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EDITORIAL COMMENT

Diversification: *Should We Be Diversifying* Trends?

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In the aftermath of the recent financial crisis, an increase in correlations between asset classes was frequently cited as having rendered diversification strategies ineffective and, thereby, causing unexpected losses to investors. This observation refers to diversification across assets in order to reduce the noise in returns. But there are two problems with such an approach. First, empirical evidence suggests that the returns of financial assets (measured as the logarithm of returns) are not normally distributed, but exhibit heavy tails. Second, market indices do not follow random walks.

Co-movements between sequences of identical and independent normally distributed log-returns can be described by their correlation; that is, correlation works well if prices or index levels follow random walks with normally distributed increments. It is well known, however, that if log returns are not normally distributed but are leptokurtic, correlation is not a good measure of the strength of co-movements between the log returns. This is so because in the presence of heavy tails the estimation of linear correlations is dominated by a few outliers. To capture the level of correlation and construct diversification strategies in the presence of heavy tails, we need to adopt more powerful nonlinear concepts such as copula functions.

In addition, the assumption that log returns can be approximately described as sequences of independent variables with constant parameters (i.e., the assumption of random walk behavior of log prices) is not plausible, especially in times of crisis. In fact, the behavior of many indices during a crisis might better be described as an inversion of trends (or drifts), that is, a shift in the expectation of returns.

To illustrate, consider the behavior of the value and returns of the S&P 500 Index over the four-year period from January 2005 to end-December 2008, as shown in the exhibit. A single random walk with normally distributed increments is an implausible model for describing this index, even approximately. In fact, the assumption of normally distributed returns is rejected at the 99% confidence level by a battery of statistical tests—the Lilliefors, Jarque–Bera, and Kolmogorov–Smirnov tests. In addition, the Chow test supports the view that the S&P 500 Index experienced a structural break during the period. At a 95% confidence level, the Chow test suggests that two contiguous random walks with different means are a better explanation than a single random walk; the estimated daily drift of the S&P 500 was 0.00035 before August 2007 and was -0.0019 after that date.

A possible break in the behavior of the S&P 500 suggests that it might be best for investors to consider a different concept of diversification. One possibility is to adopt the concept of "diversification of trends (or drifts)" given that what protects investments in times of crisis is diversification over asset classes whose conditional expected returns do not move together. This is a diversification of a higher level or order. It is not about correlations between the returns or random noise fluctuation, but rather the relation between their expectations. In the period 2005–2008, the drift of high-quality bonds and stocks did not invert all together. Bonds, therefore, effectively offered partial protection regardless of the instantaneous correlation between the two asset classes. This suggests that both investment and risk management strategies should rely not only on a static view of correlations, but should also take into consideration diversification at a higher level and with more powerful dynamic strategies capable of capturing shifts in expected asset returns.

Models such as Black–Littermann include an estimate of the conditional expectations of returns, which is very difficult to compute, especially in periods of crisis; hence, there is a need for robust risk management tools that are not required to exactly time the inversion of trends. Methods to structure portfolios based on regime shifts have been proposed by, for example, Alexander and Dimitriu [2005a,

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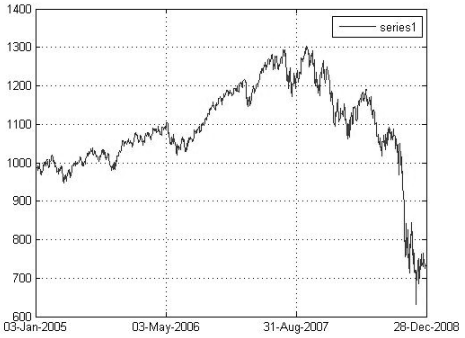
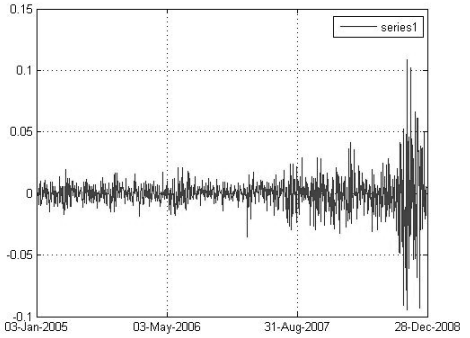
EXHIBIT
S&P 500 Value-Weighted Index, 2005–2008



Values



Daily Log Returns

2005b] and Kritzman and Li [forthcoming]. Bali [2000] and Bali, Demirtas, and Levy [2000] introduced the concept of asymmetric drifts in interest rate processes and nonlinear mean reversion in equity prices.

Representing and modeling the dynamics of return expectations is more difficult than computing correlations between fluctuations around a supposedly constant mean. Some tools, for example, the family of Markov switching models, are already available. Markov switching models represent returns as sequences of random walks whose drifts are driven by Markov chains. Of course, these models require a long series of sample data to be properly estimated. Though Markov switching models cannot predict when the next shift in trends will occur, they can offer an estimate of the correlation between trends. This ability provides a highly valuable insight for risk management: It allows a manager to select asset classes that offer *diversification of expectations* as opposed to *diversification of local fluctuations,* but fresh insights are probably also needed.

In a private communication to the authors, Jarrod Wilcox suggested that the idea of diversification of trends can be cast in the framework of estimating correlations at different time scales. Wilcox observed that correlations might be very different if computed on the scales of days or of years. Diversification of correlations on a long time horizon is a different way of stating the question of diversification of expectations. Note that both cases call for dynamic models. Correlations are inherently dynamic. Multivariate GARCH models attempt to capture the dynamics of correlations evaluated on short time horizons (e.g., days). How to look at correlations on longer time scales (e.g., beyond one year) is a subject for research.

In summary, we suggest that diversification is a multidimensional problem. Diversification in the usual sense protects only against local fluctuations. A companion concept of diversification at a higher level, that is, the diversification of expectations, holds the promise of allowing us to properly understand and manage the risk of large losses in moments of crisis. Though we already have a number of tools to perform this task, future research should lead to better modeling of the dynamics of expectations, which will likely involve linking expectations of different asset classes to macroeconomic variables

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