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BY HARALD MALMGREN AND MARK STYS

Marginalizing *of the* Individual Investor

*The inside story of
flash crashes, systemic
risk, and the demise of
value investing.*

On May 6, 2010, at about 2:30 p.m., a “flash crash” in the U.S. stock market sent the Dow plummeting by almost 999 points—the deepest intraday plunge ever recorded. From 2:45 p.m. to 3:00 p.m. the Dow recovered by about 600 points. During the flash crash, some individual stocks collapsed to pennies and then rebounded. For the day as a whole, the market closed down about 350 points.

This unprecedented shock galvanized the Securities and Exchange Commission into action to identify the cause and devise mechanisms for preventing recurrence. At first, it was thought that a “fat finger” error might have sent computerized trading into a tailspin. However, it soon became evident that the scale and speed of trading abnormalities could not have been the result of a single misplaced finger. To its chagrin, the SEC found its antiquated computer capabilities could not begin to capture the volume and speed of transactions in today’s markets. Moreover, there was no coherent

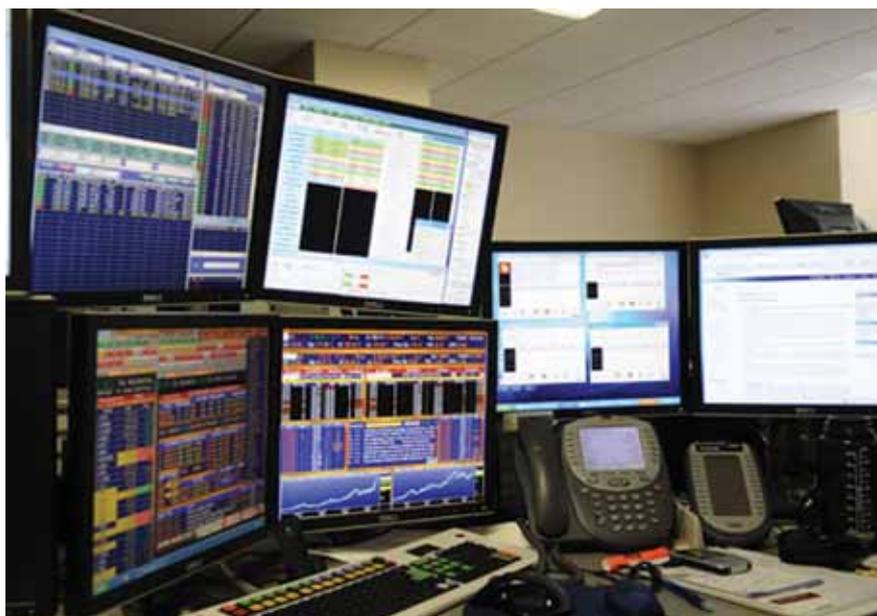
data center which encompassed the disaggregated reporting systems of nine separate U.S. exchanges, the dark pools, and the activities of new ultra-fast, computerized high-frequency trading platforms. Theoretically, it could take months to run the day’s records in ultra-slow motion to identify market malfunctions or possible manipulations. The SEC does not have the manpower or technical capability to carry out such a challenging task.

Faced with unprecedented challenges, the SEC resorted to its traditional and only immediate regulatory remedy of setting new circuit breakers for individual stocks. Then it proposed adding a requirement that broker-dealers restrict quotes to within a specified range around prior trades.

Circuit breakers may help reduce the impact of potential breakdowns in specific stocks, but they cannot prevent recurrence of massive disruptions in exchange-traded fund trading. According to *Barron’s*, ETFs were responsible for about 70

Harald Malmgren is chief executive officer of Malmgren Global, and Mark Stys is chief investment officer of Bluemont Capital.

Ten years ago, it had already been recognized that trading based on computer algorithms probably accounted for about half the total trading volume in the U.S. markets, and dominated the trading practices of major institutional investors. Since then, technology has accelerated, with high-frequency trading platforms ramping up the speed to milliseconds and more recently to microseconds.



percent of all the May 6 flash crash trades that were later cancelled by the exchange. ETFs are a small percentage of securities traded on the stock exchanges, but they were a major factor as liquidity faded away and the ETFs themselves became decoupled from their underlying baskets of stocks, while the prices of some specific stocks swung wildly.

Most important, circuit breakers are of no significance if a large-scale implosion of liquidity results from suspension of trading by high-frequency traders, threatening systemic

collapse of the entire equity market. What happened that day is that some high-frequency traders did disengage from markets, turning off computers which seemed to their operators to be conveying misinformation.

Recognizing the inadequacy of available information, the SEC has now started developing a new reporting system known as the Consolidated Audit Trail. This system is intended to bring all of the presently disaggregated, fragmentary data into one place to enable “real-time surveillance.” Development of the CAT is expected to require at least \$4 billion to build, take three years to complete, and require \$2 billion per year to operate. Long before CAT is a reality, there are likely to be more crashes. Moreover, there can be doubt whether real-time capacity could ever be achieved given the complexity of high-frequency trading “flash trades” (execute or cancel on receipt) in which a high ratio of bids automatically self-destruct. By the time CAT is finished, technology will have spread globally, posing unforeseeable jurisdictional information disclosure issues as well as new technological challenges.

Ten years ago, it had already been recognized that trading based on computer algorithms probably accounted for about half the total trading volume in the U.S. markets, and dominated the trading practices of major institutional investors. Since then, technology has accelerated, with high-frequency trading platforms ramping up the speed to milliseconds and more recently to microseconds. One of the high-frequency trading CEOs stated that the longest duration of holding a given stock by his firm was eleven seconds, although he considered that to be unusually and unacceptably long.

The combined role of computerized algorithms and high-frequency trading activities varies in intensity during

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the course of any trading day, but during some time intervals may account for more than 80 percent of total trading volume. High-frequency traders interact with the vast array of algorithms employed by large financial institutions, acting like a turbo booster. Consequently, the volume and speed of bids and asks has been growing exponentially.

High-frequency trading has revolutionized how stock markets function in the United States. High-frequency trading enterprises argue that they provide substantially increased liquidity to stock market trading, and that they improve efficiency by driving down buy-sell spreads to tiny fractions of the spreads that prevailed a decade or more ago. Such arguments initially sound appealing, especially to economists dedicated to “efficient market” hypotheses. However, high-frequency trading liquidity turns out to be illusory, totally dependent on the willingness of high-frequency trading platforms to remain active under all circumstances during all trading hours. When several high frequency traders disengaged from the markets on the afternoon of May 6, the result was a temporary implosion of liquidity. This greatly aggravated the dysfunctionality of markets during the flash crash. What has been learned from this event is that high-frequency trading platforms not only can enhance market liquidity, but they can also threaten massive meltdown, or systemic risk. The May 6 flash crash event demonstrated that a prolonged, total market shutdown could occur if some or all high-frequency traders abandoned trading.

High-frequency trading platforms essentially make profits by extracting a tiny fraction of every transaction, but generating volumes of trades at speeds never imagined a decade ago. They thrive on a combination of asymmetric information advantages and extremely short-term profit objectives. Because of their high volume of activity, high-frequency traders are able to acquire information on trades

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taking place in the “dark pools” of privately arranged transactions. They are also able to initiate large arrays of “flash orders” to ascertain the depth and breadth of the market, and identify if there are willing buyers at some level above most recent trades. Flash orders are small “immediate or cancel” orders, valid only for microseconds, that carry little risk for high-frequency traders. By ferreting out buyer limits, high-frequency traders have vastly greater knowledge of all aspects of the markets’ depth and breadth than individuals or passive investors like pension plans.

High-frequency trading also allows for exchange or market arbitrage. At present, there are nine separate U.S. exchanges that route orders to New York Stock Exchange-listed stocks: the New York Stock Exchange, Nasdaq, BATS, Arca, the Chicago Board Options Exchange, the International Securities Exchange, the Chicago Mercantile Exchange, the Boston Stock Exchange, and the Cincinnati Stock Exchange. Each makes bids and offers, with differing speeds. In pursuit of the highest possible bid, or National Best Bid, and the lowest offer, or National Best Ask, high-frequency traders can exploit not only differences in prices but also differences in response time. For example, the NYSE typically runs slower than trading on BATS. This provides opportunity for time arbitrage. It is possible to surge orders through the NYSE (some call this “quote stuffing”), forcing a slowdown of a few seconds in trading, while establishing a price in BATS which is then routed to the NYSE. Thus, with numerous venues for execution and ability to transact in all of them, high-frequency traders can take advantage of bid and offer differentials across exchanges. NANEX, LLC did a study of the May 6 flash crash and found evidence that this occurred starting on the NYSE at 14:42:46 and spread to over 250 stocks within two minutes. This type of cross-market arbitrage is not the kind of liquidity that adds value, but instead skews price to the advantage of the high-frequency traders.

High-frequency trading tends to be more profitable when markets are rising so that the bid-ask spread is maximized as high-frequency traders fill any gap between buyers and sellers. In falling markets, high-frequency trading tends to be less profitable, as sales of purchased shares become more difficult in a falling price environment and extra cost is entailed in financing short positions. When markets fall, there is a strong incentive to seek to levitate markets back up to the levels prevailing before the sag, making profitable the distribution of shares accumulated during the decline. While there are a number of independent high-frequency traders, some large-cap financial institutions also operate high-frequency trading platforms of their own. On days of thin trading volume, large-cap financial institutions can buoy up flagging markets by well-timed surges of exchange-traded fund buys, such as SPY (the S&P 500 exchange-traded fund).

Feedback Loops

Essentially, high-frequency trading platforms function as positive feedback loops. Engineers treat positive feedback loops as inherently unstable, as each positive response generates stepped-up repetition of the same actions. Positive feedback loops result in an ever-expanding balloon, but like all balloons, the risk of bursting increases with the balloon's size.

—*H. Malmgren and M. Stys*

Such surges can trigger automatic buy responses of the many algorithmic trading models on which other investors and traders rely. In sum, high-frequency trading tends to operate with an upward market bias. While the differences may only be pennies per day, over time this upward bias likely lifts share price above the level that would otherwise materialize, potentially skewing true asset value. As for risk management, high-frequency traders close all positions before markets close, or during after-market trading, avoiding any exposure to overnight global market movements.

The process of high-frequency trading gives the appearance of a huge, seemingly limitless array of buyers at any given moment, even on days of concern that markets might be overvalued or vulnerable to negative news. On such days, when traditional buyers absent themselves, negative market corrections may be avoided, delayed, or mitigated by the levitation of high-frequency trading. The greater the time between true market corrections, the greater the distortion in price and the bigger the likely correction when high-frequency levitation ends. Since major corrections invariably overshoot, the outcome will likely be uglier the longer the computer-driven postponement.

Broker-dealers who are designated “market makers” were long constrained by regulatory requirements that they must stay active and provide a bid when requested. Traditionally, broker-dealers were considered to be the principal source of market liquidity which insured continuous functioning of the market. In effect, high-frequency traders also function as market makers but they have no comparable obligations. If they sense an aberration in trading activity, particularly an abrupt downward movement in prices, they are free to withdraw from trading. In a rapid market decline, their absence would amplify the rate of descent. In other words, when active, their voluminous transactions create an illusion of ample liquidity and balance between sellers and buyers. When they step away, this illusion is instantly

dispelled. Thus, high-frequency traders may often help moderate or smooth market volatility, but since they retain freedom of action to withdraw at their own discretion, they pose systemic risk.

Essentially, high-frequency trading platforms function as positive feedback loops. Engineers treat positive feedback loops as inherently unstable, as each positive response generates stepped-up repetition of the same actions. Positive feedback loops result in an ever-expanding balloon, but like all balloons, the risk of bursting increases with the balloon's size. Some observers suggest that the risks of catastrophic market outcomes have become so great that regulators must ban high-frequency trading. Trying to reverse technological progress has never been a very successful endeavor.

Given the fundamentally different objectives of high-frequency traders, their unlimited freedom of action, and their apparent dependence on positive feedback loops, regulators need to think beyond circuit breakers to devise compensating negative feedback mechanisms. Some commentators have suggested introduction of minimum holding periods for non-broker-dealers. Alteration of incentives might be achieved by introduction of a sliding scale of fees or taxes according to volume and speed of trading. A more effective fix would be to redefine the identities and roles of “market makers” and focus instead on “liquidity providers.” In other words, if high-frequency trading entities and broker-dealers want to participate in equity trading, they should all be required to remain on line during all trading hours. The rule could be simple: If you play, you must stay. In the past, the rule was that a broker-dealer could be banned from trading in a security for which it had refused to make a bid. A new rule might be that “liquidity providers” which disengaged from trading might be banned from returning to all trading for a fixed period. That at least would reduce the evident risk of a market plunge resulting from arbitrary decisions to halt high-frequency trading. The goal should be not to get rid of high-frequency trading, but to align its incentives to eliminate the massive threat of systemic risk.

HAS HFT HIDDEN A DECREASE IN UPWARD BIAS?

Does high-frequency trading increase the overall share price that investors pay over time simply because the provision of seemingly limitless liquidity increases transactions demand? High-frequency trading does have an amplifying effect on market moves, but it would be simplistic to consider high-frequency trading as the sole cause of upward bias. We are experiencing continuing weakness in trading of U.S. equities, with thin volumes in comparison to historical performance. Unemployment and slow growth may discourage equity investing, but there have been more seismic changes in the makeup and activity of market participants.

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In past decades, the market benefited from economic expansion and an increasing cadre of “natural buyers.” These buyers included pension plans, endowments, foundations, insurance companies, and individual investors. The majority of flows came from retirement plans, including both employer-sponsored defined-benefit plans and various types of individual retirement accounts. Employer plans relied upon institutional investment managers, but their number has fallen by some 80 percent in recent years. The biggest segment of current defined-benefit plans is state and municipal employee systems. These public plans are notoriously underfunded, unable to provide support to the equity market, and in many cases even headed for default. Multi-employer plans (union plans) are down by more than one-third. IRA and 401(k) accounts now represent nearly half of all retirement assets, but individual investing is being ravaged by unemployment, debt deleveraging, and aging of the population.

Of course, markets were also buoyed by leveraged trading, especially by hedge funds. Recently, leverage has been deployed beyond equities to commodities and even to currencies and fixed income assets, while margins in equity trading have fallen from their recent 2007 peak.

Today there are roughly 5,400 public companies traded on the major U.S. stock exchanges, half the number prevailing earlier in the decade. With economic expansion, one would expect an ever-increasing number of companies to become publicly traded, but that did not happen. Instead, there has been a sharp decrease in publicly traded companies. Less choice and thin trading volume would seem to create a situation where valuation becomes skewed by other factors, such as the illusion of new liquidity generated by computerized trading alongside a rapidly expanding role for high-frequency trading.

As we continue a process of deleveraging combined with other decreasing capital flows, it appears that high-frequency trading has obscured what constitutes market liquidity. Interestingly, of the five largest outflows from equity

mutual funds as reported weekly by the Investment Company Institute, four of those big outflow weeks have been followed by rallies—with the rally since early July 2010 as the most recent. This would seem to be counterintuitive especially given that the weeks following the largest outflows were followed by more outflows in four out of five cases.

Shrinkage of “normal buyers” in a context of continuing rallies taking place on thinner and thinner volume suggests that high-frequency trading is hiding more weakness than is recognized. The upward bias from high-frequency trading on rapid buying and selling pushes equity markets higher while providing a false sense of both liquidity and market strength.

DEMISE OF “VALUE INVESTING” AND “FAIR PRICES”

For decades, professional investment advisers have continued to teach reliance on “value investing” and “buy-and-hold” as long-term guides to successful investment. Chief economists and market prognosticators for financial institutions also continue to urge us to keep focused on “market fundamentals” rather than sell when jostled by disruptive events, expecting “efficient markets” to generate a “fair price” in the whirlwind of market trading.

Technology may now have overridden such investment concepts. High-frequency trading platforms are focused solely on ramping up speed and volume so as to maximize tiny gains per transaction. Computerized algorithms that are momentum-sensitive are increasingly high-frequency trading-driven, raising serious doubts about traditional concepts of how markets should work. Investment strategies based on fundamentals such as a company’s long-term performance have been swept aside by high-frequency trading algorithms hunting for inefficiencies in daily pricing and super arbitrage opportunities. In so doing, they open investors to a new form of risk that has not been accounted for in most “buy and hold” asset allocation models.

In effect, individual traders are confronted with overwhelming momentum-driven forces that are unrelated to performance of individual businesses. A “fair price” may exist, but high-frequency traders are not seeking fair prices—they are focused solely on immediate profit. They are seeking transaction volume boosted by any form of momentum they can generate. Unfortunately, high-frequency trader interaction with computerized algorithms of large-cap financial institutions is providing opportunities for high-speed, virtually undetectable market manipulation. Where there is opportunity to “shape” the market for advantage, it is likely that such opportunity will be exploited.

Up to now, the high-frequency trading phenomenon has been primarily an American equity market phenomenon. Looking ahead, technology is not likely to respect national

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borders. Several of the high-frequency trading enterprises are already extending their networks and capabilities in Europe and Asia. Technology is also likely to spread its capabilities beyond equity trading to virtually every class of investible assets.

In the United States and many other countries, governments are wrestling with the apparent need for reforms of the functioning of financial markets. To date, many of the reforms being considered in the United States and Europe reflect problems of systemic risk experienced in the past. Little attention is given to new kinds of systemic risk posed by advances in financial technology.

At a minimum, computerized high-frequency and algorithmic trading are undermining traditional value investing strategies. Short-term liquidity and data movements are distorting information on real business perfor-

mance. In an environment where the range and speed of price movements is ever-increasing, fundamental valuation of a company would seem to be increasingly arbitrary without the ability to distinguish accelerated price movement from actual value.

In conclusion, continuing advances in computerized trading pose challenges for regulators throughout the world—and leave individual investors marginalized. Regulators will have to take into account the ability of high-frequency traders to play global regulatory arbitrage in microseconds. Regulators should not only seek to assure that markets are able to continue to function under stress, but they also need to devise remedial actions that protect individual investors who have fundamentally different objectives from the high-turnover objectives of high-frequency traders and computerized algorithms. ♦