Hedge funds have gained popularity over the past several years, especially among institutional investors. Assets allocated to alternative investment strategies, distinct from private equity or venture capital, have grown by several hundred percent since the dot-com bubble burst in 2000 and now top US$2.5 trillion. The notion of uncorrelated, absolute returns encompassing a broad range of asset classes and distinct strategies has enjoyed great acceptance among conservative investors seeking more predictable and consistent returns with less volatility. As a result, the industry has begun to mature and investors now range from risk-averse fiduciaries to aggressive high-net-worth individuals.

As the number of hedge funds and complex strategies has grown, so too have the frequency and severity of negative events—what statisticians refer to as “negative tail risk.” Five-sigma (5σ) drawdowns, which many argue are unpredictable and rare, are occurring with increasing frequency. During such episodes the finger of blame almost always points to the elusive concept of “liquidity”—that difficult-to-quantify elephant in the room that behaves well until it doesn’t. To be sure, liquidity (or illiquidity) can be correlated closely with falling prices and can be either systemic or non-systemic—depending on which argument suits your purpose at the time. But illiquidity doesn’t occur in a vacuum. When prices adjust, usually it’s for a reason, and an early signal often telegraphs the change.

This article examines three recent hedge fund failings and considers how quantitative analyses of historical performance, combined with a realistic level of qualitative due diligence, may or may not have provided warnings and/or given investors adequate time to redeem their capital. Although the article implicitly considers different forms of investment risk such as leverage and derivatives, it focuses primarily on quantitative return-based data that was publicly available rather than strategy- or security-specific risk. For illustrative purposes this article does not target any specific strategy and considers a) a multi-strategy fund, b) a global equity market neutral fund, and c) a levered credit/bond fund.

Multi-Strategy (MS). MS was perhaps the most notorious hedge fund failure since Long Term Capital Management in 1998. Formed in 2000 as a low-volatility, relative-value/arbitrage fund, MS rode the wave of institutional hedge fund popularity and grew to more than US$9 billion before experiencing a 70-percent loss in September 2006. The loss represented a remarkable failure of risk management that largely resulted from highly concentrated positions in what historically had been an esoteric sector of the futures markets. This gigantic departure from the firm’s historical investment strategy and risk-management objectives resulted in the evaporation of nearly US$6.5 billion of investor equity, virtually overnight.

Global Equity Market Neutral (GEMN). Since 2003, GEMN had managed a globally diversified, equity market neutral hedge fund. Employing various amounts of leverage while attracting several billion dollars of investor equity, the fund had developed an excellent history of low-volatility, uncorrelated, consistently positive returns. Despite the strategy’s investment objectives and track record, however, at maximum drawdown in August 2007 this market neutral fund had lost approximately 35 percent of its value.

Levered Credit/Bond (LCB). Backed by a major U.S. bank known for its fixed-income trading expertise, LCB was launched in 2003 and had never experienced a negative month until it lost 100 percent of its value around May 2007, shortly after its first negative event. All three of these incidents had several things in common: a) each had “world class” management and sector expertise, b) each was a successful business with notable institutional investors for clients, c) two were affiliated with internationally acclaimed U.S. banks, d) all had impres-
sive risk-management guidelines and dedicated personnel, and e) all appeared too large and sophisticated to fail.

This article looks at the data available to prospective investors before each negative event and considers how it may have been misused, misunderstood, or simply inadequately managed. Was the potential magnitude of these losses simply ignored by investors, which in every case included several prominent global risk-management teams? Was the historical data not robust enough to reveal the risks? Or did investors become lazy and/or complacent? The conclusion also considers how emotions may have influenced investor decisions when empirical data become opaque, and how notions of trust and goodwill, based on past performance, may have influenced and/or delayed investor decision making.

Table 1 shows historical performance data for each fund. This information was readily available from several industry sources, although MS and LCB stopped reporting when their funds failed (an important survivor-bias consideration when evaluating hedge fund indexes and peer group comparisons). Before their problem periods, all three funds boasted attractive risk-return characteristics, superior Sharpe ratios, and generally appeared to be delivering on promises of absolute returns. Each fund had a relatively long track record, especially for such a young and rapidly growing industry.

Before each failure, none of the funds ever experienced a meaningful loss (drawdown) and each had a favorable batting average, i.e., the ratio of winning months versus losing months. From a statistical perspective, an investment in any of these funds would have appeared prudent. More detailed qualitative due diligence, including office visits, meetings with management, review of risk guidelines, analyses of due diligence questionnaires, and conversations with prime brokers, auditors, fund administrators, and existing investors still would not have dissuaded most investors. Simply stated, absent a subjective dislike for the specific fund or strategy, all lights appeared green.

Monte Carlo Forecasting

Monte Carlo forecasting (stress testing) techniques are among the best, though certainly not the only, statistical methods for estimating risk and gain/loss probabilities. Integrating Monte Carlo with historical correlations results in value-at-risk (VaR) data, but basic Monte Carlo forecasting without correlations also provides a robust data stream. Monte Carlo techniques can be used to develop and actively manage risk budgets and optimally size investments. Other risk measures, such as the Omega ratio, also can be useful but may not place adequate emphasis on downside risk by assuming that positive and negative fat tails are uncorrelated.

This article focuses on whether the historical performance of a particular fund and Monte Carlo forecasting would have provided an investor with adequate information for effective decision making. This article does not meaningfully consider the full range of hedge fund related risks such as illiquidity due to initial investment lock-ups, infrequent redemption rights and notice periods, or the use of “gates” to halt or limit redemptions when a fund is receiving lots of withdrawals. Hedge fund investors can and should consider such risk factors before investing, or risk learning that a necessary or desired redemption may be unavailable for several months.

The three best-known methods of Monte Carlo forecasting—GARCH, normal, and bootstrap—provide different ranges of best- and worst-case estimates by employing different variable-relaxation techniques. Each method is good at forecasting returns although GARCH, which provides the greatest relaxation of variables, generally forecasts both higher highs and lower lows. Said differently, although the 50th-percentile forecasts of

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<td>1. Length of Track Record</td>
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all three techniques are generally similar, the best- and worst-case scenarios will differ greatly. Although we generally have experienced good risk-management results with Monte Carlo, these three funds lost substantially more than forecasted at the 99.9-percent (1/1,000) confidence level using bootstrap methodology.

Table 2 reveals the worst-case maximum drawdowns forecasted using the bootstrap method of Monte Carlo over the periods shown in table 1. We purposely used these periods because they historically were “typical” for each fund; the majority of investors would have made initial investment decisions based on these return patterns. The months immediately subsequent to these periods would have provided a different Monte Carlo view of each fund’s risk-and-return profile due to each fund’s increased volatility, potentially offering prospective investors different (i.e., greater) risk scenarios. This article focuses only on the data reasonably available to prospective or existing investors before the negative events, exclusive of those bad months when the problems were becoming statistically apparent.

The actual drawdown of each fund was meaningfully greater than the Monte Carlo forecast at the 99.9-percent confidence level. In each case, losses were characterized as rare, 5+σ events. The maximum bootstrap-forecasted drawdowns for MS, GEMN, and LCB were 12.5 percent, 14 percent, and 9.37 percent versus actual losses of 70 percent, 35 percent, and 100 percent, respectively. In other words, events forecasted to occur once every 1,000 months (or every 83.3 years) occurred within 49 months, on average, of the launch date of each fund—despite alleged management quality and risk-management disciplines.

Absent a negative predisposition toward these funds and/or their strategies, little statistical data warned a prospective investor of the risks or magnitude of future loss. My firm, for example, never has favored the mortgage loan space and, as a result, had little interest in the LCB mortgage fund, irrespective of its attractive track record. Our firm’s decision to avoid the space was not based on expectations of loss or any quarrel with management. Other investors may not have favored super-large funds such as MS or the leveraged equity market neutral sector. Either way, I’ve seen no study that meaningfully claims to have forecasted the large losses these funds experienced. The resulting damage from these investments is like what RCG Principal Ron Surz and his former colleague Frank Myer (Glenwood Funds) refer to as “airplane risk”: You know the risk is there, but nothing specific stops you from boarding the plane. And, much like a passenger on a problem flight, an investor can do little in a hedge fund crisis because of limited and lengthy redemption policies.

Simply noting that past performance is not indicative of the future is anti-climatic, useless, and needlessly fatalistic; investment managers and consultants must dig deeper and find ways to better anticipate and prepare for these events. Building well-diversified hedge fund portfolios with a stress-tested, forecast 1/1,000 (99.9-percent) likelihood of each fund losing a significant amount may provide initial comfort, but only until you are reminded that this 1/1,000 knock-out risk exists with each of your underlying investments. Naïve diversification into an equally weighted portfolio of 40 underlying funds results in average allocations of 2.5 percent per investment, which surely would limit the damage from any one bad investment. But this structure still results in a statistical 40/1,000 (i.e., 1/25) monthly probability of experiencing a similar event because you now have 40 investments that each have a 1/1,000 chance of blowing up. Increasing the size of your individual allocations can lower this probability, although the direct damage incurred by one bad investment would be proportionally greater.

The answer, we believe, is to identify signals that may correlate with fund implosions and to move aggressively to protect assets when they occur. Bernoulli odds ratio estimation, which attempts to explain why a coin flipper might flip “heads” five times in a row with only a 50–50 chance on each toss,
also may explain why a hedge fund investor might, or might not, have had investments in all three of these funds. The information below doesn’t offer any proprietary secrets for avoiding these hazards, but it does consider how a more rigorous and disciplined quantitative approach based upon Monte Carlo forecasting may have helped investors mitigate or totally avoid losses from these (or other) funds.

**Multi-Strategy.** In 2004 MS informed investors of a change that would result in allocating a portion of the fund to trading energy futures. A key member of the original energy team left the firm shortly thereafter and a new head of energy trading was appointed. Monthly letters revealed increasing allocations to this sector, although the actual extent of the capital commitment may not ever have been clearly or fully revealed. In September 2005, a full year before the fund failed, MS had a positive return of 6.2 percent, nearly twice the return of any prior month except August 2005 (the prior month), which was up 4.4 percent. Monte Carlo analyses suggest, in hindsight, that this positive return was nearly a 3σ event, but it largely was ignored because it was a positive variance, leading most investors to think they were either lucky or smart. Monthly returns and volatility increased, and in April 2006 the fund posted a +13.1-percent return. However May 2006, the following month, brought the first serious negative loss; the fund was down 10.5 percent. It quickly became obvious that the large monthly gains had correlated with an increasing probability of loss. Four months later, MS lost nearly 70 percent in a single month.

With the benefit of hindsight, we know that the September 2005 return of 6.2 percent was a preview of coming attractions, a 3σ event that represented substantial and inadequately disclosed style drift. Any investor bound by strict risk-budget guidelines should have reduced his position immediately and considered full redemption. Unfortunately for many investors, MS’s redemption terms were annual with 90-days notice or a 4-percent penalty. Many investors submitted redemptions before September 2006, but few fully appreciated the risks and therefore were unwilling to pay the 4 percent.

**Global Equity Market Neutral.** The GEMN fund returned 18.4 percent in 2004 and 20.2 percent in 2005. During 2006 the fund was down 1.1 percent following losses of 3.5 percent and 6.7 percent in October and November. The 6.7-percent November loss was nearly twice the largest prior monthly loss and approached a 3σ event. Increasing volatility led to a positive 5.74-percent return in January 2007, but a 6.6-percent loss in July 2007 revealed that volatility still was increasing and that 3σ events were becoming more frequent. In September the fund melted down with a 5+σ event—well beyond the 99.9-percent Monte Carlo forecasts. This fund had favorable redemption terms: monthly liquidity with 30-days notice. By acting quickly on the empirical data showing increasing volatility rather than delaying and discussing with management, an investor would have had ample time to redeem. Instead most investors chose to speak with management and received verbal assurances that problems were “under control,” and then got caught in the fund’s collapse.

**Levered Credit/Bond.** LCB is more of a conundrum; it had never experienced a down month before its negative event. Since its inception the fund had experienced annualized returns of 11.7 percent with an annualized standard deviation of 2.8 percent, resulting in a Sharpe ratio of 2.20. The quantitative historical data provided no clue to a problem.

**Conclusion**

Each of the funds we’ve considered had superior management and an attractive track record. Although two of the three funds had experienced 3σ events before blowing up, much of that volatility had been upside volatility. Investors were making money, so much of that risk was ignored. Had the early volatility all been negative, it’s likely that investors would have redeemed quickly. Positive beta is the addictive drug of our industry; it

“Had the early volatility all been negative, it’s likely that investors would have redeemed quickly. Positive beta is the addictive drug of our industry; it requires tremendous discipline to cut winning positions.”

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**Selecting example funds for this article:**

2007 was a year of extremes. In the hedge fund world more directly than anywhere else, large losses for one investor equate to large gains for another. Many funds had extreme results; John Paulson’s funds, which were short in the subprime mortgage space, boasted returns of between 100 percent and 500 percent for the year. Many other funds experienced their largest losses and several failed. The three funds selected for this article were selected randomly; indeed, this past year provided no shortage of subject matter in this area.
requires tremendous discipline to cut winning positions.

A call-to-action sounds whenever returns land outside the predictive bands of Monte Carlo risk budgets. Whether the volatility is positive or negative, we believe it is time to resize and/or redeem positions. The Omega ratio tends to forgive positive volatility; we believe that in practice this is an error and may lead to bad results. Indeed, monthly returns that are $2\sigma$ or $3\sigma$ outside the expected range are signals of style drift and increasing risk and/or illiquidity. Leverage only exacerbates the situation, and if equity ratios decline and margin calls are made, the combination can be disastrous. When returns begin to fall outside the Monte Carlo forecasted range of expectations, don’t call the portfolio manager and/or the fund’s marketing personnel. Push the redemption button first, then call. Given the liquidity constraints of hedge funds, a redemption notice (which often can be withdrawn) is the only prudent weapon against a rogue manager or a faulty hedging scheme. Of course, management discussions that assure investors that “everything is under control” are normal and customary (the Stockholm Syndrome)—few managers ever admit to being out of control or voluntarily share problems with investors. It’s the data that supports the conclusion that investors could have avoided both the MS and GEMN meltdowns by using Monte Carlo forecasting and strict risk-budgeting guidelines.

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Endnotes


2 Mean-variance optimization, while common with traditional investment strategies, is not as useful with hedge funds because hedge fund returns are not normally distributed. Although a diversified portfolio of hedge funds initially can benefit from passive mean-variance optimization, we have come to believe that hedge fund investors should be more concerned with fund-specific risk and should take an active role toward risk budgeting.