Correlation risk is a hot topic. After the equity bubble collapse revealed the severity of this risk within investor portfolios, volumes of research began highlighting a wide array of alternative asset classes, markets, and products. The arguments have been enormously persuasive, and investors since have shifted significant capital away from more-correlated exposures to less-correlated alternatives.

After all, modern portfolio theory no longer may have a sterling reputation, but every financial professional understands its implications: A portfolio of uncorrelated risk assets should have a higher risk-adjusted return than any individual asset within that portfolio.

The effect is so strong that the addition of an asset with uncorrelated risk can improve the risk-adjusted return even if the risk of the additional asset is greater than that of the portfolio itself.

Of course, the fact that an additional asset is risky is a necessary but insufficient criterion. The additional asset also must be uncorrelated with the assets already in the portfolio. If the additional asset has a high degree of correlation, then all bets are off.

State of the Market
Unfortunately, several markets and asset classes that historically have had low correlation have become highly correlated in recent months and years. Analysts and economists have developed a variety of theories to explain the phenomenon of rising correlation, including the convergence of financial markets, instant communication of ideas, declining asset price volatility, and global liquidity.

Regardless, this evolution has dramatic implications for investors who seek to manage an appropriately diversified portfolio. A strategic asset allocation policy established with low-correlation expectations now functions in a high-correlation environment, and it may offer diminished diversification value relative to the less-correlated historical performance observed over a longer time frame.

Looking Beyond Correlation
Correlation itself, however, is a severely limited metric for diversification and cannot contribute to a meaningful dialogue about financial market relationships. Furthermore, it is a poor foundation for asset allocation decisions, portfolio analysis, risk management, and product development.

It may seem strange to discredit the tool that establishes a common language for this category of risk, but let us examine the following key observations and considerations:
• Correlation is a linear estimation of the relationship between two variables. Nonlinear relationships, outlying observations, and external factors will significantly distort the results.
• Correlation assumes that the variables being considered are both normally distributed and that the combination also is normally distributed. Skew, kurtosis, and higher-order moments cannot be taken into account.
• Correlation assumes that the volatility of each variable does not change. If the volatility increases, the correlation will decrease regardless of the relationship.
• Zero correlation does not imply that two variables are independent. Similarly, knowing that two variables are independent does not mean that their correlation is zero. (They may be influenced by an unobserved third variable.)
• Correlation cannot provide sufficient information, intuitive or
otherwise, on the relative magnitude of risk.

- Most importantly, investors do not directly “experience” correlation.

**But If Not Correlation, Then What?**

“Spread” and “spread volatility” best describe the risk associated with combining two assets into a single portfolio or adding a new asset class to an existing portfolio. Since they are experienced directly by diversified investors, spread and spread volatility more thoroughly illustrate the nature and magnitude of multi-asset risk than correlation alone.

Let’s define “spread” as a measure of the relative performance of two variables, whether they are asset classes, indexes, sectors, stocks, or specific products.

Let’s define “spread volatility” (also known as “spread dispersion,” or simply “dispersion”) as the variability of the spread. Generally, it will be calculated as the standard deviation of the spread’s distribution over time.

**Assembling Spread and Dispersion Data**

As an example, consider the relationship between the Standard & Poor’s 500 (SPX) and the Russell 2000 (RTY) indexes from January 1, 1988, through March 31, 2007. Figure 1 shows the two indexes over time.

Figure 2 shows the rolling correlation of three-month returns for SPX and RTY. Each data point shows the correlation of three-month periods of returns for SPX and RTY observed over rolling 24, 36, and 60 month-end to month-end periods. For example, the December 2006 value for the rolling 60-month correlation of three-month returns is 90.5 percent; this is derived from the set of three-month returns observed on the last trading day of December 2006 (calculated as month-end September 2006 to month-end December 2006) and in each of the preceding 59 months (August–November 2006, July–October 2006, etc.).
Figure 2 allows us to discuss whether the correlation of three-month returns is high or low and whether it is rising or falling. But it provides little if any actionable information for a diversified investor. For example, it doesn’t show which index had the better performance, the magnitude of that relative performance, the risk of each underlying, or the frequency of outliers. In short, correlation does not give us much insight into the relationship between these two indexes.

Analyzing spread and dispersion data, however, allows a more thorough analysis.

Figure 3 shows rolling performance data for the two indexes. We’ve used a daily (rather than monthly) rolling calculation, and a 91-day metric better standardizes the subsequent analysis.

We immediately notice that SPX and RTY track each other fairly well in figure 3. By itself, this would suggest a significant degree of correlation, although the correlation strength and variability would not be obvious without further analysis.

Figure 4 shows the spread between the two sets of rolling returns, i.e., the rolling 91-day performance of RTY minus the corresponding rolling 91-day performance of SPX.

Figure 4 provides evidence that the relationship between SPX and RTY is not constant. The spread varies over time in both magnitude and velocity and contains numerous outlying observations. However, each of these aspects tends to be more muted than for either of the individual underlying indexes—just as modern portfolio theory would have it.

Furthermore, we observe an aspect of the relationship that cannot be extracted from the correlation analysis alone: This spread tends to mean-revert to zero. Of course, this likely will hold true for any pair of equity indexes that have similar long-term expected returns. In the case of SPX and RTY, mean reversion may play out over a period of years, but it certainly will get there. (If it were not the case, one of the two indexes eventually would dominate 100 percent of the equity marketplace.)

Figure 5 shows the distribution of rolling 91-day spread observations over the full period.

Figure 5 also shows the normal distribution that most closely approximates this realized dataset. Its standard deviation is approximately 6 percent—this is the metric that best captures the degree of diversification risk for the pair of underlying indexes over this time frame. Is this value high? Is this value low? Does the distribution show evidence of skew, kurtosis, or other dimensions of risk? A more thorough analysis is beyond the immediate scope of this article, but it would begin to provide the fuller picture of how the relationship between these two indexes impacts the portfolio’s diversification.

**Product Construction**

Remember that all of the data thus far are backward-looking. Relying solely on this data for investment guidance implies that certain historical relationships will persist. It would be challenging to support or justify such simplicity in a complex and rapidly evolving marketplace.

 Investors certainly would benefit from having access to the informational building blocks of dispersion—forward-looking financial products that allow for market-based discovery of dispersion. Yet no dispersion indexes, no benchmarks, no exchanges for observing dispersion expectations, and few securities exist for the pricing of dispersion risk. Innovation has been underwhelming at best as this substantial yet obvious piece remains missing from the marketplace.

In the over-the-counter marketplace, however, institutions are witnessing the creation of a dispersion options market.

**Dispersion Options**

Generally speaking, the price of a dispersion option—an option with a payoff tied to the spread between two underlying instruments—is driven by dispersion expectations. If the dispersion is expected to be wide (i.e., the spread has high variability), the option premium would be large. If the dispersion is expected to be narrow (i.e., the spread has low variability), the option premium would be small.

For example, consider a hypothetical diversified investor with a two-asset portfolio consisting of SPX and RTY. This investor’s performance will be the average performance of the two indexes (the baseline performance), which is consistent with the objective of maximizing risk-adjusted returns via diversification.

If the investor believed, however, that RTY likely would outperform SPX this year, the investor could elect to overweight their capital allocation to RTY at the expense of dispersion.
of SPX. In effect, the investor has a view on dispersion and will adjust the portfolio weights accordingly.

But the investor also could instead take a similar position utilizing dispersion options. Specifically, the investor could combine a 100-percent allocation to SPX with a call option on the spread between RTY and SPX.

The net performance of SPX and this dispersion option is economically equivalent to receiving the performance of the better-performing index, whether SPX or RTY, less the dispersion option premium.

If SPX outperforms RTY, then the investor holds 100 percent of SPX (the better performing index) and a worthless dispersion option. If RTY outperforms SPX, then the investor holds 100 percent SPX (the lesser performing index) plus a dispersion option that pays RTY’s performance over SPX; the net performance is equal to 100 percent of RTY. In either case, the investor’s performance will be the better performing index (less the dispersion option premium).

For target investments that have low spread-variability expectations, dispersion options are a relatively cost-effective approach to diversification, offer protection against cross-market dislocations, and deliver an attractive risk-reward alternative to traditional direct investments.

Further, if the realized dispersion is greater than the dispersion expectation embedded in the option price, then this portfolio’s return will be greater than that of the baseline portfolio. Such a substitution strategy has obvious diversification, risk management, and performance implications. For target investments that have low spread-variability expectations, dispersion options are a relatively cost-effective approach to diversification, offer protection against cross-market dislocation and tail risk, and deliver an attractive risk-reward alternative to traditional direct investments. The capabilities to develop effective solutions tailored to the needs of a specific investor will only continue to grow over time.

David Krein is founder and president of DTB Capital, which offers specialized advisory and strategic services in structured products, derivatives markets, risk management, and alternative indexing. He earned an M.B.A. with honors from The University of Chicago Graduate School of Business and a B.S. with distinction in mechanical engineering from Cornell University. Contact him at david@dtbcapital.com.