as high-frequency trading firms are to use them for their own accounts."

Letter from SEC Chair Mary Jo White to US Rep. Tim Johnson and US Sen. Mike Crapo (Dec. 23, 2014)[3]

HFT is not a homogeneous practice but instead includes a wide variety of strategies:

- **Market making:** Passive market making primarily involves the submission of non-marketable resting orders that offer (or "make") liquidity to the marketplace at specified prices and receive a liquidity rebate if they are executed. Incoming orders that execute against (or "take") the liquidity of resting orders are charged an access fee. The strategy is to make money on the bid-ask spread; HFTs place bets on both sides of the trade by placing a limit order to sell slightly above the current market price or to buy slightly below the current market price, thereby profiting from the difference. Most, but not all, market makers use HFT or other form of algorithmic trading.

- **Arbitrage:** An arbitrage strategy seeks to exploit momentary inconsistencies in rates, prices, and other conditions among exchanges or asset classes. For example, the strategy may seek to identify discrepancies between the price of an ETF and the underlying basket of stocks and buy (sell) the ETF and simultaneously sell (buy) the underlying basket to capture the price difference.

- **Structural:** Some proprietary firms' strategies may exploit structural vulnerabilities in the market or in certain market participants. For example, by obtaining the fastest delivery of market data through co-location arrangements and individual trading center data feeds, proprietary firms theoretically could profit by identifying market participants who are offering executions at stale prices.

- **Directional:** Neither passive market making nor arbitrage strategies generally involve a proprietary firm taking a significant, unhedged position based on an anticipation of an intra-day price movement of a particular direction. There may be, however, a wide variety of short-term strategies that anticipate such a movement in prices. Some "directional" strategies may be as straightforward as concluding that a stock price temporarily has moved away from its "fundamental value" and establishing a position in anticipation that the price will return to such value. These speculative strategies may contribute to the quality of price discovery in a stock. Two particular types of directional strategies, however, have been identified as potentially presenting problems to market integrity: order anticipation and momentum ignition.

3 SEC Chair Mary Jo White to The Hon. Tim Johnson and Sen. Mike Crapo, December 23, 2014, viewed on April 18, 2015 http://securitytraders.org/wp-content/uploads/2014/12/JOHNSON-CRAPO-EQUITY-MARKET-STRUCTURE-ES152784-Response.pdf

What do you know about dark pools?

Dark pools allow traders to hide their activities from regulators.

False: US regulators [including the SEC, Commodities Futures Trading Commission, and the Financial Industry Regulatory Authority (FINRA)] are able to monitor transactions within dark pools and can initiate enforcement actions when warranted.

What role do dark pools play?

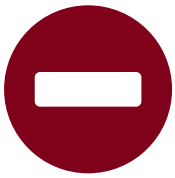
In the current market structure, high-frequency traders leverage dark pools. What are dark pools? They're a form of alternate trading system, which means they are regulated as broker-dealers rather than as exchanges. Dark pools operate with limited pre-trade transparency. The prices of orders entered into the dark pool are not displayed to other market participants and are matched anonymously against contra-side orders. Once trades are executed, they are immediately reported to the consolidated tape, which provides public post-trade transparency. Dark pools are operated by both large broker-dealers (who may match client order flow against their own accounts) and independent platforms. In general, dark pools offer trading services to institutional investors and others that seek to execute large trades with as little market movement as possible, thereby reducing trading costs.

"…High Frequency Traders (HFTs) did not cause the Flash Crash [of May 6, 2010], but contributed to it by demanding immediacy ahead of other market participants. Immediacy absorption activity of HFTs results in price adjustments that are costly to all slower traders, including the traditional market makers. Even a small cost of maintaining continuous market presence makes market makers adjust their inventory holdings to levels that can be too low to offset temporary liquidity imbalances. A large enough sell order can lead to a liquidity-based crash accompanied by high trading volume and large price volatility—which is what occurred in the E-mini S&P 500 stock index futures contract on May 6, 2010, and then quickly spread to other markets."

Kirilenko, A., Kyle, A., Samadi, M., Tuzun, T., "The Flash Crash: The Impact of High Frequency Trading on an Electronic Market," http://ssrn.com/abstract=1686004, viewed on April 15, 2015.

Competing perspectives

Both dark pools and HFT have recently received significant attention from regulators, lawmakers, investors, and other market participants, with some wondering whether the innovations have outpaced a regulatory structure designed to foster confidence in market integrity. Others point to the reasons why these techniques developed—to provide greater market liquidity, enable large trades at lower costs, facilitate faster trades, etc.—and caution against making overly broad or emotional generalizations. Objectively, we believe that aspects of HFT and dark pools can potentially both positively and negatively impact the markets.

	 ***Potential positives***	 ***Potential negatives***
Dark pools	• Lower trading costs • More easily sell lower-volume securities • Trade without triggering potentially unfavorable price movements	• Harms overall price discovery process, particularly in a security in which a significant portion of that security's trade volume is in the pools • Lack of transparency to public investors, eroding confidence in the public quote system
HFT	• Increased liquidity • Lower market volatility • Reduced bid-ask spreads, thereby lowering trading costs • Reduced execution time • Better price discovery	• Much of liquidity is "phantom" and not dependable • Exacerbates market fragility • Increases the market's systemic risk • Certain strategies may manipulate the market • Creates two-tiered trading markets that benefit investors with access to faster trading data, arguably at the expense of other investors, which in turn erodes investor confidence in the securities markets

Securities regulatory response

In January 2010, the SEC issued a *Concept Release on Equity Market Structure* through which it sought comments on a broad range of issues, including HFT and dark pools. In December 2014, SEC Chair Mary Jo White responded to a congressional inquiry into the status of the Commission's review of these issues, detailing a long list of both completed and contemplated actions.[4] Chair White's letter included actions by the SEC, FINRA, and the exchanges. These actions include:

Adopted	Under development or consideration
Timestamp: Beginning in April 2015, exchanges will add a timestamp in consolidated data feeds to indicate when a trading venue processed the display of an order or execution of a trade, thereby providing more information about latency	**Anti-disruptive trading rule:** Address the use of aggressive and destabilizing trading strategies in vulnerable market conditions when they could most seriously exacerbate price volatility
Exchange transparency: Exchanges now disclose how they are using consolidated and direct data feeds	**Regulatory authority:** • On March 25, 2015, the SEC proposed rules to require that broker-dealers trading in off-exchange venues become members of a national securities association (such as FINRA) • FINRA is separately considering expanding registration requirements to broker-dealer employees responsible for crafting or supervising algorithmic strategy
Off-exchange transparency: In May 2014, FINRA began disseminating aggregate information on the trading volume of individual alternative trading systems (ATSs)	**Off-exchange transparency:** FINRA is considering expanding transparency initiative to include non-ATS over-the-counter trading (thereby covering all off-exchange venues)
Systems compliance & integrity (Reg. SCI): Exchanges, ATSs that exceed certain trading volume thresholds, and certain other entities are now required to have comprehensive policies and procedures in place for their technological systems. The new rules also provide a framework for these entities to take corrective action when systems issues occur; provide notifications and reports to the SEC regarding problems and changes; inform members and participants about systems issues; conduct business continuity testing; and conduct annual reviews of their automated systems	**Risk management rules:** Improve firms' risk management of all types of trading algorithms and enhance regulatory oversight of their use
Limit up-limit down pilot: Generally prevents trades in exchange-listed stocks from occurring outside of a specified price band around the current market price (generally 10% for less liquid stocks and 5% for all others) [Unless extended—as it has been several times since approved in 2012—the pilot is set to expire Oct. 23, 2015.]	**ATS operational information:** Expand the information that ATSs disclose to the SEC about their operations and make that information available to the public
	Order routing practices: Set out minimum disclosures about order routing and execution quality that institutional investors could request from their brokers **Order types:** Exchanges are developing rule changes, to be published for comment, clarifying the nature of their various order types, how they interact with each other, and how they support fair, orderly, and efficient markets

4 Ibid.

The SEC has also significantly expanded public transparency around market data and related analysis that has been drawn from the SEC's Market Information and Data Analysis System (MIDAS). Launched in 2013, MIDAS collects and processes data from the consolidated tapes as well as from the separate proprietary feeds made individually available by each equity exchange. Through its website (see www.sec.gov/marketstructure), the SEC is providing the public with data highlights and research papers derived from MIDAS, including information on the speed of trading, the nature and quality of liquidity, and the nature of order cancellations. Chair White has pointed to this data and analysis as underpinning future regulations affecting equity market structure.[5]

5 Ibid.

www.pwc.com/us/InvestorResourceInstitute

Additional information

To have a deeper conversation about how these issues may affect you, please contact:

Kayla Gillan
Leader, Investor Resource Institute
(202) 312 7525
kayla.j.gillan@us.pwc.com

Joanne O'Rourke
Managing Director, Investor Resource Institute
(703) 918 6017
joanne.m.orourke@us.pwc.com

Emmanuel Chesnais
Director, Financial Services Regulatory Practice
(646) 313 3178
emmanuel.chesnais@us.pwc.com