

HEDGE FUNDS — STRATEGY AND PORTFOLIO INSIGHTS

OVERVIEW DECEMBER 2001



Interest in hedge fund investing continues unabated. Strategic mandates to hedge fund strategies by institutional asset owners are growing, and interest in long-short product lines is growing among traditional fund managers. This article reviews the performance of hedge funds in 2000–2001, and examines several key economic themes: the alpha advantage, long-short versus long-only investing, risk-adjusted performance benefits, and diversification through building a portfolio of hedge funds.

- **Hedge funds have significantly outperformed equity benchmarks in the difficult markets of 2000–2001.**
 - Our index of all hedge funds returned +4% annualized over the 21 months through September 2001, with a volatility of 8%, while the S&P 500 returned –16.9% with 18% volatility, and the Lipper Core index of mutual funds returned –16.3% with 18% volatility.
 - The best performing hedge fund strategies were Short Bias (+16.4%) and Stock Index Arb (+13.4%), and the worst performers were Long Bias (–2.3%) and Macro (+0.1%) according to MAR data.
- According to our research, **historically, hedge funds as a whole have demonstrated a better record of generating alpha than traditional equity funds.**
 - This fact could be related to superior information and skill, organizational nimbleness, or less restrictive investment constraints.
- All else equal, **long-short investors have a significantly larger opportunity set than long-only managers, given the same alpha.**
 - Giving the long-only investor the ability to go short expands investment opportunities in a meaningful way — not only can risk be reduced, but expected returns can be increased.
- **Hedge fund strategies appear to have assumed relatively low levels of market and macroeconomic risk, but the amount and significance varies greatly across strategies.**
 - The most important market factors for hedge funds are high yield bond returns and residual NASDAQ returns; Bond Arb, Long Bias, and Macro funds have the highest positive betas to these factors.
 - Two important macroeconomic risk factors for hedge funds are high yield spreads and equity market volatility; Long Bias, Macro, Distressed Securities, and Merger Arb funds are most negatively related to these two factors. GDP is also significant, with the majority of strategies having positive betas to GDP.
- **We develop a framework for building portfolios of hedge funds.** In our view, **diversifying across and within hedge fund strategies is critical.**
 - We believe that the optimal fund of funds portfolio size is at least 15 funds.
 - Historically, adding a diversified portfolio of hedge funds to a balanced equity-bond portfolio (60% equity/40% bonds) would have significantly reduced the drawdown risk, without giving up expected return (1996–2001 data). The optimal mix of funds varies depending on the investor's downside risk target. ■

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The year 2001 has been a challenging one for most investors, but the interest in hedge fund investing continues unabated. Strategic mandates to hedge fund strategies by institutional asset owners are growing, and interest in long-short product lines is growing among traditional fund managers. Fund-of-funds remain a growth area as investors see the advantages of a diversified portfolio of hedge fund strategies.

At the same time, the challenges to investors and managers are significant. Frequently encountered hedge fund questions

KEY ECONOMIC THEMES

As we consider the past year and the future of hedge funds, several economic themes remain at the forefront of our analysis. Two are covered in detail later in the article: the high historical risk-adjusted performance of hedge funds compared with U.S. mutual funds and passive benchmarks, and the importance of diversifying a portfolio of hedge funds. Here, we address the sources of relatively high alpha, and the advantages of a long-short investment process.

First note that hedge funds comprise a small proportion of managed equity and bond assets globally. The pie charts show the “supply” of global equities and bonds as well as the distribution (“demand”) of assets among different investors. Currently, hedge funds are believed to have net capital of about \$500 billion, while mutual fund managers, for example, may have upwards of \$10 trillion.³

Our research has shown that a significant proportion of the total return to hedge funds in the past has been alpha, in contrast with a small, negative total alpha for mutual

funds (see Exhibit 7B for an illustration of this). Of course, some hedge funds will have negative alpha and

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relate to measuring performance of different strategies, risk management and portfolio construction for hedge funds, and the sustainability of their alpha advantage. In this article, we review the key economic themes of our past work, “Why Hedge Funds Make Sense,” including the idea that hedge funds have an alpha advantage, update and expand on the risk and return characteristics of important hedge fund strategies, and present a framework for hedge fund portfolio (fund of funds) construction.¹

THE ALPHA ADVANTAGE

One possible explanation for an “alpha advantage” for any group of active managers is that they can forecast expected returns better than others. This means a significant ability to exploit market inefficiencies to outperform their benchmarks, presumably by virtue of skill, knowledge, and insight.² Along with their skill, the theory goes, hedge fund managers are more nimble, unencumbered by the constraints of large, sometimes unwieldy positions of traditional funds.

Exhibit 1 provides a backdrop for thinking about the competition for alpha.

some traditional funds will have positive alpha, but the total picture works out this way. The net alpha, however, must be zero because, in the end, outperformance is a zero-sum game, with hedge funds as a group possibly winning on average.

If real, is this alpha advantage likely to persist? As traditional investment managers adopt hedge fund methods and improve their own, and as the ranks of hedge funds increase (perhaps attenuating their total alpha), the distribution of alpha may well come closer to balance. If the supply of alpha through “market inefficiencies” dries up, this all becomes a moot point, but for

1. See our previous article, “Why Hedge Funds Make Sense,” Global Equity and Derivative Markets, November 2000, for a larger discussion of the evidence and outlook for market inefficiencies and alpha.
2. By alpha, we mean performance in excess of that due to market risk exposures.
3. Our estimates of asset size are rough and meant to be indicative only. Estimates are based on ICI, MSCI, MAR, FRM and Morgan Stanley estimates.

the foreseeable future, the opportunity appears to be significant.

INVESTMENT PROCESS ADVANTAGES OF LONG-SHORT STRATEGIES

Hedge funds may also be aided by their freedom from the constraints and regulations imposed on traditional managers that impede conversion of expected returns into realized returns. These constraints are in place to control different types of risk, and to protect investors from severe losses and unnecessary trading.

Among traditional managers, constraints are typically imposed on turnover, tracking risk, use of derivative instruments, constituent size, and style (e.g., value or growth). A study by Clarke et. al. (2001)

shows that ordinary portfolio constraints (including being long-only) can reduce realized return to less than half the expected return.¹ Our previous article, “Why Hedge Funds Make Sense,” also highlights other possible hedge fund structural advantages, including organizational nimbleness and size.

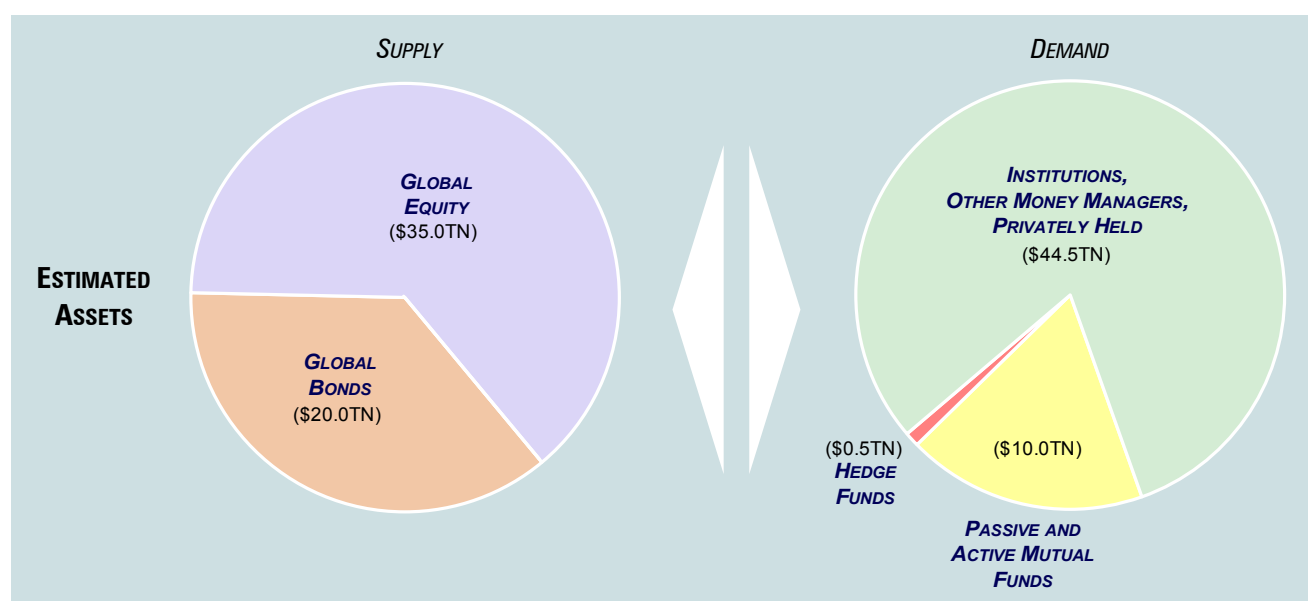
The most important constraint on traditional mutual fund managers is the difficulty of going short, which may be desired for stocks with negative expected returns.² Long-short investors therefore have a greater opportunity set than long-only investors, and their smaller number may imply less competition for the short side of alpha.³ Hedge funds seek absolute returns while most traditional funds seek returns

relative to a benchmark index. The active manager is only able to underweight a stock relative to its weight in the benchmark by setting the portfolio weight as low as zero, but the optimal weight based on the expected return may be negative.

However, efficient realization of expected returns by hedge funds is meaningful only if hedge funds have a significant alpha to begin with — greater freedom is not a stand-alone explanation of hedge fund outperformance. Nevertheless, a manager at a hedge fund who can provide alpha will have a large performance advantage over a similarly capable competitor at an institution that imposes severe constraints on his or her ability to invest and manage risk.

1. Clarke, R., DeSilva, H., and S. Thorley, 2001, “Portfolio Constraints and the Fundamental Law of Active Management,” forthcoming in Financial Analysts Journal.
2. The SEC has authorized mutual funds to sell short subject to burdensome segregation requirements. Because of these regulatory constraints, as well as the historical perception that short selling is “bad,” the investment policies of a number of mutual funds prohibit short selling.
3. It is a common view among asset managers that expertise on the short side is not as prevalent as expertise on the long side.

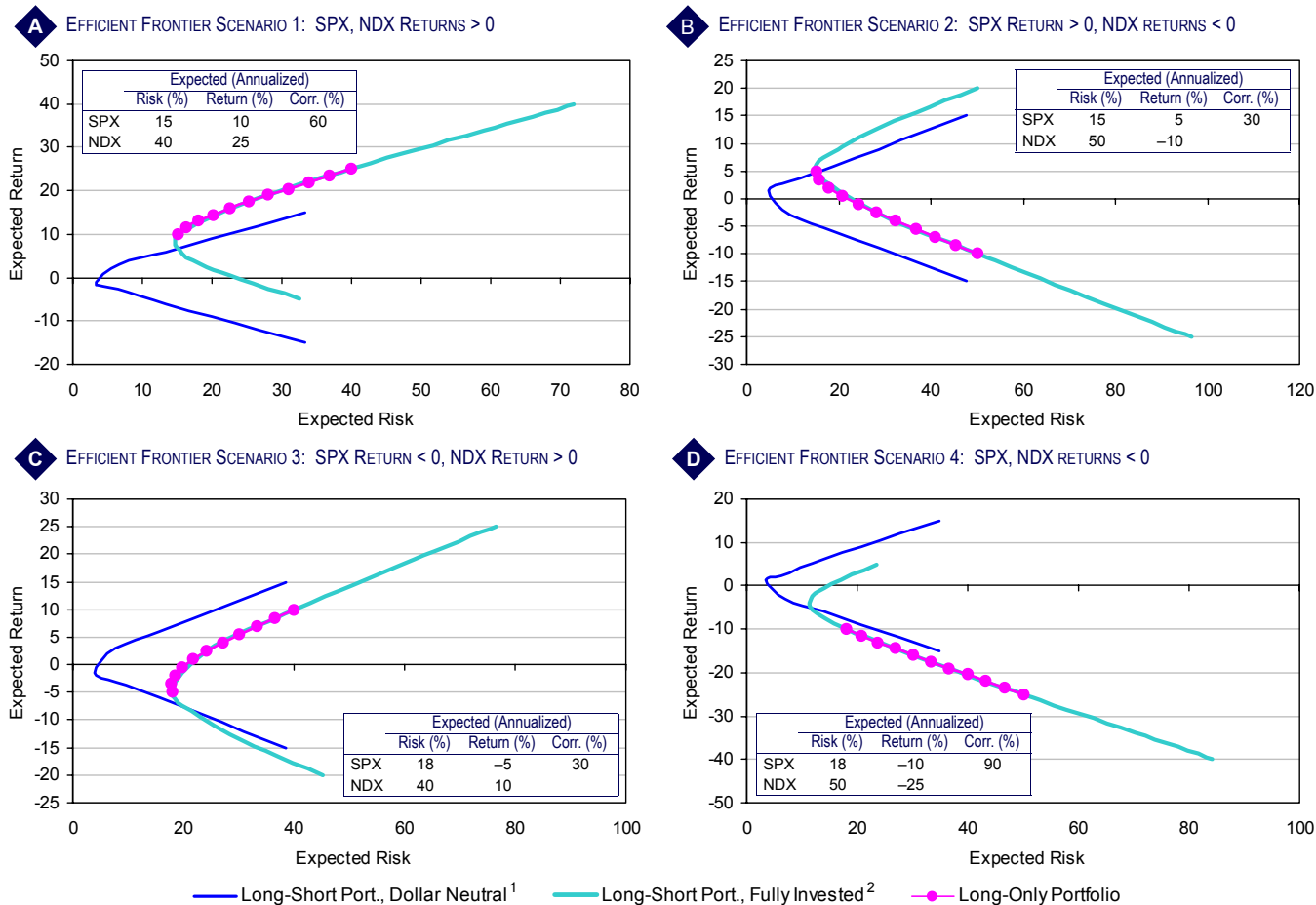
1 SUPPLY AND DEMAND FOR ALPHA¹



1. Does not include cash equivalents and short-duration fixed income. Estimates for year-end 2000, based in ICI, MSCI, MAR, FRM, Morgan Stanley estimates.
Source: Morgan Stanley Quantitative Strategies.

2 OPPORTUNITY SET — LONG-SHORT VERSUS LONG-ONLY

ILLUSTRATIVE



Note: Borrowing and lending costs are assumed to be zero in these examples.

1. Assumes long equity investment is always equal to short equity investment.

2. Assumes the long-short portfolio is fully-invested at all points, with leverage only to the degree needed to remain fully-invested.

Source: Morgan Stanley Quantitative Strategies.

Exhibit 2 illustrates the larger opportunity set that a long-short investor has relative to a long-only investor, assuming both managers have the same “alpha” in terms of expected return and risk. Four scenarios are given for a pair of assets (SPX and NDX), and three frontiers are shown for each scenario, one for the long-only manager and two for the long-short manager. The long-only manager has a short-sale constraint and

is fully invested (pink curve), while the long-short manager is either dollar neutral (dark blue) or fully invested (light blue).¹

In the case of the dollar neutral long-short manager, not only is risk-reduced, but in most cases the expected return potential is greater compared to the long-only manager. While in our example the SPX and NDX are not perfectly correlated assets, we still see the powerful risk reduction that

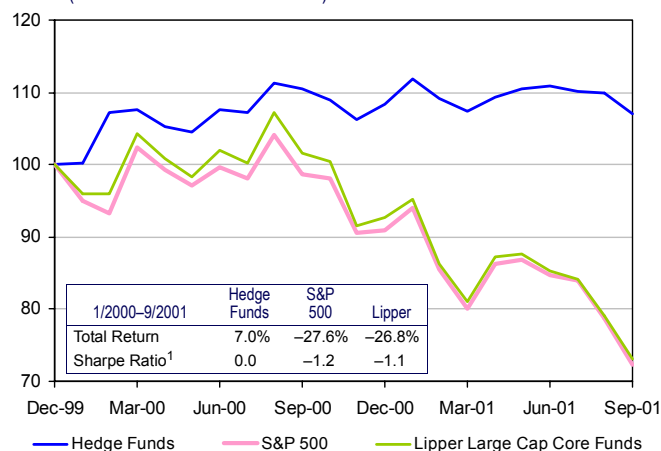
comes about from being able to short the less attractive asset. Only in the case where both assets have strong positive expected returns will the dollar neutral investor underperform or have a lower Sharpe Ratio.

The fully invested long-short manager does not have the same ability to reduce risk, but in all cases expected returns can be improved relative to long-only due to the

1. In this example, the managers are not allowed to take on leverage; the long-short manager can only use the minimum leverage necessary to remain fully invested. If additional leverage were introduced, the relative risk-adjusted performance would not change between managers.

3 RECENT ACTIVE MANAGER PERFORMANCE

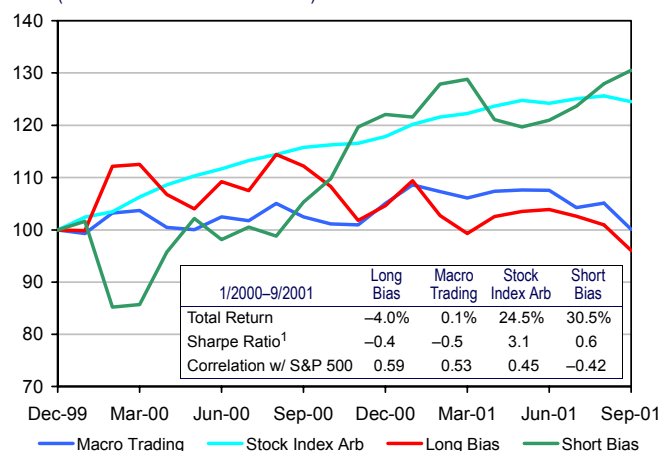
A RECENT PERFORMANCE OF HEDGE FUNDS AND MUTUAL FUNDS
(JANUARY 2000–SEPTEMBER 2001)



Note: Hedge fund strategy returns calculated according to methodology described in the Appendix immediately following this article.
1. Annualized, assumes 4% hurdle rate.

Source: Morgan Stanley Quantitative Strategies.

B BEST AND WORST PERFORMING HEDGE FUND STRATEGIES
(JANUARY 2000–SEPTEMBER 2001)



absence of the short-sale constraint. Furthermore, a higher Sharpe Ratio can often be obtained.

RECENT HEDGE FUND PERFORMANCE

The S&P 500 is down almost 30 percent since the start of 2000, with high volatility and a looming global recession raising the ante for all investors. Despite these challenges, hedge fund performance, while down from prior years, has held up remarkably well on average, according to our data and universe studied.

Exhibit 3 looks at the recent performance of hedge funds and mutual funds. All of the analysis in this article is based on the Managed Account Reports (MAR) database and classifications, although the results generally hold within our other primary research database, Financial Risk Management (FRM). In the analysis that follows,

all performance is calculated using a revised index construction methodology that controls for size, fund age, and rebalance frequency, as described in the Appendix immediately following this article. Note that the earliest reliable performance data for hedge funds generally begins in the late 1980s, an unfortunate fact that should always be kept in mind when evaluating the results.

Our aggregate hedge fund index returned seven percent from January 2000 through September 2001, while we believe that mutual funds declined 27 percent on average. This divergence reflects the more market neutral approach of many hedge fund strategies, compared with the benchmark-constrained approach of many active managers.

Each category of hedge fund strategies finished with a positive return from January 2000 through September 2001, with the exception of Long Bias, which generated a

loss of 4%. Short Bias funds had the best absolute returns since January 2000, although their annualized Sharpe Ratio was only 0.6 due to the high volatility of the strategy. On a risk-adjusted basis, Stock Index Arb funds performed the best, with an annualized Sharpe Ratio of 3.1 over the same period according to our data.

UNDERSTANDING HEDGE FUND STRATEGIES

The first step in building a portfolio of hedge funds is to have a thorough understanding of the various hedge fund strategies. There has been much debate as to the validity of categorizing hedge funds into particular strategies due to their unconstrained investment styles. Yet, from our analysis, and the analysis of others,¹ we have observed that certain groupings of hedge funds have reasonably distinct return and risk characteristics.

1. See, for example "Hedge Funds With Style," Yale International Center For Finance, S. Brown and W. Goetzmann, February 2001.

RISK AND RETURN CHARACTERISTICS

Exhibit 4 gives risk and return figures for each MAR hedge fund strategy over the past 11 years. We calculate hedge fund strategy returns using hedge fund portfolios (indexes), corrected for survivorship, age, and size biases to the extent possible.¹ The annual volatility calculation corrects for the presence of stale pricing (serial correlation) in the monthly portfolio returns.

From Exhibit 4, we can see that most hedge fund strategies have outperformed the broader market, as well as long-only managers, on a risk adjusted basis. Maximum drawdowns are significantly smaller, especially for market neutral and arbitrage-driven strategies.

SIZE AND AGE EFFECTS

Fund size affects hedge fund strategy performance in different ways. Exhibit 5 Panel A shows the effect of fund size on performance, calculated by forming three equal-weighted portfolios stratified by fund size. We see that for Bond Arb and Market Neutral, performance (Sharpe Ratio) degrades rapidly as fund size is increased, while this effect is not as dramatic or reversed for other strategies. Convertible Arb and Distressed Securities fund performance appear to improve with fund size. Capacity constraints seem to be binding for the Bond Arb and Market Neutral managers, but this is not the case for the many Long Bias and Macro Trading funds in our sample.

Age and persistence anomalies vary less across the hedge fund strategies. Exhibit 5, Panel B shows that for most strategies, the younger funds have significantly better Sharpe Ratios than the older funds (although younger funds are subject to the greatest reporting bias). It appears therefore

4 BIAS-ADJUSTED INDEX RETURNS (1990–SEPTEMBER 2001)

	Annualized Return ¹	Annual Volatility	Sharpe Ratio ²	Max Drawdown ³
All Hedge Funds	14.8%	11.3%	0.9	–9.1%
Bond Arb	12.7%	18.6%	0.4	–17.4%
Convertible Arb	13.4%	9.2%	0.9	–6.2%
Distressed Securities	16.0%	9.9%	1.1	–12.1%
Long Bias	17.4%	18.5%	0.7	–16.1%
Macro Trading	11.3%	13.1%	0.5	–13.0%
Market Neutral	13.2%	6.4%	1.3	–2.9%
Merger Arb	14.5%	8.5%	1.1	–7.6%
Multi-Strat Arb	9.1%	8.8%	0.5	–19.4%
Short Bias	6.2%	13.5%	0.1	–28.6%
Stock Index Arb	14.3%	13.4%	0.7	–7.4%
Fund of Funds	11.1%	9.5%	0.6	–9.4%
S&P 500	12.1%	14.6%	0.5	–30.5%
Bonds ⁴	7.9%	4.4%	0.7	–6.3%
Lipper Core	11.0%	14.1%	0.4	–31.7%

Note: Strategy returns are calculated according to methodology described in the Appendix immediately following this article.

1. Total return, net of fees.

2. Assumes 5% hurdle rate.

3. Largest peak-to-trough decline during the stated time period.

4. Lehman Brothers Composite T-Bond Total Return Index.

Source: Morgan Stanley Quantitative Strategies.

that younger funds/emerging managers generally possess some sort of edge early on, perhaps due to size and nimbleness, as well as a “hot” approach that is not well understood by the market.² Though not shown, annual performance persistence is minimal among hedge funds in all strategies.

RETURN CONCENTRATION

Next, we consider how episodic or concentrated the return streams of the various hedge fund strategies are. Certain strategies produce very consistent returns, while other strategies produce returns in a more “lumpy” manner. To test for return concentration, we looked at strategy returns over the past six years, and picked out the two best 12-month return periods (non-contiguous) and divided the sum of the returns for these two periods by the total return for that strategy during the entire time period.

Exhibit 6 shows that more directional hedge fund strategies like Macro Trading tend to deliver more episodic returns, while the Arb strategies (excepting Bond Arb) have the more consistent or less concentrated returns. Interestingly, the Lipper equity mutual funds in our index have had very concentrated returns during this period due to the volatile performance cycle of the equity market. Investors selecting a portfolio of hedge funds may wish to set guidelines for the stability of the return stream.

SYSTEMATIC RISK SENSITIVITIES

In setting portfolio strategy, an economic model for attributing and predicting risk according to “systematic” or undiversifiable risk factors is always valuable. Hedge funds present a special challenge to this approach, however, because they often

1. Other biases, such as backfill bias and selection bias, may still exist, but are largely beyond the control of researchers.

2. In fact, the younger funds tend to be much smaller than the older funds in our database.

5 SIZE AND AGE EFFECT ON HEDGE FUND STRATEGIES

A SIZE ANALYSIS BY STRATEGY
ANNUALIZED SHARPE RATIOS:¹ (1996–SEPTEMBER 2001)

	Fund Size (\$MM)			
	<25	25–200	>200	All Funds
All Hedge Funds	0.9	1.2	0.8	1.1
Bond Arb	1.3	0.7	0.0	1.0
Convertible Arb	1.3	2.0	n/a	2.3
Distressed Securities	0.4	0.8	1.5	0.7
Long Bias	0.9	1.0	0.8	0.9
Macro Trading	0.4	0.3	0.4	0.4
Market Neutral	1.1	2.1	0.2	1.7
Merger Arb	0.6	1.3	0.7	1.2
Short Bias	0.2	0.2	n/a	0.3
Stock Index Arb	2.4	1.9	n/a	3.3

B AGE ANALYSIS BY STRATEGY
ANNUALIZED SHARPE RATIOS:¹ (1996–SEPTEMBER 2001)

	<1yr	1–2yr	2–3yr	3–5yr	>5yr
All Hedge Funds	2.3	1.4	1.5	1.0	0.9
Bond Arb	2.5	0.8	0.8	0.1	n/a
Convertible Arb	n/a	4.4	2.4	2.1	1.1
Distressed Securities ²	1.5	n/a	n/a	0.9	1.1
Long Bias	1.9	1.3	1.3	0.7	0.7
Macro Trading	1.1	0.3	0.4	0.8	0.3
Market Neutral	2.3	1.8	1.0	2.4	1.5
Merger Arb	2.0	1.1	1.8	1.1	0.9
Stock Index Arb	2.6	1.4	1.4	1.4	2.1

Note: Age-stratified portfolios are equally-weighted and rebalanced monthly. Size-stratified portfolios are equally-weighted and rebalanced annually. n/a denotes a size bucket with insufficient funds.

1. Assumes 5% hurdle rate.

2. <1yr column includes funds of age <3yr.

Source: Morgan Stanley Quantitative Strategies.

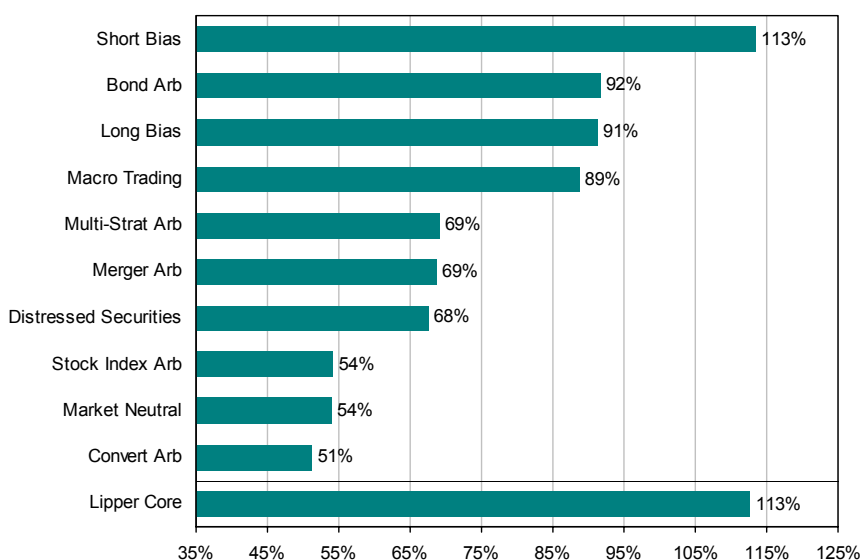
employ high-frequency trading strategies, nonlinear strategies, and tend toward more market neutral positions.

High alpha and low correlation with market risks have indeed been the norm for hedge funds. Nevertheless, with special attention to the econometrics, our research has shown that significant market and macroeconomic risks are often observable. We analyze systematic hedge fund risk with two models that span the space of hedge funds returns with different sets of factors — one using investable market factors in the spirit of “style analysis,” the other macroeconomic factors.

MARKET RISK FACTORS

We constructed a nine-factor model to measure a strategy’s systematic market risks and alpha. The factors include high yield bond returns, emerging market equity returns (EMF), commodity returns, and S&P 500 sector returns. We estimate the

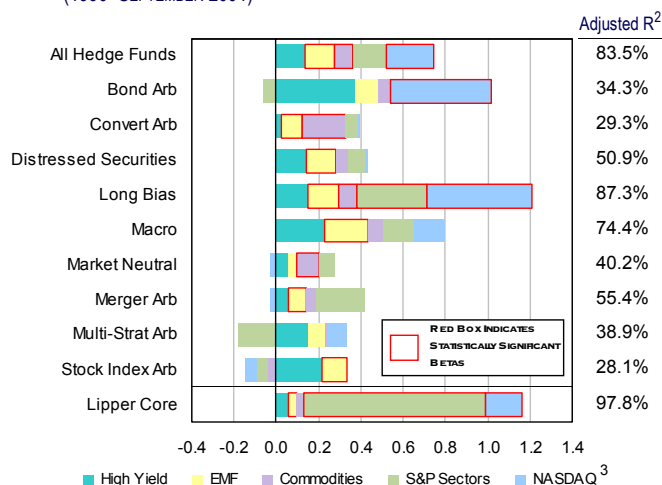
6 RETURN CONCENTRATION (1996–SEPTEMBER 2001)
MAXIMUM PERCENTAGE OF STRATEGY TOTAL RETURN OCCURRING IN ANY TWO YEARS



Note: Bar indicates the proportion of the period’s total return occurring in any two noncontiguous 12-month periods. A uniform distribution of return over time would imply a figure of about 35%.
Source: Morgan Stanley Quantitative Strategies.

7 MARKET RISK AND ALPHA

A MARKET RISK ANALYSIS OF HEDGE FUND STRATEGIES — FACTOR SENSITIVITIES¹
(1990–SEPTEMBER 2001)



Note: Quarterly returns are used in this analysis.

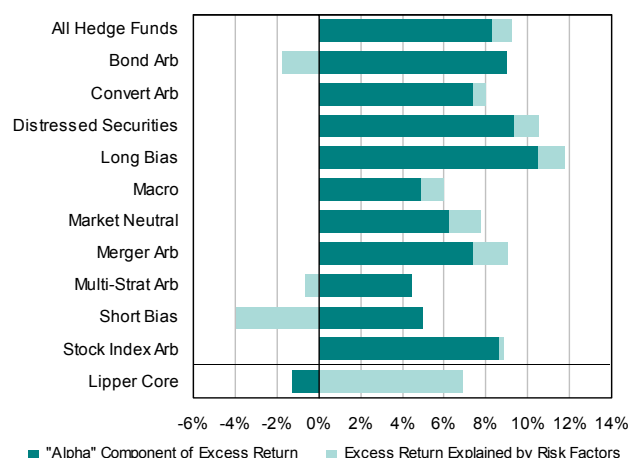
1. Bars give the magnitudes of the sensitivities or betas of the hedge fund portfolio to the risk factor.

2. Alpha component of excess return is that part which cannot be explained by exposure to systematic market risk factors.

3. Component of NASDAQ Composite return not explained by high yield, EMF, commodity, and S&P sector returns. S&P sectors are Financials, Healthcare, Technology, Telecommunications, and the remaining sectors, cap-weighted.

Source: Morgan Stanley Quantitative Strategies.

B DECOMPOSITION OF AVERAGE HISTORICAL EXCESS RETURNS²
(1990–SEPTEMBER 2001)



model using quarterly returns instead of monthly returns to minimize “stale pricing” effects.

Panel A of Exhibit 7 shows betas to market factors for each hedge fund strategy. Market factors in our model explain less of hedge fund risk and return than for mutual funds (Lipper Core), as evidenced by the low R-squared for the regressions. From this result, we can infer that hedge funds have a much greater unexplained, or idiosyncratic, risk component to their returns, relative to mutual funds. Notably, one factor to which hedge funds have had consistently high sensitivity is the high yield bond return, a proxy for the credit market. Another point of interest is that many of the strategies have a sizable exposure to the NASDAQ.

Among the stock-picking strategies, Long Bias funds have exhibited a high exposure and correlation to the equity mar-

kets, particularly NASDAQ. Long Bias funds are also very volatile, and produce highly episodic returns. In contrast, Market Neutral and Stock Index Arb funds, which attempt to eliminate systematic risk, do in fact have very low betas to equity market factors. Stock Index Arb actually has a slight negative exposure to S&P sectors and NASDAQ returns. These strategies also exhibit less episodic and volatile return streams than those of the Long Bias funds.

Arbitrage strategies, in general, have had lower exposures to broad market factors, and a lower volatility relative to other hedge fund strategies. However, Merger Arb has the second highest beta to the S&P sectors among all hedge fund strategies. Convertible Arb has a high exposure to commodities, perhaps indicating an inflation sensitivity. Not surprisingly, Bond Arb funds have the highest credit exposure among the hedge fund strategies as mea-

sured by the high yield return.

Macro Trading has the most significant exposure to more global factors like EMF returns. It also has the most concentrated returns and is highly volatile. Distressed Securities funds, as one might expect, are very sensitive to high yield returns.

Panel B of Exhibit 7 decomposes the average returns of the hedge fund strategies into the component explained by the systematic risk factors, and the component not explained by the model — the alpha. As in our prior work, every hedge fund strategy has exhibited a positive alpha since 1990, while mutual funds have had a negative alpha. This is not to say that hedge fund portfolios do not exhibit significant market risks — only that these risks account for a lower proportion of the excess returns than for traditional funds.

MACROECONOMIC RISK FACTORS

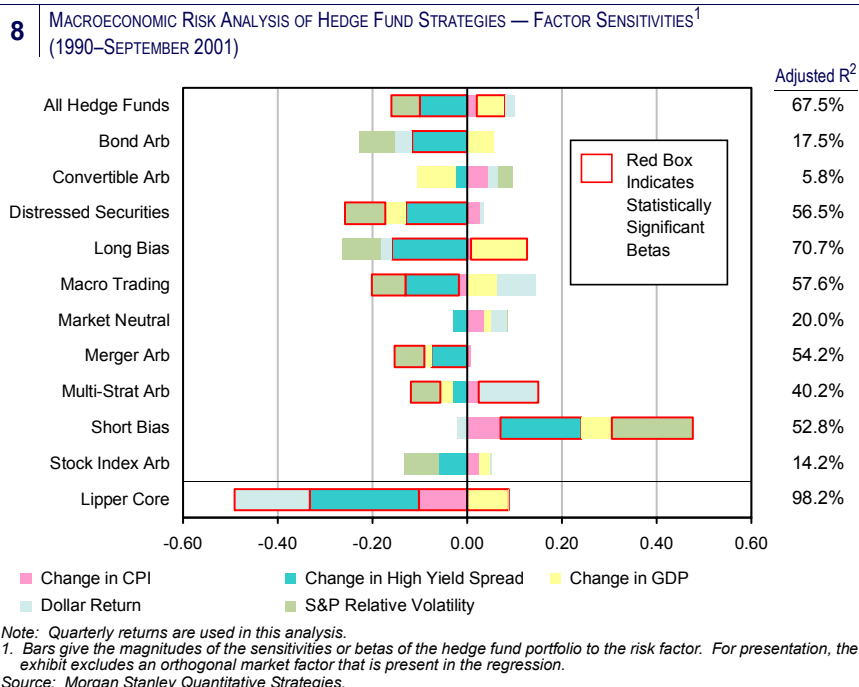
To test for evidence of macroeconomic factor exposure in hedge funds, we built a model relating quarterly hedge fund portfolio returns linearly to the following factors:

- Change in CPI
- Change in GDP
- Change in high yield spread (BB versus AAA bonds)
- Trade-weighted U.S. dollar return
- S&P 500 volatility relative to its history. (We also included residual S&P 500 returns in the regression model.)

Exhibit 8 gives the betas of each factor for each strategy, with statistically significant betas boxed in red. Consistent with the sensitivity to high yield returns in the market risk factor model, hedge funds generally have a negative relationship with high yield spreads. Macro Trading and Distressed Securities, along with Long Bias and Bond Arb, have among the highest negative betas to the factor. Notably, equity mutual funds (Lipper Core) also have a large negative exposure. Clearly, sentiment and risk aversion as reflected in this spread is central to explaining equity market risk.

The high yield spread is also correlated with S&P 500 (relative) market volatility, to which most strategies also have a strong negative sensitivity.¹ Again, Macro Trading and Distressed Securities are negatively influenced by this factor, as are Long Bias, Bond Arb, and Merger Arb.

As before, Macro Trading has a positive relationship with global factors, here reflected by a relatively strong positive beta



to the U.S. dollar. This is the weakest of the factors for hedge funds in general, but mutual funds have a significant negative beta to the dollar.

Most hedge funds are positively related to economic growth, with Long Bias funds most sensitive. Lipper Core also has a significant positive beta. Convertible Arb and Distressed Securities have a negative sensitivity to growth. Mutual funds have a significant positive sensitivity to GDP and a negative sensitivity to CPI changes.

BUILDING A HEDGE FUND PORTFOLIO

Because of their low correlations, the true advantages of hedge fund investing are realized when individual funds are pooled. Here, we explore this issue in more depth by looking at diversification within and across different hedge fund strategies.

DIVERSIFICATION ACROSS AND WITHIN STRATEGIES

To examine the diversification across hedge funds strategies, we calculated the correlations between our strategy index returns over the past 11 years, the results of which can be found in Panel A of Exhibit 9. The arbitrage strategies seem to be the best diversifying strategies, generally having correlations of about 0.3 to other strategies, while more directional based strategies, such as Macro Trading and Long Bias, have higher cross-correlations. In general, however, correlation across hedge fund strategies is fairly low on average, suggesting that a well-diversified hedge fund portfolio should include both directional and arbitrage-type investment strategies.

Do these results hold up under periods of market distress, when they count the most? We measured the correlation between strategies during down markets and up mar-

1. High volatility environments generally raise the value of the default option that investors in the credit markets are short.

9 CORRELATIONS ACROSS HEDGE FUND STRATEGIES

A CORRELATION MATRIX (1990–SEPTEMBER 1991)¹

	Macro Trading	Merger Arb	Convertible Arb	Stock Index Arb	Bond Arb	Multi-Strat Arb	Distressed Securities	Long Bias	Market Neutral	Short Bias	Avg Excl. S&P
Macro Trading											0.43
Merger Arb	0.72										0.44
Convertible Arb	0.24	0.34									0.18
Stock Index Arb	0.52	0.52	−0.14								0.25
Bond Arb	0.57	0.46	0.04	0.32							0.29
Multi-Strat Arb	0.46	0.37	0.15	0.40	0.37						0.29
Distressed Securities	0.66	0.83	0.34	0.43	0.38	0.50					0.42
Long Bias	0.79	0.65	0.19	0.34	0.66	0.24	0.61				0.35
Market Neutral	0.57	0.59	0.51	0.22	0.33	0.42	0.67	0.50			0.38
Short Bias	−0.69	−0.56	−0.07	−0.33	−0.49	−0.30	−0.62	−0.82	−0.39		−0.47
S&P 500	0.62	0.63	0.06	0.28	0.42	0.04	0.53	0.81	0.35	−0.68	0.31 ²

B CORRELATION DIFFERENCE IN DOWN VERSUS UP MARKETS³ (1990–SEPTEMBER 1991)

	Macro Trading	Merger Arb	Convertible Arb	Stock Index Arb	Bond Arb	Multi-Strat Arb	Distressed Securities	Long Bias	Market Neutral	Short Bias	Avg Excl. S&P
Macro Trading											0.09
Merger Arb	0.37										0.25
Convertible Arb	−0.37	−0.16									−0.15
Stock Index Arb	0.26	0.20	−0.46								0.13
Bond Arb	−0.41	0.17	−0.50	0.40							0.01
Multi-Strat Arb	0.50	0.96	0.02	0.42	0.14						0.38
Distressed Securities	0.41	0.32	−0.20	0.29	0.34	0.72					0.22
Long Bias	−0.06	0.42	−0.78	0.59	−0.08	0.58	0.37				0.11
Market Neutral	0.13	0.36	0.33	0.02	0.13	0.38	0.07	−0.07			0.17
Short Bias	−0.04	−0.39	0.75	−0.54	−0.11	−0.34	−0.32	0.07	0.17		−0.08
S&P 500	0.23	0.14	−0.76	0.65	−0.07	0.83	0.14	0.20	−0.11	0.04	0.13 ²

Note: Quarterly data is used in this analysis.

1. Bolded figures represent high correlations.

2. Average with S&P 500.

3. Down markets represent the bottom 33% of S&P quarters, ranked by performance. Up markets represent the top 67%. Significantly lower correlations are indicated in green, and significantly higher correlations are given in red.

Source: Morgan Stanley Quantitative Strategies.

kets over the past 11 years. Down markets were defined as months where the S&P 500's performance was in the bottom 1/3 of all quarters in terms of performance, and up markets were the top 2/3 of quarters. The differences in correlation between down and up markets are given in Panel B of Exhibit 9. While some correlations do increase in down markets, such as Long Bias

and Merger Arb, other pairs actually decrease, such as Long Bias and Convertible Arbitrage. The rightmost column in Panel B shows that the average correlation difference between the two regimes is quite low (11%). This analysis suggests that a well diversified hedge fund portfolio across multiple strategies not only reduces overall volatility, but will limit drawdown risk as well.

Given the relatively low correlation between hedge fund strategy indexes (which by definition assume investments in a large universe of funds), a practical next step is the determination of the “optimal” number of funds needed in a given strategy to achieve its risk/reward benefits. This question is best answered by looking at the reduction in volatility and gain in Sharpe Ratio that comes

HEDGE FUNDS — STRATEGY AND PORTFOLIO INSIGHTS

about from combining funds.

To provide a backdrop for our analysis, Exhibit 10 graphs the average correlation among our universe of funds within selected strategies since 1990, on a 12-quarter rolling basis. Panel A shows that the average correlation between pairs of hedge funds is significantly lower than that of mutual funds, and closer to the diversification characteristics of a portfolio of stocks. Panel B shows that the funds within Long Bias, Market Neutral, and Macro Trading have a consistently low average correlation, particularly Macro Trading and Market Neutral.

Panel C shows the average correlation within the Convertible Arb, Merger Arb, and Distressed Securities strategies. A sudden spike in correlation can be observed during August 1998, a period of great market distress. This suggests that the diversification between funds within these strategies is especially vulnerable to times of market uncertainty, another reason why investors should diversify across hedge fund strategies.

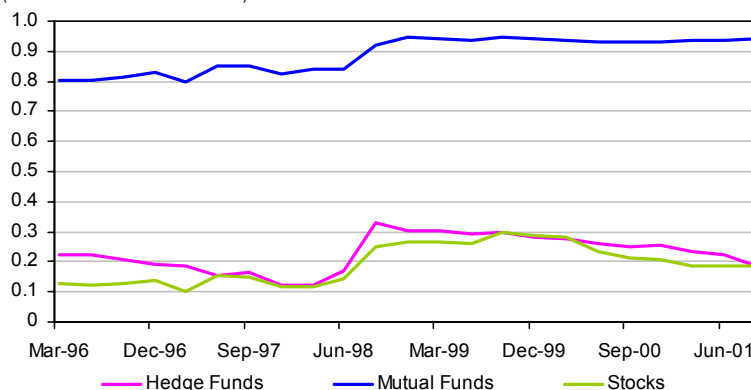
The generally low correlation between hedge funds would appear to reflect fairly unique processes for alpha generation for individual managers, even when focused on the same markets. It is also a reflection of the “market neutral” investment process that is often employed — there are fewer market factors relating managers’ performance. These economics would likely be diluted if the universe of hedge fund managers grows with no increase in potential alpha sources.

HEDGE FUND PORTFOLIOS

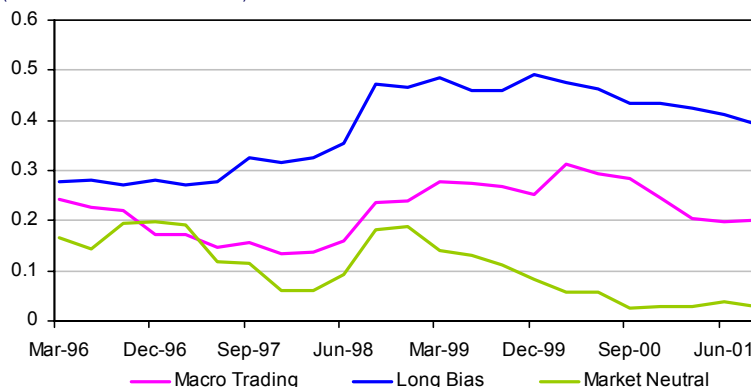
To better understand the risk reduction that can be achieved through portfolios of hedge funds, for each strategy, we randomly selected portfolios of a fixed number of funds, then calculated their risk and return

10 AVERAGE CORRELATION OF HEDGE FUNDS WITHIN STRATEGIES

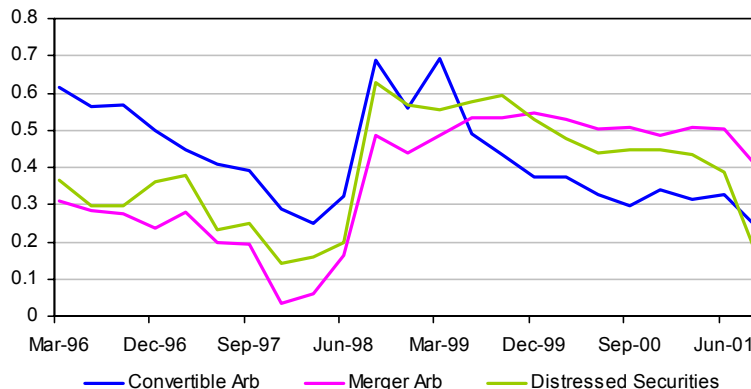
A HEDGE FUNDS, MUTUAL FUNDS, STOCKS¹ (MARCH 1996–SEPTEMBER 2001)



B MACRO TRADING, LONG BIAS, MARKET NEUTRAL (MARCH 1996–SEPTEMBER 2001)



C CONVERTIBLE ARB, MERGER ARB, DISTRESSED SECURITIES (MARCH 1996–SEPTEMBER 2001)



Note: Based on 12 trailing quarters.

1. Hedge funds encompass the MAR hedge fund database universe, mutual funds encompass the Lipper Large Cap Core universe, and stocks are the S&P 500 constituents.

Source: Morgan Stanley Quantitative Strategies.

for the period 1995 through 2001. An annual rebalance was used with equal weights, as well as the size and age cutoffs used in our index construction methodology.

Exhibit 11 reports the median Sharpe Ratio for each strategy from the simulation (for 1000 replications) for a range of portfolio sizes. For all the strategies, as the number of funds in the portfolio is increased, the Sharpe Ratio increases, corresponding to the drop in portfolio volatility. Yet not all strategies see the same pattern of improvement.

For example, the Sharpe Ratio of the Long Bias strategy does not increase significantly for a portfolio of more than five funds, while the Market Neutral strategy

correlated. A smaller number of these managers is needed to obtain their risk-adjusted return (and alpha) potential. It turns out, however, that choosing the optimal allocation to different strategies is a complicated analytical problem. We attempt to shed some light on this decision using historical data from the same 1995 through 2001 period.

“EFFICIENT PORTFOLIOS” OF HEDGE FUND STRATEGIES

We simulated the allocation process from the perspective of a “real world” investor, assumed to be deciding on a portfolio of 20 hedge funds spread across the ten possible strategies. For specific combinations (e.g., ten Bond Arb, ten Market Neutral) of fund

return. An annual rebalance to equal weights and other index criteria were used in forming these portfolios of a particular mix each year. Exhibit 12 then plots the mix of funds that achieved the highest return for a given level of average worst drawdown (in the bottom decile of drawdowns).

Panel A plots this “efficient” frontier for the hedge funds alone, assuming no other assets in the investor’s portfolio. There is a wide range of potential combinations and risk/return pairs for a pool of 20 hedge funds. At the low end of the risk spectrum, the minimum drawdown portfolios would have consisted of Convert Arb, Short Bias, Long Bias, and Distressed Securities. This mix would have resulted in

worst decile drawdowns of less than 4% over the simulation period. At the other end of the spectrum, the portfolio of 19 randomly selected Long Bias

and 1 Merger Arb fund returned over 18%, but would have experienced a drawdown of

Combining individual funds from different strategies reduces the number of funds needed in a portfolio, and the number of funds needed from each strategy.

Sharpe Ratio continues to improve well after five funds. This is due to lower average correlation among Market Neutral funds, which provides more opportunity for diversification than Long Bias funds. Investors should be mindful of these differences when choosing the number of managers for particular hedge fund strategies.

Combining individual funds from different strategies also reduces the number of funds needed in a portfolio, and the number of funds needed from each strategy. The row labeled “All Hedge Funds” in Exhibit 11 shows that a portfolio of 15–20 hedge funds from all strategies captures a majority of potential risk-adjusted return as measured by Sharpe Ratio. In contrast, most Lipper Core funds in our dataset closely track a benchmark — as a result their returns are likely to be much more highly

strategies of 20 funds we looked at 1000 random selections and calculated downside risk (worst drawdown) and geometric

11 DIVERSIFICATION ACROSS STRATEGIES — DISTRIBUTION OF MEDIAN SHARPE RATIOS BY STRATEGY AND PORTFOLIO SIZE

	Funds in Portfolio						
	1	5	10	15	20	30	40
All Hedge Funds	0.4	0.8	0.9	1.0	1.0	1.1	1.1
Bond Arb	0.5	0.8	1.0				
Convertible Arb	1.4	2.1	2.5				
Distressed Securities	0.7	1.2	1.3	1.3			
Long Bias	0.5	0.8	0.9	0.9	0.9	0.9	0.9
Macro Trading	0.1	0.3	0.3	0.4	0.4	0.4	0.4
Market Neutral	0.7	1.3	1.6	1.8	1.9		
Merger Arb	0.8	1.1	1.3	1.4	1.4		
Short Bias	0.1	0.2					
Stock Index Arb	1.2	1.8					
Lipper Core	0.5	0.5	0.5	0.5	0.5	0.5	0.5

*Note: Performance simulated from 1995–Sept. 2001. Each entry represents 1000 random portfolios. Portfolios are equally-weighted and rebalanced annually, according to the methodology described in the Appendix.
Source: Morgan Stanley Quantitative Strategies.*

nearly 30% in the worst decile. In the middle, a combination of Long Bias, Stock Index Arb, Convert Arb and Market Neutral is efficient.

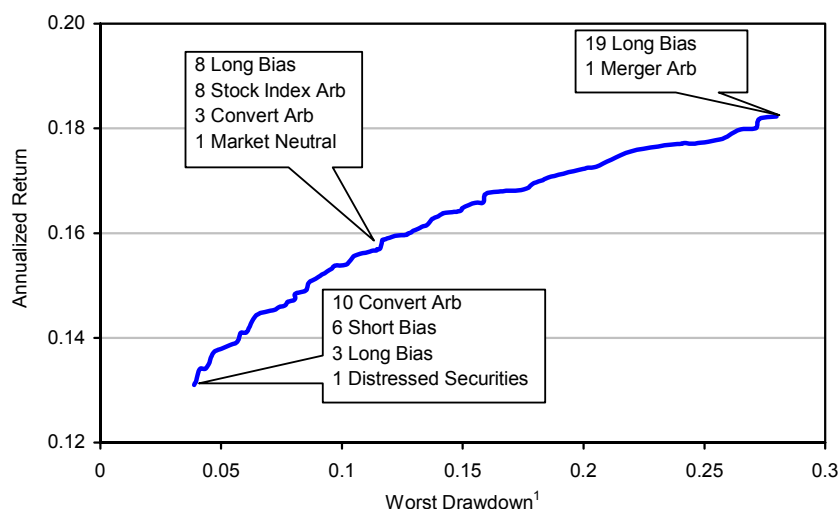
Panel B analyzes the same decision from the perspective of a diversified investor — assuming that the 20 randomly-selected hedge funds fall into a 50% stock/40% bond/10% hedge fund mix. We show incremental return and incremental worst decile drawdown risk relative to an annually-rebalanced 60%/40% stock-bond portfolio (which had return of 12.88% and worst drawdown of 14.17% during this period). The correlation between the hedge funds and stocks and bonds clearly changes the efficient mixes of hedge funds.

The greatest risk reduction occurs for a mix of Distressed Securities, Short Bias, and Multi-Strat Arb funds. This is presumably due to the favorable performance of this combination during the period from September 2000 through September 2001, during which the maximum drawdown occurred for the 60/40 stock/bond portfolio. This reduction in drawdown would have come at a “cost” of only about 0.2% in annual return. At the other end of the spectrum, the highest return would have resulted if the hedge funds were allocated 19 Long Bias, 1 Market Neutral. It is interesting that allocating 10% of assets to this combination of hedge funds increased return and reduced risk relative to a 60/40 benchmark.

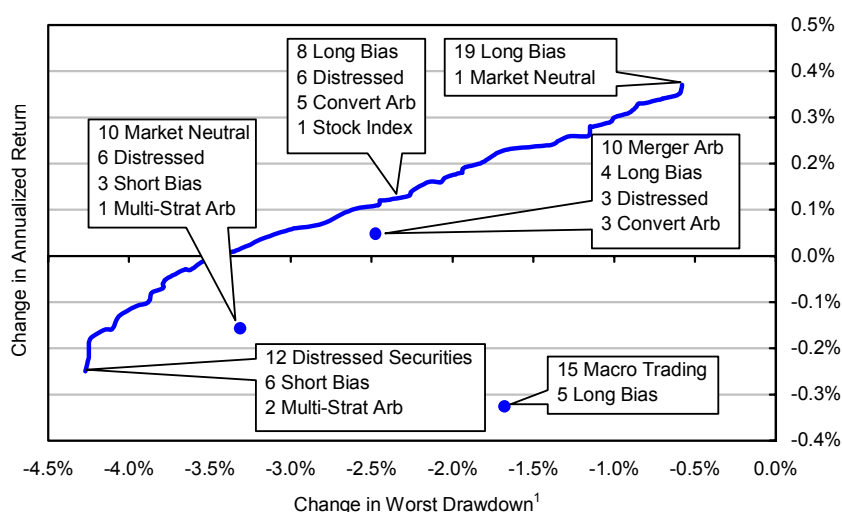
We believe that using worst drawdown as the primary risk measure is a robust framework for asset allocation decisions. Many diversified combinations of hedge funds have provided a significant reduction in this risk for a minimal reduction in average return during the 1995–2001 period.

12 EFFICIENT FRONTIER OF HEDGE FUND PORTFOLIOS (1995–2001)

A RISK AND RETURN OF HEDGE FUNDS ONLY



B CHANGE IN RISK AND RETURN OF 60/40 EQUITY/BOND PORTFOLIO FROM ADDING 10% HEDGE FUNDS²



1. Axis indicates average drawdown in worst 10 percent of scenarios.

2. Change assumes adding hedge funds to 50% equity, 40% bond portfolio.

Note: Efficient frontier plots portfolios of 20 hedge funds with the highest return for a given level of risk from 1995 through September 2001, using an annual rebalance and reselection, and the minimum size criteria of our indexes for each portfolio mix. 1000 random samples of funds are taken to determine the average drawdown in the bottom decile.

Source: Morgan Stanley Quantitative Strategies.

13 KEY RISK/RETURN AND PORTFOLIO CHARACTERISTICS BY STRATEGY (1990–SEPTEMBER 2001 DATA)

Hedge Fund Strategy	Performance	Age and Size Effects	Market and Macro Risk Exposures	Correlation	Efficient Portfolios
Bond Arb	<ul style="list-style-type: none"> High return concentration since 1996 High volatility 	<ul style="list-style-type: none"> Large decline in Sharpe among bigger funds Pronounced age effect 		<ul style="list-style-type: none"> Least sensitive to down equity market 	<ul style="list-style-type: none"> Since 1995, need at least 5 funds to maximize Sharpe
Convertible Arb	<ul style="list-style-type: none"> High Sharpe, low drawdown since 1990 Least concentrated returns 	<ul style="list-style-type: none"> Pronounced age effect 	<ul style="list-style-type: none"> High sensitivity to CPI Largest beta to commodity returns 	<ul style="list-style-type: none"> Lowest with S&P since 1990 Lowest average versus other strategies Fund correlation jumped in August 1998 	<ul style="list-style-type: none"> Need about 10 funds to maximize Sharpe Since 1995, large role in low risk efficient hedge fund portfolios
Distressed Securities		<ul style="list-style-type: none"> Sharpe increases for bigger funds 	<ul style="list-style-type: none"> Negative beta to high yield spread, S&P volatility 	<ul style="list-style-type: none"> High with Macro, Merger Arb Higher in down market Fund correlation jumped in August 1998 	<ul style="list-style-type: none"> Need about 5 funds to maximize Sharpe Large role in lower risk hedge fund portfolios since 1995
Long Bias	<ul style="list-style-type: none"> Worst in 2000-2001 High concentration High volatility 	<ul style="list-style-type: none"> No size effect Pronounced age effect 	<ul style="list-style-type: none"> Largest S&P sector, NASDAQ betas Positive beta to GDP, negative beta to volatility 	<ul style="list-style-type: none"> Highest with S&P since 1990 High with Macro Trading 	<ul style="list-style-type: none"> Need 5-10 funds to maximize Sharpe Large role in highest risk hedge fund portfolios
Macro Trading	<ul style="list-style-type: none"> High concentration 		<ul style="list-style-type: none"> High sensitivity for high yield return, EMF Positive beta to U.S. dollar, GDP, negative beta to S&P volatility 	<ul style="list-style-type: none"> High with Merger Arb, Long Bias 	<ul style="list-style-type: none"> Need 5-10 funds to maximize Sharpe
Market Neutral	<ul style="list-style-type: none"> Highest Sharpe, smallest drawdowns since 1990 Low return concentration 	<ul style="list-style-type: none"> Sharpe declines for bigger funds 	<ul style="list-style-type: none"> Insignificant exposure to virtually all factors 		<ul style="list-style-type: none"> Need 15-20 funds to maximize Sharpe
Merger Arb	<ul style="list-style-type: none"> High Sharpe, small drawdown since 1990 	<ul style="list-style-type: none"> No size effect 	<ul style="list-style-type: none"> High S&P sector exposure 	<ul style="list-style-type: none"> High with Macro, Long Bias Higher in down market Fund correlation jumped in August 1998 	<ul style="list-style-type: none"> Need 10-15 funds to maximize Sharpe
Multi-Strat Arb				<ul style="list-style-type: none"> Low with S&P Higher in down market 	
Short Bias	<ul style="list-style-type: none"> Best in 2000-2001 Lowest Sharpe highest drawdown since 1990 Most concentrated returns 		<ul style="list-style-type: none"> Negative exposure to the market 	<ul style="list-style-type: none"> Negative versus all strategies and the market 	
Stock Index Arb	<ul style="list-style-type: none"> Strong in 2000-2001 Low return concentration 		<ul style="list-style-type: none"> High sensitivity to high yield return 	<ul style="list-style-type: none"> Low with S&P 	

Source: Morgan Stanley Quantitative Strategies.

CONCLUSION

Exhibit 13 summarizes by strategy the significant insights on hedge fund performance and portfolio construction.

Our research continues to make a strong case for hedge fund investing and the long-short investment approach. Drawing on multiple databases, hedge funds have exhibited larger alphas than long-only funds, higher Sharpe Ratios, relatively lower levels of systematic risk, and fairly low correlation with other asset classes. The key qualification is that adequate infor-

mation about hedge fund performance is not available prior to about 1990, and significant reporting biases are unavoidable, so our empirical conclusions are limited to that extent.

Analysis of hedge fund portfolio construction shows that the number of funds which maximizes risk-adjusted performance varies by strategy, but is generally in the range of about 15–20 funds for a diversified portfolio of hedge fund strategies. In the past seven years, different mixes of funds have provided the best returns (both incremental to an equity/bond mix and sep-

arately) for a given level of drawdown risk.

A number of practical challenges remain for hedge fund investors. Competition for alpha in the long-short space is likely to grow, and therefore we expect fund selection and portfolio construction methods to come under greater scrutiny. A better understanding of these issues is needed. In addition, data quality and strategy transparency present a double-edged sword, but are critical to hedge fund analysis. We believe economic benchmarks for hedge fund investing are also necessary. ■

We are grateful to Peter Fanelli for his contributions to this article.

APPENDIX

DATABASE ISSUES: MAR AND FRM

The data presented in this article is from Managed Account Reports (MAR), a commercial provider of hedge fund data. Our previous report on hedge funds was based on data provided by Financial Risk Management (FRM). FRM is working with MSCI to develop commercially available hedge fund indexes.

Coverage of the current hedge fund universe by the two databases is similar. The MAR database has approximately 1269 distinct funds out of 1548 with data for June 2001, while the FRM database has 1439 funds as of June 2001. Both databases have similar coverage of funds in 1990 (146 for MAR, 174 for FRM).

The MAR database was selected for this study for several reasons:

- To confirm the results of our previous research using a different dataset.
- The MAR dataset includes performance for many more funds that have stopped reporting, while the FRM database does not include any funds that stopped reporting prior to 1997. As a result, the MAR dataset is less susceptible to survivorship bias in the early years.

- The MAR classification system differs from the provisional MSCI classification used in our earlier work.
- The MAR dataset includes information about the fund (such as the name of the fund's parent company) that was not provided by FRM for reasons of confidentiality. We used this data to identify funds in the MAR data that were essentially the same, and used only distinct funds in our analysis.
- The coverage of assets under management historically by MAR is more extensive than FRM's, enabling us to further explore issues of size.

INDEX CONSTRUCTION METHODOLOGY

Our index construction methodology is similar to that proposed by MSCI for their indexes. It is designed to be representative and investable. A fund is eligible for inclusion if it has 12 months of reported history and meets the minimum size requirement described below. The index is rebalanced every year. At the beginning of each year, the index consists of the equal-weighted portfolio of funds that were then eligible. Each month, the weights change according

to the monthly returns of the funds. If a fund ceases to report returns, its weight is distributed among the surviving funds. If a fund becomes eligible in a month between rebalance periods, it is added with the weight that it would have had in that month if it had been included in the index at the last rebalance. (This weight can always be computed because of the requirement of 12 months of return history.)

A size threshold was included to make the index more representative of the investable universe. However, because of the small number of funds in the database with substantial assets under management more than four years ago, a sliding minimum size was adopted: no minimum size before 1996, \$10MM from 1996 through 1998, and \$25MM after 1998.

By fixing the investment in each fund at the start of each year, the methodology approximates the one-year lockup period typical of hedge funds. The use of an equal-weighted portfolio at each annual rebalance was chosen because it is simple and representative of the hedge fund universe, as well as being closer to the typical portfolio. An asset-weighted portfolio would also be reasonable, but a few very large funds would drive the performance of the aggregate index, especially for the strategy indexes. The minimum size requirement prevents the index from being dominated by a large number of tiny funds.

We remind investors that these investments are subject to market risk and will fluctuate in value.

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