Battle for Alphas: Hedge Funds versus Long-Only Portfolios

Duen-Li Kao

The study reported here empirically examined whether the alphas of hedge funds and those of long-only portfolios present different distributions and are derived from different risk factors. Adjusted for return volatility differences, hedge funds seem to offer more consistent alphas for potential transfer to either equity or bond asset classes than do long-only portfolios—even under extreme market conditions. Potential explanations for the findings include lack of data reliability and differences between hedge funds and actively managed long-only funds in compensation, investment constraints, and structures. Factors related to market index returns do not adequately detect hedge funds’ risk postures beyond a fund’s exposure to the market-directional risk of standard asset classes. Risk factors derived from asset prices in financial markets do provide timely and systematic descriptions of the risks underlying trading strategies used by hedge funds. The multifactor style-risk analysis presented here can effectively monitor a hedge fund’s exposure to systematic versus idiosyncratic risks and volatility-risk factors over time.

Despite the long equity bull market in the 1990s and liquidity/credit crises in the late 1990s, hedge-fund investing has been gaining significant popularity among various types of investors. The amount of total funds under management by hedge funds increased fourfold during the 1994–2000 period.¹ The Internet bubble and valuation concerns in the global equity markets, especially among such sectors as telecommunications, media, and technology, provided additional catalysts for the soaring interest in hedge funds since 2000.

Institutional investors often use hedge funds as part of “absolute return” strategies to pursue capital preservation while seeking returns in the high-single-digit to low-double-digit range. This strategy is implemented primarily by such investors as endowments, foundations, and high-net-worth individuals. Allocation by corporate and public pension plans to hedge funds as a defined asset class is a recent phenomenon.

A second application of hedge funds is as an alternative to long-only investing through an alpha-transfer process. This application often involves combining hedge funds with various derivative overlays. The pension consulting and hedge-fund communities have been advocating this application because of long-only managers’ difficulties in achieving active returns over benchmarks. For example, pension plans can overlay an equity market-neutral fund with equity index futures to create a synthetic long equity portfolio. To the extent that the hedge-fund component outperforms its funding cost (e.g., LIBOR), the alpha may be transferred back to a long-only equity portfolio via derivatives. In theory, one can reverse this process to form a pseudo hedge fund; that is, an equity long-only manager’s alpha over an equity index can be transferred back to an absolute-return fund by shorting equity futures. Most likely, endowments and foundations would not pursue this fantasy strategy. A pure mathematical equivalence would fail to convince these institutional investors to “expand” their hedge-fund-manager universe.

Because, theoretically, one can transfer alphas from either long-only or long-short portfolios to a desired target investment, these two types of alphas over their respective benchmarks (an index benchmark or LIBOR) can be compared on a common basis. The general perception is that, as a group, hedge-fund managers produce just enough active return to earn their overall fees whereas long-only managers fail to do so.

¹ Duen-Li (Tony) Kao is managing director of the Global Fixed Income Group at General Motors Asset Management, New York.
How different are these two types of alpha? Do alphas from long-only and long–short investments provide different return distributions? Do the alphas derive from different risk factors? I analyze these questions by examining empirical data on the active performance differences in long-only versus long–short investing. I also discuss potential explanations, namely, compensation differences, investment constraints, and other structural differences.

As is well known and empirically documented, the payoffs from hedge-fund investing exhibit nonlinear features similar to those obtained from option strategies.2 Furthermore, many well-publicized cases of catastrophic losses incurred by hedge funds provide additional evidence of extreme return skewness. These facts present an analytical challenge for long-only investors accustomed to the mean–variance framework. To gain insight into how hedge funds incur risks, I review the evolution of methodologies for analyzing hedge-fund risk, the return–risk patterns of various hedge-fund investments, and data reliability. I propose an alternative method of analyzing “investment style” as applied to hedge-fund investments, and I review the contingent-claims approach to hedge-fund risk analysis by replicating hedge funds’ option-like payoffs or trading strategies.

Classification of Hedge Funds

Conventionally, hedge funds are classified into categories according to their trading strategies or styles. Subsectors of hedge funds include trend-following, global/macro strategies, long-only, arbitrage, long–short, and so on. Despite attempts by data vendors, practitioners, and academics, no clear standard of classification currently exists (as is evident from the diverse categories used by various data vendors). In addition, given the variety of dynamic investment strategies and multiple capital market instruments used within individual hedge funds, style classification of a hedge fund can be easily mishandled by data vendors or hedge funds themselves.3 Fung and Hsieh (1999) provide a comprehensive discussion of the nature of hedge-fund strategies. For brief descriptions of the hedge-fund strategies mentioned in this article, please see Appendix A.

In a broad sense, hedge-fund styles can be classified according to how the funds manage the first or second order of the distribution of systematic risk factors. From the viewpoint of the first order of factor distribution, hedge funds differ as to whether they are taking “market directional” bets—that is, whether they are taking systematic risk versus idiosyncratic risk (e.g., credit, spread, or event risks). How a hedge fund manages against the second order of factor distribution, volatility, can also be examined. For example, practitioners, for simplicity, often consider commodity trading advisors (CTAs) to be long in volatilities while arbitrageurs are short in volatilities. Thus, during periods of extreme market volatility, these two types of hedge funds tend to offset each other.

Active Performance

In this section, I address two questions about differences in the alphas produced by hedge funds and by long-only portfolios: Do hedge funds produce different types of alpha distributions from those that active equity managers produce? What type of hedge fund is a better source of alpha for a given asset class?

Alpha Distributions. To isolate and compare the two types of alpha, I benchmarked the funds’ performances versus their respective benchmarks. The hedge funds were measured against LIBOR, and the long-only portfolios were measured against the appropriate equity or bond market index. The long-only bond and equity returns were represented by the Frank Russell institutional long-only universe. I chose this data set instead of a mutual fund universe, as is conventionally used in other studies, because I believe that the clientele of hedge funds is more likely to resemble holders of institutional long-only portfolios than mutual fund investors. Long-only portfolios and hedge-funds both target the more sophisticated and longer-term investor who may not require daily liquidity, which allows the portfolio/fund managers to pursue the desired strategies. For the equity market-neutral hedge-fund returns and the fixed-income arbitrage fund returns, I used the CSFB/Tremont Hedge Fund Indexes, which are increasingly becoming the industry standard.

Note that the following simulation results make an implicit assumption that the alpha-transfer process is perfect; that is, the financing costs for the hedge funds and the derivatives used in the transferring process are identical. As experienced by many practitioners in recent years, the violation of this assumption can introduce significant return variance to the transfer process.

Figure 1 compares after-fee quarterly alphas (in percentage points, pps) of actively managed long-only U.S. equity accounts with the alphas of the equity market-neutral index (the CSFB/Tremont index) for the 1994–2001 period.4 The 45 degree line represents even performance of these two universes. The points represent paired quarterly active performance in different equity market environments.
Figure 1. U.S. Equity Long-Only Excess Returns versus Market-Neutral Excess Returns, 1994–2001

![Graph](image)

**Note:** Active, after-fee returns were measured quarterly.

**Sources:** Data are from Frank Russell Company and CSFB/Tremont.

during the period, as determined by the S&P 500 Index return. For example, the circles and squares represent, respectively, large negative and large positive equity market movements (observations greater than 1 standard deviation of the S&P 500 quarterly return distribution). Note that a point below the “Even Performance” line indicates that the active return from an equity market-neutral strategy was greater than that from an active long-only equity account in the period. The fact that more points lie below the “Even Performance” line indicates that the market-neutral strategies generally outperformed the long-only accounts.

Examination from the direction of the x- or y-axis shows that market-neutral strategies had wider active return distributions than long-only accounts, with a few observations at the extremes. The market-neutral strategies outperformed the benchmark on an after-fee basis much more often than did the active long-only accounts, as indicated by the fact that more points lie to the right of the vertical line at zero than lie above the horizontal line at zero. Furthermore, market-neutral strategies performed better than the long-only accounts during extreme market conditions, as depicted by more circles and squares among the shapes below than above the “Even Performance” line. Another interesting phenomenon is that the long-only accounts produced negative excess returns when equity markets were very strong. This outcome is consistent with the findings for the active performance of equity mutual funds from 1965 to 2000 by Mezrich, Zeng, and Rothman (2000). Conversely, the market-neutral funds generated positive alphas over LIBOR in these situations, perhaps because of their positive exposures to the market risk factor (discussed in a later section).

Turning to bond markets, Figure 2 shows similar results for fixed-income arbitrage funds as compared with active U.S. bond managers. The active returns from the long-only bond portfolios produced a substantially narrower distribution than that of fixed-income arbitrage strategies. The most noticeable outliers for fixed-income arbitrage performance are from the difficult periods for hedge funds—early 1994 and late 1998.

Highly volatile outcomes should not surprise arbitrage fund investors because those funds tend to use leverage that can average 5–10 times the fund’s capital. In general, the investment objective of many fixed-income arbitrage funds is to produce absolute returns comparable to equity market
returns but with lower volatilities or to produce higher returns with comparable volatility. Because potential returns from relative-value trades are often small, leverage is usually used to achieve the return objective, but this practice comes with a stiff price during credit or liquidity crises. Thus, hedge funds often incur substantial losses from the rapidly rising financial costs of leveraged positions, forced liquidations stemming from margin calls in the worst market conditions and demands for true “marking to market” by broker/dealers or stemming from investors’ panicky withdrawals.

Another possible reason for fixed-income arbitrage funds having a more diverse excess-return distribution may be the differences in performance benchmarks. Fixed-income arbitrage funds tend to stay within niches of the market where they have substantial expertise and can devise various strategies to exploit investment opportunities. The performance index reflects this variety of fixed-income arbitrage funds using a variety of debt relative-value strategies. When they are measured against a simple benchmark with low volatility in returns (e.g., LIBOR, U.S. T-bills), the variance of alphas can easily be magnified. Long-only managers, however, tend to emphasize tracking error when facing a more diversified and complex market benchmark. In measuring alpha, their return variance is largely offset by the market benchmark.

One way to deal with arbitrage funds’ volatility is to “de-lever” the investment by combining arbitrage investments with either short-term cash portfolios or a bond index fund. The strategy depends on whether the objective of the overall portfolio is to achieve absolute return or to achieve broad bond market exposure. Figure 3 depicts the results for excess returns of active long-only U.S. bond portfolios versus results for the fixed-income arbitrage index de-levered by a ratio of 1 to 10. The de-levered bond portfolio would invest one-tenth of the asset in a fixed-income arbitrage fund, with the remainder in a bond index fund. The hedge-fund portion would be further overlaid with bond derivatives (e.g., futures and swaps) to create synthetic bond exposure.

As can be seen in Figure 3, a de-levered fixed-income arbitrage portfolio still offered higher alphas with comparable volatility than the active long-only bond portfolio in the 1994–2001 period. Moreover, the negative returns of this fund were generally not as severe as those of the long-only portfolios during extreme bond market conditions.


data-driven insights and analysis.
The investor’s ability to de-lever hedge-fund investments also defuses the misperception that hedge funds charge substantially higher fees than actively managed long-only funds. Because the expected and realized alphas and active risks of fixed-income arbitrage funds are much higher than those of long-only bond funds, de-leveraging reduces hedge-fund fees to a level more comparable to their long-only counterparts.

**Best Sources of Alpha.** First, to consider sources of alpha from U.S. equities, one approach is to evaluate whether equity market-neutral funds or fixed-income arbitrage funds are the better source of equity alpha if the hedge fund’s alpha is transferred back to the equity asset class. Figure 4 compares excess returns of equity market-neutral funds and fixed-income arbitrage funds in light of equity market performance over the past eight years. The equity market-neutral managers apparently performed significantly better than the fixed-income arbitrage managers in most equity market conditions, even in extreme cases. They also had an excess-return distribution slightly tighter and less fat tailed.

Now, what would have happened if the alphas from these two types of hedge funds had been transferred to the fixed-income asset class? Figure 5 compares these alphas in different environments for the U.S. investment-grade bond market. Similar to the results in Figure 4, the equity market-neutral funds appear to provide more consistent sources of transferable alpha for the U.S. bond asset class than does a fixed-income arbitrage strategy.

Based on Figures 1–5, Table 1 presents information on three potential sources of after-fee excess returns for the equity and bond asset classes for 1994–2001. The performance of the classes is given for overall market states and two substates: the top-half and bottom-half market performance among 32 quarters. A few observations are worth noting:

- Equity market-neutral funds provided better and more consistent alphas for both the equity and bond asset classes than other funds, as is evidenced by the high average active returns and information ratios for the market-neutral funds in all market conditions.
- Fixed-income arbitrage funds seem to be more suitable for the bond asset class than for the equity asset class, although the information ratios are extremely low in both cases.
Figure 4. Equity Market-Neutral Alpha versus Fixed-Income Arbitrage Alpha Provided for the U.S. Equity Asset Class, 1994–2001

Note: Active, after-fee returns were measured quarterly. 
Source: Data are from CSFB/Tremont.

Figure 5. Equity Market-Neutral Alpha versus Fixed-Income Arbitrage Alpha for the U.S. Bond Asset Class, 1994–2001

Note: Active, after-fee returns were measured quarterly. 
Source: Data are from CSFB/Tremont.
Table 1. Source of Quarterly After-Fee Excess Returns, 1994–2001

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Equity Asset Class</th>
<th>Bond Asset Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equity Market</td>
<td>Fixed-Income</td>
</tr>
<tr>
<td></td>
<td>Neutral Arbitrage</td>
<td>Arbitrage</td>
</tr>
<tr>
<td>A. Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average excess return (pps)</td>
<td>1.37</td>
<td>0.27</td>
</tr>
<tr>
<td>Volatility (%)</td>
<td>2.03</td>
<td>2.28</td>
</tr>
<tr>
<td>Information ratio</td>
<td>0.67</td>
<td>0.12</td>
</tr>
<tr>
<td>B. Top-market returns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average excess return (pps)</td>
<td>1.89</td>
<td>1.09</td>
</tr>
<tr>
<td>Volatility (%)</td>
<td>2.23</td>
<td>2.08</td>
</tr>
<tr>
<td>Information ratio</td>
<td>0.85</td>
<td>0.52</td>
</tr>
<tr>
<td>C. Bottom-market returns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average excess return (pps)</td>
<td>0.78</td>
<td>-0.66</td>
</tr>
<tr>
<td>Volatility (%)</td>
<td>1.66</td>
<td>2.20</td>
</tr>
<tr>
<td>Information ratio</td>
<td>0.47</td>
<td>-0.30</td>
</tr>
<tr>
<td>D. Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>0.42</td>
<td>0.19</td>
</tr>
<tr>
<td>Top-market returns</td>
<td>0.49</td>
<td>-0.60</td>
</tr>
<tr>
<td>Bottom-market returns</td>
<td>0.17</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Note: The information ratio is excess returns divided by volatility of excess returns.
Source: CSFB/Tremont.

- The long-only equity and bond portfolios performed poorly in comparison with the hedge funds, except that the long-only bond accounts provided the most consistent alpha for the bond asset class when the market was performing poorly (Panel C).
- As Panel D shows, active returns of equity market-neutral funds were positively correlated with the equity markets (with a coefficient of about 0.4). This finding confirms the general perception that market-neutral funds exhibit some market directionality.
- The fixed-income arbitrage funds had higher correlations with the equity markets than with the bond markets. They performed poorly, however, when equity market returns were high.
- Excess returns from the market-neutral and arbitrage funds were uncorrelated with bond markets.
- Excess returns of equity long-only and bond long-only accounts were negatively correlated with their respective benchmarks in all market conditions; at -0.74, the long-only bond portfolios were highly negatively correlated.

In the sections that follow, I examine potential explanations for why market-neutral and arbitrage hedge funds appear to be better sources of excess returns than long-only portfolios. But at this point, the question arises as to why equity market-neutral funds have a more attractive active risk–return profile than fixed-income arbitrage strategies.

First, even though the CSFB/Tremont indexes used in this study are considered superior to most other hedge-fund data (Lhabitant 2001), the time period covers only 1994 forward. Moreover, not only is the period examined here short, but it is generally regarded as a tough period (particularly the years 1994, 1997, 1998 and 1999) for fixed-income arbitrage strategies. As shown in Table 1, equity market-neutral funds’ positive exposure to market risk enhanced their performance advantages over fixed-income arbitrage funds during equity bull markets.

Furthermore, equity-related hedge funds (e.g., the market-neutral, convertible arbitrage, and risk/merger arbitration funds) have significantly longer histories than the fixed-income funds. The equity-related hedge funds have made many mistakes, especially in 1990 and 1991, to learn from. Of course, debt-related hedge funds learned an expensive lesson from the Long-Term Capital Management (LTCM) episode in 1998—namely, the danger of accounting-based leverage, the power of margin calls, the importance of marking to market, and the unreliability of levered trades without proper downside-risk hedges. Since then, fixed-income hedge funds and the broker/dealer community have (willingly or unwillingly) devised many remedies to avoid the
same mistakes. For example, more fixed-income arbitrage funds are using leverage constraints, downside-risk analytics, risk budgeting, and strategic alliances (among small funds). Perhaps fixed-income hedge funds will in the future be able to reduce the gap between their alpha performance and the performance of equity hedge funds.

Explanations of Performance Differences

Why do hedge funds appear to be better sources of active returns than long-only portfolios? I consider four potential explanations: data reliability, compensation differences, investment constraints, and structural differences.

Data Issues. The previous section provided an empirical comparison of the performance of hedge funds versus long-only portfolios. On the one hand, the conclusions should be taken with a grain of salt because hedge-fund data inspire numerous debates among practitioners and academic researchers regarding the data’s usefulness and reliability. Potential biases in the construction of hedge-fund databases include survivorship, self-delisting, selection, and back filling. On the other hand, even with the help of stringent disclosure requirements from investors and regulatory agencies, most performance databases of long-only portfolios also exhibit one or more of these biases.

The self-delisting bias appears to be unique to hedge funds. Firms may stop reporting a fund’s performance data to database vendors for a variety of reasons, such as difficulty in executing trades because of the fund’s size or potential liability in reporting errors. In addition, almost all the databases exhibit a significant selection bias. Most databases do not even include or gain the support of some large and preeminent hedge funds. Furthermore, many large hedge funds with impressive performance records catering primarily to financial institutions and institutional investors are not part of publicly available hedge-fund databases.

Perhaps the more significant issue of data reliability is stale pricing—questionable “marking to market” and “marking to model” practices of prime brokers and hedge funds (Asness, Krail, and Liew 2000; Tremont Advisers, Inc., 2000). According to a recent survey of hedge-fund valuation practices, price differences and valuation adjustments made by hedge funds can be substantial (30–40 percent). This practice is especially problematic for illiquid or less liquid securities (e.g., funds investing in high-yield and distressed bonds, private securities, OTC options, and mortgage derivatives).

Stale pricing/modeling is essentially an artificial and costless process to smooth performance variation and “amortize” gains and losses. If most likely contributes to hedge funds’ low return volatility and low correlations with other asset classes, which in turn, enhance the notion that hedge funds are investment vehicles with high information ratios and are great diversifiers. Stale pricing may well be the key factor underlying the quarterly performance persistence of hedge funds that Agarwal and Naik (2000b) found.

Despite efforts in numerous studies to document and quantify hedge-fund data biases, conclusions about biases based on the existing hedge-fund databases have been diverse and remain dubious. Thus, the extent or even the direction of performance differentials between hedge funds and long-only accounts induced by database bias is difficult to identify.

Structural Differences. One may argue that what lies beneath performance differences between hedge funds and long-only accounts are the different compensation structures of the two investment forms, differences in investment constraints from guidelines and regulations, and other structural factors. These differences may allow hedge-fund managers to:

- focus on extracting returns related to idiosyncratic risks rather than relying primarily on taking systematic risks,
- serve as liquidity providers to hedgers,
- effectively execute certain investment strategies via various forms of derivatives, and
- customize investment/security structures to explore certain properties of return distributions.

Exhibit 1 outlines various factors that may contribute to the return differentials of these two types of alphas. A common belief pertaining to hedge funds’ perceived outperformance is that their unique compensation structure generally attracts more skillful professionals. Arguably, the most important factor is the setting of higher management fees (in addition to potentially large payoffs from the incentive fee schedule; see Ackermann, McEnally, and Ravenscraft 1999). Furthermore, on the one hand, performance hurdle rates, high-water marks, and fund managers contributing their own capital may provide hedge funds with additional drivers in achieving superior performance. On the other hand, because stringent legal obligations are generally lacking, the same hurdle rate and high-water-mark incentive devices allow a hedge-fund manager to walk away from a severely underperforming fund.
In addition to differing fee and incentive structures, another factor often cited for hedge funds’ outperformance is the flexibility they have in pursuing investment strategies. For example, short selling and the use of leverage are two trademarks of hedge-fund management. Short selling allows fund managers to take advantage of their investment views on both sides of factor or security valuation. Grinold and Kahn (2000) developed an analytical framework to quantify the efficiency gain from loosening the short-selling restriction. They found that the restriction can have a significant impact on active managers, especially if they deal with large sets of assets, low volatilities, and high active risk. However, whether this flexibility would generate twice the amount of alpha is questionable. Alexander (2000) showed empirically that if one considers Regulation T restrictions, liquidity haircuts, and derivatives availability in short selling, abnormal returns from popular pricing “anomalies” based on zero investment strategies may not exist at all.

Leverage is conventionally defined as a discrete, accounting-based measure, but this definition does not give a complete indication of the type or amount of risk taken. It does not consider market volatilities and possible diversification benefits within a portfolio from different strategies. In fact, a fund may be able to reduce its leverage while increasing portfolio risk. Recent advances in hedge-fund risk management call for risk-based definitions of leverage instead of conventional accounting measures (even if they include on- and off-balance-sheet items). Incorporating value-at-risk and scenario stress tests, for example, should help investors evaluate the true impact of portfolio leverage. In addition to the lack of actual leverage information, researchers have had difficulty analyzing empirically whether and how leverage improves a hedge fund’s risk-adjusted return. Further research is needed to understand (1) the relationship between hedge-fund return distribution and leverage, (2) leverage limits and proper leverage for various hedge-fund strategies, and (3) leverage dynamics—that is, what factors influence hedge funds’ use of leverage during a market cycle.

In sharp contrast to long-only portfolios, hedge funds face few, if any, investment guideline restrictions. They are not limited as to the capital markets they can trade in, constraints imposed by the Investment Company Act of 1940, or investment guidelines (e.g., sector/security limits and duration/spread duration risk limits) that are often applied to a long-only portfolio. This freedom may account for the tendency of hedge funds to use exotic securities or derivatives and to hold concentrated positions in what the managers consider to be “the best ideas” rather than hold the overly diversified positions found in many long-only portfolios.

Of the “Other Factors” listed in Exhibit 1, the most interesting is the difference in benchmarks. Because most hedge funds focus on generating absolute returns with “below-market” volatility, they are often measured against a simple performance benchmark—the funding cost. As a result, unlike long-only fund managers, hedge-fund managers do not have to deal with issues related to benchmark style drift (see Brealey and Kaplanis 2001) or investment style “boxes.” Pension sponsors and the consulting community are increasingly relying on “style” indexes to monitor long-only fund managers and to construct risk-return profiles of overall asset classes. The result is a tendency for investors to end up with a locally optimized asset class because their focus is often a collection of “optimized” managers within individual investment styles. Perhaps in response to this trend in institutional investing, long-only fund managers have shown increasing concern with tracking error and maverick risk. Unlike hedge-fund managers, they tend to stay close to the given style benchmark rather than stay with their investment convictions. Focusing on “style” products and benchmarking by style may prove to be detrimental to long-only asset management in the future.
Finally, most hedge funds have investment lockup periods, which allow hedge funds the freedom to use illiquid and restricted securities. Anecdotally, all the flexibility discussed here may contribute to the seemingly better risk-adjusted returns earned by hedge funds versus long-only portfolios.

Potential Performance-Confounding Issues. Recently, questions have been raised regarding practices supposedly used by some hedge funds and traders that may distort the true picture of hedge-fund performance. These suspected practices include self-serving trade allocations and preferential treatment of hedge funds by traders.

Potential conflicts of interest can arise from trade allocations by a firm managing both long-only and hedge funds because of the differences in compensation. The possibility that profitable trades may be allocated to funds with substantially more profitable compensation structures has caught regulatory attention.

In broker/dealers’ order-handling sequence, traders may be favoring hedge funds (Santini 2001). The alleged preferential treatment of hedge funds may be a result of the tendency of hedge funds to have higher portfolio turnover rates and their willingness to pay higher commissions to obtain information flows from Wall Street traders.

Understanding Hedge-Fund Risk
Because hedge funds use diversified and dynamic trading strategies in a rather loosely defined operating environment, the return-generating process of hedge funds can be complex and hard to analyze. Most studies show that factors based on market returns of standard asset classes are not sufficient to describe the risks taken by hedge funds, especially those that use market-neutral or arbitrage strategies. So, what are additional systematic risks that hedge funds incur?

Hedge-fund risk is a function of quantity of risk (leverage), the instruments/markets traded, market volatility, strategy diversification within the fund, and liquidity. Some argue that investors can increase their understanding of the risk exposures of a hedge fund by examining the portfolio holdings and trades. The value added from this exercise, however, is generally considered questionable. Hedge funds tend to shift trading positions and exposures to risk factors dynamically and rapidly—daily and even within a day. Thus, portfolio holdings or transactions are difficult to trace back to their original tactical or strategic purposes.

Perhaps the most important aspect in hedge-fund risk analysis is to understand the nature of trading strategies and the underlying risk elements of each strategy. By doing so, the investor can develop reasonable risk–return expectations for the fund and an understanding of how and when the trading strategies in which their funds are invested are correlated.

Low correlation is often found between hedge-fund categories that focus on different “styles” or “markets.” Within each hedge-fund category, correlations vary. For example, individual funds in market-directional hedge-fund categories tend to have higher correlations with each other whereas nondirectional funds often exhibit low correlations with each other (Brealey and Kaplanis; Martin 2000). Diversification of trading strategies within a hedge fund is also a powerful tool for delivering consistent performance in various market conditions. Table 2 shows paired monthly return correlations for the period May 1998 through December 2001 of six investment strategies used by a successful multistrategy arbitrage fund. These correlations range widely—from −0.35 to 0.39. Nevertheless, for hedge funds to be able to perform consistently and survive difficult market environments, a manager needs to dynamically manage the optimal mix of the slightly correlated strategies.

Conventionally, the hedge-fund community likes to use single measures to describe hedge-fund performance and risk. For example, hedge-fund marketing materials often present, in addition to the fund’s standard deviation of returns, maximum

<table>
<thead>
<tr>
<th></th>
<th>Convertible Arbitrage</th>
<th>Yield to Call/Put</th>
<th>Capital Structure Arbitrage</th>
<th>Multiclass Stock Arbitrage</th>
<th>Paired Trades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield to Call/Put</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Structure Arbitrage</td>
<td>0.14</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiclass Stock Arbitrage</td>
<td>0.27</td>
<td>0.03</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paired Trades</td>
<td>0.15</td>
<td>−0.01</td>
<td>−0.35</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Special Situations</td>
<td>0.05</td>
<td>0.23</td>
<td>0.06</td>
<td>−0.15</td>
<td>−0.07</td>
</tr>
</tbody>
</table>
drawdowns (peak-to-trough performance) and percentage of negative months (or quarters). Various risk-adjustment ratios are also popular—for example, the Sharpe ratio or information ratio (excess returns divided by volatility of excess returns), efficiency ratio (ex ante risk divided by realized return volatility), and appraisal ratio (significance of the intercept of a capital asset pricing model type of regression). None of these risk-return measures captures the nature of a fat-tail return distribution, nor do they address investors’ concerns that in certain market conditions, the “true” risk of hedge-fund investing will appear.

Figure 6 depicts the returns of fixed-income arbitrage funds in relation to various levels of bond market performance. To create the figure, I classified monthly returns of the Lehman Brothers Aggregate Bond Index from 1994 to 2001 into eight buckets according to their return rankings. As Figure 6 shows, the fixed-income arbitrage funds earned positive excess returns in all types of bond market conditions.

**Figure 6. Excess Returns of U.S. Fixed-Income Arbitrage Funds and Bond Market Returns, 1994–2001**

<table>
<thead>
<tr>
<th>Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>-1</td>
</tr>
<tr>
<td>-2</td>
</tr>
</tbody>
</table>

**State of Market Performance (lowest return to highest return)**

- Fixed-Income Arbitrage Funds
- Lehman Aggregate

*Note: Returns were measured monthly.*

Searching for methods to analyze hedge-fund risk beyond exposures to various market/sector portfolios, researchers have attempted to identify economic or financial market factors that bring additional systematic risk to hedge funds. The financial market factors have been primarily based on publicly traded instruments (e.g., changes in levels and volatilities of market indexes, index futures, options, swaps, and other forms of derivatives). Unlike information based on economic conditions (e.g., inflation, GDP growth, and industrial production), financial market factors have the advantage of greater pricing frequency and they are directly related to trading strategies used. Combined with market factors, these factors provide investors with a better analytical framework and empirically explain higher portions of return variance than market risk factors alone. Different hedge-fund strategies may require different sets of factors to describe their risk propensity.

Following the approach shown in Figure 6, I examined the performance of the fixed-income arbitrage funds in different environments of fixed-income volatility in the 1995–2001 period. Volatility was represented by the changes in volatilities implied in the swaption market. As shown in Figure 7, the fixed-income arbitrage strategy performed remarkably consistently in all but the highest-volatility scenarios. In fact, the only regime in which fixed-income arbitrage funds averaged negative returns is when bond markets experienced their largest increases in implied volatilities (e.g., October 1997 and August to October 1998).

Table 3 shows the relationship of the excess returns of fixed-income arbitrage funds to other systematic risk factors critical to bond markets: the change in high-yield spreads, Treasury volatility (implied volatility of Treasury options), swap volatility, and equity volatility (implied volatility of S&P 100 Index options). As shown in the last column of Table 3, the monthly excess returns (over LIBOR) of fixed-income arbitrage funds show modest overall negative correlations with the first three factors.
The funds underperformed from equity Treasury tive debt-related on the arbitrage fixed-income from excluded, LTCM ship March/April critical declines four worst funds excess with increased. This August most returns) volatility small active impact systematic volatility funds. This system of August 2002 equity Swap Treasury High-yield spreads Table 3. Average Monthly Excess Returns of Fixed-Income Arbitrage Funds in Different Risk Conditions, 1995–2001 (returns in percentage points) 

<table>
<thead>
<tr>
<th>Factor</th>
<th>Down Most</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Up Most</th>
<th>7</th>
<th>Overall Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-yield spreads</td>
<td></td>
<td>0.72</td>
<td>0.62</td>
<td>0.41</td>
<td>0.21</td>
<td>0.44</td>
<td>0.06</td>
<td>-1.35</td>
<td>-0.37</td>
<td></td>
</tr>
<tr>
<td>Treasury volatility</td>
<td></td>
<td>0.53</td>
<td>0.57</td>
<td>0.40</td>
<td>0.32</td>
<td>0.12</td>
<td>0.25</td>
<td>-1.09</td>
<td>-0.45</td>
<td></td>
</tr>
<tr>
<td>Swap volatility</td>
<td></td>
<td>0.50</td>
<td>0.34</td>
<td>0.32</td>
<td>0.42</td>
<td>0.31</td>
<td>0.42</td>
<td>-1.22</td>
<td>-0.47</td>
<td></td>
</tr>
<tr>
<td>Equity volatility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.70</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Whole period</td>
<td></td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.08</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>Excluding 9/98 and 10/98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

debt-related systematic risk factors (about −0.5). The funds were most vulnerable (with large negative excess returns) when systematic risks drastically increased. Changes in high-yield spreads and Treasury volatility had a reasonably linear relationship with arbitrage funds’ excess returns. As for the equity volatility factor, arbitrage funds performed the worst during extreme scenarios (both large declines and large increases in the factor). If the large decreases in equity volatility following the LTCM episode (September and October of 1998) are excluded, however, the correlation changes only from a small positive amount to a small negative amount. This result indicates that observations from that August to October 1998 period have a critical impact on the historical risk analysis of fixed-income arbitrage funds.

The impact of the same factors on convertible arbitrage funds is shown in Table 4. As can be seen, the four systematic risk factors had similar impacts on the active returns of these hedge funds. The underperformance of the convertible arbitrage funds was most pronounced in regimes with the largest increases in the three fixed-income factors. At first glance, the correlation of convertible funds with changes in equity volatilities for the full seven years appears to be virtually zero. At second glance, however, the funds can be seen to have performed poorly at extreme market volatilities (the first and seventh states) as compared with their performance in more normal scenarios. Significantly negative performance from August to October 1998 (the impact is shown at the bottom of Table 4) further demonstrates the vulnerability of convertible hedge funds during extremely volatile markets. Convertible hedge funds are believed to have suffered significant mark-to-market problems during and after the LTCM debacle, which may have masked the extent of this vulnerability (Tremont Advisers).

Table 5 examines the risk-factor exposures of equity market-neutral and long–short (directional) hedge funds. In addition to the implied volatility of the equity market, Table 5 includes exposures to the three Fama–French (1993) return factors (beta, size, and value versus growth). Market-neutral funds show insignificant relationships to changes in the

Table 4. Average Monthly Excess Returns of Convertible Arbitrage Funds in Different Risk Conditions, 1995–2001 (returns in percentage points) 

<table>
<thead>
<tr>
<th>Factor</th>
<th>Down Most</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Up Most</th>
<th>7</th>
<th>Overall Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-yield spreads</td>
<td></td>
<td>0.90</td>
<td>0.91</td>
<td>0.81</td>
<td>0.71</td>
<td>1.25</td>
<td>0.44</td>
<td>-0.57</td>
<td>-0.39</td>
<td></td>
</tr>
<tr>
<td>Treasury volatility</td>
<td></td>
<td>0.59</td>
<td>0.90</td>
<td>0.75</td>
<td>0.75</td>
<td>1.26</td>
<td>1.01</td>
<td>-0.81</td>
<td>-0.44</td>
<td></td>
</tr>
<tr>
<td>Swap volatility</td>
<td></td>
<td>0.88</td>
<td>0.92</td>
<td>0.79</td>
<td>0.97</td>
<td>0.94</td>
<td>0.76</td>
<td>-0.81</td>
<td>-0.44</td>
<td></td>
</tr>
<tr>
<td>Equity volatility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.29</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Whole period</td>
<td></td>
<td>-0.29</td>
<td>1.12</td>
<td>0.98</td>
<td>1.19</td>
<td>0.85</td>
<td>0.14</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluding 8/98</td>
<td></td>
<td>-0.29</td>
<td></td>
<td></td>
<td></td>
<td>0.62</td>
<td>0.37</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluding 9/98 and 10/98</td>
<td></td>
<td>0.54</td>
<td></td>
<td></td>
<td></td>
<td>0.14</td>
<td>-0.31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
size and value factors. Their active performance was essentially flat when equity volatility increased the most.

Despite what the name implies, the market-neutral funds have positive directionality toward the market factor (i.e., positive excess return for the funds increased when the equity market was performing well). As for the long–short hedge funds, they apparently have strong correlations with all four systematic risk factors: negative correlations with equity volatility and the value factor and positive correlations with the market and size factors. Across the seven regimes, the active returns of long–short funds had an almost perfectly linear relationship with these factors.

Style Analysis and Hedge-Fund Risk

Style analysis, pioneered by Sharpe (1988, 1992), uses market/sector benchmark portfolios as systematic factors to derive the asset mix implied in an active portfolio’s return series. For a long-only portfolio, exposure to these market portfolios is constrained to be positive and to sum to 1. Many studies apply style analysis to analyzing hedge-fund risk by relaxing these two constraints (e.g., Fung and Hsieh 1997; Brown, Goetzmann, and Ibbotson 1999; Agarwal and Naik 2000a). Although most studies have used capital market or style index portfolios as the implied building blocks in style analysis, Lhabitant used hedge-fund style indexes as risk factors to directly derive a fund’s implied exposure to conventional hedge-fund styles/strategies. Brown and Goetzmann (2001) extended hedge-fund style analysis by allowing factor loadings on market portfolios (i.e., the coefficients) to vary over time. Using time-varying factor loadings in style analysis is constructive because the method accommodates dynamic trading strategies with nonlinear payoffs.

All these studies found, however, that individual hedge-fund returns have lower correlations with standard asset class returns than do mutual fund returns. Hedge funds with market neutrality, arbitrage, or commodity trading as styles have significantly low to nil exposure to those asset classes. Moreover, one of the criticisms of conventional style analysis is that investment risk as defined by these styles is too narrow and single faceted. It fails to recognize that investment risks are often multidimensional, asymmetrical, and potentially correlated (Michaud 1998). This problem is severe in the analysis of hedge-fund risk. The active returns of hedge funds generally exhibit asymmetrical sensitivities to risk factors in different market environments. For example, Lo (2001) showed that hedge funds perform differently in positive versus negative equity markets and in rising versus declining interest rate scenarios. Previous sections of this article presented empirical evidence that the changes in implied volatilities in various capital markets may be important in evaluating hedge-fund strategies. In summary, to analyze hedge-fund risks, one not only has to incorporate various systematic risk factors beyond conventional market return factors but also use a multidimensional framework.
Style-Risk Analysis in a Long-Only Framework. Kao (2000a) presented a return-based approach to analyzing investment styles of fixed-income managers. It involves identifying several systematic risk factors important to active performance of a fixed-income portfolio—for example, changes in the 10-year Treasury rate, implied volatility of interest rate options, swap spreads, swaption volatility, and systematic risks in equity markets. Exposure to these risk factors in relation to a bond benchmark can be grouped and summarized along two dimensions: interest rate risk and spread risk.

Figure 8 compares the distinct investment styles of two long-only managers of U.S. high-quality fixed-income assets (U.S. Treasury, mortgage, and investment-grade corporate debt). The construction of this risk-factor model follows Kon (1999), in which factors are adjusted for the variable dependence of prominent risk factors, such as the level of interest rates. For example, the changes in implied volatilities are adjusted for the direction of 10-year Treasury rates; the changes in swap spreads are adjusted for both the changes in interest rates and the adjusted changes in volatility.

Figure 8 shows how the managers of two core bond portfolios managed active exposure to two risk dimensions—interest rate risk and spread risk—in the August 1999 to June 2000 period. The center point represents a neutral position of risk exposures versus the benchmark. Each circle for Manager A and Manager B covers a rolling 36-month period. To illustrate the changes in exposures over time, the largest circle is the most recent observation and the smallest is the earliest.

Manager A’s portfolio is a highly risk controlled bond fund of funds (diversified fund with multiple investment advisors), as is evident by its stable exposure to both risk dimensions. When viewed from the standpoint of both interest rate and spread risk related to their benchmark, Manager B took more active risks, with drastic shifts in exposures.

Table 6 presents the average statistics on risk exposures of the bond index and these two managers’ portfolios according to the four-factor style-risk model. The significance of the t-statistics and R^2 indicates that the risk-factor model explains return variances of the index and two portfolios well. Manager B had larger exposure to all four risk

<table>
<thead>
<tr>
<th>Measure</th>
<th>Average Statistic</th>
<th>Average R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-Year Rate</td>
<td>Interest Rate Volatility</td>
</tr>
<tr>
<td>Bond index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>-3.92</td>
<td>-0.77</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>-31.65</td>
<td>-6.54</td>
</tr>
<tr>
<td>Manager A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>-3.87</td>
<td>-1.09</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>-24.62</td>
<td>-7.33</td>
</tr>
<tr>
<td>Manager B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>-3.80</td>
<td>-1.40</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>-12.16</td>
<td>-4.71</td>
</tr>
</tbody>
</table>

Notes: Statistics are averages of 36-month rolling regressions. The 10-year rate and swap spreads were measured in basis points; interest rate volatility was measured in 10bps; and equity risk was measured in percentages.
factors than Manager A and the index benchmark, except for Manager B’s exposure to changes in 10-year Treasury rates. Changes in swap spreads and lagged \((t - 1)\) equity market volatility are important in explaining the return volatility of Manager B’s performance; when those two factors are added to exposure to interest rate risk, the \(R^2\) increases from 0.77 to 0.83.

I applied the same risk-factor model to examine the relative risk exposures of fixed-income arbitrage funds versus the long-only bond fund of funds from June 1998 to December 2001. The results are in Figure 9 and Table 7. I assumed that the monthly excess returns of fixed-income arbitrage funds over LIBOR transferred to a bond market index in order to make the arbitrage fund returns comparable with the long-only portfolio. Also, as in the case of Figure 3, to make the return volatilities of these two portfolios more comparable, I de-levered the performance of the arbitrage fund index by investing \(1/10\) of the assets in hedge funds and the remainder in a bond index fund. Again, the analysis was carried out on a 36-month rolling basis to explore the funds’ changes in risk exposures (only quarter-end observations are displayed).

Table 7 shows that these two investments possess similar and rather consistent exposures to both directional and volatility risks. The de-levered fixed-income arbitrage overlay has slightly lower relative interest rate and spread risks than the long-only bond fund. This outcome was achieved by having lower exposures to 10-year interest rate risk and risk factors related to the equity and swap markets. Compared with the bond market index, however, the arbitrage portfolio had higher exposures to interest rate volatility and equity risk factors. Remarkably, the hedge-fund overlay and the long-only portfolios also changed their exposures over time in a similar pattern. After the LTCM debacle, both portfolios became more spread-risk neutral in relation to the benchmark, as shown in Figure 9 by the larger bubbles (recent postures) moving toward the center point (market neutrality).

**Figure 9. Long-Only Risk Framework: Style Risk of U.S. Fixed-Income Arbitrage Overlay versus High-Quality Long-Only Bond Fund, June 1998–December 2001**

![Figure 9](image)

Notes: The benchmark is the Lehman Aggregate Index. Exposures were measured monthly. Fixed-income arbitrage funds were de-levered by 10:1.

**Style-Risk Analysis in a Hedge-Fund Framework.** To analyze the source of active risk of hedge funds on a stand-alone basis (i.e., without an overlay process), the risk-factor model requires some modifications. The first step is to define style-risk dimensions relevant to hedge-fund investment

---


<table>
<thead>
<tr>
<th>Measure</th>
<th>Average Statistic</th>
<th></th>
<th></th>
<th>Average (R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-Year Rate</td>
<td>Interest Rate</td>
<td>Swap Spread</td>
<td>Equity Risk ((t - 1))</td>
</tr>
<tr>
<td><strong>Coefficient</strong></td>
<td>-3.83</td>
<td>-0.77</td>
<td>-2.55</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>t-Statistic</strong></td>
<td>-31.28</td>
<td>-5.59</td>
<td>-5.76</td>
<td>2.03</td>
</tr>
<tr>
<td><strong>Fixed-income arbitrage overlay</strong></td>
<td>-3.69</td>
<td>-1.08</td>
<td>-2.26</td>
<td>1.24</td>
</tr>
<tr>
<td><strong>t-Statistic</strong></td>
<td>-20.60</td>
<td>-5.51</td>
<td>-3.81</td>
<td>1.65</td>
</tr>
<tr>
<td><strong>Long-only bond fund</strong></td>
<td>-3.86</td>
<td>-1.06</td>
<td>-2.34</td>
<td>1.29</td>
</tr>
<tr>
<td><strong>t-Statistic</strong></td>
<td>-24.15</td>
<td>-6.39</td>
<td>-4.41</td>
<td>2.01</td>
</tr>
</tbody>
</table>

*Note: See the notes to Table 6.*
risks: directional risk (first order) and volatility risk (second order). The next step, continuing with the example of the fixed-income arbitrage fund, is to categorize the systematic risk factors important to fixed-income arbitrage funds into directional or volatility risks. For example, exposures to changes in interest rates and credit spreads are jointly formed (that is, the correlation of these two factors is considered) to measure directional risk. Volatility risk combines the changes in implied volatilities of equities and interest rate options. Again, the model construction requires the adjustment of variable dependence.

In a hedge-fund risk framework, Table 8 depicts the average risk exposures of the after-fee excess returns of the fixed-income arbitrage index in comparison with the excess returns of a long-only bond fund (in each case, returns in excess of the relevant benchmark). As shown, the fixed-income arbitrage funds, unlike the long-only fund of funds, have large and statistically significant risk exposures to all four factors, especially to changes in the 10-year rate and equity volatilities. Table 8 also shows that both interest rate and equity volatility risk had a significant impact on the active returns of the long-only bond fund. And in contrast to the fixed-income arbitrage funds, the directional risk factor (changes in 10-year Treasury rates and high-yield spreads) had no effect on active return variance of the long-only bond fund.22

As indicated by the $R^2$ measures in the next to last column in Table 8, factors related to directional risk, on average, explained about 26 percent of the active return variance of the fixed-income arbitrage portfolio (ranging from 10 percent to 41 percent during the period). This figure is substantially higher than the 7 percent explained when only the changes in interest rate levels (10-year Treasury rates) were used.23 Adding the volatility risk factors increased the average explanatory power to 55 percent for the arbitrage index. For the long-only bond fund, directional risk explained 14 percent of active return variance and volatility risk factors added another 25 percentage points.

**The Mimicking Portfolio/Strategy Approach.**

Recently, several researchers have taken a more direct approach to analyzing hedge funds' systematic risk than is possible in simply analyzing their relationship to market returns. The approach is called "mimicking portfolio/strategy" because it attempts to replicate either the payoff pattern or the explicit trading strategies of hedge-fund activities.24 The approach draws from Fung and Hsieh (1997), who applied principal-component analysis to extract benchmarks for various trading strategies as implied in hedge-fund return series. When combined with conventional asset-class factors, this approach can effectively capture the essence of hedge funds' extreme outcomes.

Following the contingent-claims concept of performance measurement advocated by Glosten and Jagannathan (1994), several studies have used a series of financial options to directly replicate the option-like pattern that exists in hedge-fund return data.25 Fung and Hsieh (2000b) used the replication approach by constructing return series to mimic trading strategies using futures and options. With five trend-following mimicking benchmarks, they were able to produce straddle option payoffs similar to those commonly observed in hedge-fund returns.26 Agarwal and Naik (2001) used a similar methodology to study event-driven and relative-value arbitrage funds by replicating passive option buying/writing strategies.


<table>
<thead>
<tr>
<th>Measure</th>
<th>10-Year Rate</th>
<th>High-Yield Spread</th>
<th>Interest Rate Volatility</th>
<th>Equity Volatility</th>
<th>10-Year Rate</th>
<th>Directional Risk</th>
<th>Four Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed-income arbitrage index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.18</td>
<td>-0.18</td>
<td>-0.23</td>
<td>0.14</td>
<td>0.07</td>
<td>0.26</td>
<td>0.55</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>2.37</td>
<td>-2.30</td>
<td>-2.27</td>
<td>3.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long-only bond fund</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.00</td>
<td>-0.04</td>
<td>-0.30</td>
<td>0.08</td>
<td>0.03</td>
<td>0.14</td>
<td>0.39</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>0.04</td>
<td>-0.46</td>
<td>-2.66</td>
<td>2.24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Notes:* The benchmark for the fixed-income arbitrage index is three-month LIBOR, and for the long-only bond fund, it is the Salomon Brothers Broad Investment Grade Index. Active after-fee returns were measured monthly. See also the notes to Table 6.
Another school of the mimicking approach to hedge-fund risk analysis involves constructing naive trading strategies based on those actually used by hedge funds. This approach thus provides a direct and realistic evaluation framework. It has been applied to studies of such hedge funds as risk arbitrage, paired trades, equity long–short, and commodity futures.27 Tang (1999) extended the framework by simulating hypothetical investment opportunities available to hedge-fund managers (rather than replicating hedge funds’ trading strategies and the instruments used). This approach attempted to address a difficult task in hedge-fund research stemming from the practice of hedge funds (especially arbitrageurs) of using, within a single fund, multiple investment strategies that are seemingly uncorrelated and hard to replicate by trading individual instruments.28

In all these studies, the authors found that return patterns from the simulated passive trading strategies resemble those of actual hedge funds or CTAs. The risk attributes detected from these time series are generally consistent with what one would expect from specific trading strategies used by hedge funds. The return series obtained from this analytical approach can be used to

- evaluate and extract various systematic risks not observed by return series of conventional asset classes (in the spirit of Sharpe’s style analysis framework, mimicking portfolios can be viewed as alternative or additional asset/benchmark style factors),
- directly model hedge funds’ asymmetrical return distributions,
- examine how hedge funds manage their risk exposures in extreme market conditions,
- serve as a “true” hedge-fund benchmark (performance in excess of these benchmark portfolios is considered a better indication of the manager’s skill than performance measured against other benchmarks),29 and
- avoid biases found in most hedge-fund databases, as discussed previously.

The replication approach to studying hedge-fund performance is expected to extend to other types of trading strategies. This development should shed light on the myth surrounding hedge-fund activities.

**Investment Style and Performance Evaluation.** Both style-risk factors and mimicking portfolios can be useful in understanding hedge-fund risk. They serve as better yardsticks for measuring hedge funds’ performance and their true active skill than construction of naive trading strategies. However, the hedge-fund investment community should keep in mind the experience that came with the improved methods of measuring long-only portfolio performance in recent years. Style analysis was originally designed to facilitate the evaluation of a money manager’s active skill by analyzing the manager’s exposure to some systematic risks. Style indexes created from this analytical framework are not intended to be a primary tool for managing money managers. Investors and consultants tend to put too much emphasis on the tracking error versus a style benchmark or a customized benchmark based on a set of systematic risk factors. By doing so, they “delegate” to a classification scheme based on single-factor measures their responsibility to understand managers’ investment processes and what is truly driving active performance. The potential danger is that further restrictions (implicit or explicit) will be placed on investment managers’ expressions of their true investment convictions. This result would be especially troublesome for hedge funds, whose active returns rely on multiple, complex, and dynamic trading strategies that may not be easily classified into one particular style box.

**Conclusion**

This article has provided empirical evidence for the usefulness of various approaches to analyzing active risks and returns of hedge funds versus long-only portfolios. The discussion reconciled potential explanations of the apparent attractiveness of hedge funds as alpha providers to investing in both the equity and bond asset classes. Several unique characteristics of hedge-fund structures that may contribute to hedge-fund success can provide important lessons for structuring and managing long-only portfolios.

Investors considering hedge funds should avoid the pitfalls of chasing winners and investing in blind pools. Understanding the fundamental attributes of particular hedge-fund strategies remains the most important task in evaluating the active risk of hedge funds versus long-only portfolios. Therefore, investors need tools for analyzing hedge-fund risks that go beyond conventional single risk measures and style analysis based on market index returns.

Information implied by financial market asset pricing, such as volatility measures, can provide investors with timely and relevant risk indicators. The multifactor risk analysis framework presented here could be helpful in analyzing hedge funds’ investment style and risk drifts over time. The example presented, which compared fixed-income arbitrage funds with long-only bond...
funds, demonstrated the similarity and differences in the funds' risk taking. Recent advances in analytical approaches that directly replicate hedge funds' optionlike payoff profiles or trading strategies should enhance investors' understanding of the fundamental nature of hedge-fund risk. Such analysis offers a promising research direction for hedge-fund asset pricing.

The author would like to thank Pengfei Xie and Kam Chang for their insightful research assistance. The author is also grateful for many useful discussions with colleagues in the Global Fixed Income Group and constructive comments from Stan Kon, Ron Leisching, Eric Tang, and participants at the Spring 2001 Q Group Conference.

Appendix A: Selected Hedge Fund Strategies

Arbitrage Strategies:

Capital structure arbitrage: purchase of one part of a company's capital structure and shorting of another to exploit potential mispricing created from corporate events.

Convertible arbitrage: taking of long (or short) positions in convertible bonds and hedges by going short (or long) common stocks.

Event-driven (or "special situations") arbitrage: attempt to capture price movements from such corporate events as merger, bankruptcy, reorganization, or restructuring.

Fixed-income arbitrage: taking of long and short positions in any related fixed-income securities (bonds or derivatives) to profit from perceived mispricing in different fixed-income market segments.

Multiclass stock arbitrage: exploitation of pricing differences between two classes of the same or similar stock (e.g., voting and nonvoting).

Relative-value arbitrage: broad classification of strategies to exploit pricing discrepancies between a pair of related securities while maintaining neutral positions vis-à-vis market risks.

Risk/merger arbitrage: subsector of event-driven arbitrage strategies in which long and short positions are taken in companies involved in mergers and spin-offs.

Commodity Trading: trading strategy used by Commodity Trading Advisors investing in listed financial, currency, and commodity futures and option markets worldwide.

Equity Market Neutral: strategy of taking long and short positions in equity securities while maintaining neutral positions vis-à-vis market systematic risks as defined by beta, industry, sector, size, or style.

Equity Long–Short: strategy similar to the equity market-neutral strategy, except for its tendency to make active bets (net of long and short positions) related to market systematic risks.

Global/Macro: strategy of taking long and short positions in any world capital or derivatives market to reflect a manager's expectations of market directions, sector valuations, or economic trends.

Paired Trades: strategy to exploit valuation differences between closely related securities through fundamental or statistical analyses.

Trend Following: use of systematic, technical, and often quantitative methods to identify trade entry and exit points by examining the trend of price or valuation movements.

Yield to Call/Put: purchase of high-yielding securities that have a good chance of being called/put or have short maturities.

Notes

1. See TASS (2000). The estimated market size of the hedge-fund industry varies greatly. For example, Renaissance Hedge Fund Advisory put it at $408 billion at the end of 2000, in contrast to the $210 billion reported by TASS.


3. In fact, misclassification by vendors is one of the toughest problems in style classification. Most data vendors use the category of "multisector strategies" to group those funds that are not easy to classify.

4. Spear and Wiltshire (2000) also investigated the return differences of equity market-neutral managers and the long-only equity universe and found similar results.

5. This de-leverage ratio was selected to make portfolio volatilities comparable; it is close to the leverage commonly used by fixed-income arbitrage funds.

6. If the investment objective of the de-levered portfolio is to achieve cash return, the implied assumption is that 90 percent of the portfolio's assets are invested in LIBOR-based instruments.
7. I thank Eric Tang for pointing out these issues.
8. For comprehensive discussions of issues related to hedge-fund data, see Fung and Hsieh (2000a, 2002) and Brown, Goetzmann, and Ibbotson (1999).
10. Pricing issues are even more severe and common in the data during the LTCM debacle, and we cannot untangle numerous other issues surrounding that market environment, including the price-discovery process and the impact of dealer margin calls.
12. Arguably, this practice is similar to the book-value accounting used in the insurance community.
14. Many have argued that this feature may encourage managers to take undue risk, but empirical studies indicate that hedge-fund managers do not necessarily take more risk than long-only funds unless the implied option is deep out of the money (Carpenter 2000).
15. See also Clarke, De Silva, and Thorley (2001).
16. An excellent report on risk disclosure and management of hedge funds that was jointly developed by several well-known large hedge funds is Sound Practices for Hedge Fund Managers (2000). The President’s Working Group on Financial Markets (1999) and Norland, Quintana, and Wilford (2000) also provide excellent discussions of this subject.
17. Ackermann (1999) showed empirically that the provision for lockup periods and the incentive structure are two of the most important contributors to hedge funds’ superior performance.
19. For example, see Schneeweis and Spurgin (1998) and Martin.
21. See Kao (2000b) for an application of the approach to analyzing determinants of the changes in corporate credit spreads.
22. Unlike most investment-grade bond funds, the long-only multiple-manager bond fund was prohibited from investing in high-yield bonds. Thus, we would expect an insignificant exposure to changes in high-yield spreads.
23. As a reference, if one follows the conventional approach of using a bond market index as the risk factor (e.g., the Lehman Aggregate Index), the $R^2$ is only 3 percent.
24. Broadly speaking, style analysis using market/factor portfolios or risk factors can also be considered a mimicking portfolio strategy for analyzing a fund’s risk and return.
25. Lo (2001) used a trading strategy of selling out-of-the-money puts on an equity index to demonstrate the illusion of a hypothetical hedge fund’s superior “risk-adjusted” performance.
26. The $R^2$s were about 48 percent versus an average of 7 percent with standard asset return factors.
27. See Gatev, Goetzmann, and Rouwenhorst (1999) on paired trading (a convergence strategy used to explore relative pricing of close substitutes of financial instruments), Mitchell and Pulvino on risk arbitrage strategy, Richards (1999) on relative-value trades, and Liew (1999) on equity long-short risk factors. Return indexes (e.g., the Mount Lucas Management Index) based on naive trading strategies in active commodity and financial futures have been used in analyzing CTA investment risks (Spurgin 1999; Schneeweis and Spurgin).
28. In Tang’s approach, composite relative-value indexes are constructed for capital market segments in which hedge funds operate. Each relative-value index combines factors related to rich/cheap valuation and technical indicators for the market at a given point of time. For example, for yield-curve trades, the approach calculates the relative-value opportunities available to levered and basis trades. As for technical factors, it uses such measures popular among practitioners as spreads versus their historical averages.
29. In fact, some hedge-fund-replicating indexes or naive trading strategies are being publicized as passive alternatives to active hedge-fund investing.

References


(Continued on pg. 36)


