Introduction

The U.S. equity markets have dramatically evolved over the last decade. The evolution has been fueled by the rapid advance of technology, changes to market structure, increased competition amongst traditional and non-traditional market exchanges, changes in the regulatory framework and a lack of coordinated oversight from regulators.

While trading in financial markets has changed substantially with the growth of new information processing and communications technologies, many of the issues centered on the fiduciary responsibility of providing best execution remain unchanged. Traders still face the same challenges as before: minimizing total trading costs and reducing overall market impact, remaining anonymous to market participants about exposing information, and embracing new technologies to implement traditional strategies more effectively and efficiently.

Regulation and market structure have also changed. From decimalization, to the Regulation National Market System (Reg NMS), to increased competition amongst traditional and non-traditional exchanges, transactions costs have been reduced while liquidity has not only been fragmented, but geographically fragmented as well. Opportunities for gaming are more present than ever before. Yet, as technological innovations continue to fuel change, regulation, enforcement and oversight seem to be continually behind the curve.

This paper examines the current state of the U.S. equity markets. It explores how changes to market structure and regulation over the years have led us to where we are today and asks, *is this really what we asked for?*
A Decade in the Making

The unintended results of several key changes to market structure that took place over the last decade, beginning with the move to decimalization in 2001, could have hardly been imagined at the time.

On June 13, 2000, then-SEC Chairman Arthur Levitt testified before the Subcommittee on Finance and Hazardous Materials on decimal pricing in the U.S. securities and options markets. He stated the overall benefits of decimal pricing were likely to be significant and said, “Investors may benefit from lower transaction costs due to narrower spreads. Moreover, the markets will be easier to understand for the average investor.” To some extent, he was right. Bid-ask spreads on the NYSE following the reduction of the minimum price variation, or tick size, were dramatically reduced from quoting in one-eighth to one-sixteenth and then to one cent.

Yet, while bid-ask spreads narrowed, and transactions costs lessened, liquidity began to become fragmented. The average size of reported trades has fallen significantly in the last decade. Average trade size on the New York Stock Exchange (NYSE) by the end of 2009 was approximately 300 shares, half of what it was five years earlier.

With the potential for less cost impact, came the greater potential for manipulation. Now, rather than trading in one-eighth or one-sixteenth, manipulators would be able to affect markets at a reduced transaction cost of just one penny. The move to decimalization sought to lessen trading costs and enhance liquidity, but opened a flood gate for the technology and algorithmic trading evolution.

In 2005, Reg NMS was created to foster competition both among individual markets and among individual orders to promote efficient and fair price formation across securities markets. At the heart of Reg NMS, lies the National Best Bid or Offer (NBBO). The concept was aimed at requiring brokers to execute customer transactions at the best available ask price when buying securities, and the best available bid price when selling securities. In addition to NBBO, some of the more notable rules put forth in Reg NMS were: Order Protection, which provided inter-market price priority for quotations that were immediately and automatically accessible (Rule 611); Access Rule, which addressed access to market data such as quotations (Rule 610); Sub-Penny Rule, which established minimum pricing increments (Rule 612); and general Market Data Rules, which were intended to institute a new market data revenue allocation formula, create advisory committees, and govern market data (Rules 600, 601, 603).

Among those notable rules, it is important to consider the potential future effects from the general Market Data Rules, specifically the rule that was intended to institute a new market data revenue allocation formula. As competition increases, and traditional exchanges lose market share, the implications from this rule will be key to several exchanges in terms of revenue survival, and future market structure.

By 2007, Reg NMS was fully implemented, and the SEC maintained it comprised a series of initiatives designed to modernize and strengthen the national market system for equity securities. However, what ensued was the creation of exchange competition that forced liquidity to become geographically fragmented across both traditional and non-traditional exchanges. The potential for greater price manipulation now came at less of a cost impact (decimalization), and was now possible across more marketplaces or exchanges (Reg NMS). Similar to the effects of decimalization, Reg NMS would also foster the effects of technology advances and electronic trading.
Beginning in the mid-2000s, and following the move to decimalization and the implementation of Reg NMS, market share at traditional exchanges began to noticeably decline. Reg NMS had freed electronic platforms to compete with traditional exchanges such as the NYSE. Subsequently, new entrants gained significant market share. Traditional specialists and market-makers were now facing increased competition from computers and electronic market-markets as technological advances allowed for more efficient automation.

The NYSE market share of volume in its listed stocks fell from approximately 80% at the beginning of 2003 to approximately 25% by the end of 2009. NASDAQ (matched) share volume also increased, but later fell as volume traded through new non-traditional exchanges such as BATS and DirectEdge. Also gaining market share were dark pool trading systems, as broker-dealers began internalizing more orders flow to further reduce costs associated with executing transactions on traditional exchanges.

The U.S. market structure is now an aggregation of exchanges, broker-sponsored execution venues and alternative trading systems (ATS); a far cry from the traditional days of specialists and natural price discovery. By 2010, it was estimated that high-frequency trading (HFT) accounted for more than 70% of equity trades taking place in the U.S. and was rapidly growing in usage in Europe and Asia. Currently, no single trading destination executes more than approximately 25% of the total U.S. equity market.

Current Market Structure: Trading, at the Speed of Light

By 2010, and following the unintended consequences of decimalization and Reg NMS, the U.S. equity market structure had dramatically changed, for better or for worse. Algorithms, dark pools, internalization, co-location, latency, indications of interest and actionable indications of interest, alternative trading systems (ATS), and high-frequency trading (HTF) were now the new buzz words on Wall Street.

Currently, there are more than twelve major exchanges, or “lit” markets, in the U.S., approximately fifty to sixty dark pool trading centers, or “dark” markets, and countless algorithmic trading strategies. In fact, adoption of algorithmic execution as a percentage of total U.S. equities trading volume has increased from approximately 28% in 2004 to just over 50% in 2010.

As technology has altered the current state of the U.S. equity markets, speed or low latency, has grown to become an important area for competitive differentiation among exchanges. It now takes less than one hundred microseconds for a co-located server – a machine in the same building as the exchange’s equipment – to get an order to a matching engine that matches bids and offers to execute a trade. And in theory, a trader could send an order, have it executed and receive an acknowledgment in less than three hundred microseconds, or one thousand times faster than the blink of an eye.

Recall Market Data Rules from Reg NMS, which were intended to institute a new market data revenue allocation formula. As the need for speed is driving technological innovation, there is also a need for access to the exchange data centers. If a carrier is connected to an exchange and a trading firm is a member of that exchange, the trading firm could in theory locate its equipment virtually right next to the matching engines, allowing for faster access to the data, and essentially, faster execution times. Yet, most of the data
centers owned by the exchanges are full, so not all members can be in the same building. As a way around this, carriers offer what is known as co-location, where they host trading firms’ servers close to the exchange’s data center, and link them with high-speed fiber-optic cables. However, while speed and data are available, they come at a cost. And as traditional exchanges continue to lose market share, this has been a valuable resource for several of them to make up for lost revenue.

Quote traffic, trading volume and volatility have also risen over the last decade as the structure of the market continues to change. Innovations in electronic trading have produced new trading platforms and order types. Participants now use more advanced and faster tools to execute orders, and the markets changed as a result.

Reported equity trading volumes have tripled in the last several years. As the direct costs of trading have fallen substantially over the last several years, it is now easier to implement strategies that would have been uneconomic at higher costs.

The increase in derivative products has also increased the amount of trading as arbitrage activity keeps derivatives prices linked with prices in the underlying cash markets. And also, the rapid growth in the number of exchange-traded funds (ETFs) has contributed to the increase in trading volume. In recent years, ETF volume expanded from 291 million average daily shares traded in 2005 to approximately 1.9 billion average daily shares trading in 2009, and accounted for 19.3% of total U.S. volume.

Quote traffic has also increased as a result of higher trading volumes and the increased use of algorithmic trading strategies. As volume became fragmented, and then geographically fragmented following decimalization and Reg NMS, algorithmic trading broke larger block orders into many smaller orders. As a result, the frequency of quote updates increased dramatically in recent years, with a noticeable spike during the period of intense volatility and volume associated with the recent global financial crisis.

Consider the following example of Dell Inc. (ticker: DELL), listed on the Nasdaq Exchange. On August 25, 2011 at 15:45:48, in a one second period of time, there were more than 10,000 quotes, yet, exactly zero trades executed in DELL. Research conducted by Nanex found that of the 10,000 quotes, the bid and ask prices remained the same. The only real variation was the ask size of the quote, and was one that repeated in a mathematical pattern with a long cycle; making it difficult to detect, but also confirmed that it must have been emanating from a single source.

Consider the following example of Abbot Laboratories (ticker: ABT), listed on NYSE. On August 17, 2010, the number of buy or sell orders for ABT every second from 09:30:00 to 09:51:00 was approximately thirty eight. At 09:51:01, there were 10,704 buy or sell orders. At 09:51:02, there were 5,483 buy or sell orders. Over the next several minutes, the best offer declined while the NYSE bid stayed constant for several more minutes before natural price equilibrium was found.

Examples, such as the ones above, continue to occur in the market place at an increasing pace, despite recent changes or proposed changes to the regulatory structure.

As HFT has grown to account for approximately 70% of equity trades taking place in the U.S., its impact, either beneficial or detrimental, to current market structure – continues to be passionately debated. One fact does remain clear; the effects of HFT are not just felt by equity markets, but by a diverse range of asset classes.
U.S. Market Structure: Is This What We Asked For?

The effects of HFT have been felt by traders for some time and was highlighted on May 6, 2010 in what the popular media called the “flash crash,” where natural price discovery failed and liquidity disappeared as HFT firms failed to provide the “structure” they had claimed to provide in light of the technology evolution. Another example came during the week of August 8, 2011, in which the S&P 500 saw dramatic daily moves of -6.66%, +4.74%, -4.42%, +4.63% and +0.52% over the course of one trading week.

While proponents of HFT claim that its strategies provide increased liquidity, efficiency and natural price discovery to the market, many institutions are growing concerned about its effects. A Greenwich Associates survey found that 45% of participating institutions believe HFT poses a threat to current market structure, while 36% believe it benefits the market and investors by increasing overall liquidity. The balance say they do not know enough to judge.

As existing evidence related to the impact of HFT on certain market quality and efficiency indicators remain inconclusive, certain issues still exist.

HFTs are under no affirmative market-making obligation; they are not obliged to provide liquidity by consistently displaying high-quality, two-sided quotes. This may translate into a lack of available liquidity, particularly during volatile market conditions. HFTs also contribute little to market depth due to the marginal size of their quotes, potentially resulting in larger orders having to transact with many smaller orders and may affect overall transaction costs. In addition, HFT quotes are accessible for very short periods of time, due to the short duration for which the liquidity is available when orders are cancelled within milliseconds.

In recent years, the ratio of orders canceled to orders executed has more than tripled. In 2002, the ratio of canceled orders to executed orders was approximately 10:1. By 2010, it was estimated that the ratio of canceled orders to executed orders was approximately 30:1.16

Regulation, Enforcement and Oversight, or Lack Thereof

Following the market events of May 6, 2010, it was clear that the regulatory framework for the rapidly changing market structure appeared to be disjointed. On that day of extreme volatility, the Dow Jones Industrial Average (DJIA) fell by 998.5 point within seconds, which marked the biggest one-day decline on an intraday basis in the history of the DJIA stock index.

On September 30, 2010, the U.S. Securities and Exchange Commission (SEC), along with the U.S. Commodity Futures Trading Commission (CFTC), issued a report on Findings Regarding the Market Events of May 6, 2010, almost four months after the event took place.

Among the findings, the Commissions noted, “At 2:32 p.m., against this backdrop of unusually high volatility and thinning liquidity, a large fundamental trader (a mutual fund complex) initiated a program to sell a total of 75,000 E-Mini contracts (valued at approximately $4.1 billion) as a hedge to an existing equity position.”17 The report went on to highlight that the “large fundamental trader” chose to execute the sell program via an automated execution algorithm that was programmed to feed orders to target an execution rate set to 9% of the trading volume calculated over the previous minute, but without regard to price or time. With regard to their mention of HFTs, the reports said, "HFTs and intermediaries were the likely buyers of the initial batch of orders submitted by the sell algorithm, and, as a result, these buyers built up temporary long positions. Specifically, HFTs accumulated a net long position of about 3,300 contracts. However, between 2:41 p.m. and 2:44 p.m., HFTs aggressively sold about 2,000 E-Mini contracts in order to reduce their temporary long positions. At the same time, HFTs traded nearly 140,000 E-Mini contracts or more..."
than 33% of the total trading volume. This is consistent with the HFTs’ typical practice of trading a very large number of contracts, but not accumulating an aggregate inventory beyond three to four thousand contracts in either direction. What happened next is best described in terms of two liquidity crises – one at the broad index level in the E-Mini, the other with respect to individual stocks.” Most importantly, the report pointed out, “Based on their respective individual risk assessments, some market makers and other liquidity providers widened their quote spreads, others reduced offered liquidity, and a significant number withdrew completely from the markets. HFTs in the equity markets, who normally both provide and take liquidity as part of their strategies, traded proportionally more as volume increased, and overall were net sellers in the rapidly declining broad market along with most other participants.”

In other words, the primary reason for ongoing market instability can be attributed to: HFT’s dominance in the market and its ability to pull all bids or “liquidity” based on current market conditions. And, in response to the manipulative practices of quote-stuffing that occurred on May 6, 2010 in the midst of extreme volatility, the report noted, “It has been hypothesized that these delays are due to a manipulative practice called ‘quote-stuffing’ in which high volumes of quotes are purposely sent to exchanges in order to create data delays that would afford the firm sending these quotes a trading advantage. Our investigation to date reveals that the largest and most erratic price moves observed on May 6 were caused by withdrawals of liquidity and the subsequent execution of trades at stub quotes.”

The 104 page report did little to calm fears that adequate regulation, oversight and knowledge were in place to combat the current market structure. Of several “lessons learned” from the market events of May 6, 2010, the report noted it was an “important reminder of the interconnectedness of derivatives and securities markets” and that “analysis of that day reveals the extent to which actions of market participants can be influenced by uncertainty about, or delays in, market data.”

One cannot help but wonder whether the SEC and other major regulatory commissions have the adequate resources to properly fulfill their missions for investors in the age of technology, algorithms, dark pools, alternative trading systems and high-frequency trading. Consider the mission of the SEC, as outlined in its Fiscal Year 2009 Request by Strategic Goal, “The mission of the Securities and Exchange Commission is to protect investors; maintain fair, orderly, and efficient markets; and facilitate capital formation. The SEC is responsible for overseeing more than 12,000 publicly traded companies, over 10,000 investment advisers that manage more than $38 trillion in assets, nearly 1,000 fund complexes, 6,000 broker-dealers with 172,000 branches, and close to $44 trillion worth of trading conducted each year on America’s stock and option exchanges.”

To be fair, following the December 2008 Bernard Madoff Ponzi scheme, the SEC began taking decisive and comprehensive steps to reduce the chances that such frauds will occur or be undetected in the future. And among other things, the SEC has been revitalizing its Enforcement Division, enhancing safeguards for investors’ assets, recruiting staff with specialized experience, expanding trading and seeking additional resources.

Several short-term solutions were implemented following May 6, 2010, including the creation of single stock circuit breakers for the Russell 1000 stocks and actively traded ETFs, as well as enacting rules that provided great certainty as to which trades will be “broken” when there are multi-stock aberrant price movements. Regulators also implemented minimum quoting requirements by primary and supplemental market-markets that effectively eliminated the ability of market-makers to employ “stub quotes.”

On February 18, 2011, the Joint CFTC-SEC Advisory Committee on Emerging Regulatory Issues issued recommendations to the CFTC and SEC regarding regulatory responses to the market events of May 6, 2010. Of the notable proposed changes, the Committee recommended circuit breakers be expanded to cover all but the most inactively traded listed securities, ETFs, and options on single stock futures. The Committee also recommended implementation of a “limit up/limit down” process to supplement the single stock circuit breakers, supported the SEC’s “naked access” rulemaking and recommended that the CFTC use its rulemaking authority to impose strict supervisory requirements on Designated Contract markets (DCMs) or Futures Commission Merchants (FCMs) that employ or sponsor firms implementing algorithmic order routing strategies and that the CFTC and the SEC carefully review the benefits and costs of directly restricting “disruptive trading activities” with respect to extremely large orders or strategies.

The proposed changes were the first meaningful step towards addressing the current market environment. The Committee also made an important recommendation towards market-maker obligations, HFT and liquidity, by recommending that the SEC evaluate whether incentives or regulations can be developed to encourage persons who engage in market-making strategies to regularly provide buy and sell quotations that are reasonably related to the market.
More recently, the SEC finalized a rule aimed at both identifying, and obtaining trading information on, market participants that conduct a substantial amount of trading activity, as measured by volume or market value, in the U.S. securities markets. It is the first step towards the concept of a consolidated audit trail. The rule will require a “large trader,” defined as a person whose transactions in National Market System (NMS) securities equal or exceed 2 million shares or $20 million during any calendar day, or 20 million shares or $200 million during any calendar month, to identify itself to the Commission and make certain disclosures to the Commission. The Commission will assign to each large trader an identification number that will uniquely and uniformly identify the trader, which the large trader must then provide to its registered broker-dealers. Such registered broker-dealers will then be required to maintain records of two additional data elements in connection with transactions effected through accounts of such large traders. While the rule is a move in the right direction, several question whether the SEC has the resources to disseminate and act on such information.

While regulation, enforcement and oversight continue to take a reactive, rather than a proactive approach to current market structure, it cannot be denied that the debate appears to be moving in the right direction, albeit slowly.

As these topics continue to be discussed and changes are implemented, the more likely markets will operate efficiently in a technology driven industry.

**Conclusion**

Over the last decade, technological advances and changes to the regulatory framework have dramatically changed the current structure of U.S. equity markets. Algorithmic trading, dark pools and alternative trading systems have taken market share from traditional exchanges and increased competition.

Technology has paved the way for new innovations, and its benefits can be seen in greater efficiencies in the way we execute orders. While its role in the current market structure has brought great benefit, it can be argued that its role has brought great detriment as well. Greater oversight and enforcement from regulators, as well as additional resources and expertise are essential to keep up with current times.

The current state of the U.S. equity market is here to stay; it is the environment in which we all operate, whether we like it or not. Yet, one cannot help but wonder, *is this really what we asked for?*