The Impact of Equity Market Fragmentation and Dark Pools on Trading and Alpha Generation

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Table of Contents

Executive Summary

- Regulatory changes, ever-evolving trading technology and the use of commission sharing arrangements (CSAs) have caused secular changes in the dynamics of both buy-side and sell-side business models and approaches to trading. While institutional investors seek "best execution" for equity trades, these dynamics — which include fragmentation, a shift in daily liquidity distribution and changes in typical order size/frequency — are redefining the term.
- A free-market structure has emerged in which liquidity providers compete based on pricing and functionality, resulting in market fragmentation that has changed the profile of price discovery, liquidity distribution, transparency and market integrity.
- Fragmentation has also transformed the order size/frequency disparity; the difference between average order size and average trade size has dramatically decreased while the frequency of trades has skyrocketed, resulting in a much more dynamic intraday size/volume profile with potential for greater velocity in pricing and thus market impact.
- In today's market, buy-side traders have full control over their access to liquidity, best execution and the responsibility to protect the alpha produced by the portfolio managers' decision process.
- In evaluating active equity managers, investors should consider their awareness and management of the forces at play in equity trading today, especially their understanding of market structure.

Introduction

When trading equities, institutional investors seek "best execution" — by understanding prior to execution 1) the characteristics of an order and how that will impact its costs and 2) the expected alpha from the trade, investors can optimize the trading frontier (i.e., how long to trade) and attain the best available price for the order. In the context of an institutional portfolio, this implies that a trading desk seeks to identify the optimal balance between market impact and volatility exposure over time in order to realize the alpha forecast by the portfolio manager. Anything short of best execution suggests that a trade may have been executed at an adverse price (due to trading too aggressively or too passively) and that there is the potential for an intermediary to realize an almost risk-free profit at the expense of portfolio performance.

Making informed decisions about what constitutes best execution depends largely on interpretation, which has become increasingly more complicated in recent years as markets have shifted to a dynamic, constantly evolving system. Markets today are fragmented across 11 exchanges and over 60 electronic crossing networks and ATSs — alternative trading systems or "dark pools" that are not always fully transparent on a pre- and post-trade basis — and well over 200 broker-dealers. Today, exchange trading accounts for approximately 60–65% of an average day's trading volume, while off-exchange trading accounts for approximately 35–40%.

Prior to 2000, sell-side broker-dealers were the only way asset managers could access liquidity in the two dominant market centers, which at the time were the New York Stock Exchange and NASDAQ. Due to changes in the regulatory environment and improvements in technology, the role of a broker as an execution facilitator has declined enormously — as have reasons to trade with traditional brokers. By embracing trading technology, the buy side has gained almost full control of access to liquidity. As trading has been insourced, market structure and regulatory changes have led to more widespread use of alternative trading systems, dark pools and commission-sharing arrangements.

Off-exchange trading raises potential concerns about public price discovery, liquidity and the integrity of markets because "dark" trading brings privatized order flow, potentially reduced transparency and increased complexity by which orders may be routed and executed. With a new reliance on technology and emphasis on speed of execution, concerns about market impact and information leakage have grown.

In a world with complex sourcing of liquidity and no single trading venue or exchange accounting for more than 20% of total market volume, the average trade size has declined to less than 175 shares as volume has held steady or expanded, resulting in secular changes to both sell-side and stock exchange revenue models. Given that custodians charge by trade, fragmentation and execution through multiple brokers has had cost implications for institutional investors. Smaller, more distributed trades drive expenses higher — a growing concern that brings best execution and trading cost control to new levels of prominence.

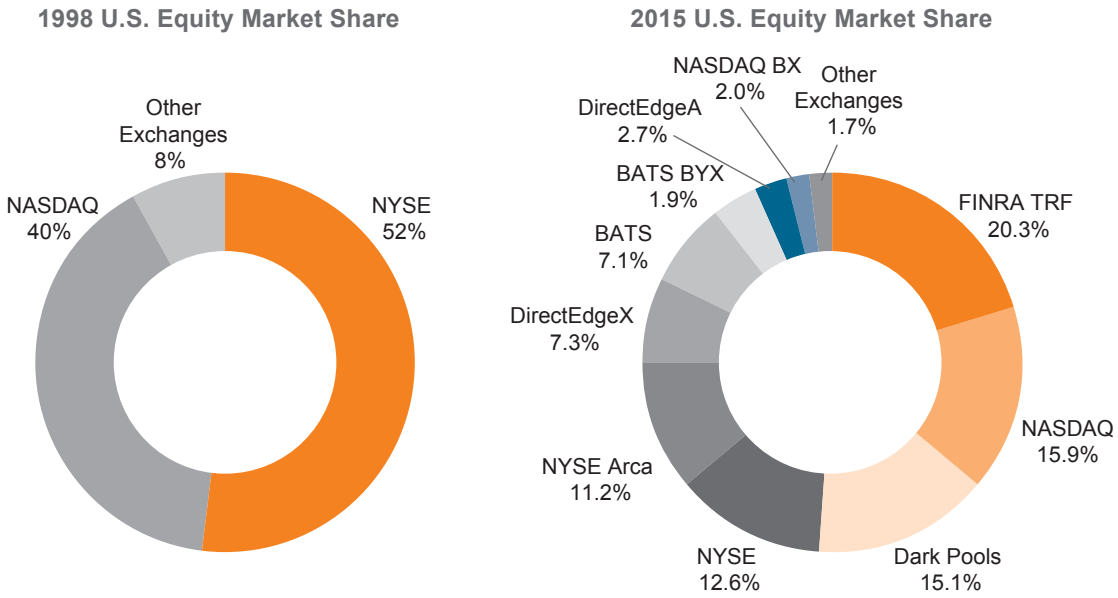
Evolution of Stock Exchanges and Brokerage Services

Originally, stock exchanges were privately held, not-for-profit entities. Today they are for-profit with most of them being publicly traded companies. There are now a total of 11 registered exchanges in the United States, six of which were added in the past five years. Ten of the 11 exchanges are the product of just three exchange groups: NYSE, NASDAQ and BATS. Each exchange group has created multiple venues with different rules and cost structures to suit the priorities of different investors.

Aside from the evolution of stock exchanges, the justifiable reasons to trade with traditional sell-side brokers have diminished. The broker's role as execution facilitator has declined, as sell-side traders now have less market color or value-add to offer asset managers. As a result, there are fewer opportunities to match orders naturally, particularly in the case of block trades. Additionally, separate payment for distribution is not allowed in the equity asset class. In such a climate, fragmentation of both markets and trading is not surprising.

Off-exchange trading grew out of regulatory changes and technological development coupled with the desire by asset managers and other market participants to execute trades with greater customized interaction and liquidity. An unintended consequence of this trend has been market fragmentation and increased trading frequency, leading to many smaller-sized orders and more focus on understanding cost factors in completing large trades and redefining the meaning of best execution by optimizing impact versus volatility while minimizing information leakage to market participants.

Figure 1. Fragmentation Evident from Comparison of Market Structure in 1998 vs. 2015



Source: Credit Suisse Trading Strategy
Note: "Other TRF" includes broker capital commitments and internalizations. "Other Exchanges" includes NYSE Amex, CBSX, Chicago, National and PSX.

Characteristics of Today's Fragmented Market Structure

- In the U.S. there are 11 exchanges and over 60 dark pools, 20 of which trade regularly.
- More than half of an issuer's volume is executed on a venue other than where it is listed.
- ETF trading is now 30–40% of all U.S. volume, leaving a significant part of total market volume traded by participants with no interest at all in company fundamentals.
- The top ten securities traded by volume represent 15% of the total market volume and about 25% of total block volume. Two-thirds of U.S. tickers don't even have block volume!
- Average trade size is about 175 shares; average institutional order size is 180,000 shares.
- Trades of at least 100,000 shares now account for only 3–4% of overall trading volume.
- Commission-sharing arrangements (used by 75–85% of long-only asset managers)[1] and advanced trading algorithms have increased buy-side self-trading.

Regulatory Milestones

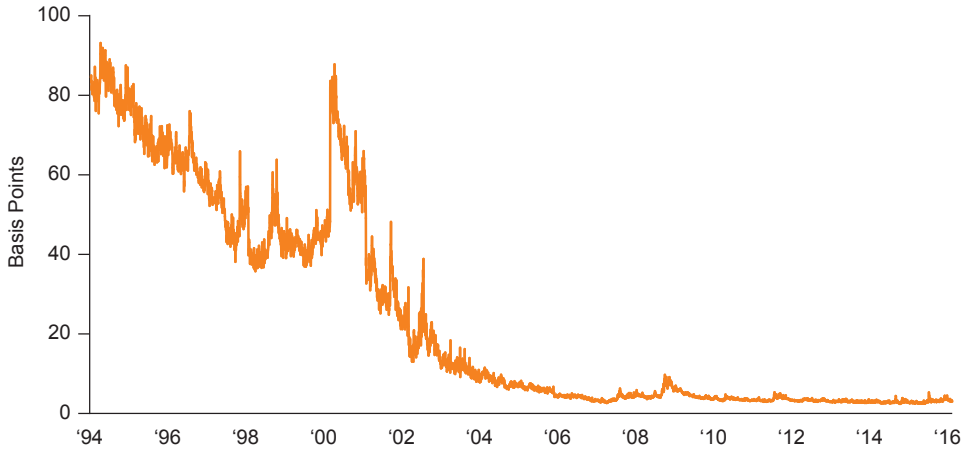
- In 1998, the Regulation Alternative Trading System ("Reg ATS") was designed to promote competition across exchanges by streamlining the registration process for alternative trading systems.
- Regulation National Market System (known as "Reg NMS") passed in 2007 to improve fairness in price execution, the display of quotes and access to market data and require exchanges to seek the best price, even on another venue.

[1] See End Notes on page 15.

Impact on Trade Volume and Trade Sizes

Changes in the exchange landscape, decimalization and the increased use of algorithmic trading have driven bid-ask spreads and average trade sizes down while total volume and the number of trades per day have climbed.

Figure 2. Decimalization, Fragmentation and Regulation Have Compressed Spreads for 20 Years
Median S&P 500 Bid-Ask Spread

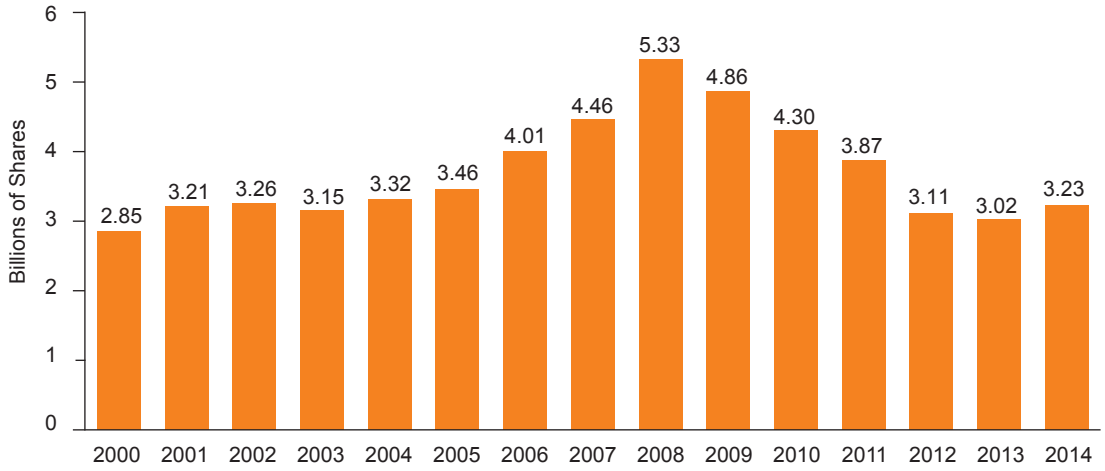


Source: CS Derivatives Strategy

Moreover, as indicated in Figure 3, daily trade volume has retreated 36% from its 2008 peak but remains about even with exchange volume a decade ago.

Figure 3. Fragmentation Has Impacted Volume and Distribution Across Major Exchanges

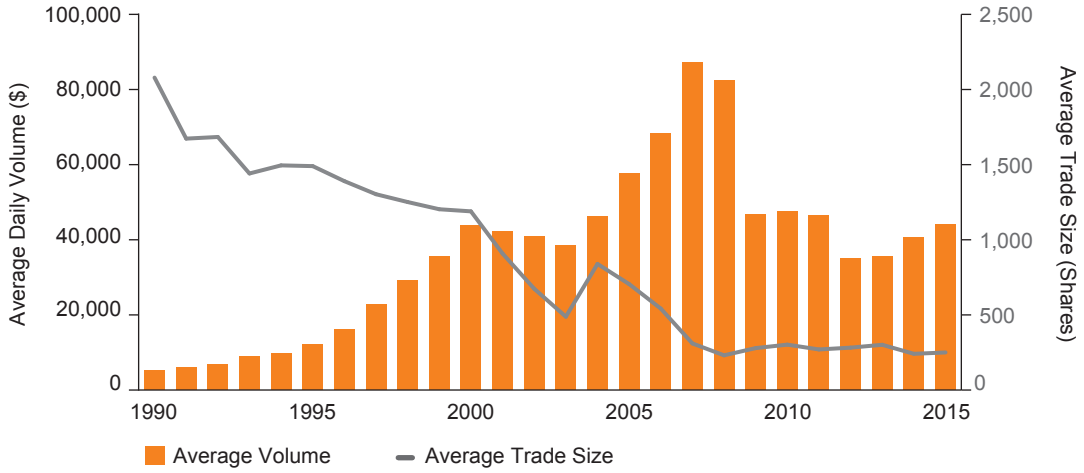
Average Daily Trading Volume in U.S. Equity Markets, NYSE & NASDAQ



Source: Securities Industry Financial Markets Association

Figure 4. Average Trade Size Has Declined Dramatically as Average Trade Volume Has Grown

Average Trade Volume vs. Average Trade Size



Source: NYSE, Voya Investment Management

Some believe fragmentation, technology and competition for orders between displayed and dark-trading venues have lowered bid-offer spreads, generally leading to improved market quality. While we are inclined to accept this assessment, fragmentation also has had other less wholesome effects:

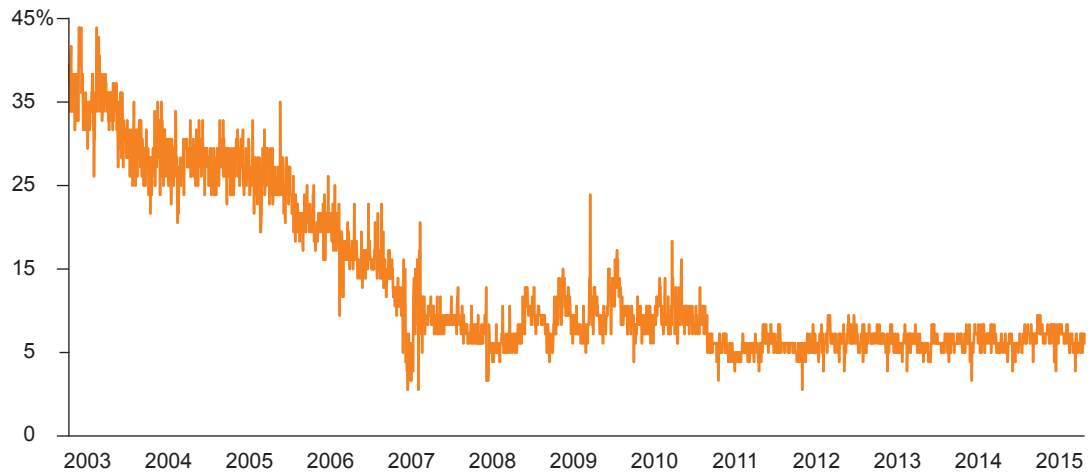
- To the extent some traders are unprepared or unequipped to pursue trade alternatives available across venues, fragmentation may interfere with price discovery and best execution.
- Fragmented markets may mean additional costs implicit in the time and resources needed to execute trades as investors search for the best prices.
- Orders touching multiple markets before execution may increase the potential for information leakage — i.e., signaling to market participants the presence of a large institutional order being worked in the marketplace.

Institutional Block Trading Trends and the Increase in Order Size Disparity

A traditional institutional block trade is defined as at least 10,000 shares. In today's market, block trades make up only 11% of market volume, and only 27% of stocks traded each day involve block executions of greater than 10,000 shares. According to Reuters, 71% of block trades are for 25,000 or fewer shares. ETFs account for 21% of block trade volume.

The dispersion of liquidity and increasing use of algorithmic trading has led to "virtual" block trades being split into many orders while traditional block trades have declined as a percentage of total volume.

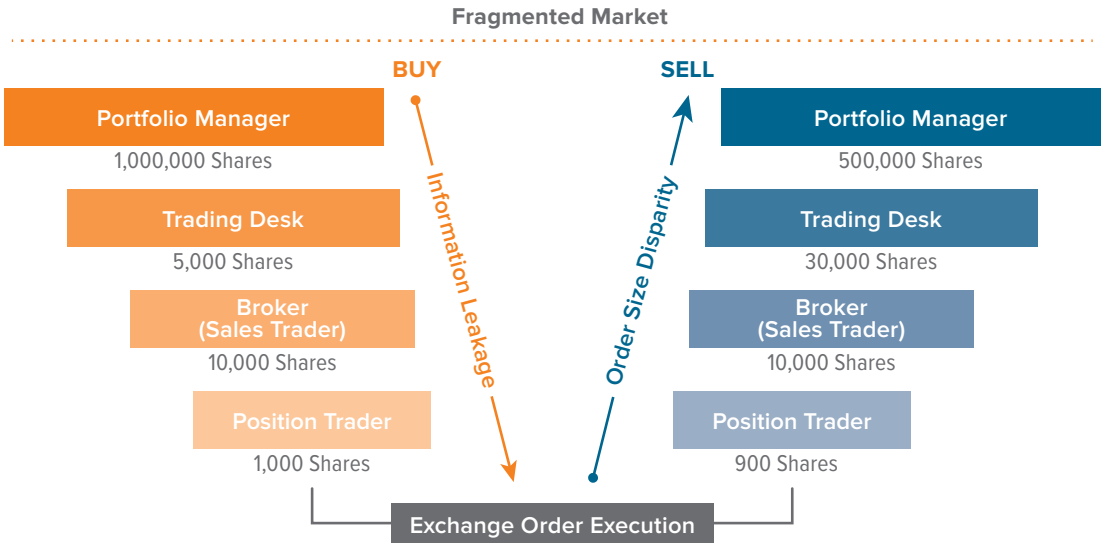
Figure 5. The Portion of Equity Volume Traded in Blocks Has Declined Steadily
Percent of U.S. Equity Traded as a Block (Block = 10,000 shares)



Source: Tabb Group

When trading on a public exchange, order size disparity — that is, the difference between the size of a position and the size of the multiple trades required to liquidate it — may tend to increase the potential for information leakage. Ideally, an institutional investor wants to trade without signaling to other market participants that it is trying to establish or liquidate a large position, thus minimizing information leakage. Institutional investors such as investment managers tend to favor an environment that offers as little information leakage as possible to other opportunistic traders that, with early access to information, might alter a stock's bid or offer price to the detriment of the institution's interest.

Figure 6. In Exchange Trading, Order Size Disparity and Information Leakage Are Virtually Inseparable



Source: Voya Investment Management

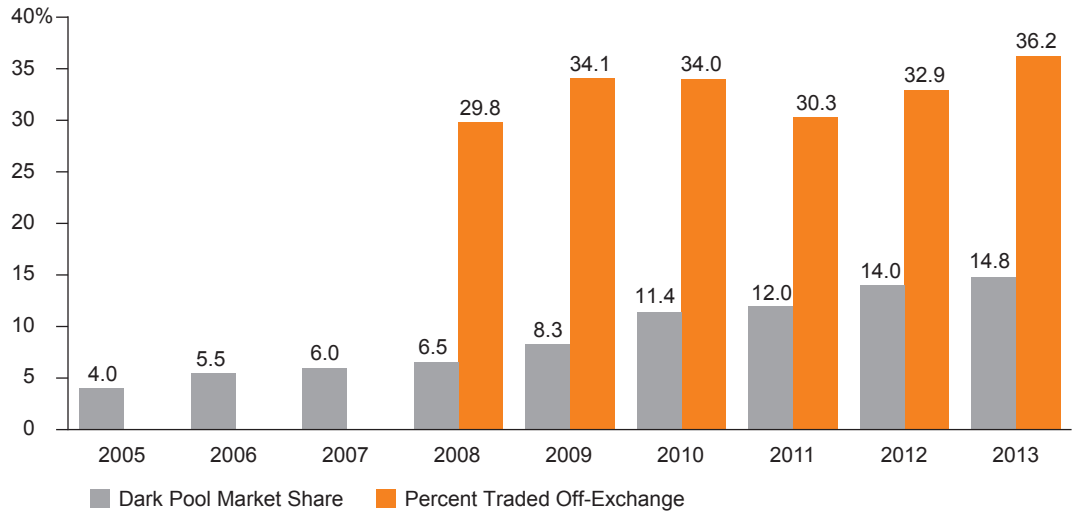
Emergence and Benefits of Dark Pools

Market impact is a primary cost associated with equity trading, and information leakage is one of its components. There are now thousands of human and systemic day traders, hedge funds and other automated algorithmic traders that continually seek to capitalize on information leakage using order-detection strategies that benefit from volume and trade frequency distortions relative to historic norms. A paramount focus for buy-side traders today is to attempt to minimize information leakage. It can be a virtually inescapable cost for institutional investors mainly because of order size disparity. The difference between the average institutional order size of 180,000 shares and the average execution size of 175 shares highlights the imbalance in the market and the potential for information leakage to impact prices. The order size/trade size imbalance — along with regulatory changes such as Reg ATS and Reg NMS —has been the motivation behind the birth and adoption of alternative trading systems.

Alternative trading systems are platforms for trading the same securities that trade on the exchanges but in a non-displayed manner, hence the term dark pool. They are meant to be marketplaces to bring together purchasers and sellers of securities — anonymously and typically at the midpoint of the bid/ask spread while not directly impacting the national best bid and offer price (NBBO — used primarily for price discovery and current interest by the market participants). There are over 60 registered ATSs, but only about 20 of them actively trade with a respectable level of volume. Alternative trading systems are required by FINRA to report, on a post-trade basis, daily and weekly trading volume information and number of transactions by security. FINRA publishes this information every week on its Web site; the information is accessible by issuer or trading venue.

Figure 7. Dark Pool and Off-Exchange Trading Spiked Post-Financial Crisis

Dark Pool Market Share and % Traded Off-Exchange as % of Total U.S. Equity Volume

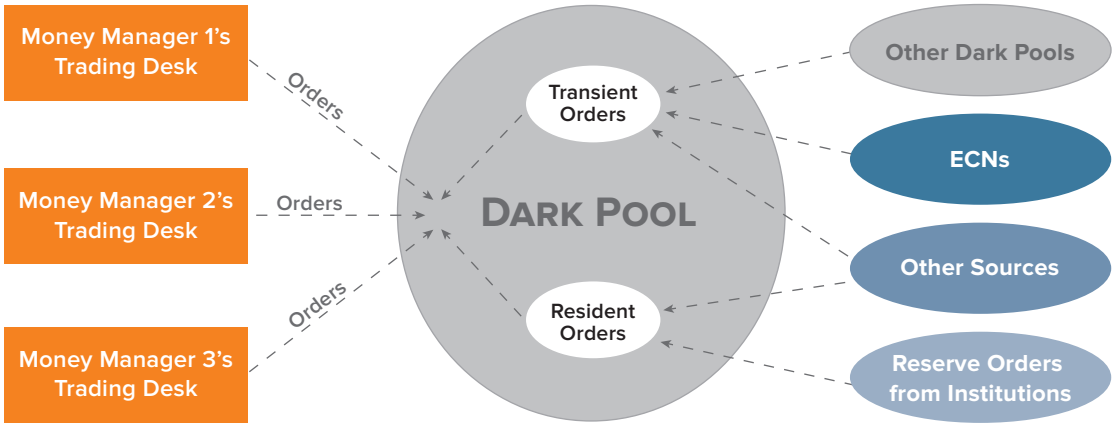


Source: Tabb Group

Note: Off-exchange volume data unavailable prior to 2008.

For investors seeking liquidity across various open and closed trading venues, dark pools serve an important and necessary function of allowing price and size discovery to be obtained. Since, unlike stock exchanges, dark pool participants do not disclose trading intentions to the open market before execution — there is no publicly visible order book — trade details are only released after execution. Below is an illustration of how various types of orders pass through what is a typical dark pool.

Figure 8. Potential Order Flow Into and Across Dark Pools



Source: Voya Investment Management

Categories of Dark Pools

Although the distinctions are often blurred, the main categories of dark pools include:

- **Broker internalization.** Set up by large broker/dealers such as Credit Suisse, Goldman Sachs and Citigroup to accommodate trading across their various trading desks on behalf of their clients as well as for themselves in a risk book. They derive their liquidity from internal order flow across various trading desks and clients, so there is an element of price and order size discovery.
- **Agency broker or exchange-owned pools.** Acting as agents, not principals, these dark pools derive their prices from the exchanges — often the midpoint of the national best bid and offer prices. Examples of agency broker dark pools include Instinet and Liquidnet; exchange-owned pools include those offered by BATS Trading and NYSE Euronext.
- **Exchange crossing networks.** Dark pools offered by independent operators that function as principals for their own account.

New Risks of Toxicity From Dark Pools

While dark pools have brought new trading mechanisms for institutional investors, new concerns have also materialized. Traders do not know the intention of the other side of any given trade, and reduced transparency can allow the potential for abuse to occur depending upon how the dark pool operates and the participants it allows in the pool. Like other trading venues, dark pools can be "gamed" by certain traders, resulting in what some call "toxicity". As an example, a trader could send a small sell order for an illiquid stock to a dark pool, probing to see if there is a large volume of resident buy orders for the stock; if the order is executed promptly, the trader could subsequently send a larger buy order — in order to push up the price — followed quickly by a very large sell order, which is then executed at an artificially inflated price. Accordingly, most dark pool operators claim they monitor stock prices immediately after a trade and may prohibit trading with certain tiers of pool participants. They may also impose other restrictions, such as large minimum trade sizes or giving preference to larger orders at the same price (even if smaller orders arrived earlier).

The new risks have brought increased attention to the way dark pools operate and whether their internal controls and regulatory compliance are sufficient to protect the interests of customers. The major risks are 1) that information leakage may allow other traders to detect the existence of a large trade and manipulate orders and 2) exposure to gaming algorithms that can detect large orders and manipulate the sequencing in the order books, not only in the trading pool but across public exchanges as well. Across the various pools, there are numerous variations on pricing, market making, types of clients, types of orders and internal controls. Institutional traders (such as Voya Investment Management) are therefore strong users of pre- and post-trade transaction cost analysis to determine toxicity of order execution and to evaluate the venues through which they transact and how their brokers may be routing and executing orders. Ultimately, the functional quality and accuracy of the trading infrastructure should assure that capacity, security and regulatory controls are consistent with expectations.

Advantages of Dark Pools

- **Lower explicit transaction costs —** No exchange fees are payable
- **Lower market impact costs —** The main advantage for large orders
- **Potential price advantages over best bid/ask on exchanges —** Bid-ask midpoint transactions do not incur the full spread
- **Anonymity —** A significant positive feature
- **Reduced likelihood of information leakage —** No visible order book

Potential Disadvantages of Dark Pools

- Toxicity or gaming
- Internalization by broker/dealers with proprietary trading capabilities
- Fragmentation with small executions and/or "child orders"
- Lack of post-trade transparency on executions
- Damage to public price discovery process
- Increased ticket charges

Broker Internalization Dominates Retail Markets

Broker/dealer internalization is an over-the counter trading system in which broker/dealers execute trades as principals against their own accounts and thus act as the counterparty for all incoming orders. It is a form of off-exchange dark liquidity because pre-trade quotes are not publicly displayed, and the OTC market makers — who may or may not be affiliated with the broker firms — may freely discriminate among the investors from whom they will accept orders. Broker/dealers must provide best execution for customers, so internalized order prices must match or beat the national best bid and offer prices — the highest bid and lowest offer price quoted on a national exchange at any particular time — but with no obligation to display quotations, price improvement may take the form of sub-penny executions. Broker/dealer internalization is believed to constitute about 18% of all consolidated volume — making it the majority of total dark trading — and close to 100% of retail marketable order flow.[2]

Some observers contend that internalization may enhance liquidity, lower transaction costs, accelerate execution and, for large orders, preserve anonymity. Others point out that internalization impedes liquidity and price discovery since orders are not exposed to market scrutiny. Moreover, because an internalized trade need only match — but not improve — the NBBO, the broker/dealer may have less incentive to quote more attractive prices.

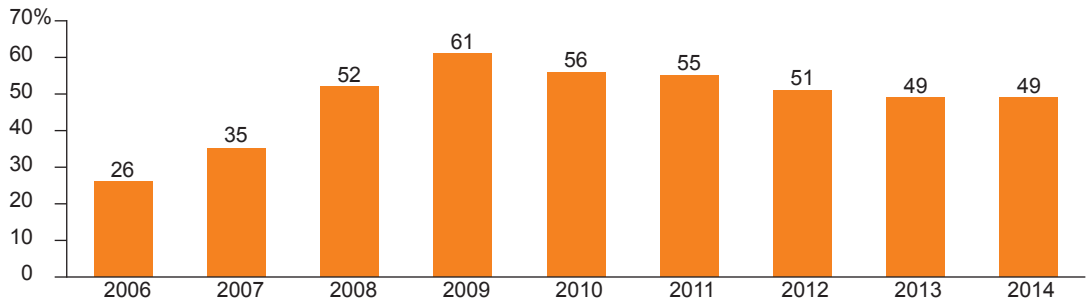
High-Frequency Trading Has Declined but Remains a Force

High-frequency trading is an automated trading strategy used by investment banks, hedge funds and institutional investors that utilizes powerful computers to move in and out of positions at very high speeds. Specific types of high-frequency traders include the automated market-makers or latency arbitrage traders focused on capturing sub-penny (1/10 of a cent) profits on every trade. To make up for razor-thin margins, these traders use enormous volume and scale. Done well, these trading strategies afford market participants that use them a huge advantage. These types of high-frequency traders tend to prosper when markets are normal and turnover volumes are high. As an illustrative example, an automated market maker who made markets in 12,000 securities globally and made an average of $150 per security per day could generate $451 million in revenues in one year.

High-frequency traders remain a major force in the market and are the primary intermediaries maintaining continuous market integrity (i.e., continuous quotes), but they are not as dominant as they were a few years ago and cannot be expected to be the backstop for failing markets. As can be seen in Figure 9, high-frequency trading in 2014 accounted for 49% of U.S. stock market volume, according to research and advisory firm Tabb Group; while this is down from 61% in 2009, it is up from only 26% in 2006. As market volatility declined following the financial crisis, strategies that relied on volatility also decreased. Technologies have also evolved, which has leveled the playing field among market participants. Required regulatory disclosures have contributed as well.

Figure 9. High Frequency Trading Now Represents Almost Half of U.S. Equity Shares Traded

High-Frequency Trades as a Percent of U.S. Equity Market Volume



Source: Tabb Group

[2] See End Notes on page 15.

Some have argued that the high-frequency trading is essentially a form of front running that capitalizes on delays in the execution of orders to exploit earlier access to information. Nevertheless, high-frequency traders may add valuable liquidity to the market and enhance the transfer of risk in the marketplace, narrowing the bid/ask spreads for securities and keeping the pricing of derivative products and intermarket pricing efficient. On the other side of the argument, high-frequency traders may increase the number of daily trades, decrease the average trade size, increase market volatility and also game orders, potentially harming thinly traded or smaller-capitalization securities and large institutional orders that may be in process in the marketplace. High-frequency traders have been the conduit in the market's transformation from a manual, human-focused one to an automated, systematic-driven one that is heavily dependent on technological advancement.

Example of High-Frequency Trading

A typical example of high-frequency trading would be an "order anticipation" strategy in which a high-frequency trader puts out in the market small sell orders for various stocks at slightly increasing prices (for example, orders of odd lot shares to 100 share lots at $20.00 per share, then $20.01 per share and so on). When each of the orders for a particular stock are immediately executed up to, but not above, a certain price — e.g., $20.04 per share — the trader can ascertain that there is an institutional investor with a large buy order for that stock that is willing to pay up to $20.04. The high frequency trader then instantaneously buys a large number of shares from other sources at prices between $20.00 and $20.03 per share, which it immediately offers on the market at $20.04 per share; if indeed a large reserve order exists, the large sell order is filled immediately at a price of $20.04 per share. As a result, the high-frequency trader earned $0.01–0.04 per share almost instantly and with little, if any, risk.[3]

[3] See End Notes on page 15.

The Effect of Commission-Sharing Agreements

A commission-sharing agreement (CSA) is a contractual arrangement between a client and broker that allows for separate payment mechanism for research and trade execution. With a commission sharing arrangement in place, a trader can select his best execution dealers and allocate a portion of the execution costs to selected research providers. In so doing, an investor can reduce implicit and explicit trading costs while also obtaining valuable research. CSAs effectively separate the best trading and liquidity providers from the best content providers, allowing institutional asset managers to achieve best execution.

Conclusion: Market Fragmentation Has Altered the Alpha-Seeking Process

In a market in which more than 65% of all trade orders are self-executed, buy-side traders have full control and discretion over access to liquidity, and best execution responsibility resides almost exclusively with them.

With increased ability to access liquidity directly, traders have become much more tactical. Traders need to be continually educated in new and emerging execution venues and strategies in order to be the leaders in sourcing liquidity. The ability to continually adapt to evolving market structure is paramount. While many new liquidity tools are on traders' desktops, they must apply them deliberately and methodically in the context of market conditions and order urgency.

Most important, traders are responsible for minimizing trading costs and understanding the contributions to cost in order to add or protect the alpha produced by the portfolio managers' decision process. Toward that end, both pre-trade and post-trade transaction cost analysis is an integral part of the order interaction, starting with the portfolio manager all the way down to the executing venue.

The link between potential increased trading costs and alpha opportunities has been irreversibly changed. While commissions represent the explicit portion of overall costs, the majority of trading costs are linked to implicit factors such as price impact and exposure to volatility as a result of information leakage, spread cost, volume participation and venue selection to name a few — all of which can be measured or estimated. Analysis of these factors is paramount.

A key theme in the evaluation of active equity managers is their keen awareness and management of many of the forces at play in equity trading today. The partnership between traders and portfolio managers has never been more important; close alignment between managers and traders is necessary to protect, as much as possible, the idea generation from potential impact costs through effective execution. With the proper communication and dialogue between portfolio managers, analysts and traders, trading can be a valuable source of alpha.

Addendum: Dark Pool Violations Produce Harsh Settlements

The most recent SEC administrative proceedings against dark pool operators Barclays and Credit Suisse produced harsh penalties for misstatements and inadequate disclosures to investors. Barclays Capital, Inc. and Credit Suisse Securities (USA), LLC agreed to pay more than $150 million in settlement charges in cases finding they had violated federal securities laws.

The eighth in a series of enforcement actions since October 2011, these were the largest settlements to date on behalf of investors in dark pools and other alternative trading systems. SEC officials acknowledged the importance that dark pools now play in today's equity marketplace but also asserted that failure to operate as advertised or failure to comply with regulatory requirements surrounding disclosures would be met with severe penalties.

In the current actions, Barclays acknowledged that it had failed to continuously police its dark pool for toxic order flow and had misled dark pool customers about data connection speeds. Credit Suisse was charged with misrepresenting its pool's order flow features, alerting high frequency traders to the existence of orders and executing millions of illegal sub-penny orders. Credit Suisse consented to the SEC's orders but did not admit or deny the findings.

Other pertinent SEC actions and settlements have included the following:

- October 2011 — Pipeline Trading Systems, LLC misled dark pool customers about how the dark pool would match orders.
- January 2015 — UBS Securities LLC failed to inform all customers about an order type that favored market makers and high-frequency traders.
- August 2015 — ITG Inc. and Alternet Securities maintained a secret trading desk that had access to confidential data about its dark pool customers.

In the public announcement on January 31, 2016, SEC Chair Mary Jo White asserted, "The SEC will continue to shed light on dark pools to better protect investors." At the SEC Equity Market Structure Advisory Committee (EMSAC) in April 2016, Chair White ended her opening remarks with a statement that has become a hallmark of her approach in effecting regulatory changes, "As I have said before, while we do not require perfect solutions, our regulatory changes must be informed by clear-eyed, unbiased, and fact-based assessments of the impacts — positive and negative — on market quality for investors and issuers."

End Notes

[1] Greenwich Associates 2014 Equity Investors Study

[2] Lemke, T. and Lins, G. *Soft Dollars and Other Trading Activities*, 2015 edition, Chapter 2.

[3] Lemke, T. and Lins, G. *Soft Dollars and Other Trading Activities*, 2015 edition, Chapter 2.

Past performance does not guarantee future results.

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