S&P DOW JONES INDICES
McGRAW HILL FINANCIAL

The Landscape of Risk

CONTRIBUTORS

Tim Edwards, PhD

Director
Index Investment Strategy

timothy.edwards@spdji.com

Craig J. Lazzara, CFA

Senior Director
Index Investment Strategy

craig.lazzara@spdji.com

J.P. Morgan famously remarked, when asked what the stock market would do, that "it will fluctuate." It was a safe prediction. **No matter how we regulated or managed our markets, spikes in volatility persisted.** From a classical point of view, higher volatility presents greater opportunities—the canonical example being the increases in both risk and return that result from the application of leverage. Thus, by implication in the typical legal disclaimer, an increased opportunity for return is associated with increased risk.

Yet periods accompanying extreme fluctuations in the equity market are more often than not associated with losses. In Section 1, we examine the negative correlations that emerge between market prices and volatilities of the U.S. equity market. Two themes emerge—first, that market behavior is fundamentally different during periods of high volatility. Second, that the opportunities presented might be comprehended as simply the chance to purchase equities at a discount.

In Sections 2 and 3, we examine the structural composition of market risk via the relationship between the volatilities of individual securities and market benchmarks, and relate each to the other with approximating equations**. These equations describe a three-dimensional surface, a "landscape of risk,"** which we compare to historical market behavior in Section 4.

Not all crises are the same. Although each major pullback in U.S. equities during the past decade has been characterized by unusually high correlations, the bear markets of the early 2000s were instead accompanied by a large degree of independence among the stocks of different sectors. **The results of Section 4 describe the role of correlations in crisis periods** and describe the potential evolutions of volatility and stock-to-stock correlation that might accompany the next one

A second goal of this paper is framed by the notion of seeking opportunity in crisis. This theme emerges in Section 1 in the context of market performance, and in Section 2 we discuss the subtleties that arise in applying the same concepts to single securities. In Section 3, we introduce the concept of "dispersion" in order to address these subtleties. In Section 5, **we attribute the historical relative performance of equal weight, growth, value, and momentum strategies to changes in U.S. equity dispersion**. Finally, in Section 6, we describe the current environment.

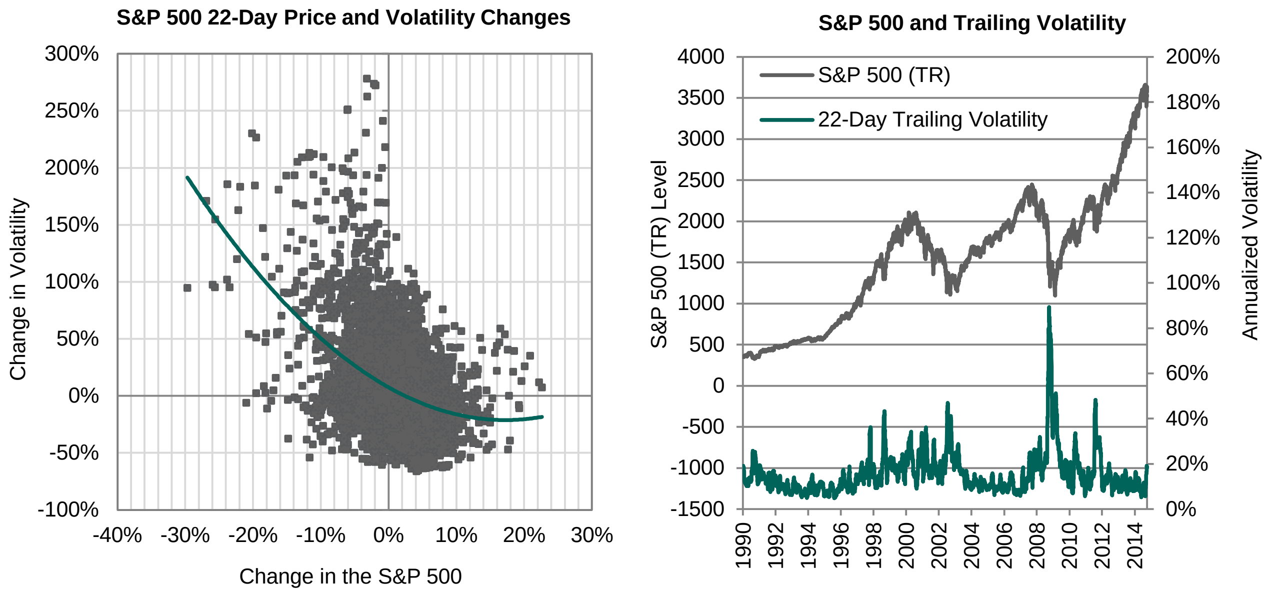
Section 1: Market Volatility

There is typically a strong and inverse relationship between the time series describing the volatility of an asset and that asset's returns. Although this relationship is familiar in practice, its existence is historically controversial; it is absent from the majority of models that populate the textbooks of classical finance.

Exhibit 1 compares the S&P 500 total return index to its volatility, expressed as the annualized standard deviation of the previous 22 days' returns. There are several ways to measure the relationship between volatility and price changes, for purposes of Exhibit 1, the important link is the strong negative correlation between *changes* in the level of market volatility and changes in the level of the S&P 500. The correlation between changes in volatility and the market's returns is significantly negative at -0.39.

RESEARCH

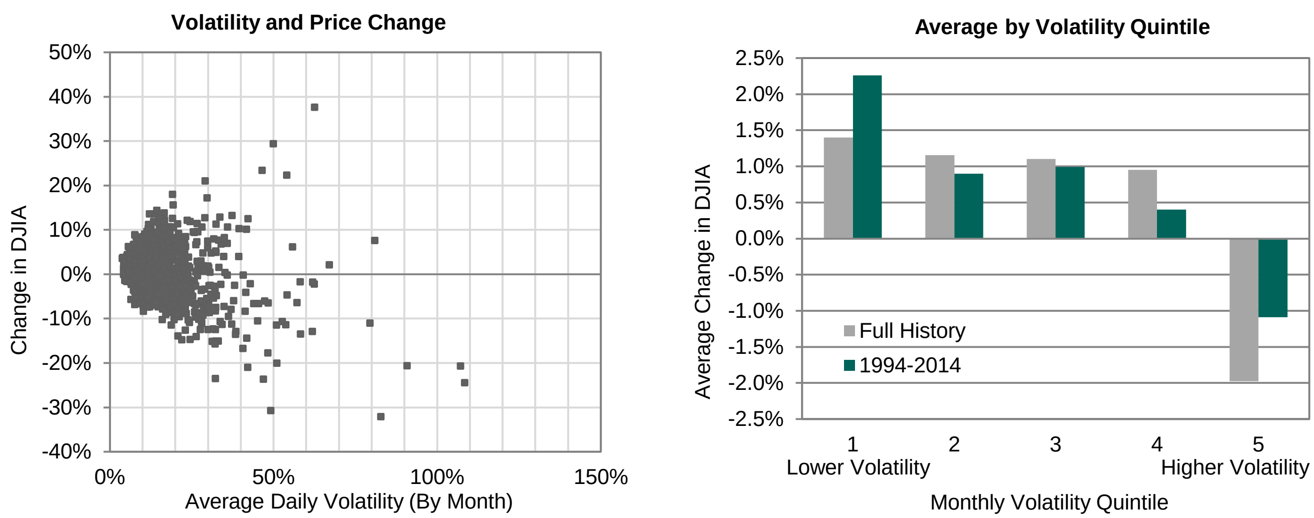
Exhibit 1: Return and Volatility Correlations for the S&P 500



Source: S&P Dow Jones Indices LLC. Data from Jan 1990 to October 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

A second, and less familiar, way to think about the relationship of volatility to return is shown in Exhibit 2, which compares the relationship between the market's return and the *level* of volatility during that month. Exhibit 2 relies on a longer-term database, showing the results for the full history of the Dow Jones Industrial Average™ (DJIA) and its concurrent volatility for every month since July 1896.[1]

Exhibit 2: Return and Volatility Correlations for the Dow Jones Industrial Average



Source: S&P Dow Jones Indices LLC. Data from July 1896 to July 2014. Charts and tables provided for illustrative purposes. Past performance is no guarantee of future results.

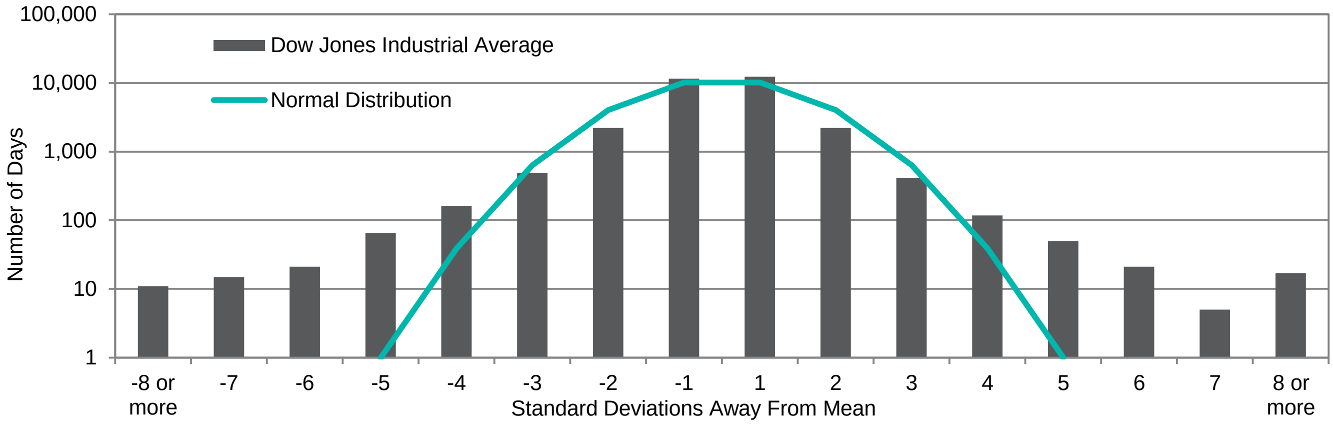
The relationship shown in Exhibit 2 also has a negative correlation, this time equal to -0.29. Yet it is less convincing; visually, the scatter offers little more than confirmation that higher volatility accompanies greater movement. More pertinently, the bar graph in Exhibit 2 indicates the structural source of negative correlation. If we sort the series of nearly 1500 monthly periods into quintiles by volatility, the average change in the DJIA in

[1]Our measure of volatility is the standard deviation of daily returns for each month in the database. The bar graph of Exhibit 2 also includes more recent statistics (spanning just the past two decades). The patterns are remarkably similar.

each quintile is different; markedly so during periods of extremely low or extremely high volatility. In fact, excluding the most-and least-volatile quintiles from the sample provides a resoundingly indifferent -0.03 correlation between price change and volatility**. The behavior at the extremes of the equity return distribution is different.**

The tails of the distribution embody a second key feature, which also distinguishes real-world equity markets from their simplest models. Exhibit 3 shows the number of days in history on which the DJIA moved by various amounts, grouped by the multiple of standard deviations that particular day's move represented. Note that the scale of the vertical axis is logarithmic in order to emphasize the (otherwise pixel-tall) frequency of extreme events.

Exhibit 3: Non-normality and "Fat Tails" in the DJIA Daily Returns



Source: S&P Dow Jones Indices LLC. Data from July 1896 to July 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

The distribution of daily returns is far from normal.[2] Overlaid onto the distribution, the line graphed in Exhibit 3 indicates the expected number of days in each category if such returns followed the bell curve of a normal distribution. (Remember that the vertical scale is logarithmic, which is why the line does not look much like a bell.)

Exhibit 3 demonstrates that, when it comes to estimating the likelihood of extreme events, **the margin of error from an assumption of normality can reach astronomical proportions**. If daily returns were normal, even allowing for the lengthy history of the DJIA, one would still not expect to see any daily movements greater than five standard deviations away from the mean. Assuming a normal distribution and the historical average annual volatility of 18%, a 10% single-day loss in the DJIA would be expected roughly once every 3,000 trillion years. In reality, there have been six such instances, the most recent being the October 1987 "Black Monday," when the DJIA fell by 22%.

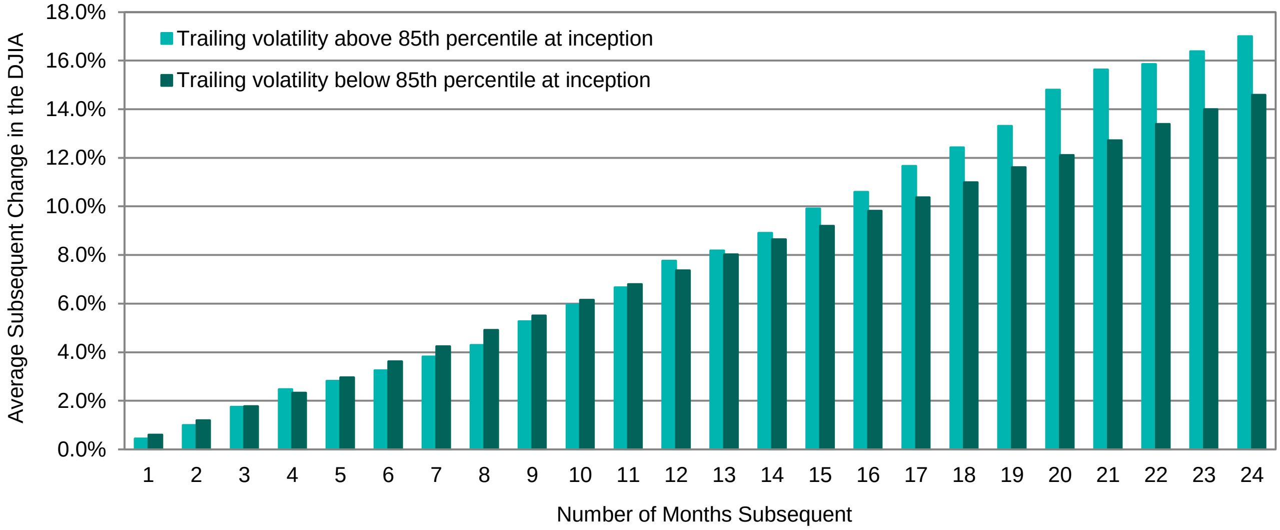
Simply put, **large movements occur with far greater frequency than one might otherwise expect** and, as shown in Exhibits 1 and 2, returns in volatile environments are negatively biased. Taken together, these observations describe the lethal cocktail that is volatility. They also help explain the increasing popularity of tools designed to mitigate the extreme peaks and valleys of investment performance. From hedge funds and tactical strategies to the ever-increasing trading volumes on VIX® futures, avoiding volatility or otherwise attempting to manage it underpins a large part of the modern professional focus of investing.

Yet volatility, to say a word in its defense, is not universally objectionable. **The forces of creative destruction have turbulent wakes**, and—from the perspective of sharp-eyed investors—volatile markets are more likely to toss up the occasional bargain. If volatility indicates distress for existing investors, it may simultaneously indicate a more attractive entry point for new ones.

[2]The non-normality of asset returns was first pointed out by the mathematician Bernoit Mandelbrot in the 1960s. The normal distribution is remarkably accurate for the bulk of day-to-day behavior, however, and Mandelbrot's observations, ignored among others by Black-Scholes in their options pricing model, were not widely celebrated until much later. See Benoit Mandelbrot *The Misbehavior of Markets* (2004).

Exhibit 4 compares the volatility of the DJIA in each month from 1897 to 2012 with the hypothetical price return from an investment in the index made at the close of the final trading day of that month and held for various periods ranging up to two years. We can then compare the average subsequent hypothetical return for investors as a function of the market's trailing volatility at inception.[3] In this case, the simplistic "trading signal" is whether the DJIA's monthly volatility was particularly high (above the 85th percentile).

Exhibit 4: DJIA Price Returns at Entry Points of Varying Historical Volatility



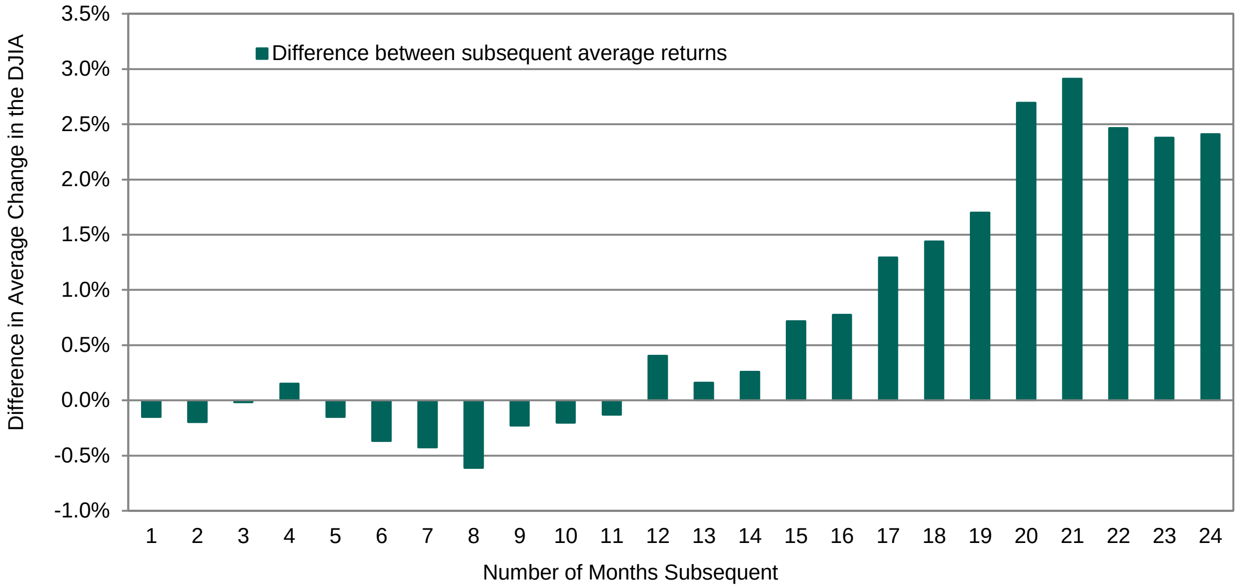
Source: S&P Dow Jones Indices LLC. Data from July 1896 to September 2012. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

A more nuanced analysis might elicit stronger effects, and we are guilty if charged with look-ahead bias (since the full distribution of volatility is unknown at the beginning). However, Exhibit 4 explains the popularity of the aphorism attributed to Nathan Mayer Rothschild, "**Buy when there's blood in the streets, even if the blood is your own**."

Note that the effect shown in Exhibit 4 increases with the holding period; there is little to suggest that the most volatile markets present a reliably stronger investment in the short term. Investing in distressed circumstances has been compared to "catching a falling knife." The risk of short-term loss is material and, at the very least, a degree of patience (or a thick skin) may be necessary. Exhibit 5 shows the difference between the two series of returns shown in Exhibit 4: initially, returns from investing at points of high trailing volatility are lower than returns from investing after low volatility, increasing from about eight months subsequent to entry in a J-curve.

[3] It is not possible to invest in an index, particularly (as in this case) without including the effect of dividends, excluded from this analysis in order to encompass the fuller price history of the Dow Jones Industrial Average.

Exhibit 5: Difference in DJIA Price Returns at Entry Points of Varying Historical Volatility



Source: S&P Dow Jones Indices LLC. Data from July 1896 to September 2012. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

Exhibit 4 shows that, at least for the DJIA, there were indeed greater returns generated from bouts of volatility. But Exhibit 5 shows **that those returns may be viewed as an ex-post reward for a risk that was particularly acute in the short term.** This seems quite compatible with the classical view of risk and return, a refutation of the “controversy” supposedly demonstrated by Exhibits 1 and 2. For indexed investors tracking broad market benchmarks, perhaps this is sufficient. When it comes to single securities, the situation is more complicated.

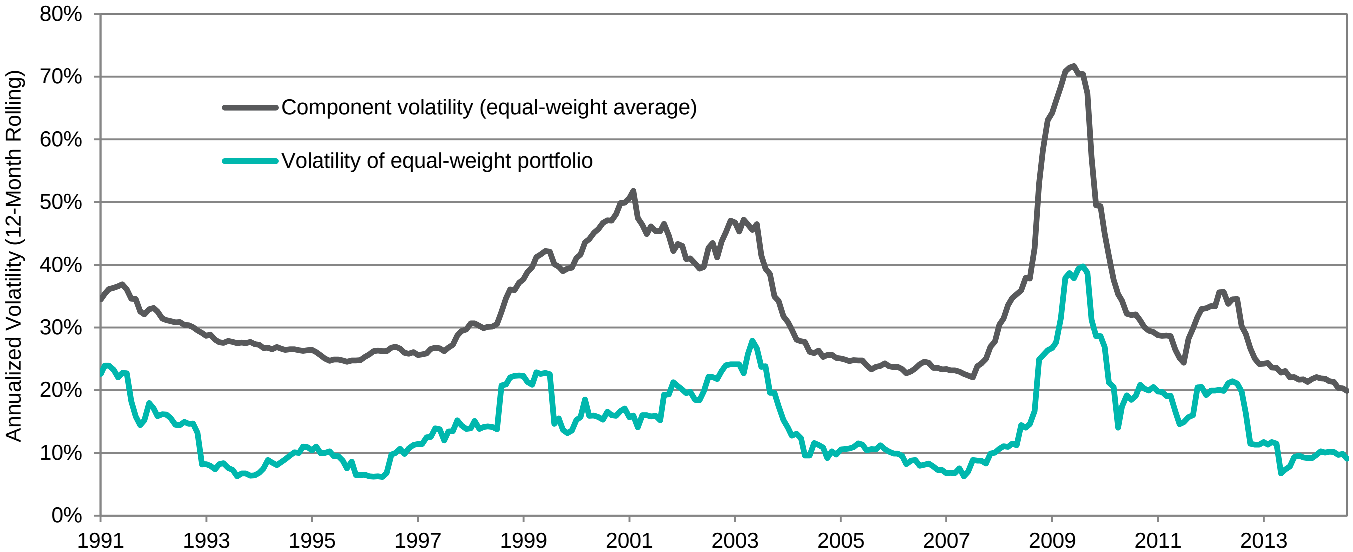
Section 2: Component Volatility

Market benchmarks and their volatilities, including forward-looking measures such as the VIX, have become ubiquitous in describing the prevalent risk regime. But despite their convenience and concision, **more granular risks are often just as relevant**. For example, in the more concentrated portfolios typical of active management, in which diversification effects may be muted, market volatility expresses only a fraction of the overall opportunity set and risks.

How important are changes in the volatility of individual securities? Like many things, it depends—in this case, it depends not only on how widespread the changes are, but also on how similar their effects are. If a relatively small number of stocks becomes more volatile, such a development will be of interest primarily, if not solely, to the owners of those stocks. If nearly all the stocks in a market become more volatile, it suggests a wider cause of alarm, although perhaps not a major concern to a sufficiently-diversified investor. More perilously, if stocks are dancing to the same tune, then diversification is likely no panacea. Indeed, this is when multiple-standard-deviation moves are likely.

Nonetheless, there are times when the risks of stocks have risen, even in aggregate, without an equal increase in market risk. **There is a material difference between the volatility of the average stock and the volatility of stock market averages**, as shown historically for the S&P 500 in Exhibit 6.

Exhibit 6: The Difference Between Portfolio and Component Volatility for Members of the S&P 500



Source: S&P Dow Jones Indices LLC. Data from 1991 to October 2014. Note: Since an equal-weight average is applied to express component volatility, the appropriate combination for purposes of this comparison is the S&P 500 Equal Weight Index rather than the capitalization weighted S&P 500. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results. These charts and tables may reflect hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The concept of volatility in single securities encompasses both movements arising from market sensitivities—the stock's "beta"—as well as stock-specific effects independent of the overall market. Stocks may return more after periods when the average stock is more volatile simply because, *on average,* they reflect a relationship between stock market returns and stock market volatility. And while they are different, Exhibit 6 demonstrates that both market and component volatility have followed similar broad trends over time, so Exhibit 4 suggests that a strategy of investing in single stocks subsequent to high-volatility periods might perform relatively well.

Exhibit 4 defines high and low volatility relative to its own history. For individual stocks, of course, we might also examine the volatility of one stock against another to identify more attractive investments. However**,** there is a wealth of historical evidence countering this identification across single securities. Quite the opposite, the persistent failure of high-octane stocks to outperform their more pedestrian peers is the much-celebrated "low volatility anomaly." This phenomenon is far from specific to any single equity market—in fact, it is difficult to find counterexamples.[4] If more volatile stocks do not offer more attractive returns to new investors, then hopes for a *cross-sectional* analog of Exhibit 4 are not promising for single securities.

In summary, since the most risky stocks have reliably offered poorer returns even to the patient investor, a more nuanced characterization of their risk may be required. And in terms of timing, component volatility tracks that of the market as a whole, so analyses based on it are likely to yield market-driven results.

We have still to account for the portion of component volatility that is distinct from overall market volatility. Exhibit 6 shows that when the average trailing 12-month volatility among the then-current members of the S&P 500 (the upper series) peaked at 52% in February 2001, the volatility of the equal-weight index (the lower series), registered only 16% - less than a third that of the components. This relatively subdued portfolio volatility emphasizes the idiosyncratic and sector-led markets of the early 2000s; diversification limited the damage to broad-based investors. Such scenarios are quite rightly the first and most-compelling argument for diversified investing. However, the assumption that such diversification benefits are permanent or inevitable was proved resoundingly wrong only a few years later. The peak in both measures occurred in October 2008, when, during the "credit crisis" (as it was then called), over half of the component volatility was reflected at the index level. **The difference between component and market volatility is captured in the market's dispersion.**

[4]Baker and Haugen, "Low Risk Stocks Outperform within All Observable Markets of the World" (2012); Chan and Lazzara, "Is the Low Volatility Anomaly Universal?" (2013). For a modern treatment in historical context, see Aye M. Soe, "The Low-Volatility Effect: A Comprehensive Look", (2012).

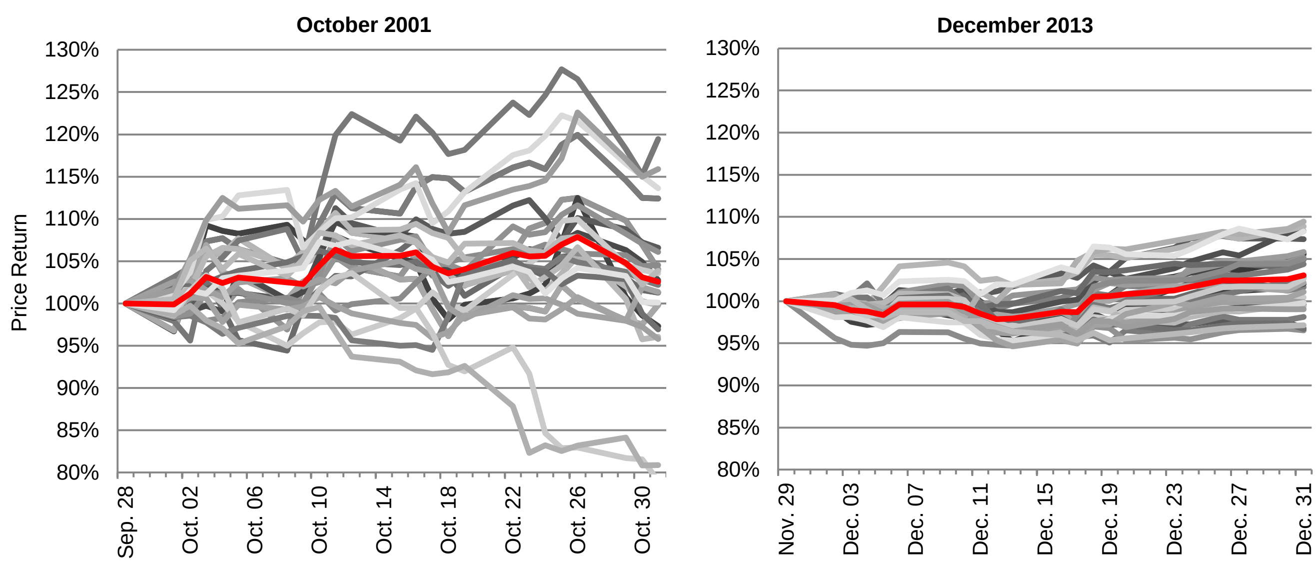
Section 3: Cross-Sectional Volatility, or Dispersion

Component volatility and market volatility both represent important aspects of the investment environment. The former, arguably, matters more for concentrated portfolios, stock pickers and individual companies. The latter matters more for diversified investors. It is well known that component volatility and market volatility are related to each other through correlation. In addition, the difference between the two is driven by dispersion.

In the specific sense that we use the term, "dispersion" is a single-period measure defined as the portfolio-weighted standard deviation among component returns.[5] Dispersion is less familiar than correlation to most analysts; it arguably deserves greater prominence as a measure of idiosyncratic effects (and it is easier to calculate).

Exhibit 7 illustrates the concept of dispersion, showing the relative performance of the 30 stocks composing the DJIA during a period of relatively high dispersion (October 2001) and a period of relatively low dispersion (December 2013).

Exhibit 7: High and Low Dispersion Environments in the DJIA



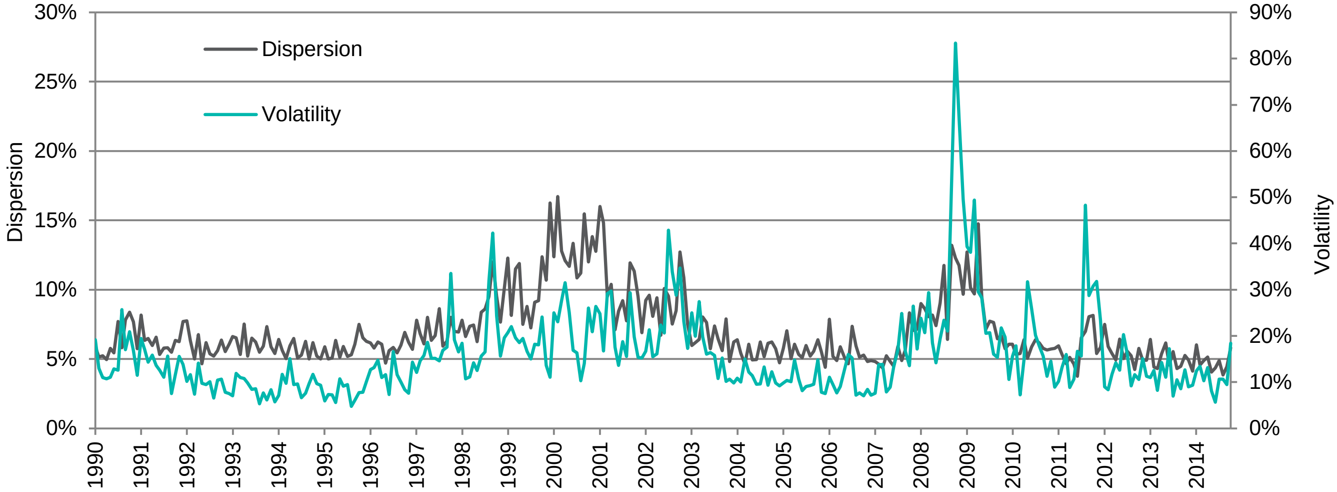
Source: S&P Dow Jones Indices LLC. Data from October 2001 and December 2013. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

The two months shown in Exhibit 7 have similar market returns and correlation levels.[6] Yet they also represent fundamentally different market environments, not fully captured in the observation that market volatilities were different. The gray lines in Exhibit 7 represent the performance of the various companies included in the DJIA at the time; the red lines show the performance of the parent index. The wide spread of returns among index components is key to the environment of October 2001—during the popping of the tech bubble. The remarkable level of globally coordinated fiscal stimulus and its equitable effect across the majority of financial assets contributed to the similarity of component returns in December 2013.

Dispersion is similar to volatility in many respects, not least in that they are highly correlated in the short term. Both capture the degree of movement within a market over a specified time period via variance of returns, and they are both themselves highly volatile, exhibiting short-term persistence as well as a propensity for reversion to the mean over longer time periods. Exhibit 8 shows the historical dispersion for the S&P 500, calculated at the stock level over calendar month periods, in comparison to daily volatility during the month.

[5]See Edwards and Lazzara, "Dispersion: Measuring Market Opportunity" (2013). For an equally weighted portfolio, dispersion and the standard deviation of component returns are identical.
[6]In both months the index's return was approximately 3%; the average correlation of each stock to the index was 0.57 in October 2001 and 0.69 in December 2013.

Exhibit 8: S&P 500 Monthly Realized Dispersion and Annualized Volatility



Source: S&P Dow Jones Indices LLC. Data from January 1990 to November 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

Since volatility and dispersion have frequently followed a parallel course, we may gain greater insight from the periods in which they diverge. The inflation and deflation of the tech bubble at the turn of the millennium represented a peak in dispersion that was not reflected commensurately in market volatility. The three subsequent peaks in volatility correspond to the credit crisis, the May 2010 "flash crash" and the "debt ceiling" political crisis over the U.S. government's ability to borrow in August 2011.

Exhibit 8 reminds us that, regardless of its other uses (e.g., as a measure of active managers' opportunity to add value), dispersion is still a form of risk. Bubbles popping and dislocations in prices are not necessarily welcome. It is important to recall that a dramatic increase in the volatility of an individual stock still suggests that the price has fallen, even if it has nothing to do with the broader economy.

This leaves us (so far) with three concepts of risk:

- Market Risk
- Dispersion or Cross-sectional Risk
- Component Risk

Once suitably defined for a given market, these types of risk are simply related. Correlations, in the sense of a weighted average correlation between every pair of market components, complete a pair of simple approximations:[7]

Market Variance + Cross-sectional Variance = Average Component Variance

and

Market Variance = Average Component Variance x Correlation

The first equation tell us that, if the difference between component and index volatilities defines the benefit achieved through diversification, then dispersion measures it in units comparable to those of market volatility. From that perspective, for a passive, total-market investor, dispersion measures a diversification benefit: the caliber of a bullet, dodged. This beneficial aspect of dispersion qualifies its description as a risk. If there is opportunity to be found in crisis, perhaps it stems from increases in dispersion. We shall return to this topic in Sections 5 and 6. We first examine how **dispersion and correlation interact to create market volatility**.

[7] "Risk" here implies variance opposed to volatility, and dispersion requires an averaging over multiple time periods in order to make such comparisons. Readers who wish to dig into the details of these equations can find them, along with the underlying assumptions and examples of their application, in Edwards and Lazzara, "At the Intersection of Diversification, Volatility and Correlation" (2014).

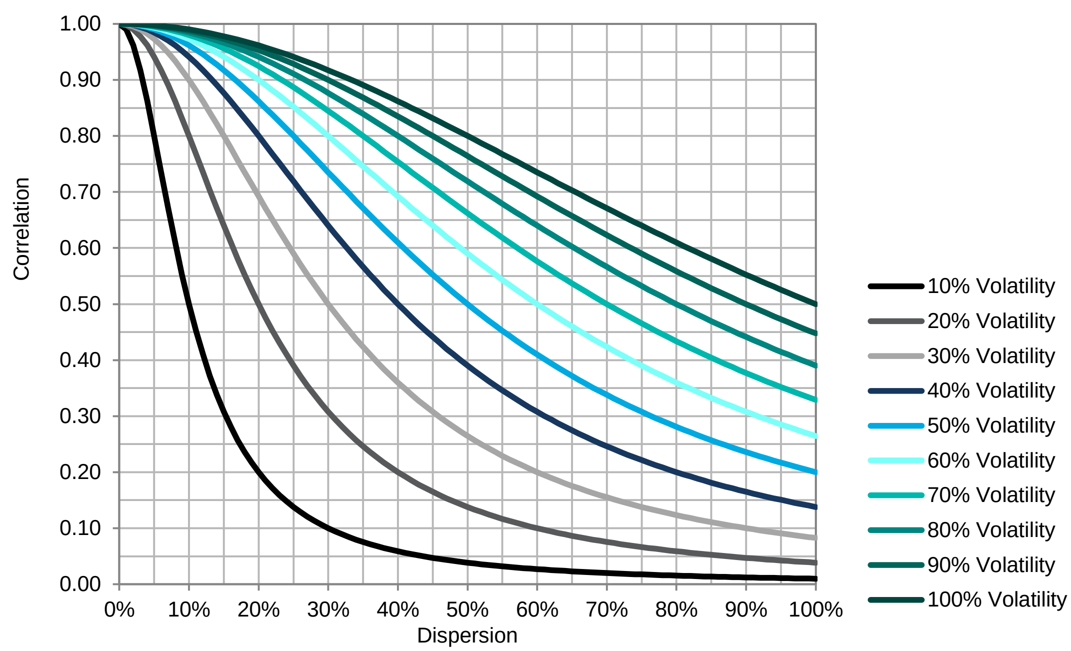
Section 4: The Landscape of Risk

Market correlation, properly defined as the weighted average of the correlation of every security in a market with every other security in the same market, is a fairly complex statistic.[8] However, the links it supplies among the three key measures of risk summarized at the end of Section 3 are simple and useful. The sum of the squares of market volatility and dispersion approximate the square of average component volatility, and correlation defines the proportion of component variance that is currently reflected in the market.

Once the conceptual validity of these relationships is granted, they imply a structural decomposition of events. **The same level of market volatility can arise from different combinations of correlation and dispersion, and these combinations tell us something important about the event.**

The situation suggests a three-dimensional perspective: if correlation and dispersion were to range freely of each other, their different possible combinations can be pictured as longitude and latitude, with the height of points on the map corresponding to the resultant market volatility. A visualization is shown in Exhibit 9; each curve represents the various combinations required to produce the indicated level of volatility.

Exhibit 9: Isometric Volatility Lines

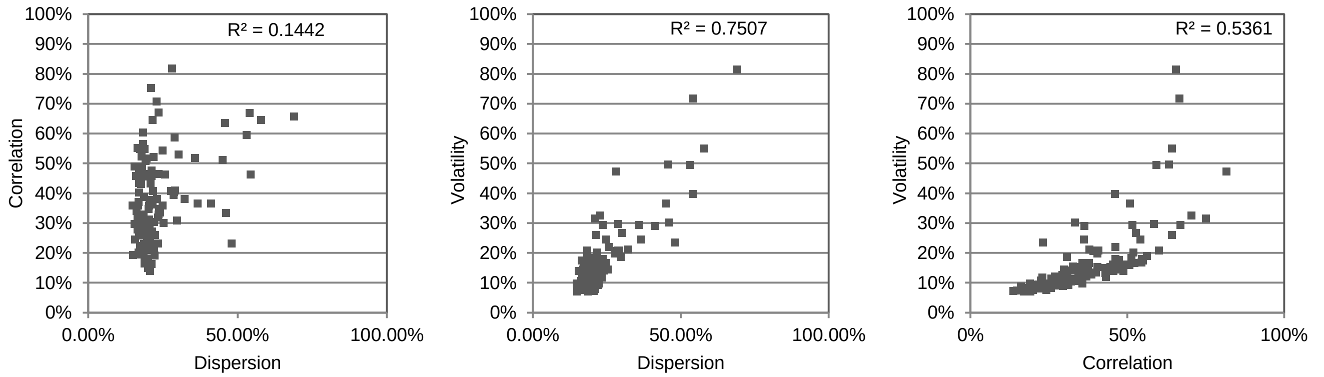


Source: S&P Dow Jones Indices LLC. Charts and tables are provided for illustrative purposes.

In the real world, correlation and dispersion do not range freely, and the clean lines of a surface are not to be found. But the cloud of historical points can be examined by its shadows. Exhibit 10 decomposes the risk of the S&P 500 over the past 10 years in two dimensional projections.

[8] It is also a beast to compute. For the S&P 500, e.g., it requires determining 124,750 separate pairwise correlations, and then calculating their weighted average. For an N-stock index, there are N * (N-1)/2 pairwise correlations.

Exhibit 10: Scatter Plots of Monthly Volatility, Dispersion and Correlation for the S&P 500



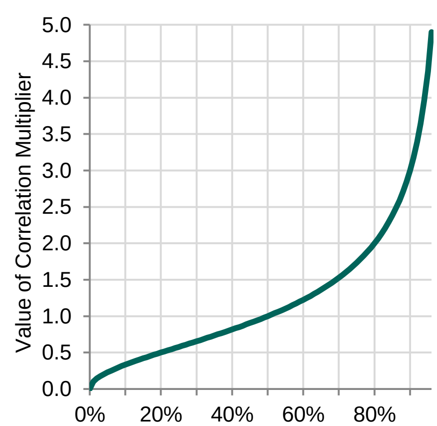
Source: S&P Dow Jones Indices LLC. Data from January 2004 to October 2014. Charts and tables provided for illustrative purposes. Past performance is no guarantee of future results.

Some technical observations on the scatter plots shown in Exhibit 10 are appropriate. The lower correlation in the left chart is perhaps surprising, suggesting that **correlation and dispersion are more independent than one might think**. The central chart represents the data of Exhibit 8 and confirms that dispersion and volatility tracked each other closely and approximately linearly. The right chart of Exhibit 10 has, strictly speaking, the second-lowest explanatory power, but that understates its importance: it is not reflecting a straight-line dependency. The effect of correlation on market volatility can be estimated by manipulating the equations at the end of the previous section, which results in the following approximation.[9]

$$\text{market volatility} = \text{dispersion} \times \sqrt{\frac{\text{correlation}}{1 - \text{correlation}}}$$

We can refer to the last term on the right side of equation as the "correlation multiplier." It tells us **how much dispersion is converted into overall market volatility**. When correlations are 0.5, the correlation multiplier is 1 and dispersion equals market volatility. If correlations are below 0.5, the correlation multiplier is less than 1 and market volatility is less than dispersion. **More importantly, if correlations are above 0.5, any changes in dispersion that do occur have a multiplied impact on market volatility.** Exhibit 11 shows the value of the correlation multiplier for various levels of correlation, and may explain the curvature shown in the scatter plot of volatility and correlation (the right panel of Exhibit 10).

Exhibit 11: Values of the Correlation Multiplier for Various Levels of Correlation



Source: S&P Dow Jones Indices LLC. Charts and tables are provided for illustrative purposes.

In times of economic crisis and shocks to the system, market volatility rises for two reasons. Average component volatility rises, taking market volatility up with it. In addition, correlations, and the correlation multiplier, rise so that

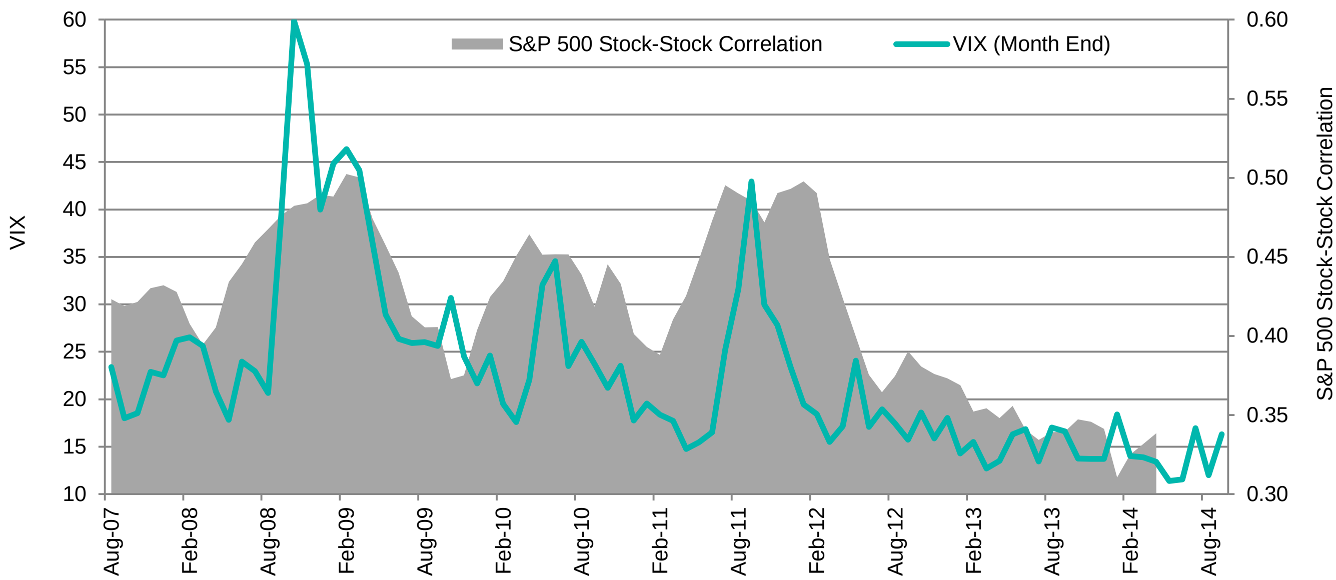
[9] As before, see Edwards and Lazzara (2014), op. cit. for the details.

a larger fraction of component volatility is reflected in market volatility. **The exhibits of this section and the equations used to create them represent, in our view, a specific and fundamental insight into the structure of volatility, particularly at the extremes.** All other things being equal, an increase of either correlation or dispersion will increase volatility. But **at high correlation levels, any subsequent increase in dispersion will generally convert at an elevated multiple into market volatility**. Otherwise said, **idiosyncratic events will have systemic consequences** until correlations revert to their pre-crisis levels**.** In an example from recent history, an event otherwise navigable without undue panic, such as a "fat finger" trade in S&P 500 futures (a supposed progenitor of the April 2010 "flash crash"), is credited with triggering outsized responses (in that instance, a thousand-point intraday move in the DJIA).

High correlations are certainly associated with many of the events occurring at the extremes identified in Exhibit 3. It is a notable fact of financial history that high volatility begets high volatility, and crisis begets crisis. The pattern of market volatility has been compared to that of earthquakes, in which an initial violent event is often followed by a series of aftershocks.[10] It seems that in the aftermath of a crisis, any reduction in volatility is likely to provide only temporary respite.

Exhibit 12 illustrates this aftershock effect via the CBOE Volatility Index in the years following the financial crisis—although the bulk of the crisis was over by the end of the decade, correlations did not persistently return to pre-crisis levels until early 2014.

Exhibit 12: VIX and the S&P 500 Correlation During the Financial Crisis and Aftershocks



Source: S&P Dow Jones Indices LLC, CBOE. Data from August 2007 to August 2014. Charts and tables provided for illustrative purposes. Past performance is no guarantee of future results. Note: The correlation series is a 12-month rolling average of daily stock-to-stock correlations during the month, the midpoint of which is plotted against the VIX for that month-end.

Few market disruptions have singularly identifiable causes. (Even the cause of the "flash crash" remains debated.) It is tempting to suppose that some of the spikes in Exhibit 12 may be appropriately characterized as the exaggerated impact from idiosyncratic events on market volatility, engendered by high correlations.

[10] See http://www.indexologyblog.com/2013/12/13/volquakes/ and, Petersen et al, "Market dynamics immediately before and after financial shocks: quantifying the Omori, productivity and Bath laws" (2010).

Section 5: Navigation

A greater difference in performance between one stock and another increases the potential rewards from judicious security selection; the consequences of portfolio decisions are of greater financial magnitude when the spread among securities grows. Dispersion also naturally coincides with periods during which the difference in performance of the "best" and the "worst" managers is likely to be greater.[11] Of course, high dispersion periods may also imply a greater opportunity for underperformance or a harsher punishment for mistakes. Intriguingly, however, **levels of dispersion may identify periods favoring certain active styles or strategies**.

Imagine an environment in which high dispersion creates, first, abundant opportunities for profitable positions and, second, conditions that prevent such opportunities from being immediately arbitraged away by professional investors. Lord Keynes neatly summarized such a market**: "It is largely the fluctuations which throw up the bargains and the uncertainty due to fluctuations which prevents other people from taking advantage of them."**[12]

Consider what high dispersion environments entail: stocks prices move around in a highly disconnected manner, without regard for each other or perhaps even to their own fundamentals. Such environments may well produce large and widespread price dislocations, in the sense of a departure from a perceived, "correct" fair value. These are precisely the conditions required by arbitrageurs to identify such "mispricings" and to exploit them. One might moreover expect the benefits from exploiting such opportunities to be realized not immediately, but instead when there has been a return to "normal" market conditions. The latter might accordingly be identified with a subsequent period in which much lower dispersion was prevalent. **Value investors, in this scenario, might benefit during a reduction from high dispersion levels.**

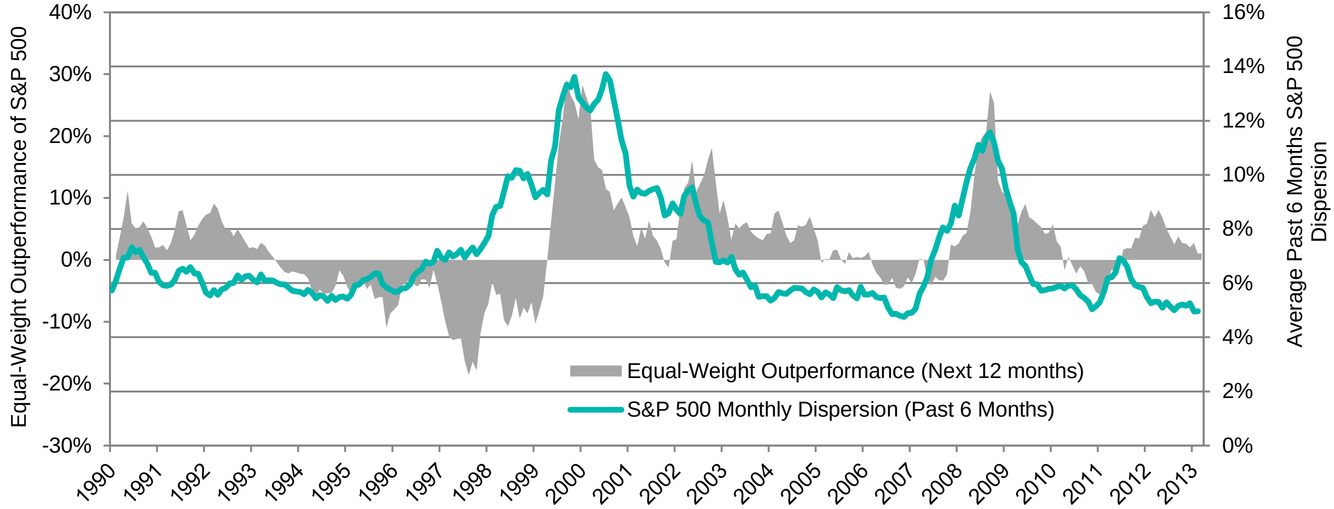
However, while prices may indeed return to more rational levels, there is an "in the meantime" of great importance: in periods of high dispersion, the risks of further dislocations are unusually elevated. This short-term risk, combined with the prevalence of performance-chasing investors, can discourage fund managers from taking advantage of such opportunities; many cannot "double down" or reinforce recently poor-performing positions precisely because of the risk that they continue to lose, an unpalatable error to their investors. **Quite possibly, such structural performance-chasing could favor momentum strategies in times of increasing dispersion.**

There is growing empirical evidence in support of these possibilities.[13] For example, it appears that equity hedge funds have historically delivered their strongest performances *subsequent* to periods of unusually high dispersion. In terms of favored strategies, it appears that both value and contrarian strategies benefited from high or decreasing dispersion, whereas growth and momentum strategies appear to benefit from low or increasing dispersion. Finally, it appears that active managers do indeed decrease the relative size of their bets in response to higher equity dispersion. Taken together, **such studies suggest that real life markets conform, at least in the key respects, to Keynes' estimate of them.**

However, the question naturally arises whether a high level of expertise (or the associated cost of hiring it) is required to exploit changes in dispersion. Can index fund investors take advantage of changes in dispersion just as effectively? Exhibit 13 shows the historical relationship between the dispersion of the S&P 500 and the relative performance of the S&P 500 Equal Weight Index.

[11] See Edwards and Lazzara, op. cit. (2013).
[12] J.M. Keynes, *General Theory of Employment, Interest and Money* (1936).
[13] For evidence of the relationships between dispersion and hedge fund returns see Connor, "Market Dispersion and the Profitability of Hedge Funds" (2009) and Smith, "Equity Hedge Fund Performance, Cross-Sectional Return Dispersion, and Active Share" (2014). For the various strategies, see Stivers et al, "Cross-sectional Return Dispersion and the Payoffs of Momentum, Longer-run Contrarian, and Book-to-Market Strategies" (2008). For the sizing of active bets and dispersion, see Gorman, Sapra and Weigand, "The Role of Cross-Sectional Dispersion in Active Portfolio Management" (2010).

Exhibit 13: S&P 500 Dispersion and Outperformance of the S&P 500 Equal Weight Versus the S&P 500



Source: S&P Dow Jones Indices LLC. Data from 1990 to June 2013. Index performance shown is relative total return in USD. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results. Note: as the objective is to examine a predictive relationship, the relative returns in the future are compared to trailing dispersions.

The difference between the S&P 500 Equal Weight Index and its cap weighted parent is that the former rebalances back to equal weights once per quarter. This rebalancing, by definition, sells stocks that outperformed their peers and purchases those that lagged, thereby returning each weight to equal fractions of the whole. In comparison to cap weighting, equal weight is thus a contrarian strategy. And if movements in securities are exaggerated (perhaps unduly so) in periods of high dispersion, such contrarian rebalancing should prove profitable if excess changes in prices are subsequently corrected.

Exhibit 13 demonstrates that **each peak in equity dispersion since 1990 closely coincided with the start of periods during which equal weight materially outperformed cap weight**. Although visually the correlation appears strongest for the contrarian equal-weight strategy, similar effects can be viewed in momentum, growth and value indices, as shown in Exhibit 14.

Exhibit 14: Relative Performance of Four S&P 500 Strategies in Changing Dispersion Periods

Dispersion	Decreasing From High		Increasing from Low	
Total Return (Relative to the S&P 500, %)	December 1999 - December 2003	March 2009 - May 2011	June 1996 - December 1999	February 2007 - March 2009
S&P 500 Momentum	-21	-17	132	11
S&P 500 Growth	-15	-2	45	8
S&P 500 Value	17	2	-43	-7
S&P 500 Equal Weight Index	46	41	-56	-5
S&P 500 Total Return (absolute, %)	-20	76	132	-41

Source: S&P Dow Jones Indices LLC. Data from June 1996 to May 2011. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results. These charts and tables may contain hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Of particular interest in Exhibit 14 is the irrelevance of market direction: the two central columns both represent bull markets in the S&P 500, the outer two columns bear markets. We are not, it seems, simply measuring a beta effect. However, the evidence of direct relationships in both Exhibit 13 and Exhibit 14 is not perfect, and we remain open to the objection that both reflect simple coincidences within a limited sample set. Yet the historical fact of such coincidence is important in itself, given that it may go some way toward explaining the results already cited regarding hedge fund, value and momentum strategies and their conditioning through dispersion. Such results, whether or not coincidental, may also explain the common belief that even average hedge fund managers can benefit from changes in dispersion.

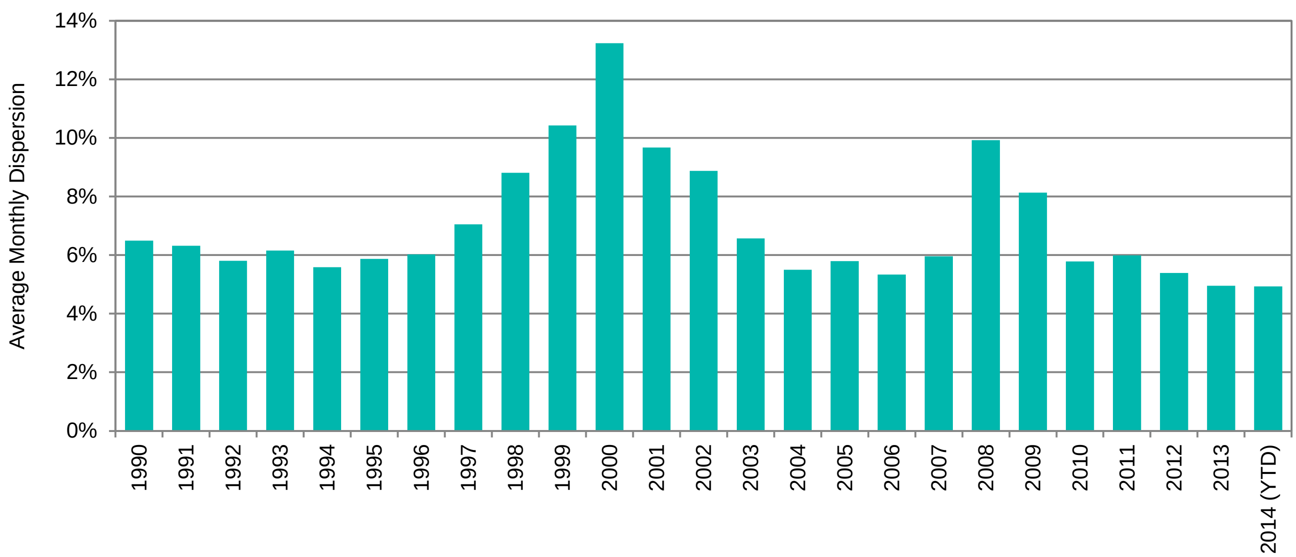
A related observation here is that whenever the S&P 500 Equal Weight Index outperformed, the average stock outperformed the market. This sounds oxymoronic, but it in fact turns on an important subtlety. Capitalization weighted indices like the S&P 500 tell us the return of the average dollar invested, not the return of the average stock. An equal-weight index tells us the performance of the average stock. The spread between cap- and equal-weighted performances tells us how much incremental return an investor could achieve by picking stocks randomly. The higher the spread between equal and cap weight, the stronger the tailwind at the active manager's back, particularly in the context of traditional "stock-pickers."[14]

Taken together, Exhibits 13 and 14 suggest that the peaks and troughs in equity dispersion might be profitably used as guideposts for the application of growth or value and contrarian or momentum tilts to portfolio construction. Naturally, this brings us to an examination of the current landscape.

Section 6: The Current Environment

U.S. equities, in the past few years, have demonstrated moderately high correlations (although the so-called "risk on/risk off" behavior has attenuated over the past 12 months) and severely depressed volatility. One implication of Exhibit 4 and the currently low level of market volatility is that future equity market returns are apt to prove less favorable than would be the case if market volatility were unusually high. As predicted by the relationships discussed in Sections 3 and 4, this low level of volatility has been duly accompanied by especially low dispersion. Exhibit 15 shows the annual average of monthly dispersion for the S&P 500; this year's level is on track to register a two-decade low.

Exhibit 15: Annual Average S&P 500 Monthly Dispersion

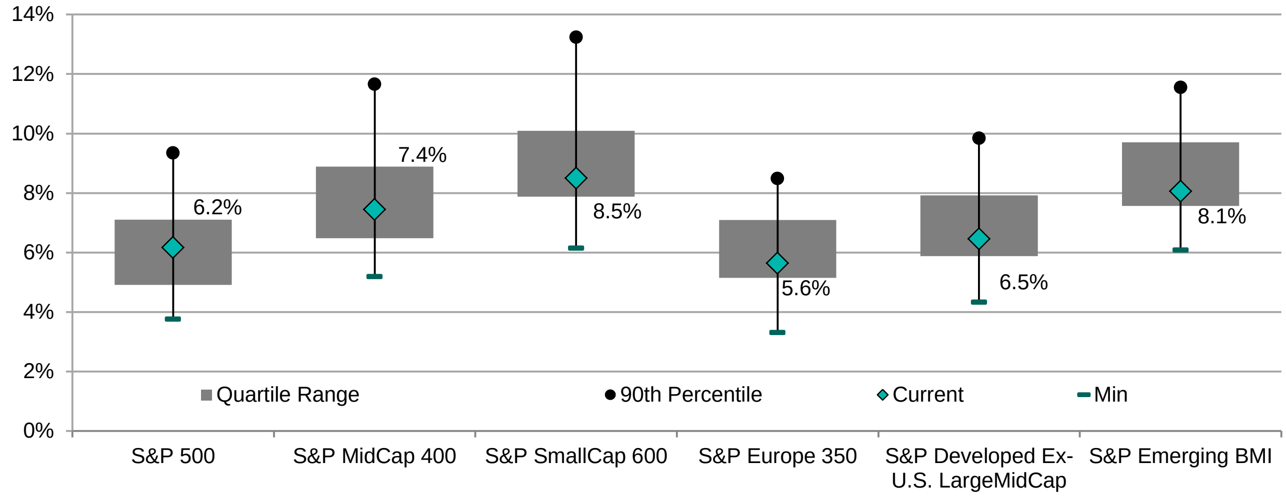


Source: S&P Dow Jones Indices LLC. Data from January 1990 to November 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

Accordingly, **any U.S. large-cap equity strategies that benefit from high dispersion, or from a decline from high dispersion, look particularly challenged at present. Those that benefit from a rise in dispersion may be better positioned**. Exhibit 16 shows that U.S. mid caps, U.S. small caps and emerging market equities each registered dispersion close to their longer-term averages in November 2014.

[14] For an explanation of the historical importance of equally weighted index performance in the context of factor indices and active management, see Edwards and Lazzara, "Equal-Weight Benchmarking: Raising the Monkey Bars" (2014).

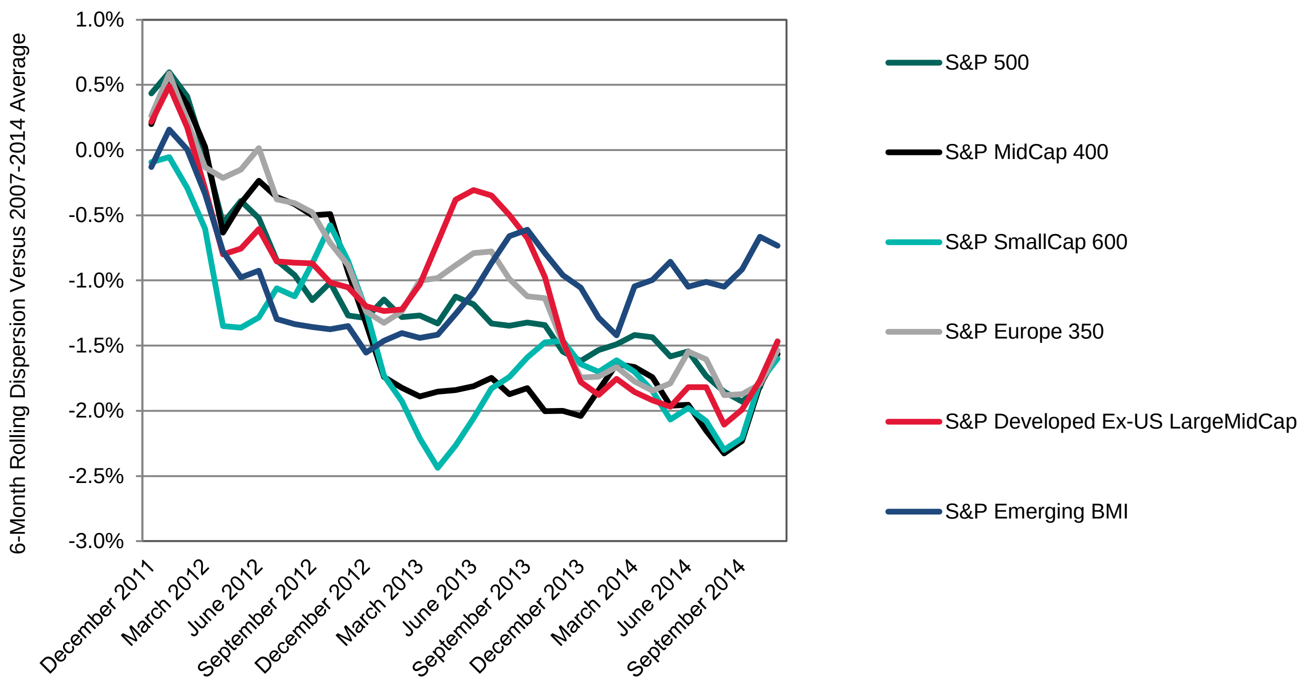
Exhibit 16: Global Monthly Dispersion Versus Averages



Source: S&P Dow Jones Indices LLC. Data from January 2007 to November 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

The trend in dispersion seems as important as its current level. Exhibit 17 shows the recent evolution of dispersion in the markets of Exhibit 16, on a six-month rolling basis and in comparison with the average monthly dispersion for each index in the period from January 2007 to November 2014. Dispersion's six-month average in each market remains low and, with the exception of emerging markets and perhaps small- and mid-caps, a downward trend characterizes each market.

Exhibit 17: Global Monthly Dispersion Versus 2007-2014 Average



Source: S&P Dow Jones Indices LLC. Data from January 2007 to November 2014. Charts and tables are provided for illustrative purposes. Past performance is no guarantee of future results.

Conclusion

Since market volatility has recently been low, the next big move (if there is a big move) is likely to see volatility increase. By the same token, dispersion in most of the markets of Exhibit 16 is more likely to rise than to fall. (Perhaps it has already begun to do so in one or two.) J. P. Morgan’s remarks, quoted in our introduction, remain as relevant now as ever; given the outsized movements associated with periods of high volatility, the professional focus on avoiding risk is apt. The evidence also suggests that periods of volatility can be harnessed by opportunistic investors, a concept as least as old as the Rothschilds’ pioneering of international finance in the Napoleonic era.

But our understanding of risk, and the technology available to measure it, has evolved. At the next major period of financial distress, the balance among the prevalent levels and trends in volatility, correlations and dispersion will determine how we later describe what happened; an understanding of their dynamic interactions may also help investors to navigate through the period. The questions of whether it is a better environment for growth or value investments, or whether a contrarian or momentum-following outlook is better suited to the current landscape, have been historically influenced by trends in dispersion.

Those able to anticipate the trends in volatility have always been able to “time the market.” The results of this paper suggest that the ability to anticipate trends in dispersion and correlations may determine a preference among equity factors as well. Their various levels can also characterize the source and nature of equity weaknesses. Taken together, a multidimensional view of risk may help distinguish crisis from opportunity—and for whom.

ABOUT S&P DOW JONES INDICES

S&P Dow Jones Indices LLC, a part of McGraw Hill Financial, Inc., is the world's largest, global resource for index-based concepts, data and research. Home to iconic financial market indicators, such as the S&P 500® and the Dow Jones Industrial Average™, S&P Dow Jones Indices LLC has over 115 years of experience constructing innovative and transparent solutions that fulfill the needs of institutional and retail investors. More assets are invested in products based upon our indices than any other provider in the world. With over 1,000,000 indices covering a wide range of assets classes across the globe, S&P Dow Jones Indices LLC defines the way investors measure and trade the markets. To learn more about our company, please visit www.spdji.com.

PERFORMANCE DISCLOSURES

The S&P 500 Equal Weight Index was launched on Jan. 8, 2003. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect on the launch date. Complete index methodology details are available at www.spdji.com.

The S&P 500® Momentum was launched on Dec. 3, 2014. All information presented prior to the launch date is back-tested. Back-tested performance is not actual performance, but is hypothetical. The back-test calculations are based on the same methodology that was in effect on the launch date. Complete index methodology details are available at www.spdji.com.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency on their products. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live; index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public Web site or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of Introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities (or fixed income, or commodities) markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

Additionally, it is not possible to invest directly in an Index. The Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices maintains the Index and calculates the Index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. For example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US$ 10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US$ 1,650), the net return would be 8.35% (or US$ 8,350) for the year. Over a three-year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US$ 5,375, and a cumulative net return of 27.2% (or US$ 27,200).

GENERAL DISCLAIMER

It is not possible to invest directly in an index. Exposure to an asset class represented by an index is available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other vehicle. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice. Closing prices for S&P US benchmark indices and Dow Jones US benchmark indices are calculated by S&P Dow Jones Indices based on the closing price of the individual constituents of the index as set by their primary exchange. Closing prices are received by S&P Dow Jones Indices from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof (Content) may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

S&P Dow Jones Indices keeps certain activities of its business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain business units of S&P Dow Jones Indices may have information that is not available to other business units. S&P Dow Jones Indices has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process.

In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.