22 June 2010

Elizabeth Murphy
Secretary
Securities and Exchange Commission
100 F Street, NE
Washington, DC 20549-1090

Re: File No. S7-02-10; Concept Release on Equity Market Structure

Dear Ms. Murphy:

CFA Institute, ("CFA Institute")[1], with the counsel of its Capital Markets Policy Council[2], appreciates the opportunity to comment on the U.S. Securities and Exchange Commission's concept release. This release raises a number of issues relating to the current structure of the equity markets in the U.S., and we applaud the Commission and its staff for bringing to light, and seeking input on, such a broad range of relevant issues.

Executive Summary

Trade-at Rule. We believe the most important part of this release is the proposal to create a so-called "trade-at" rule to prevent market participants from stepping ahead of the national best bid or offer ("NBBO") unless they had previously displayed a bid or offer at that price. We strongly support implementation of this rule and believe it will help alleviate many of our concerns

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[1] CFA Institute is a global, not-for-profit professional association of nearly 101,000 investment analysts, advisers, portfolio managers, and other investment professionals in 139 countries, of whom nearly 90,000 hold the Chartered Financial Analyst® (CFA®) designation. The CFA Institute membership also includes 137 member societies in 58 countries and territories.

[2] The Capital Markets Policy Council ("CMPC") consists of investment professional with extensive expertise on issues and experience in the global capital markets. In this capacity, the CMPC provides analysis and practitioner expertise on issues affecting the integrity of global capital markets.

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related to price discovery, limit orders, sub-penny trading, systematic internalization, and dark pools[3].

Focus of Market Structure. The U.S. capital markets need both short-term traders and long-term investors to remain competitive and responsive. Both need transparent and adequate information for making informed decisions, though long-term investors need more in-depth information about issuers and the investment vehicles in which their capital will be invested.

High-frequency trading. This practice provides benefits to the markets by making pricing more efficient. Nevertheless, we believe there are a number of concerns that need to be addressed, including the lack of transparency relating to high-frequency traders' ("HFTs") capitalization, the relatively unregulated nature of these entities and systemic risk implications. We encourage the Commission to consider transparency and capital requirements on these firms if they are going to benefit from direct access services from their brokers.

Co-location Services. We do not support an outright ban of these services. However, we believe that such services must be offered on an equal basis to all market participants.

Dark Pools. We are concerned that while dark pools benefit from the price discovery of so-called "lit" markets, they do not contribute to the formation of securities prices. At the same time, we recognize the role these trading venues have sought to fill—to help minimize the market effects of large institutional orders—and would not support a market-wide ban. Regardless, we believe these venues must adhere to the same post-trade transparency requirements imposed on traditional regulated exchanges.

Our comments below focus on selected issues raised in the Concept Release. Also provided in the Appendix to this letter is a detailed analysis of market quality metrics for a sample of 100 stocks listed on the NYSE.

Discussion

Performance of Equity Market Structure

In a recent survey of CFA Institute members (the "Survey"), 58% of respondents said the SEC's primary focus should be both on investor protection and maintaining competitiveness of the U.S. markets. We appreciate, however, the difficultly in achieving this balance at a time of increasing market complexity and turmoil.

 In considering the fairness of the current market structure, we recognize the perceived conflicts between short-term and long-term investors. At first glance, the interests of long-term investors may appear to be threatened by the speed and frequency with which short-term investors trade.

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[3] See http://www.cfainstitute.org/Comment%20Letters/20100106.pdf for a letter to the Commission dated 6 January 2010 describing CFA Institute concerns about sub-penny trades and their effects on markets.

Given the range of technology and the more sophisticated tools and systems used by professional traders, it is clear that they can trade faster than typical long-term investors.

We believe that as a practical matter, however, both groups of investors have their place and serve vital roles in maintaining the vibrancy and stability of the marketplace. Short-term investors weigh different factors in deciding to invest, including price anomalies between markets, momentum and other factors that have little to do with long-term performance.

Long-term investors generally are motivated by factors other than precise price movements or comparisons. Rather, they are interested in such factors as corporate strategy, financial results and corporate governance as determinants of value, and therefore price. Moreover, at the time of trading, they are more likely to use limit orders to buy or sell and are therefore less sensitive to minor price changes.

At the moment of actual trade, however, there is no difference between short-term and long-term investors, and there should be no difference in the SEC's treatment of the two types of investors. In fact, we believe it may be impossible for the Commission to differentiate between the two types at that point. In terms of actual market trading functions, therefore, there should not be much difference in how short-term vs. long-term investors are treated.

As indicated by responses to the Survey, investing for the short-term and its associated offshoots are a concern to our U.S.-based members. Respondents who believe that the SEC should use its influence to encourage long-term investing overwhelmingly (82%) believe that it should require enhanced transparency about market activity and company performance. A majority of those (56%) also think that the SEC should adopt measures for enhanced shareowner rights.

As noted above, long-term investors need more in-depth information on the companies and investment vehicles in which their capital will be invested. In this respect, the SEC needs to continue to require the types of disclosures that provide investors with relevant audited and quarterly financial reports, as well as with information about corporate transactions and changes that they need for their investment decisions. Such disclosures would recognize the interests of long-term investments and their role in providing market stability.

Likewise, a company's corporate governance policies are more important to long-term investors than they are to short-term traders. The longer the holding period, the more likely that risk stemming from corporate governance breakdowns can affect returns. Therefore, we appreciate and support corporate governance disclosures that provide meaningful information to, and active participation by, long-term investors.

High-frequency trading

HFT in general

While high-frequency trading raises a number of concerns among market participants, CFA Institute does not support a ban on such activities. We believe that markets do benefit in some

ways from high-frequency trading, such as through lower bid and ask spreads, additional liquidity (though not at all times), and improved price discovery across different platforms.

We nevertheless have a number of concerns about operational aspects of high-frequency trading and the potential for certain risks that it poses, including systemic risks. These particular concerns relate to the lack of transparency in this area and the lack of specific regulatory oversight of these traders who operate in ways similar to broker-dealers but without similar regulatory guidelines.

1. *Lack of transparency*

There is a general acceptance that high-frequency traders have largely taken over the role of traditional market makers. However, unlike traditional market makers, HFTs perform their roles without any overt obligations and operate in a manner that evades neatly fitting into any category of regulated firms. In the recent so-called "flash crash," for example, high-frequency traders were seen as not serving the traditional specialist role of providing liquidity.

Part of the discomfort surrounding the practice of high-frequency trading is the lack of disclosures the traders provide that shed light on their finances. This opacity leads to speculation that many high frequency traders are thinly capitalized and thus susceptible to a contraction in both credit and liquidity. Furthermore, it is not evident that these firms are subject to meaningful oversight. These unknowns raise serious questions about the ability, not to mention their willingness, of HFTs to maintain fair and orderly markets, particularly in periods of volatility.

2. *Lack of regulatory oversight*

As opposed to holding themselves out as a type of new liquidity-creating "specialist," high-frequency traders instead operate in the manner of a broker-dealer without any concomitant checks in terms of the adequacy of the capital underlying their activities. Currently, HFTs have arrangements with their broker-dealers that give them direct access to the exchanges, but without any of the controls or regulations required of their broker-dealers. Thus, HFTs can bypass the brokerage control systems and trade quicker than most other traders.

 These firms regularly argue that they should be afforded special regulatory treatment in the same manner given to specialists because they help make markets more efficient. However, along with their special treatment, specialists also had an obligation to make markets for certain securities, an obligation that high-frequency traders do not have. Moreover, exchanges used to monitor capital balances and equity positions of specialists, safeguards which do not exist for HFTs.

We believe that having certain regulatory or market advantages should be balanced with obligations on the part of these firms, such as transparency and capital requirements. This would

remove an uneven regulatory playing field while simultaneously responding to questions of market safety.

3. *Potential risks to the market and investors*

We do have concerns about the effect of high-frequency trading on the long-term investor, as well as on the markets, in general. However, our concerns focus primarily on the costs associated with the execution of smaller trades, as well as the potential risks stemming from the lack of disclosure about this new area (are there dangers that have not been assessed yet because not enough is known?), the effect on the market from the use of the same or similar algorithms, and the potential for errors.

The lack of transparency and uncertainty about the "stability" of high-frequency trading also raises substantial concerns about the potential effect of such trading on the markets in the event of a crisis. In a "normal" environment, actions of HFTs may have little detrimental or long-term effect. But we are concerned about the large percentage of trading accounted for by high-frequency traders and the substantial risk to the stability of the system if the majority of traders are using algorithms/programs with similar assumptions and trading strategies.

Moreover, we are concerned further by the potential for mistakes to affect markets. Specifically, given the numbers of orders placed daily through high-frequency traders, the distortion on the market that could result from these errors and the resulting increased volatility could have lasting effects on market confidence.

On a practical level, we believe that high-frequency trading may prove costly to the average investor who invests through large mutual funds. Given that HFT transactions typically execute small orders, it follows that there are higher and/or disproportionate associated costs to longer-term investment funds that must pay additional trading fees to execute many small trades to deal with large positions.

Co-location services

U.S. markets have long operated on the principle of allowing participants to gain access to information on an equal footing. The vibrancy of markets also depends on competition, where some firms succeed through strong research and development and others gain advantages through investments in technology. It is with this perspective in mind that we have concluded that on its face, co-location services are permissible, but only so long as they are provided through a system of equal access to all market participants.

At the same time, we are concerned about exchanges permitting high-speed data access for those firms willing to use faster connections, such as firm-supplied T3 lines, than the exchange uses to deliver its trading data to the general public. On this issue, we believe that Exchanges should only provide such high-speed communications links if they are willing to provide similar speed

to all market participants. Such high-speed access permits advantages based on the speed at which the data emerges from the Exchange servers, not the speed at which the data is processed.

Undisplayed Liquidity (Dark Pools)

We appreciate the purported correlation between the growth of high-frequency trading and the growth of dark pools. In contrast to its relative comfort level with high-frequency trading, however, the CMPC expressed serious concerns about the structure and extent of dark pools, particularly with respect to their effect on market transparency and price discovery. Likewise, 76 percent of respondents to the Survey indicated that trades executed through dark pools have a negative effect on price discovery for displayed markets. These concerns are enhanced by the increasingly blurred lines between lit and unlit markets.

Our concerns have increased as we have watched the nature of dark pools evolve. As originally designed, dark pools were used to disguise large block orders by breaking them into smaller, parent-child orders, and thus avoiding alerting the market to impending large trades which would have produced a significant market effect. Dark pools also had the effect of averting the ability of broker-dealers to front-run their clients' orders.

Today, however, the original purpose of dark pools has been replaced as traders have used these venues to execute smaller orders to avoid disclosure and transparency requirements. Research consultant Mondo Visione recently released data showing that the value of orders trading on 14 of the top exchanges worldwide has decreased on average by 50% in five years. And whereas proprietary trading and internalization once served as the main source for undisplayed liquidity, dark pools have not only added to the supply of unlit liquidity, but have surpassed those other sources. As a consequence, exchanges now own their own dark pools in order to recapture large orders from external dark pools.

While forcing all orders to trade through central markets may discourage the competition that ultimately drives efficiency and better prices for market participants, the salient issue is at what point does this balance start to "tip" by injecting too much risk into the system as markets become more fragmented. The use of dark pools may actually bring efficiency to the markets by using electronic market algorithms vs. working block orders manually. On the other hand, the additional post-trade costs from having to executive a larger number of small trades may undo those benefits.

Finally, the increase in order flow going through dark pools raises questions about their effect on price discovery and the reliability of publicly displayed price quotes. Firms trading through these venues benefit from prices displayed on lit markets, but do little to support the pricing.

We are aware of the SEC's recent proposals to stem the decline in trade sizes coming from unlit markets. By restricting the use of unlit markets only to large orders, the Commission believes this could benefit investors through reduced transaction costs and increased price transparency.

Trade-At Rule

In response to market changes, the SEC has proposed a trade-at-rule that would prevent an HFT, a broker-dealer, or any other trader to meet or beat the NBBO unless it had posted a bid or offer at that price for at least a brief period prior to a trade. Under current rules, firms are permitted to meet or beat the NBBO without having displayed any orders at or above that price, leading many such orders to trade at prices that provide as little as $1/100^{th}$ of a cent in price improvement.

In a letter submitted to the Commission in January, CFA Institute expressed concern about such trades, suggesting that they created a number of potential problems for markets. These problems included:

- Negative effects on the willingness of investors and market makers to submit limit orders;
- Negative effects on price discovery as a consequence of investors refraining from submitting limit orders; and

We strongly support imposition of the kind of trade-at rule proposed by the Commission as we believe it would promote public price discovery by reducing the ability of certain traders to undermine the NBBO. We also believe that this rule could limit the advantage gained by diverting marketable orders to undisplayed trading centers. That broker-dealers route customer market orders to OTC market makers often compromises public price discovery and discourages liquidity providers. Returning order flow to displayed trading centers will help provide incentives for liquidity providers to place passive orders.

Finally, we raised concerns about how unlit orders were "stepping in front of" displayed orders, thus undermining the viability of market makers and the effects of these circumstance may have on market liquidity, particularly in falling markets. We recognize that the primary sources for these concerns are the actions of systematic internalizers and entities trading through dark pools. As noted in our 6 January 2010 letter, such actions reduce the willingness of market makers to provide liquidity at critical times, such as when buy orders are in short supply during market sell-offs. We believe the proposed trade-at rule should help remedy most of these concerns.

Conclusion

We appreciate the Commission's decision to consider the issues raised in this Concept Release. Should you have any questions about our positions, please do not hesitate to contact Kurt N. Schacht, CFA at kurt.schacht@cfainstitute.org or 212.756.7728; or Linda L. Rittenhouse at linda.rittenhouse@cfainstitute.org or 434.951.5333.

Sincerely,

/s/ Kurt N. Schacht   /s/ Linda L. Rittenhouse

Kurt N. Schacht, CFA   Linda L. Rittenhouse
Managing Director,   Director, Capital Markets Policy
CFA Institute   CFA Institute

Appendix

SEC Concept Release on Equity Market Structure

Analysis of Market Quality Metrics

Market quality metrics have been analysed for a random sample of 100 stocks listed on the NYSE, drawn from the constituents of the S&P 500 Index. The metrics examined comprise 1) volatility (a function of liquidity and market confidence); and 2) bid-ask spreads (a measure of liquidity and indirect trading costs). To supplement these metrics, we have examined 3) the relation between volatility and bid-ask spreads; and 4) the relation between volatility and trading volumes.

In each case, the analysis has been conducted over a near six-year period, spanning from 1st April 2004 to 29th January 2010. Within this period, the metrics have been analysed and compared over two equal time windows. Each time window comprises 734 trading days either side of 5th March 2007 – the 'trading phase' date for Regulation NMS[4]. Accordingly, 'Period 1' spans from 1st April 2004 to 4th March 2007; and 'Period 2' spans from 5th March 2007 to 29th January 2010.

1) Volatility

Two measures of volatility have been analysed: i) standard deviation of daily returns; and ii) ratio of standard deviation of monthly returns to standard deviation of daily returns (referred to as the 'standard deviation ratio').

i) Standard deviation of daily returns

For each of the 100 stocks sampled, the daily return (excluding dividends) has been calculated on each trading day in the period. The standard deviation of daily returns has then been calculated for Period 1 and Period 2, respectively. Secondly, non-systematic stock returns[5] have been calculated on each trading day and the standard deviation of these returns has also been calculated for Periods 1 and 2, respectively.

The results show that the standard deviation of daily returns has increased over the two periods for each stock sampled. In the case of non-systematic returns, shown in **Appendix A.1**, the standard deviation has increased for 99 stocks in the sample. The difference in standard deviation between the two periods is statistically significant for approximately 90% of the sample (all but the smallest changes in standard deviation of non-systematic returns are statistically significant).

The increase in volatility can be seen in **Figure 1**, which shows the daily percentage price change for the S&P 500 Index. The dividing line corresponds to 5th March 2007, which splits the data into two equal periods.

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[4] The 'trading phase' date of 5th March 2007 relates to the beginning of the phased-in compliance with Rule 611 (Order Protection Rule) and Rule 610 (Access Rule).
[5] Calculated as the difference between the individual stock return and the market return, where the market return is taken as the return on the S&P 500 index excluding dividends.

Figure 1

S&P 500 Index - Daily Return %
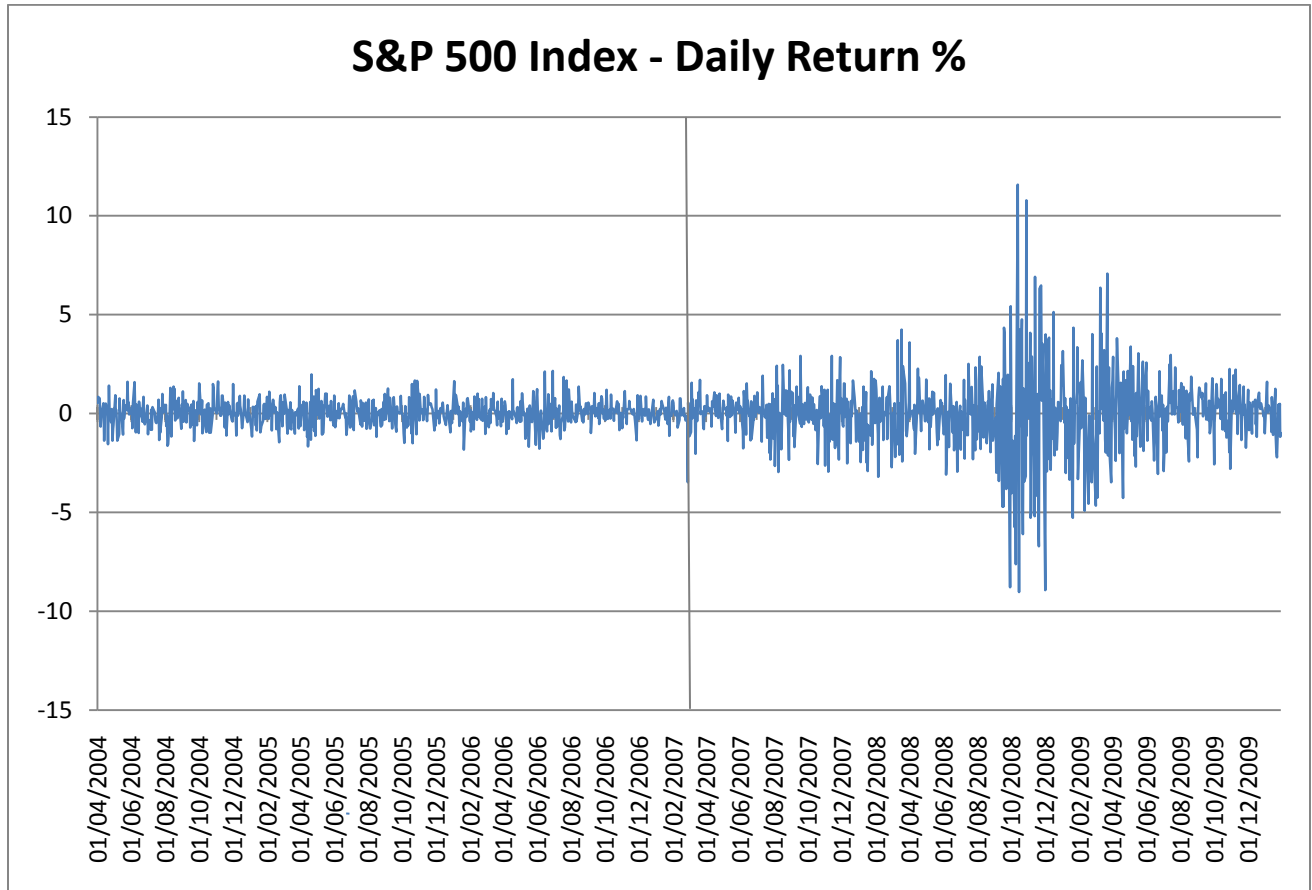
It is notable that the higher volatility in Period 2 coincides with the timing of systemic events related to the financial crisis. The variability of returns begins to pick-up in the summer of 2007, before increasing significantly in the fourth quarter of 2008 following the collapse of Lehman Brothers. In the second half of 2009, volatility subsides, although it remains elevated compared to Period 1. This trend is consistent with the trends exhibited globally amongst other major equity markets, as shown in **Appendix A.2**.

The pattern of volatility exhibited in Figure 1 therefore indicates that systemic events are at least partly accountable for the higher individual stock volatility in Period 2. In order to attempt to identify whether the increase in volatility is also structural, we examine standard deviation ratios of long-term to short-term volatility measures.

ii) Standard Deviation Ratio

For each stock sampled, daily non-systematic returns have been calculated (as specified in part (i)) for each day in the period under review, along with monthly non-systematic returns[6]. The standard deviation (σ) has then been calculated for both daily and monthly non-systematic returns, for both Periods 1 and 2. The 'standard deviation ratio' has simply been calculated as the ratio of the two metrics, using superscripts 'm' and 'd' to denote 'monthly' and 'daily', respectively:

$$Std.Dev.Ratio = \frac{\sigma[r(i)^m - r(M)^m]}{\sigma[r(i)^d - r(M)^d]}$$

The rationale for this type of analysis is set out in the SEC's *Report on the Comparison of Order Executions Across Equity Market Structures* (2001)[7], which states (p.17-18):

"In efficient markets, the return variance measured over any time interval should be proportional to the length of the interval (i.e., the longer the time interval, the greater the expected return variance). Market inefficiencies… will all tend to cause return reversals. The tendency of relatively high (low) returns to be followed by relatively low (high) returns is called negative serial autocorrelation…In the presence of negative serial autocorrelation of returns, the observed variances over shorter time intervals (such as days) can be greater than one would predict given the observed variances over longer time intervals (such as weeks or months). In other words, the greater the extent of return reversals in a particular market, the more likely that short-term return variances will be greater in relation to long-term return variances."

In other words, the smaller is the variance or standard deviation ratio, the greater is the daily volatility relative to the monthly volatility, hence the greater likelihood of negative serial correlation – or market inefficiency - in daily returns.
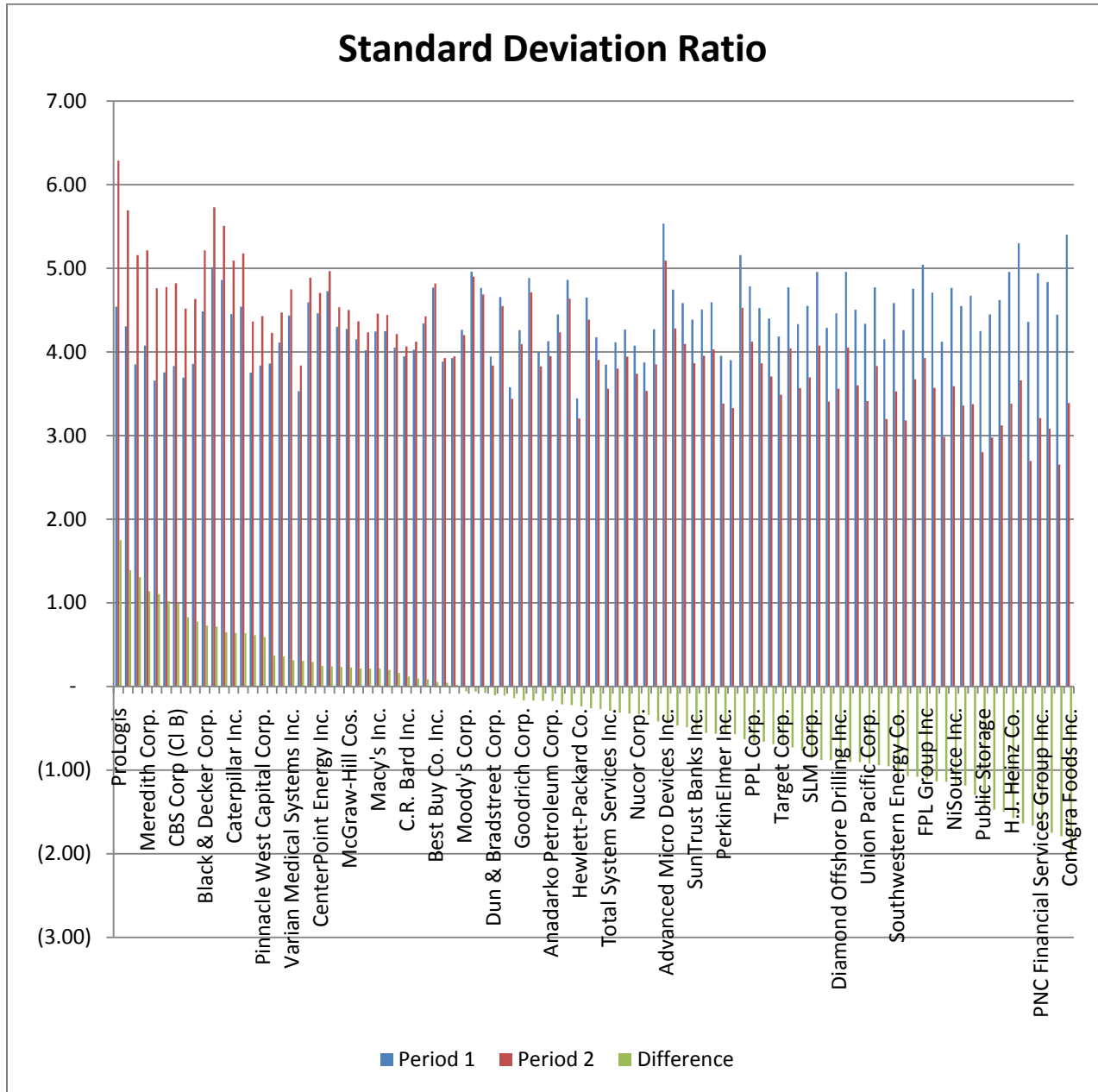
The standard deviation ratio has been presented for both Period 1 and Period 2, for each of the 100 stocks sampled, in **Appendix A.3**. Whilst both monthly and daily return volatility has increased, the volatility *ratio* has decreased over the two periods for 64 stocks in the sample. Therefore, for those 64 stocks, the standard deviation of daily returns (denominator) has increased proportionately more than the standard deviation of monthly returns (numerator), thus reducing the value of the ratio in Period 2 compared to Period 1. This means that the market is becoming more volatile over a short time horizon.

The standard deviation ratios for both Periods are illustrated in **Figure 2**. The green bar represents the change in the ratio between the two periods. We can see that the 64 stocks to the right-hand side of the chart have experienced a fall in the standard deviation ratio, indicating an increase in short-term volatility relative to longer-term volatility.

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[6] Calculated as the monthly return on stock *i* minus the monthly return on the market, taken as the S&P 500 Index. Monthly non-systematic returns have been calculated on each trading day in the period, such that there are an equal number of observations used in the standard deviation calculation for both daily and monthly returns.

[7] Office of Economic Analysis, United States Securities and Exchange Commission, "Report on the Comparison of Order Executions Across Equity Market Structures", January 2001, pp.17-20.

Figure 2

Standard Deviation Ratio — chart showing Period 1, Period 2, and Difference values for various companies including ProLogis, Meredith Corp., CBS Corp (Cl B), Black & Decker Corp., Caterpillar Inc., Pinnacle West Capital Corp., Varian Medical Systems Inc., CenterPoint Energy Inc., McGraw-Hill Cos., Macy's Inc., C.R. Bard Inc., Best Buy Co. Inc., Moody's Corp., Dun & Bradstreet Corp., Goodrich Corp., Anadarko Petroleum Corp., Hewlett-Packard Co., Total System Services Inc., Nucor Corp., Advanced Micro Devices Inc., SunTrust Banks Inc., PerkinElmer Inc., PPL Corp., Target Corp., SLM Corp., Diamond Offshore Drilling Inc., Union Pacific Corp., Southwestern Energy Co., FPL Group Inc, NiSource Inc., Public Storage, H.J. Heinz Co., PNC Financial Services Group Inc., ConAgra Foods Inc.

Sources: FactSet, CFA Institute calculations

Whilst short-term volatility (by all measures) has increased in the post-Regulation NMS period, it is difficult to isolate the structural factors causing this phenomenon. Indeed, it is likely that technological factors, global competitive forces, and innovation in trading methods are at least as likely to account for these developments as regulation.

2) Bid-ask spreads

Quoted bid-ask spreads[8] have been calculated for each of the 100 stocks sampled on each trading day in the period under review.

The results are illustrated in **Appendix B.1**, which shows the mean bid-ask spread for each stock sampled in Periods 1 and 2, respectively. The results indicate that 81 out of the 100 stocks sampled have experienced a reduction in mean spreads, 77 of which are statistically significant. These findings show that, despite the increase in volatility over the full review period, at least one measure of liquidity has improved on average. In other words, the reduction in average spreads reflects a resilient market structure.

To supplement these findings, the market value-weighted average spread for the portfolio of 100 stocks has been calculated on each trading day in order to determine the aggregate trend in spreads over the period. The weighted average spread on any day t is given by:

$$Weighted\ Avg.Spread = \sum_{\forall i} \left\{ \frac{MV_{i,t}}{\sum_{i=1}^{n} MV_{i,t}} \right\} . S_{i,t}$$

where:

$MV_{i,t}$ = market value (in dollars) of stock i on day t;

$S_{i,t}$ = quoted bid-ask spread (in dollars) for stock i on day t; and

n = 1,…,100 stocks.

The weighted average spread for the portfolio is illustrated in **Figure 3** below:

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[8] Based on closing quotes. The absolute value of the spread based on closing quotes is likely to be greater than the value based on average spreads through the trading day, given intra-day trading patterns and the level of activity around the close. However, it is the trend in spreads over time rather than the actual size of the spread that primarily matters here.

Figure 3

Weighted Avg. Bid-Ask Spread - U.S. Stocks
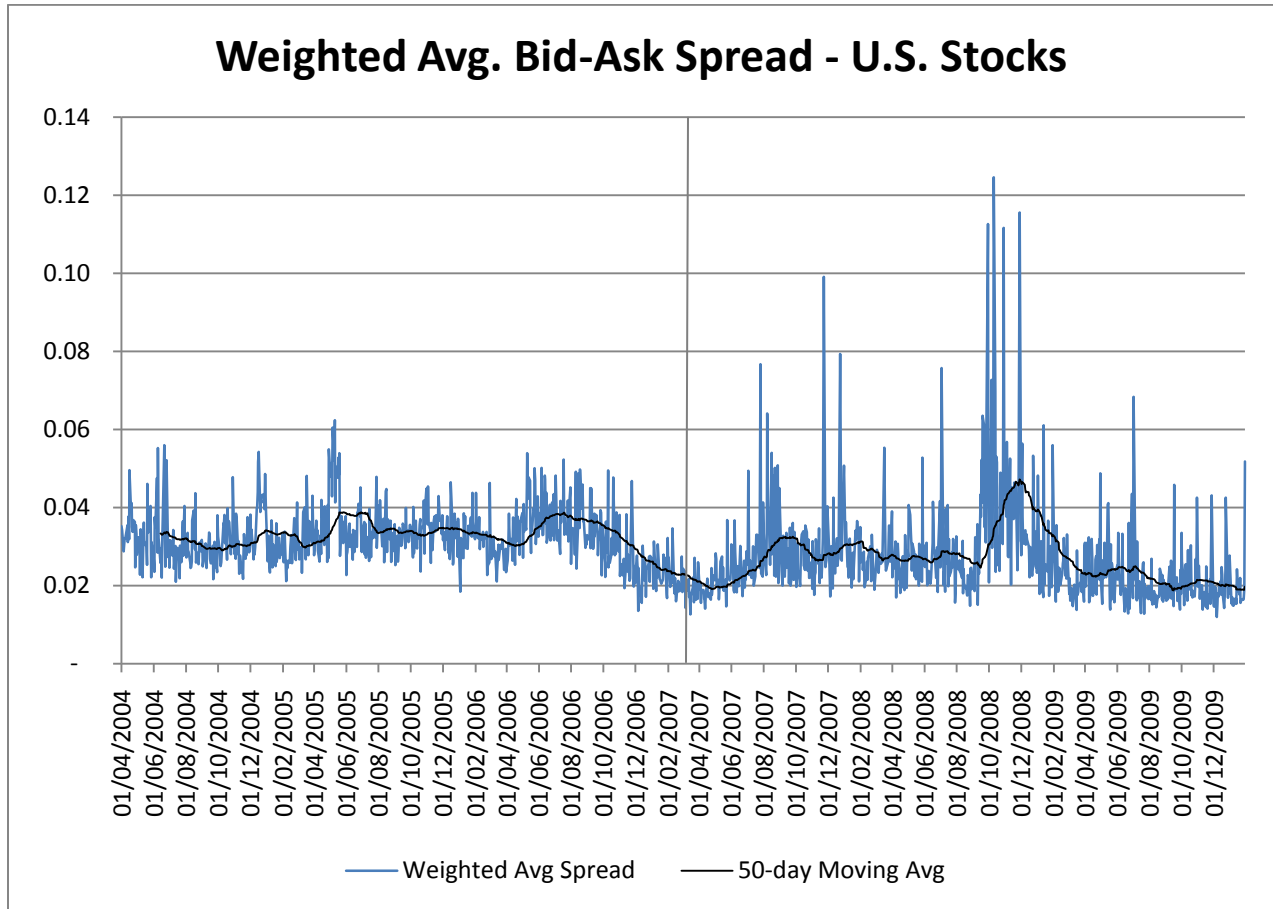
Sources: FactSet, CFA Institute calculations

The chart shows that bid-ask spreads have remained fairly stable through Period 1, with the 50-day moving average spread ranging between 2 and 4 cents. This trend continues into Period 2 until the fourth quarter of 2008, where spreads spike upwards in response to the market crisis triggered by the default of Lehman Brothers. The higher level and variability of bid-ask spreads, which peak above 12 cents, reflect the collapse in investor confidence and reduction in liquidity around this time. As markets stabilized in 2009, spreads trend downwards again, with the 50-day moving average spread drifting below 2 cents by the end of the period.

Consistent with the preceding volatility analysis, the variability of spreads is visibly greater in Period 2 compared to Period 1. However – as reflected in the disaggregated results in Appendix B.1 – average spreads have fallen over the two periods. The mean spread for the portfolio is 2.7 cents in Period 2 compared to 3.2 cents in Period 1, a decline of approximately 18%[9].

The reduction in average bid-ask spreads over this period may be explained by (among others) greater competition between trading venues and market participants, and technological innovation. In

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[9] The difference is statistically significant at the 5% level.

particular, improvements in technology and connectivity have led to a reduction in latency, which helps to reduce dealers' inventory risk and thereby improve liquidity. High Frequency Trading can have a similar effect on spreads (a greater number of transactions means the same profits can be made from smaller spreads).

However, the smaller average transaction sizes that have arisen from the dominance of technology-driven trading may increase other transaction costs if it becomes necessary to complete more trades to fill a client order. It is likely that this trend has fuelled the growth in popularity of dark pools. The growth in technology-driven trading (and simultaneously the growth in dark pools) may also be a factor contributing to the increase in volatility if the smaller sizes being transacted reduce the depth at each pricing point, thereby leading to thinner markets.

3) Relation between Volatility and Bid-Ask Spreads

The SEC's Concept Release, under Section A.1.a, p.40-41, discusses the effect of broad economic forces on market quality metrics and refers to the Chicago Board Options Exchange Volatility Index ("VIX")[10].

A ten-year chart of the VIX is presented below:

Figure 4
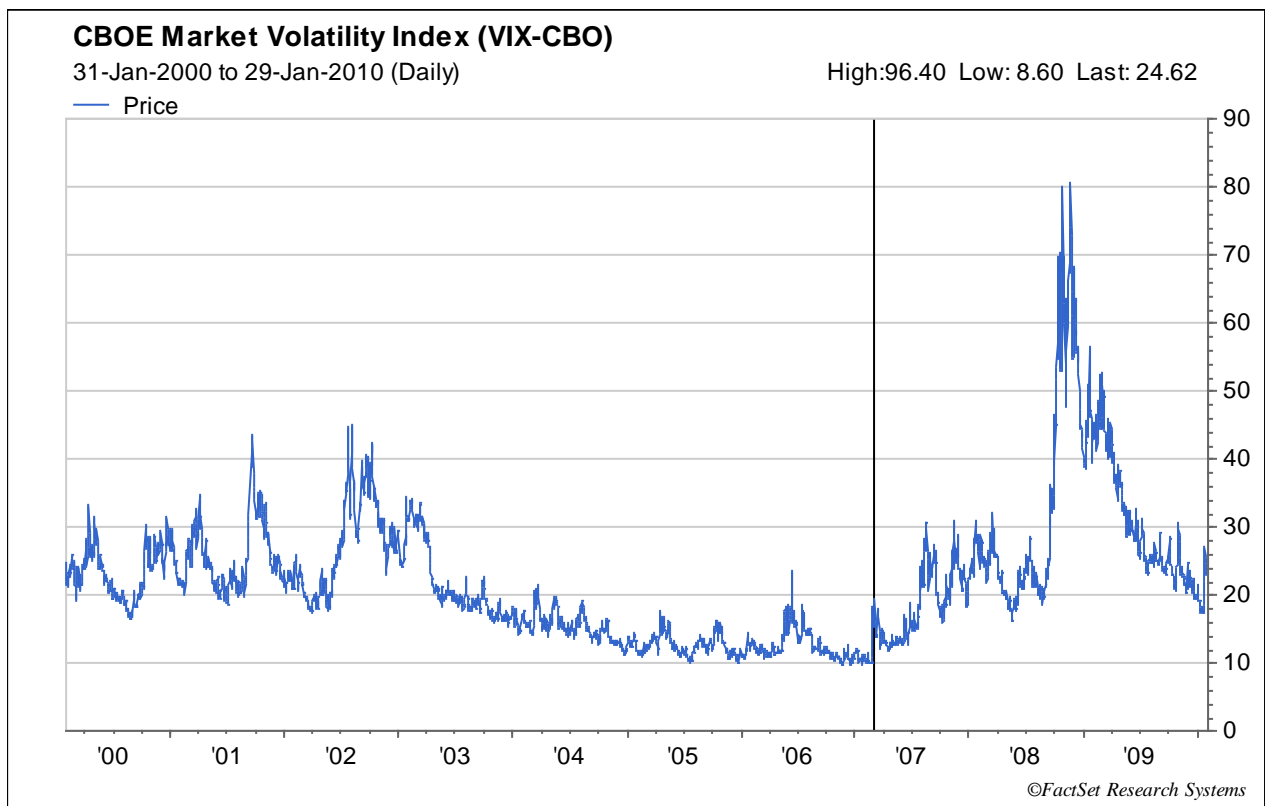
Source: FactSet

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[10] The VIX measures the implied 30-day volatility of S&P 500 Index options contracts. As such, it provides an estimate of the market's expectation of volatility for the S&P 500 Index.

In accordance with the discussion in the Concept Release, the relationship between the VIX and bid-ask spreads has been examined over time.

The weighted average spread for the portfolio of 100 stocks and the level of the VIX have been rebased[11] and compared over the period under review. The rebased series each start at 100, facilitating analysis of the extent of co-movement over time. The series are illustrated in **Figure 5** below. The blue line shows the rebased bid-ask spread for the portfolio; the violet line represents the rebased VIX. The trend lines represent the respective 200-day moving averages.

Figure 5
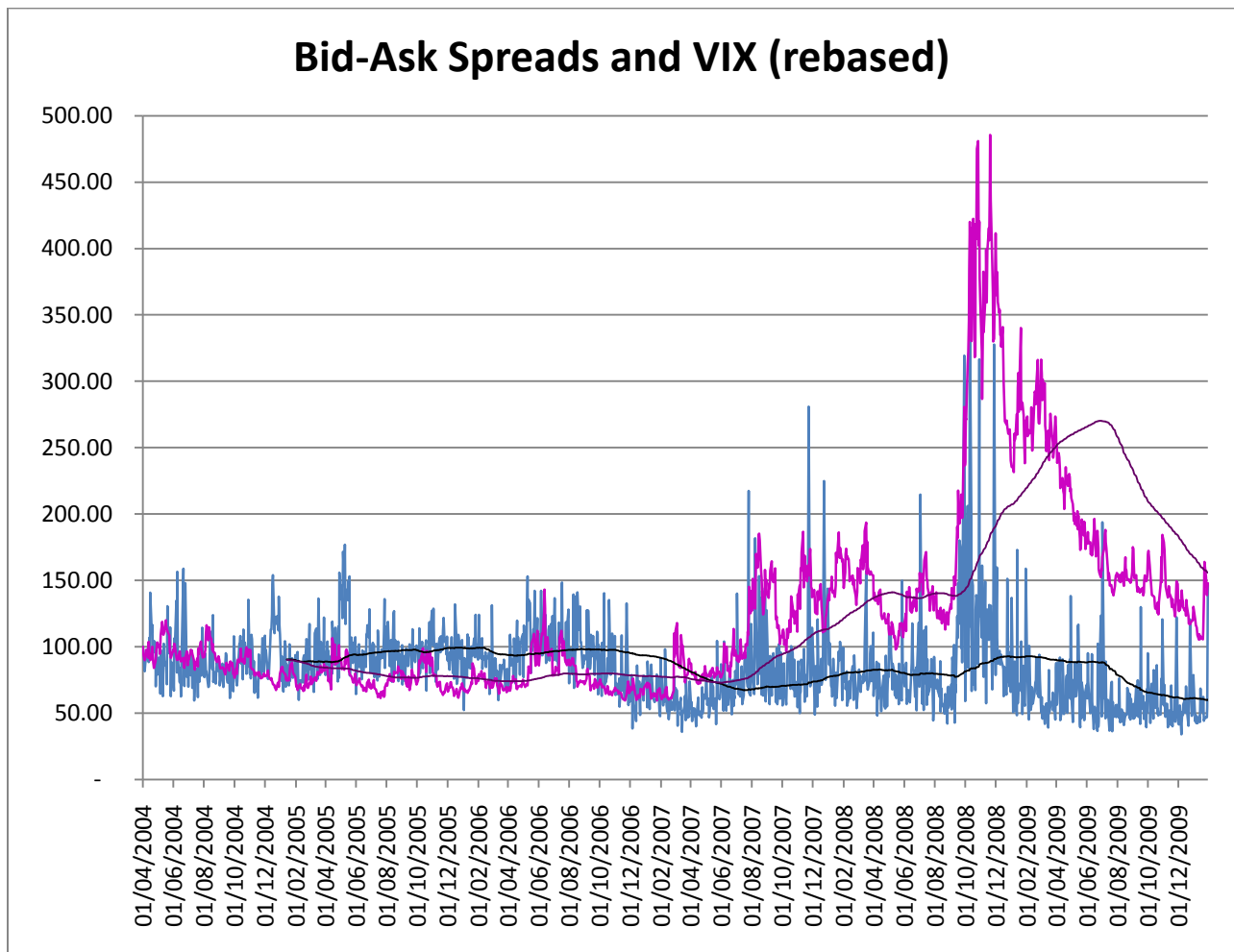
Sources: FactSet, CFA Institute calculations

The chart shows that, prior to the beginning of the credit crisis in the summer of 2007, trends in bid-ask spreads and the VIX were closely related, with movements in each series generally following the same pattern. Thereafter, there is some dislocation in the relationship. In June 2007, the 200-day moving averages cross, from which point the VIX trends markedly upwards whilst the trend in spreads remains

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[11] 1st April 2004 = 100.

muted. Even after spreads normalize, the VIX remains elevated, despite its downward trend through 2009.

The normalization of spreads suggests that, despite the investor uncertainty manifested by the high level of the VIX through this period, the underlying market structure is robust. To illustrate this point, the VIX 200-day moving average at the end of the period remains above the level of the index at the start of the period; whilst the 200-day moving average spread is below its level at the start of the period.

In short, spreads have fallen to their lows for the period under review, even though volatility remains elevated. This indicates that the market structure is robust in providing tighter spreads for investors, spurred by competition, decimal pricing, and electronic order flow.

4)   Relation between Volume and Volatility

The volume of shares traded for each of the stocks sampled has been obtained for each trading day in the period under review. Individual volumes have been summed to give the total volume for the portfolio of 100 stocks on each trading day.

The total volume has been plotted in **Figure 6** below, using rebased values[12] (analogous to the preceding analysis). This allows a comparison with movements in volatility, measured by the (rebased) VIX, over the period under review. The green line represents the total volume for the portfolio, whilst the violet line represents the VIX. The trend lines depict the 200-day moving averages for each series.

Figure 6

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[12] 1st April 2004 = 100

Volume and Volatilty (rebased)
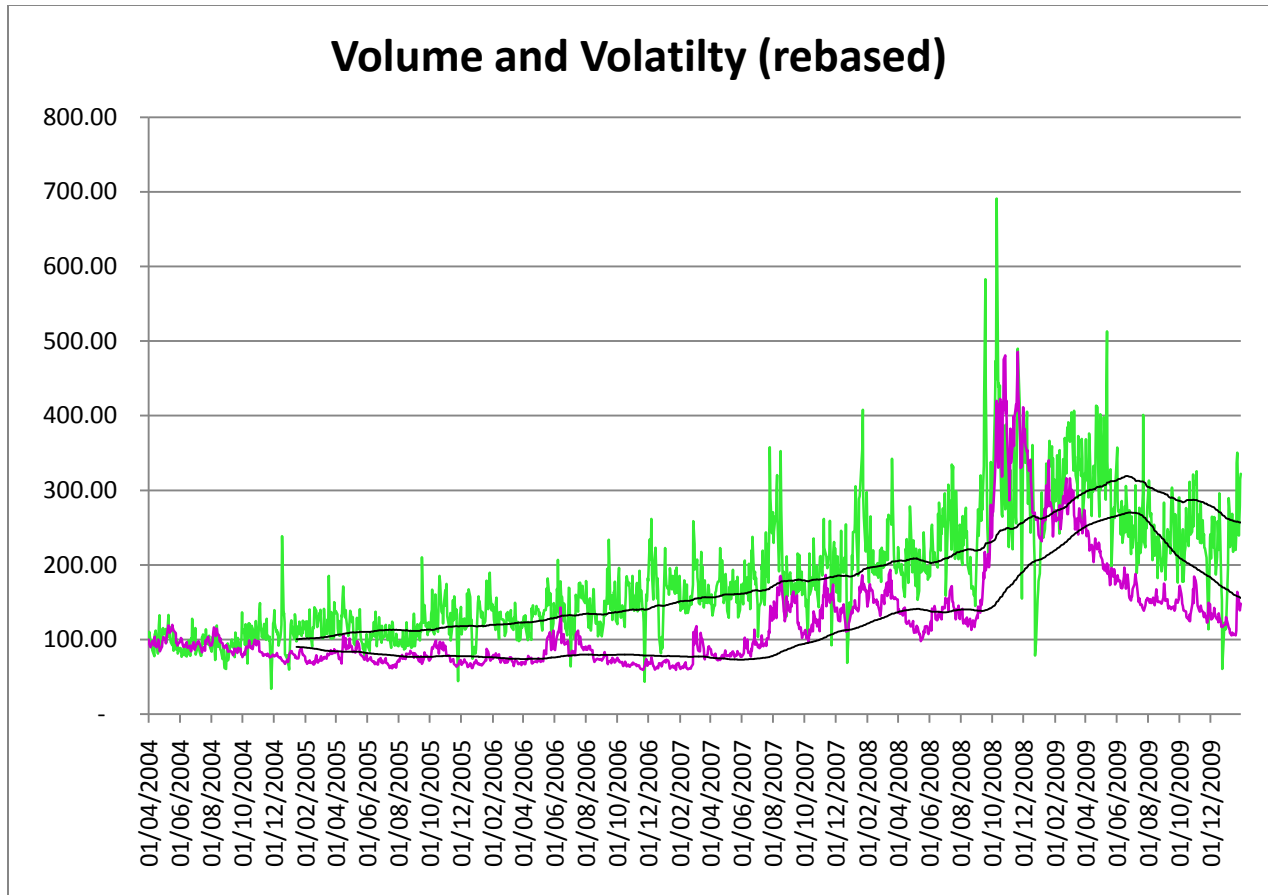
The chart shows an upward trend in volume over the period, peaking following the market crisis in the fourth quarter of 2008. The volume trend line follows broadly the same movements as the VIX trend line, although the growth in volume is more stable.

These patterns reinforce the view that electronic trading and greater automation in the trading process have led to greater volumes of shares being transacted.

Appendix A.1

The table below shows the standard deviation of non-systematic stock returns. The difference in standard deviation between the two periods is statistically significant[13] for the 88 largest observations (according to difference in standard deviation).

Stock	Std. Dev. [r(i) - r(M)]		
	Period 1	Period 2	Difference
ProLogis	1.18%	5.89%	4.71%
SLM Corp.	1.24%	5.32%	4.08%
Morgan Stanley	1.04%	4.85%	3.82%
Principal Financial Group Inc.	0.84%	4.64%	3.80%
SunTrust Banks Inc.	0.71%	4.51%	3.80%
State Street Corp.	1.08%	4.15%	3.07%
PNC Financial Services Group Inc.	0.79%	3.73%	2.95%
Tenet Healthcare Corp.	2.05%	4.42%	2.38%
AFLAC Inc.	1.02%	3.37%	2.35%
Equity Residential	1.05%	3.39%	2.34%
U.S. Bancorp	0.72%	3.02%	2.30%
New York Times Co. (Cl A)	1.12%	3.34%	2.22%
Ford Motor Co.	1.81%	3.95%	2.14%
Simon Property Group Inc.	1.16%	3.29%	2.14%
D.R. Horton Inc.	2.05%	4.15%	2.10%
Massey Energy Co.	2.38%	4.47%	2.09%
CBS Corp (Cl B)	1.14%	3.08%	1.94%
Macy's Inc.	1.42%	3.21%	1.78%
Interpublic Group Of Cos.	1.31%	3.02%	1.70%
AvalonBay Communities Inc.	1.08%	2.76%	1.68%
Cummins Inc.	1.46%	3.04%	1.58%
Ventas Inc.	1.30%	2.84%	1.54%
Moody's Corp.	1.23%	2.72%	1.49%
Flowserve Corp.	1.39%	2.84%	1.44%
Public Storage	1.17%	2.60%	1.44%
CIGNA Corp.	1.57%	3.00%	1.43%
SUPERVALU Inc.	1.20%	2.54%	1.34%
Whirlpool Corp.	1.39%	2.70%	1.31%
Newell Rubbermaid Inc.	1.16%	2.37%	1.21%
McGraw-Hill Cos.	1.03%	2.17%	1.14%
Meredith Corp.	0.98%	2.10%	1.13%
Peabody Energy Corp.	2.52%	3.61%	1.09%
International Game Technology	1.63%	2.65%	1.03%
Advanced Micro Devices Inc.	2.79%	3.79%	1.00%
Republic Services Inc.	0.92%	1.88%	0.97%
Black & Decker Corp.	1.29%	2.25%	0.96%
Deere & Co.	1.39%	2.27%	0.89%
Pepsi Bottling Group Inc.	1.07%	1.94%	0.87%
Time Warner Inc.	0.89%	1.76%	0.87%
Target Corp.	1.17%	2.03%	0.86%
ConAgra Foods Inc.	0.97%	1.83%	0.86%
Qwest Communications International Inc.	2.09%	2.94%	0.85%
Union Pacific Corp.	1.11%	1.92%	0.81%

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[13] Based on an F-test at the 1% level of significance.

FirstEnergy Corp.	0.91%	1.72%	0.81%
FPL Group Inc	0.89%	1.69%	0.80%
CSX Corp.	1.32%	2.10%	0.79%
Nicor Inc.	0.76%	1.53%	0.77%
Gap Inc.	1.40%	2.15%	0.76%
PPL Corp.	0.96%	1.71%	0.75%
Polo Ralph Lauren Corp.	1.52%	2.25%	0.72%
PepsiCo Inc.	0.76%	1.48%	0.72%
Anadarko Petroleum Corp.	1.66%	2.37%	0.71%
Becton Dickinson & Co.	1.02%	1.72%	0.70%
Baker Hughes Inc.	1.76%	2.45%	0.69%
Home Depot Inc.	0.97%	1.65%	0.69%
Kroger Co.	1.21%	1.89%	0.68%
NiSource Inc.	0.83%	1.52%	0.68%
Eastman Chemical Co.	1.23%	1.90%	0.67%
Hormel Foods Corp.	1.18%	1.85%	0.67%
Wal-Mart Stores Inc.	0.89%	1.55%	0.67%
Southwestern Energy Co.	2.74%	3.40%	0.66%
Pinnacle West Capital Corp.	0.84%	1.49%	0.65%
AutoZone Inc.	1.28%	1.93%	0.64%
Dun & Bradstreet Corp.	0.95%	1.59%	0.64%
Abbott Laboratories	1.05%	1.68%	0.63%
Kimberly-Clark Corp.	0.80%	1.41%	0.61%
Nucor Corp.	2.19%	2.80%	0.61%
H.J. Heinz Co.	0.78%	1.38%	0.60%
Emerson Electric Co.	0.83%	1.43%	0.60%
Occidental Petroleum Corp.	1.62%	2.21%	0.59%
Apache Corp.	1.67%	2.23%	0.56%
Leggett & Platt Inc.	1.27%	1.82%	0.55%
Abercrombie & Fitch Co. (Cl A)	2.07%	2.62%	0.55%
PerkinElmer Inc.	1.56%	2.10%	0.55%
C.R. Bard Inc.	1.22%	1.75%	0.53%
CenterPoint Energy Inc.	1.08%	1.61%	0.53%
Burlington Northern Santa Fe Corp.	1.31%	1.83%	0.51%
AmerisourceBergen Corp.	1.27%	1.78%	0.51%
Quest Diagnostics Inc.	1.22%	1.73%	0.51%
Caterpillar Inc.	1.36%	1.83%	0.48%
Estee Lauder Cos. (Cl A)	1.47%	1.94%	0.46%
Omnicom Group Inc.	0.96%	1.35%	0.39%
McDonald's Corp.	1.12%	1.49%	0.37%
United Parcel Service Inc. (Cl B)	0.93%	1.30%	0.36%
Goodrich Corp.	1.39%	1.74%	0.35%
Walt Disney Co.	1.01%	1.35%	0.33%
Harris Corp.	1.72%	2.03%	0.31%
Exxon Mobil Corp.	1.04%	1.35%	0.31%
Western Digital Corp.	2.48%	2.75%	0.27%
Best Buy Co. Inc.	1.71%	1.98%	0.27%
Diamond Offshore Drilling Inc.	2.15%	2.37%	0.22%
Ball Corp.	1.23%	1.44%	0.21%
Varian Medical Systems Inc.	1.77%	1.97%	0.20%
Total System Services Inc.	1.57%	1.71%	0.15%
Pfizer Inc.	1.29%	1.38%	0.09%
Stryker Corp.	1.51%	1.60%	0.08%
Equifax Inc.	1.19%	1.27%	0.08%
Hewlett-Packard Co.	1.50%	1.58%	0.08%

Computer Sciences Corp.	1.54%	1.57%	0.03%
Agilent Technologies Inc.	1.69%	1.60%	-0.09%

Sources: FactSet, CFA Institute calculations

Appendix A.2

Volatility patterns amongst major equity markets are illustrated in the charts below. In each case, the daily percentage price change is shown over time for the benchmark equity index in the countries selected. The volatility patterns broadly correlate with the pattern exhibited for the S&P 500 Index (as shown in Figure 2).
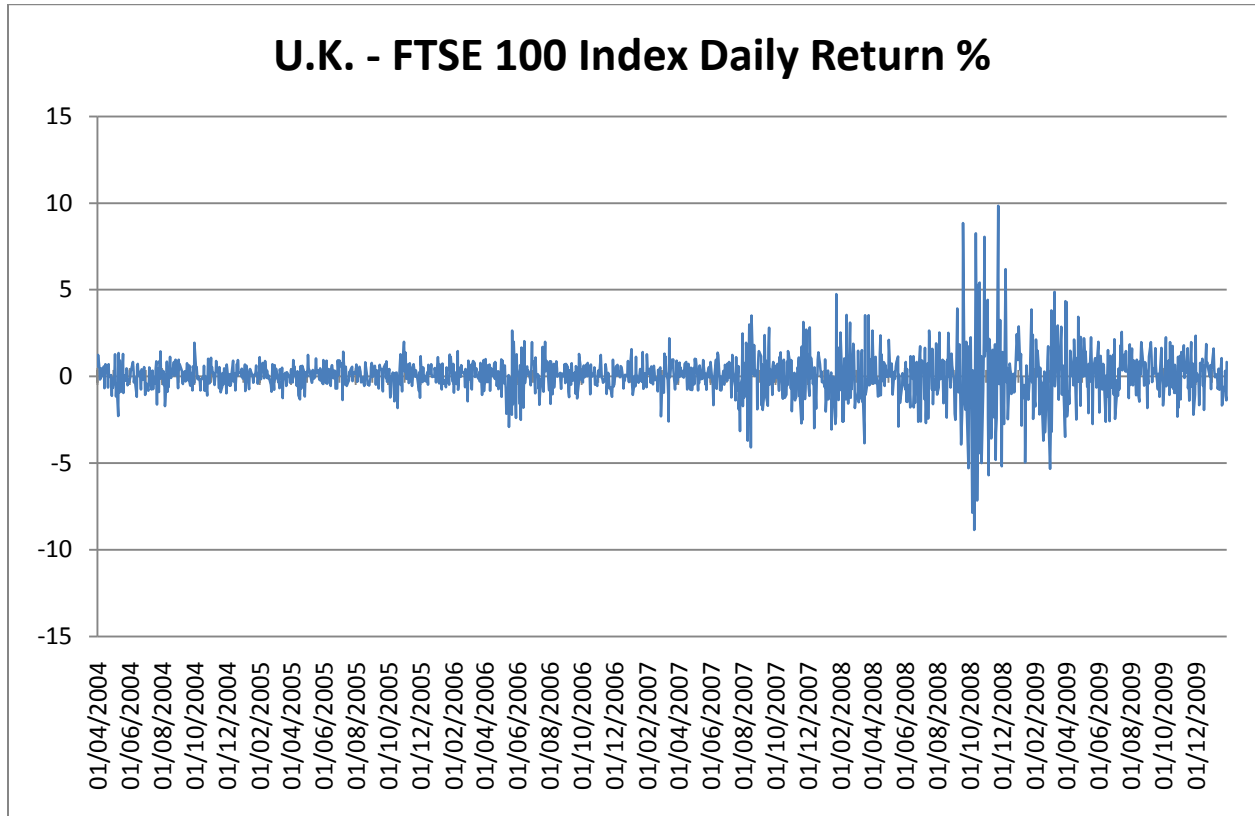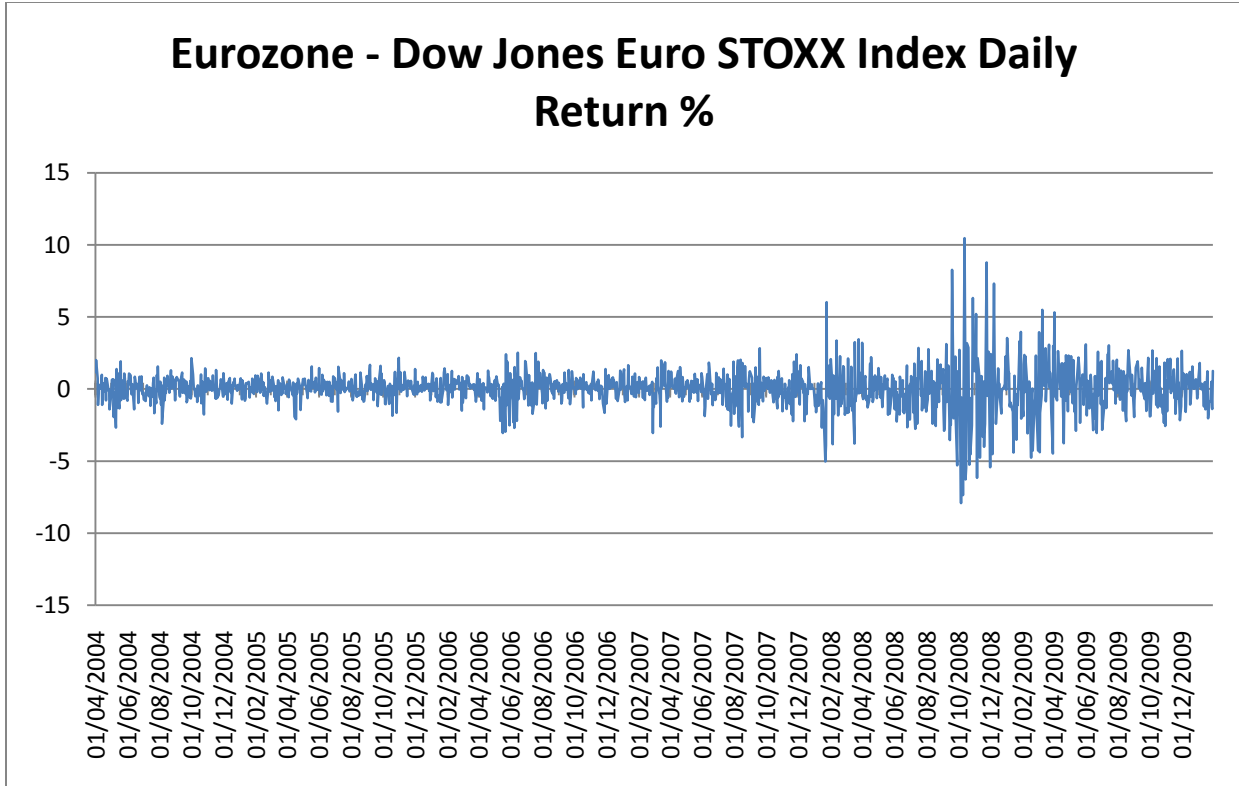
U.K. - FTSE 100 Index Daily Return %

Sources: FactSet, CFA Institute calculations

Eurozone - Dow Jones Euro STOXX Index Daily Return %

Sources: FactSet, CFA Institute calculations

Japan - Topix Index Daily Return %
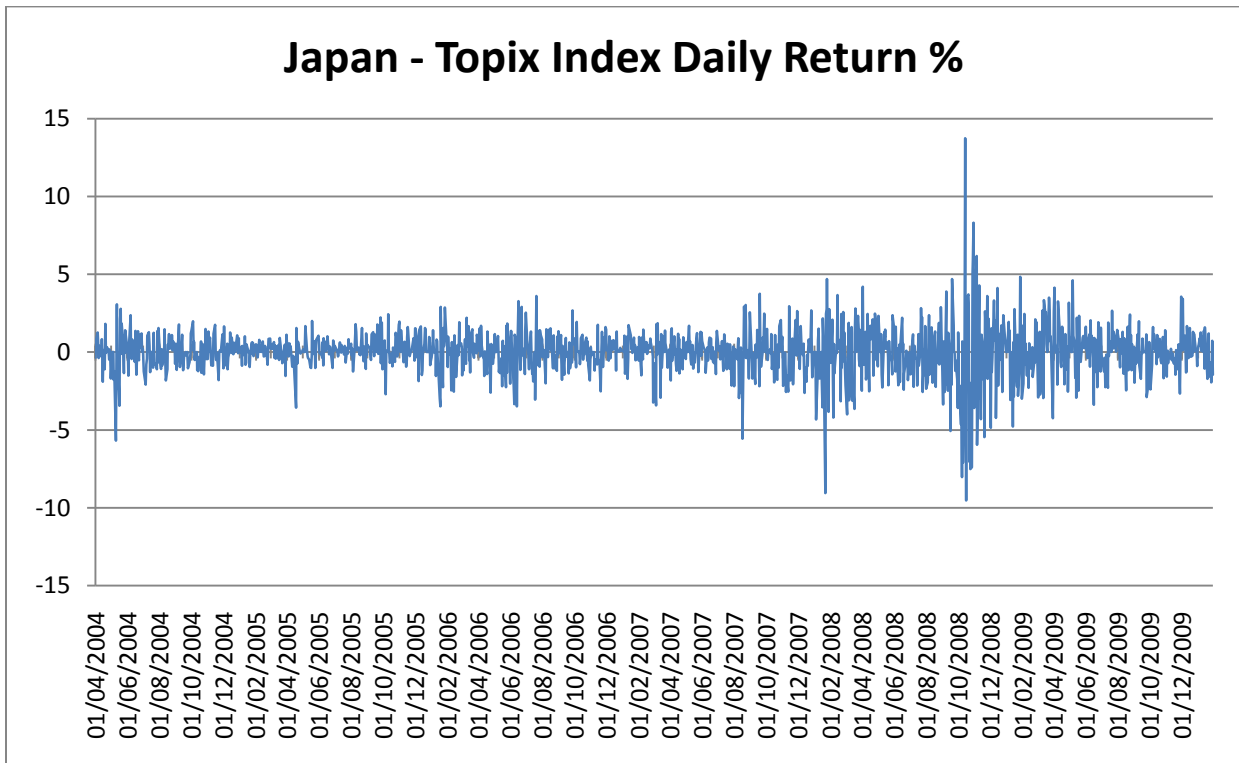
Sources: FactSet, CFA Institute calculations

Appendix A.3

The table below shows the standard deviation ratio, measured as the ratio of the standard deviation of monthly non-systematic returns to the standard deviation of daily non-systematic returns. The ratio has decreased over the two Periods for 64 out of the 100 stocks sampled.

Stock	Standard Deviation Ratio		
	Period 1	Period 2	Difference
ProLogis	4.54	6.29	1.75
Ford Motor Co.	4.30	5.69	1.39
Whirlpool Corp.	3.85	5.16	1.31
Meredith Corp.	4.08	5.21	1.14
Newell Rubbermaid Inc.	3.66	4.76	1.10
Ball Corp.	3.75	4.77	1.02
CBS Corp (Cl B)	3.83	4.82	0.99
Computer Sciences Corp.	3.69	4.52	0.83
New York Times Co. (Cl A)	3.86	4.63	0.78
Black & Decker Corp.	4.49	5.21	0.73
Tenet Healthcare Corp.	5.01	5.73	0.72
Eastman Chemical Co.	4.86	5.51	0.65
Caterpillar Inc.	4.45	5.09	0.64
SUPERVALU Inc.	4.54	5.18	0.64
Pepsi Bottling Group Inc.	3.75	4.36	0.61
Pinnacle West Capital Corp.	3.84	4.43	0.59
Polo Ralph Lauren Corp.	3.86	4.23	0.37
Harris Corp.	4.11	4.47	0.36
Varian Medical Systems Inc.	4.43	4.75	0.31
McDonald's Corp.	3.53	3.84	0.31
Massey Energy Co.	4.59	4.89	0.29
CenterPoint Energy Inc.	4.46	4.70	0.24
Agilent Technologies Inc.	4.73	4.97	0.24
Home Depot Inc.	4.30	4.53	0.23
McGraw-Hill Cos.	4.27	4.50	0.23
AutoZone Inc.	4.15	4.37	0.21
AFLAC Inc.	4.02	4.23	0.21
Macy's Inc.	4.24	4.46	0.21
Principal Financial Group Inc.	4.25	4.44	0.20
Equifax Inc.	4.05	4.21	0.16
C.R. Bard Inc.	3.95	4.06	0.12
Stryker Corp.	4.03	4.12	0.09
International Game Technology	4.34	4.42	0.08
Best Buy Co. Inc.	4.77	4.82	0.05
Kimberly-Clark Corp.	3.88	3.93	0.04
CSX Corp.	3.93	3.94	0.02
Moody's Corp.	4.26	4.20	(0.06)
Nicor Inc.	4.96	4.90	(0.06)
Leggett & Platt Inc.	4.76	4.69	(0.08)
Dun & Bradstreet Corp.	3.94	3.84	(0.11)
FirstEnergy Corp.	4.66	4.55	(0.11)
Emerson Electric Co.	3.58	3.44	(0.14)
Goodrich Corp.	4.26	4.09	(0.17)
Abbott Laboratories	4.88	4.71	(0.17)
Republic Services Inc.	4.00	3.83	(0.17)

Anadarko Petroleum Corp.	4.13	3.95	(0.18)
Pfizer Inc.	4.45	4.23	(0.22)
Exxon Mobil Corp.	4.86	4.63	(0.23)
Hewlett-Packard Co.	3.44	3.20	(0.24)
Western Digital Corp.	4.65	4.39	(0.26)
Gap Inc.	4.17	3.90	(0.27)
Total System Services Inc.	3.85	3.56	(0.29)
Becton Dickinson & Co.	4.12	3.80	(0.31)
Estee Lauder Cos. (Cl A)	4.26	3.94	(0.32)
Nucor Corp.	4.07	3.74	(0.34)
Hormel Foods Corp.	3.87	3.53	(0.34)
Apache Corp.	4.27	3.85	(0.42)
Advanced Micro Devices Inc.	5.53	5.09	(0.44)
CIGNA Corp.	4.74	4.28	(0.47)
Kroger Co.	4.58	4.10	(0.49)
SunTrust Banks Inc.	4.39	3.86	(0.52)
Deere & Co.	4.51	3.95	(0.55)
D.R. Horton Inc.	4.59	4.03	(0.57)
PerkinElmer Inc.	3.95	3.38	(0.57)
AmerisourceBergen Corp.	3.90	3.33	(0.57)
United Parcel Service Inc. (Cl B)	5.16	4.53	(0.63)
PPL Corp.	4.78	4.12	(0.66)
Baker Hughes Inc.	4.52	3.86	(0.66)
U.S. Bancorp	4.40	3.71	(0.69)
Target Corp.	4.18	3.49	(0.70)
Cummins Inc.	4.77	4.04	(0.73)
Omnicom Group Inc.	4.33	3.57	(0.77)
SLM Corp.	4.55	3.70	(0.85)
Wal-Mart Stores Inc.	4.96	4.08	(0.88)
Ventas Inc.	4.29	3.41	(0.88)
Diamond Offshore Drilling Inc.	4.46	3.56	(0.90)
Abercrombie & Fitch Co. (Cl A)	4.96	4.05	(0.90)
Walt Disney Co.	4.51	3.60	(0.90)
Union Pacific Corp.	4.33	3.41	(0.92)
Quest Diagnostics Inc.	4.77	3.83	(0.94)
Occidental Petroleum Corp.	4.15	3.20	(0.95)
Southwestern Energy Co.	4.58	3.53	(1.06)
Qwest Communications International Inc.	4.26	3.18	(1.08)
PepsiCo Inc.	4.75	3.67	(1.08)
FPL Group Inc	5.04	3.93	(1.11)
Flowserve Corp.	4.71	3.57	(1.14)
AvalonBay Communities Inc.	4.12	2.98	(1.14)
NiSource Inc.	4.76	3.59	(1.18)
Peabody Energy Corp.	4.55	3.36	(1.19)
Burlington Northern Santa Fe Corp.	4.67	3.37	(1.30)
Public Storage	4.25	2.80	(1.45)
Simon Property Group Inc.	4.45	2.97	(1.47)
State Street Corp.	4.62	3.12	(1.50)
H.J. Heinz Co.	4.96	3.38	(1.57)
Interpublic Group Of Cos.	5.30	3.66	(1.64)
Morgan Stanley	4.36	2.69	(1.66)
PNC Financial Services Group Inc.	4.94	3.21	(1.73)
Time Warner Inc.	4.83	3.08	(1.75)
Equity Residential	4.44	2.65	(1.79)
ConAgra Foods Inc.	5.40	3.39	(2.02)

Appendix B.1

Mean bid-ask spreads for the 100 stocks sampled are presented in the table below. The change in bid-ask spreads between the two periods is highlighted in grey where statistically significant[14]. The stocks are presented in order of magnitude of the difference in spreads.

Stock	Mean bid-ask spread ($): period 1	Mean bid-ask spread ($): period 2	Difference ($)	Difference +/-
Time Warner Inc.	0.061	0.033	(0.028)	-
CBS Corp (Cl B)	0.042	0.013	(0.028)	-
AvalonBay Communities Inc.	0.091	0.069	(0.022)	-
Total System Services Inc.	0.042	0.021	(0.021)	-
D.R. Horton Inc.	0.033	0.014	(0.019)	-
Advanced Micro Devices Inc.	0.031	0.012	(0.018)	-
Target Corp.	0.041	0.023	(0.018)	-
Varian Medical Systems Inc.	0.042	0.024	(0.018)	-
Computer Sciences Corp.	0.042	0.026	(0.017)	-
PepsiCo Inc.	0.036	0.020	(0.016)	-
SunTrust Banks Inc.	0.043	0.028	(0.015)	-
Hormel Foods Corp.	0.037	0.023	(0.015)	-
Kimberly-Clark Corp.	0.037	0.023	(0.015)	-
FirstEnergy Corp.	0.040	0.026	(0.014)	-
New York Times Co. (Cl A)	0.030	0.016	(0.014)	-
Stryker Corp.	0.039	0.025	(0.014)	-
Becton Dickinson & Co.	0.043	0.029	(0.014)	-
Abercrombie & Fitch Co. (Cl A)	0.045	0.031	(0.014)	-
Pfizer Inc.	0.027	0.013	(0.014)	-
Leggett & Platt Inc.	0.028	0.014	(0.013)	-
C.R. Bard Inc.	0.047	0.034	(0.013)	-
Pinnacle West Capital Corp.	0.033	0.021	(0.013)	-
United Parcel Service Inc. (Cl B)	0.037	0.025	(0.012)	-
Estee Lauder Cos. (Cl A)	0.034	0.021	(0.012)	-
Walt Disney Co.	0.028	0.016	(0.012)	-
Public Storage	0.066	0.054	(0.012)	-
Moody's Corp.	0.034	0.022	(0.012)	-
ProLogis	0.041	0.029	(0.012)	-
Wal-Mart Stores Inc.	0.029	0.018	(0.011)	-
Best Buy Co. Inc.	0.033	0.022	(0.011)	-
Polo Ralph Lauren Corp.	0.048	0.037	(0.011)	-
Equifax Inc.	0.031	0.020	(0.011)	-
International Game Technology	0.029	0.019	(0.011)	-
Agilent Technologies Inc.	0.028	0.017	(0.011)	-
SLM Corp.	0.036	0.025	(0.011)	-
SUPERVALU Inc.	0.027	0.017	(0.010)	-
PerkinElmer Inc.	0.025	0.015	(0.010)	-
Home Depot Inc.	0.027	0.016	(0.010)	-
Equity Residential	0.036	0.026	(0.010)	-
Nicor Inc.	0.035	0.025	(0.010)	-
ConAgra Foods Inc.	0.023	0.014	(0.010)	-
Newell Rubbermaid Inc.	0.024	0.014	(0.010)	-
Eastman Chemical Co.	0.039	0.029	(0.010)	-

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[14] Based on a t-test at the 5% level of significance.

Meredith Corp.	0.032	0.023	(0.009)	-
Caterpillar Inc.	0.034	0.025	(0.009)	-
Macy's Inc.	0.027	0.019	(0.008)	-
McGraw-Hill Cos.	0.030	0.022	(0.008)	-
Pepsi Bottling Group Inc.	0.025	0.017	(0.008)	-
Anadarko Petroleum Corp.	0.039	0.031	(0.008)	-
Omnicom Group Inc.	0.026	0.019	(0.007)	-
H.J. Heinz Co.	0.026	0.019	(0.007)	-
NiSource Inc.	0.020	0.013	(0.007)	-
Massey Energy Co.	0.042	0.035	(0.007)	-
Abbott Laboratories	0.029	0.022	(0.007)	-
CenterPoint Energy Inc.	0.019	0.013	(0.006)	-
Gap Inc.	0.021	0.015	(0.006)	-
McDonald's Corp.	0.029	0.022	(0.006)	-
Qwest Communications International Inc.	0.017	0.011	(0.006)	-
Tenet Healthcare Corp.	0.016	0.011	(0.006)	-
Principal Financial Group Inc.	0.031	0.025	(0.006)	-
Burlington Northern Santa Fe Corp.	0.038	0.033	(0.005)	-
Quest Diagnostics Inc.	0.031	0.026	(0.005)	-
Black & Decker Corp.	0.039	0.034	(0.005)	-
Ball Corp.	0.030	0.025	(0.005)	-
Morgan Stanley	0.034	0.030	(0.005)	-
Kroger Co.	0.020	0.015	(0.005)	-
Interpublic Group Of Cos.	0.016	0.012	(0.004)	-
Hewlett-Packard Co.	0.025	0.021	(0.004)	-
Baker Hughes Inc.	0.035	0.031	(0.004)	-
FPL Group Inc	0.031	0.027	(0.004)	-
Western Digital Corp.	0.023	0.020	(0.003)	-
Emerson Electric Co.	0.024	0.021	(0.003)	-
Republic Services Inc.	0.024	0.021	(0.003)	-
PPL Corp.	0.026	0.023	(0.003)	-
Apache Corp.	0.048	0.045	(0.003)	-
AFLAC Inc.	0.032	0.029	(0.002)	-
Ford Motor Co.	0.015	0.012	(0.002)	-
CIGNA Corp.	0.024	0.022	(0.002)	-
U.S. Bancorp	0.020	0.018	(0.001)	-
Whirlpool Corp.	0.045	0.044	(0.001)	-
AmerisourceBergen Corp.	0.012	0.011	(0.001)	-
Ventas Inc.	0.044	0.044	0.001	+
Peabody Energy Corp.	0.029	0.030	0.001	+
Goodrich Corp.	0.031	0.033	0.002	+
Simon Property Group Inc.	0.052	0.055	0.003	+
Exxon Mobil Corp.	0.030	0.034	0.004	+
PNC Financial Services Group Inc.	0.040	0.044	0.004	+
Nucor Corp.	0.030	0.035	0.005	+
CSX Corp.	0.019	0.024	0.006	+
Dun & Bradstreet Corp.	0.051	0.056	0.006	+
Deere & Co.	0.023	0.030	0.008	+
Occidental Petroleum Corp.	0.030	0.038	0.008	+
Union Pacific Corp.	0.020	0.028	0.008	+
Harris Corp.	0.029	0.038	0.009	+
State Street Corp.	0.035	0.045	0.010	+
Southwestern Energy Co.	0.014	0.024	0.010	+
AutoZone Inc.	0.059	0.070	0.012	+

Cummins Inc.	0.015	0.030	0.015	**+**
Diamond Offshore Drilling Inc.	0.055	0.084	0.029	**+**
Flowserve Corp.	0.034	0.070	0.036	**+**

Sources: FactSet, CFA Institute calculations