

Standard & Poor's Managed Futures Index Structure, Methodology, Definitions, and Practices

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Executive Summary

The S&P Managed Futures Index is constructed to offer investors a standardized and investable benchmark that is representative of systematic, i.e., model-driven, managed futures funds. Managed futures are a particularly interesting alternative investment because historically they have offered a certain amount of downside protection, especially in periods of prolonged down movement in equity markets. As with all investments, however, it is prudent to remember that past performance is not necessarily indicative of future results.

The S&P Managed Futures Index is a build-out of the Managed Futures sub-strategy in the S&P Hedge Fund Index, all of whose members are in the S&P Managed Futures Index. The index enhances transparency of managed futures investments, as it requires an independent verification of the portfolio positions for all the constituent funds within the index. In addition, the Standard & Poor's index construction methodology is designed to ensure reliable and timely reporting, standardized due diligence, and transparency of rules.

S&P Managed Futures Index construction uses rigorous quantitative and qualitative methods to determine fund selection. The index construction process involves two complementary procedures. The first procedure determines the number of funds required to construct a representative and investable index. Standard & Poor's has used sampling bootstrap simulation techniques to conclude that a portfolio of 12 to 15 managed futures funds represent the risk/return characteristics of the broader managed futures universe. To increase representativeness, the index includes funds with several volatility levels to reflect the various levels of risk among managed futures strategies. The S&P Managed Futures Index is thus representative.

The second procedure determines a universe of suitable candidates for inclusion in the index. This process begins with an examination of strategy consistency and screening the managed futures funds sample for self-reporting bias and inconsistency to create a candidate pool cohesively defined in terms of strategy adherence. The candidate pool is then further screened for length of track record, assets under management, and investment capacity to ensure investability. The remaining investable funds undergo a rigorous due diligence process to verify management experience, investment philosophy, risk management policy, and operational capabilities. After this extensive screening, fund selection is determined by the S&P Managed Futures Index Committee. Managed futures funds in the index are investable and have passed the due diligence evaluation. The S&P Managed Futures Index is thus investable.

The S&P Managed Futures Index is equally weighted to ensure diversification among the funds included. The rules governing construction and maintenance of the index—annual rebalancing to equal weights and the procedure to change index constituents—are clear and publicly announced.

1. Introduction

Standard & Poor's has long been recognized worldwide as a global provider of equity indices. In October 2002, Standard & Poor's launched the S&P Hedge Fund Index to provide an investable benchmark for this growing asset class. The S&P Hedge Fund Index is representative of the broad range of major strategies that hedge funds employ. The index has 40 constituents divided into three sub-indices: S&P Arbitrage, S&P Event-Driven, and S&P Directional/Tactical, which in turn represent a total of nine specific strategies. These strategies are Equity Market Neutral, Fixed Income Arbitrage, Convertible Arbitrage, Merger Arbitrage, Distressed, Special Situations, Long/Short Equity, Managed Futures, and Macro. The strategies are equally weighted to ensure well-rounded representation of hedge fund investment approaches and to avoid overrepresentation of currently popular strategies. Index values for all four indices commenced September 30, 2002, and are publicly available.

While the nine strategies of the S&P Hedge Fund Index are reflective of the general characteristics of their respective investment strategies, they are not designed to be used as separate sub-indices. The S&P Managed Futures Index (S&P MFI) is an expanded version of the managed futures strategy represented in the main index with constituents added to ensure broader representativeness as a standalone index. It is the first build-out of the nine strategies underlying the S&P Hedge Fund Index. The same rigorous and transparent index construction methodology is used for all S&P Hedge Fund Indices.

Although managed futures funds tend to have a higher degree of transparency compared to the overall alternative investment business, we believe benchmarks serve as a cornerstone of enhanced transparency by providing timely and reliable pricing information. In addition, benchmarks promote the growth of markets by establishing a performance standard.

1.1 Managed Futures Investment Strategy

Managed futures funds managed by commodity trading advisors (CTAs) have been in existence for many years. As the name implies, the trading programs driving these funds originally focused on commodities such as corn and gold, but expanded as the futures exchanges around the world developed new products such as currency, interest rate, stock index and energy futures. CTAs do not hold direct interests in the underlying commodities or financial instruments, but utilize futures to initiate positions. An exception to this is when currency traders go to the over-the-counter market seeking a more liquid alternative to futures.

Managed futures funds tend to make less profit when the markets are flat and there is little opportunity to take advantage of expected price changes—either up or down. Volatile, or more accurately, steadily trending markets have proven to be profitable for managed futures funds as a whole. It is this potential to earn positive returns in a

variety of down equity market outcomes that has made managed futures funds attractive to investors.

The majority of managed futures programs base their investment decisions on quantitative methods to analyze historical prices in order to identify patterns or trends that can be used to predict future values or price/trend direction. A shrinking number of managed futures funds use discretion alone to implement opportunistic trading strategies. Systematic trend-followers identify trends in the marketplace over varying time periods using quantitative models based on, for example, moving averages, momentum, price range break-outs, or technical rules. Specifically, technical managers identify trends using chart patterns of historical prices while fundamental managers review fundamental valuation or economic parameters for various commodities. Either can be discretionary, that is, free from any predetermined trading models, and based on an individual manager's evaluation of market conditions.

Momentum pattern recognition attempts to identify trends in the market that will continue whereas countertrend managers will trade against the current trend in hopes there will be a reversion. Spread traders take advantage of what they perceive to be as a relative value between two futures contracts that is too wide or a too narrow compared to historical pricing.

Graph 1.1 illustrates that given the two different trading approaches, the supporting analysis and trading style can be one of a variety of permutations. Timing of implementation—whether short-, medium-, or long-term—can vary. Finally, the number of futures products is ever increasing and investors can choose to focus on a single sector/market or be broadly diversified. The area outlined is considered by the S&P MFI.

Graph 1.1 Managed Futures Programs

Trading Approach→	Systematic	Discretionary
Methodology →	Technical	Fundamental
Trading Style →	Momentum	Countertrend
Holding Period →	Under 1 Month	Under 6 Months
		Greater Than 6 Months
Markets →	Broadly Diversified	Niche

1.2 Characteristics of S&P Managed Futures Index

Academic research has shown that managed futures funds are highly correlated to each other and, therefore, risk and return within this strategy can be defined by a single factor. Although there may be various approaches to managed futures investments, systematic strategies explain much of managed futures as a whole. To a

large extent, this is because the preponderance of funds follows a systematic approach, with only a limited number following a discretionary approach.

Other than minor discretionary elements incorporated into systematic strategies, discretionary strategies are excluded from the index because it is difficult to represent individualistic strategies and they can be quite similar to those in the Macro hedge fund sector. Funds are selected from only the systematic bucket as it tends to be non-correlated to and more distinct from other alternative investment strategies.

The S&P MFI has characteristics that make it a suitable benchmark for managed futures performance, as outlined in Table 1.1.

The S&P MFI is designed to be standardized, representative, and investable, with independent verification of its constituents' portfolio holdings. The index values are published daily, based on verified information received from managed accounts with selected managers. A due diligence process vets actual and potential constituents on several dimensions, including management experience, investment philosophy, risk management policy, and operational capabilities. Finally, the index is governed by transparent guidelines.

TABLE 1.1 CHARACTERISTICS OF S&P MANAGED FUTURES INDEX

Feature	Description
Representation	The S&P MFI is representative of the investment opportunities in the systematic managed futures strategies across the volatility spectrum, without being optimized or biased to particular criteria. Rigorous quantitative and qualitative methods are used to construct a representative index as well as select constituent funds.
Investability	The constituents of the index are required to make representations regarding their capacity for new investment at the time of their inclusion in the index. The capacity of the managed futures funds within the index is assessed frequently.
Independent Verification	Independent verification of positions is performed by a fund administrator on a daily basis.
Accurate and Timely Reporting	Daily publication enables timely, detailed information on volatility and correlations with other asset classes. Index values are based on independently verified information from managed accounts. In addition, the administrator's independent valuations of all positions and the managed futures funds' valuations are reconciled every month.
Defined Due Diligence Process	Consistent quantitative and qualitative screenings and due diligence are performed before inclusion and on an ongoing basis to minimize manager risk.
Transparent Index Maintenance	Rules governing construction and maintenance of the index, e.g., rebalancing frequency and changes to index constituents, as well as constituents, are clear and publicly announced.

1.3 S&P Managed Futures Index Construction

The index construction process begins by establishing an empirical framework. Graph 1.2 shows the systematic process used to construct the S&P MFI. Section 2 describes

the various statistical techniques for fund selection. The statistical analysis focuses on four risk/return characteristics—annualized return, annualized standard deviation, Sharpe ratio, and correlation with the S&P 500. We show that the range of the four statistics is narrow for samples of 10 to 15 funds selected at random. Section 3 provides details on index construction, beginning with the selection of representative managed futures funds with capacity to accept investment. We describe the processes used to screen for operational risk, to ensure transparency, and to minimize manager risk through due diligence. Section 3 also gives details of index calculation and maintenance. Section 4 presents pro forma performance of the S&P MFI that shows it is representative of the major managed futures fund investment strategies.

Graph 1.2 S&P MANAGED FUTURES INDEX DESIGN

Process of determining number of funds needed for a representative and investable index:

- Screen database for self-reporting bias
- Identify funds in different volatility groups
- Determine number of funds needed to represent strategy

Process of selecting funds:

- Define universe (250)
- Select funds meeting basic criteria (50)
- Check strategy consistency; conduct initial review (25)
- Review and selection by S&P Managed Futures Index Committee (14)

2. S&P Managed Futures Index Design

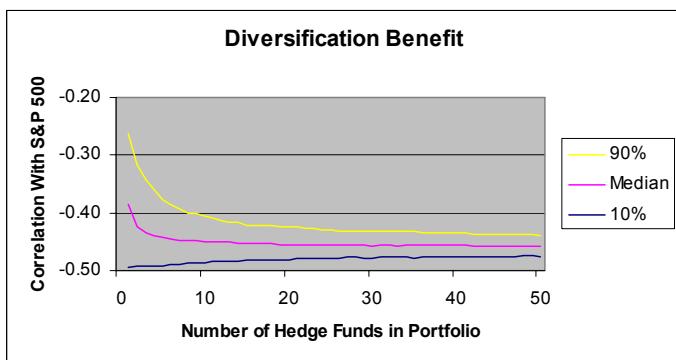
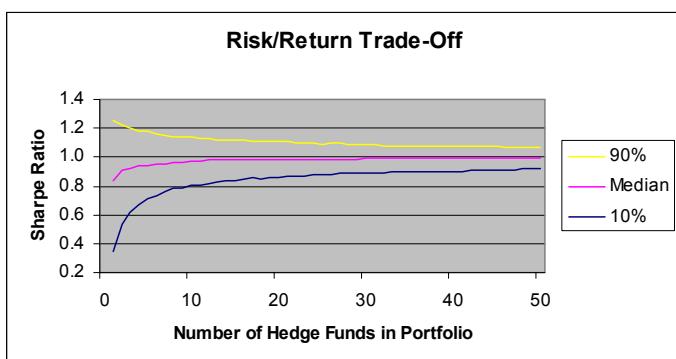
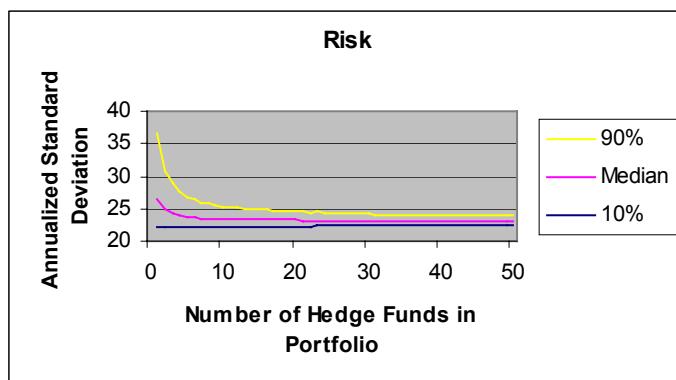
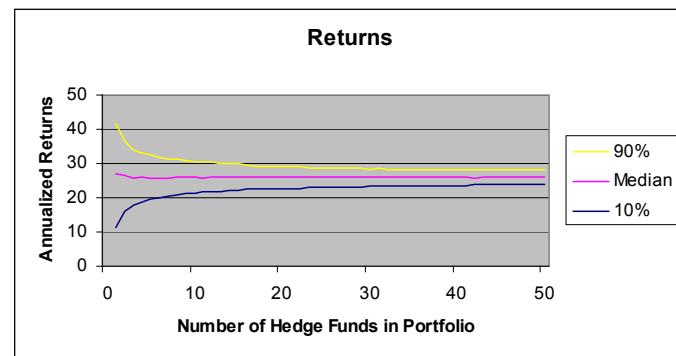
The requirements of representation and investability exert conflicting pressures on the number of funds required in the index. Representation requires a larger number of funds, but this often includes large numbers of inaccessible funds that are not investable. Furthermore, investability demands fewer funds because each fund requires additional administration, due diligence, ongoing monitoring, and operational coordination. The S&P MFI is designed to balance these elements to be both highly representative and readily investable.

Standard & Poor's applied a number of statistical techniques to construct a representative and investable managed futures index. Section 2.1 shows that the distribution of risk and return characteristics of portfolios of managed futures funds selected at random stabilizes once the number of funds rises above 12.

2.1 Number of Managed Futures Funds Needed to Construct a Representative Portfolio: Random Sampling

We begin by replicating findings of previous studies and confirm that the risk/return characteristics of randomly selected fund portfolios of a single strategy type stabilize in the range of 10 to 15 funds. We perform simulations consisting of 1000 randomly selected portfolios of a predetermined number of funds. Four statistics are calculated for each simulated portfolio: annualized return, standard deviation, Sharpe ratio, and correlation with the S&P 500. Graph 2.1 shows the 10th, median, and 90th percentile values for each statistic as a function of the number of funds. Note in each panel that the median values for the four statistics stabilize with as few as 12 managed futures funds in the portfolio.

Graph 2.1 DIMINISHING BENIFITS OF MANAGED FUTURES FUNDS DIVERSIFICATION



2.2 Cohesiveness within Managed Futures Strategy

To improve strategy purity, we use four quantitative screens:

1. For each fund in the proprietary database compiled by Standard & Poor's from a number of commercially available databases and industry sources, we compute two correlation distributions: correlations with funds in the managed futures category, and correlations of those funds with funds in other categories. We compute the Kolmogorov-Smirnov p-statistic, described in Appendix 1, to test whether the two correlation distributions are different.
2. We test whether the median of the correlations with funds in the same strategy is higher than the median correlation with funds in all other strategies.
3. We evaluate the degree of correlation of the individual funds with the appropriate managed futures indices.
4. Finally, we compare the volatility of a fund to the volatility of comparable funds, as determined by historical return variance.

As part of the risk analysis, we distinguish between “good” volatility stemming from high positive but variable returns, and “bad” volatility stemming from variable returns around zero or a negative mean.

With the design of the index in place and the determination that 10 to 15 funds provide representation for the managed funds strategy, we now begin the process of quantitatively screening the universe to establish a list for candidate funds and performing due diligence.

3. S&P Managed Futures Index Construction

We now describe the index construction process. Section 3.1 explains the quantitative screens, and Section 3.2 discusses the due diligence process. Sections 3.3 and 3.4 present the process to ensure independent verification of portfolio holdings and the steps to ensure accurate and timely reporting of returns. Section 3.5 describes the index calculation and index maintenance processes.

3.1 Quantitative Screens

The first step in construction of the S&P MFI is to calculate an aggregate quantitative score of a fund, following the four quantitative screens described in Section 2.3. The first two statistics measure whether correlations of managed futures fund returns with other funds in the same strategy are different from correlations with funds in other strategies. The third statistic evaluates the correlation of the managed futures fund return with an appropriate managed futures fund index. The fourth statistic compares the risk taken by a fund to the risk taken by comparable funds, as determined by historical volatility.

Our initial index candidate pool consists of the managed futures funds with high quantitative scores after all four tests.

3.2 Due Diligence

Due diligence is a critical requirement for investing in the alternative investment market. The scale and complexity of investment strategy risks, the diversity of investment instruments, the demands on operational infrastructure, and a lack of transparency regarding portfolios all require that investors perform substantial due diligence on an ongoing basis. The S&P MFI Committee stipulates that independent, rigorous, and standardized due diligence be conducted on all index candidates. Members of the S&P MFI Committee participate in the formal review of the managed futures funds.

The formal review involves an interview with the managed futures fund manager regarding the fund's strategy purity, trading approach and practices, infrastructure, and operations. Albourne Partners Limited,¹ an outside consulting firm, has been engaged to help perform these analyses.

The due diligence process has three main components:

1. Screens of funds to select funds with sufficiently long track records to give an initial indication of their trading performance and funds with sufficient assets

¹ Albourne Partners Limited, founded in 1994, is a leading investment consultancy on alternative investments. It advises on the construction, management, and monitoring of hedge fund portfolios, as well as performs risk analysis and due diligence services.

- under management to attest to their appeal to investors and the likely sustainability of their strategy and business.
2. An initial due diligence examination of the track record, operating setup, strategy, and personnel of the fund to determine, among other things, the quality of management, the nature of the trading strategy used, risk management, operating controls, and the likely capacity of the fund to accept further investment.
 3. Ongoing due diligence to monitor the fund's trading strategy to ensure that it continues to conduct its business in the manner established, and to detect any significant changes in how the fund is being operated, including strategy drift, large changes in returns, volatility, and instruments traded.

Initial due diligence is achieved through questionnaires and interviews with key personnel at the funds. Ongoing due diligence consists of a combination of periodic visits with fund personnel and monitoring of trading positions and results. The due diligence process addresses areas of concern as follows:

- General questions about the fund
- Management team and company background
- Investment strategy-specific questions
- Risk policies
- Portfolio composition
- Systems and infrastructure
- Service providers
- Performance analysis
- Degree of strategy cohesiveness

3.3 Independent Verification of Portfolio Holdings

The S&P MFI is constructed to maintain a high level of integrity of portfolio return calculations. Integral to this is independent verification of portfolio holdings. Ensuring this level of transparency can be difficult for alternative investments. To maintain consistency and control throughout the process, each fund in the index is represented by a managed account that is generally run parallel to that fund, unless otherwise noted. In some cases the managed account's mandate may vary from the main fund to maximize strategy purity. A third-party administrator, DPM (Derivatives Portfolio Management),² verifies trades and reconciles valuations of the funds' managed accounts on a daily basis. PlusFunds Group, Inc.³ maintains the managed accounts.

² Established in 1993, DPM offers a portfolio of integrated services that include: investment accounting, financial reporting, multiple broker and trader reconciliation, risk transparency, and fund administration services to fund managers, asset allocators, institutional investors, and proprietary traders whose portfolios cover almost all asset classes and instruments traded worldwide.

³ Founded in 1998, PlusFunds Group, Inc. provides information and investment services to hedge funds and their investors. PlusFunds Group, Inc. has been exclusively licensed to create a fund of funds product which tracks the S&P MFI using managed accounts.

3.4 Timely Reporting

Standard & Poor's publishes daily values of the S&P MFI and conducts regular performance and correlation reviews of the funds. Constituent net asset values are transmitted through DPM and PlusFunds, Ltd. to Standard & Poor's, which monitors their movements for any anomalies and computes the daily index values.

To allow for initial pricing checks, daily index values will be published with up to a two-day lag. As certain instruments that may be included in the S&P MFI may not trade or price on a daily basis, the daily index values published by Standard & Poor's should be considered indicative only. After each month end, the month's returns are reviewed to produce a finalized month-end index value that, as a result of the finalization process, may differ from the daily series. Daily indicative index values will not be restated to match finalized month-end index values. Index values will not be calculated on days the New York Stock Exchange is closed; nor will values from two days prior be published on exchange holidays.

Both daily and monthly index values for the S&P MFI are published on the Standard & Poor's website.⁴ In addition, a number of data vendors distribute daily indicative and monthly finalized values, including Bloomberg and Reuters:

S&P Managed Futures Index	<u>Bloomberg</u> SPHGMFI	<u>Reuters (daily, monthly)</u> .SPHGMFI, .SPHGMFIM
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3.5 Index Calculation and Maintenance

We provide here an overview of the index calculation. The calculations are explained in greater detail in Appendix 2.

3.5.1 Equal Weighting

The S&P MFI gives equal weightings to each fund. This is consistent with creating a representative index that reflects a passive investment approach that diversifies both fund risk and manager risk over time.

An equally weighted index avoids favoring large funds that are attracting significant capital flows. The alternative investment market is prone to flows of capital chasing recent historical results, and a market capitalization-weighted index tends to reflect the impact of these capital flows. Unlike equities, which are generally covered by analysts and have more efficient pricing so a market-capitalization weighting reflects a stock's significance in the market, hedge fund size may be more the result of strong sales distribution rather than importance in the market.

Funds are selected for inclusion in the index on the basis of their ability to represent the managed futures strategy. Apart from a minimum size requirement, fund size does not influence its weight since funds are equally weighted. To minimize frictional costs for investors replicating the index, these equal weightings are rebalanced annually.

⁴ Standard & Poor's is not responsible for errors in daily or monthly S&P MFI values.

3.5.2 Performance Fees and High-Water Marks

Table 3.2 illustrates the fee structure governing funds within the S&P MFI.

TABLE 3.2 S&P MANAGED FUTURES INDEX CONSTITUENT FEE STRUCTURE

Fees	Description
Hedge Fund Expense	The fee charged to managed futures funds for trading and credit activities
Manager Fee	The flat management fee charged by the managed futures fund manager
Performance Fee	The fee charged by the managed futures fund, which may use the concept of the high-water mark

The gross asset value (GAV) is the total performance less the hedge fund expense and the flat manager fee. The net asset value (NAV) is the GAV less the performance fee. Performance fees are calculated on the increase in the GAV of a fund. Many performance fee calculations use the concept of a high-water mark. The high-water mark is the highest GAV for the fund that has been used in calculating the performance fee.

Further performance fees can be charged only on a GAV that exceeds this high-water mark. To facilitate index level calculations, the high-water marks are initially set at the price at which constituents enter the index. They are reset each year based upon price appreciation. Suppose an investor invests in a fund with a GAV of 100, and the GAV, before performance fees, grows to 115 in a year. If we assume the performance fee is 20% of the increase in GAV, then the performance fee to be paid to the manager is equal to 3. The year-end GAV, after performance fees are paid, is then 112 (115-3) and this becomes the high-water mark for the start of the following year.

3.5.3 Fund Removals and Additions

Funds in the index are required to undergo regular due diligence reviews. The representativeness and strategy cohesiveness analysis is periodically repeated on the “universe” that includes new qualifying funds as they become available.

Removal of a Fund

A fund can be removed from the index if it becomes closed to new investment, if it fails to continue to represent its respective strategy, or if it does not continue to pass the due diligence reviews. The decision to remove a fund from the index is made by the S&P MFI Committee. Reasons for removal consideration include:

- Violation of qualitative due diligence standards
- Non-cooperation with reporting process or major valuation concerns
- Significant departure from original mandate and stated strategy
- Legal, regulatory, or compliance issues

- Major team changes, managerial changes, or business continuity
- Concerns about excessive growth or redemptions

Addition of a Fund

A fund can be added to the index if it meets all the qualifications and is considered to produce a more representative group of funds for the managed futures strategy. This may occur with or without the removal of another fund, at the discretion of the S&P MFI Committee. For either additions or deletions, in the short term, constituents may be building or unwinding portfolio positions, creating minor volatility distortions. A decision by the S&P MFI Committee to add or remove a fund from the S&P MFI does not constitute a buy or sell recommendation. Funds are chosen based on overall index representation.

4. Historical Performance of the Pro Forma Index

We reconstruct the S&P MFI based on the index constituents as of December 30, 2002, using monthly performance data from January 1998 through December 2002.⁵ All references to S&P MFI performance in this section refer to the S&P Managed Futures Pro Forma Index.

Past performance of the pro forma index is based on backtested results that do not represent the results of actual trading but are achieved instead through retroactive application of an index strategy designed with the benefit of hindsight. Past performance is not necessarily indicative of future results.

4.1 Index Performance Comparison Summary

Table 4.1 compares annual return and volatility for the pro forma index and other prominent benchmarks for the time period January 1998 through December 2002.⁶ Graph 4.1 shows the growth of \$1,000 invested in the pro forma index and other prominent benchmarks at monthly intervals.

⁵ Standard & Poor's commenced public calculation of the S&P MFI values in January 2003. Actual S&P MFI values begin as of December 31, 2002 and are available on www.standardandpoors.com in the S&P Indices section. For purposes of analysis, Standard & Poor's constructed a pro forma version of the S&P MFI that is based on the index constituents as of December 2002 using monthly performance data from January 1998 through December 2002 from the fund companies themselves. Returns for some constituents may not extend back to January 1998. Standard & Poor's has not verified the validity or accuracy of this data. The pro forma version of the S&P MFI is rebalanced to its original equal weights annually in August. Standard & Poor's does not guarantee the accuracy of these pro forma returns and does not recommend any investment or other decision based on their results. Pro forma index returns do not take into account reinvestment of dividends or other fund distributions, capital gains, loads, or brokerage fees and commissions. If the foregoing had been factored in, the pro forma index returns would have been lower. Past performance is no indication of future returns.

⁶ The pro forma returns of the four funds in the Managed Futures strategy of the main S&P Hedge Fund Index are presented for comparison only; they do not constitute an index.

TABLE 4.1 PERFORMANCE OF S&P MANAGED FUTURES PRO FORMA INDEX

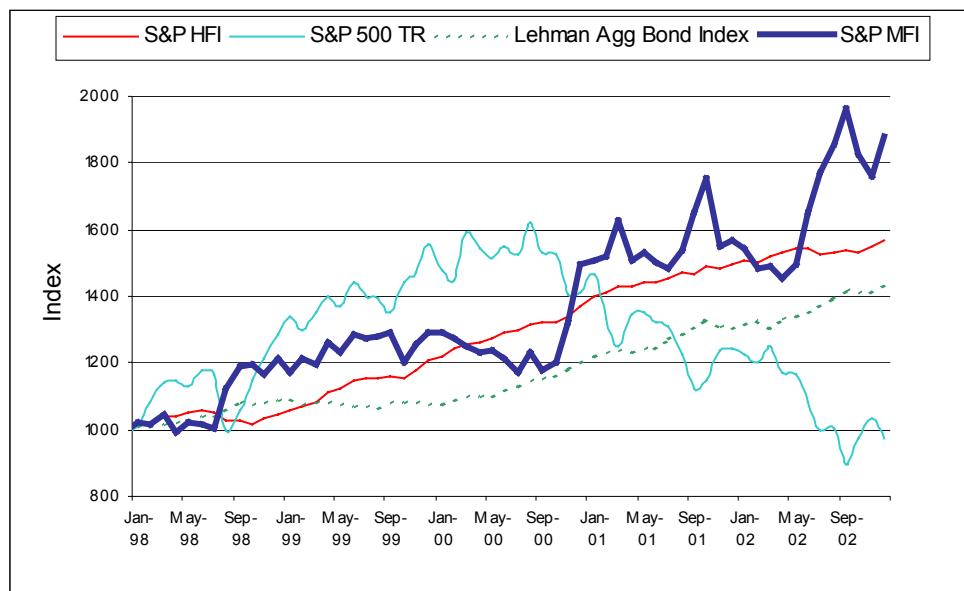
	1998 (%)	1999 (%)	2000 (%)	2001 (%)	2002 (%)	60-Month Return (%)	Avg Ann. Return (%)	Excess Over			Annualized Std. Dev. (%)	Sharpe Ratio
								S&P 500 (%)	U.S. T-Bills (%)			
S&P Managed Futures Pro Forma Index	21.6%	6.3%	15.9%	5.7%	20.0%	90.0%	13.7%	14.3%	9.6%	16.6%	0.58	
S&P Hedge Fund Pro Forma Index*	4.5%	15.4%	13.5%	9.4%	4.2%	55.8%	9.3%	9.9%	5.2%	3.2%	1.63	
S&P Hedge Fund Pro Forma Managed Futures Strategy* ⁶	18.4%	4.1%	13.4%	5.1%	16.9%	71.7%	11.4%	12.0%	7.4%	12.8%	0.58	
Barclay CTA Index	6.0%	-1.1%	7.8%	11.5%	11.6%	40.7%	7.1%	7.7%	3.0%	8.1%	0.37	
S&P Commodity Index	-27.6%	7.2%	42.4%	-31.7%	27.2%	-4.0%	-0.8%	-0.2%	-4.9%	17.0%	-0.29	
U.S. T-Bills	4.8%	4.7%	5.9%	3.4%	1.6%	22.0%	4.1%	4.6%	--	0.4%	--	
Lehman Aggregate Bond	8.7%	-0.8%	11.6%	8.4%	10.3%	43.8%	7.5%	8.1%	3.5%	3.3%	1.05	
Merrill U.S. High Yield	2.9%	2.5%	-5.2%	4.5%	-1.9%	2.6%	0.5%	1.1%	-3.5%	8.8%	-0.40	
S&P 500	28.6%	21.0%	-9.1%	-11.9%	-22.1%	-2.9%	-0.6%	--	-4.6%	18.9%	-0.25	
S&P Global 1200	24.6%	25.1%	-10.8%	-15.0%	-19.6%	-4.9%	-1.0%	-0.4%	-5.1%	17.6%	-0.29	

* Combines S&P Hedge Fund Pro Forma Index (fund reported returns for 1/98-9/02) with S&P Hedge Fund Index (actual returns 10/02-12/02).

With an annualized return of 13.7% for the five-year period, the S&P MFI considerably outperformed the managed futures and other asset class benchmarks. An investment of \$1,000 in managed futures, bonds, or equities would have grown to \$1,900, \$1,438, and \$971, respectively, over the five-year period. Notably, each year had positive returns, unlike the equity indices or the Lehman Aggregate Bond Index.

A standard deviation of 16.6% for the S&P MFI is fairly high—especially in comparison to the 3.2% standard deviation of the main S&P Hedge Fund Index—but not as high as 18.9% for the S&P 500. The S&P MFI Sharpe ratio of .58 compares favorably to the Barclay CTA Index's .37.

GRAPH 4.1 CUMULATIVE RETURNS OF S&P MANAGED FUTURES PRO FORMA INDEX AND OTHER ASSET CLASSES



4.1.1 Returns and Drawdown

Annual returns for the S&P MFI have been positive, but monthly returns show frequent, often significant, swings into negative territory, although they have historically been relatively short-lived.

TABLE 4.2 MONTHLY RETURNS OF S&P MANAGED FUTURES PRO FORMA INDEX: TOTAL NUMBER OF MONTHS: 60

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1998	2.2%	-0.3%	3.0%	-5.5%	3.3%	-0.9%	-1.0%	11.7%	6.2%	0.4%	-2.5%	4.1%	21.6%
1999	-3.7%	3.7%	-1.3%	5.4%	-2.6%	4.7%	-1.0%	0.5%	1.0%	-6.8%	4.3%	2.8%	6.3%
2000	0.0%	-1.4%	-1.8%	-1.4%	0.3%	-2.1%	-3.4%	5.0%	-4.1%	2.1%	9.6%	13.5%	15.9%
2001	0.5%	0.8%	7.3%	-7.3%	1.5%	-1.9%	-1.5%	3.9%	7.1%	5.8%	-10.3%	1.1%	5.7%
2002	-1.3%	-3.8%	0.4%	-2.7%	3.1%	10.7%	6.7%	4.0%	5.7%	-6.6%	-3.7%	7.4%	20.0%

Number of months return is negative = 25 out of 60

Table 4.3 shows that the worst drawdown was -15.82% over the six months that began after October 2001. Recovery to gain back these losses was not complete until three months after that period in July 2002.

TABLE 4.3 DRAWDOWN ANALYSIS

Drawdown	Length	Recovery	Peak	Valley
-15.82%	6	3	Oct-01	Apr-02
-10.06%	2	0	Sep-02	Nov-02
-9.49%	10	4	Sep-99	Jul-00

4.1.2 Sortino Ratio

The Sortino ratio was developed to differentiate between good and bad volatility. It is similar to the Sharpe ratio, except it uses downside deviation for the denominator, whereas Sharpe uses standard deviation. Downside deviation considers only returns that fall below a determined threshold, rather than the mean. One would expect that a fund managing within tight risk limits would have a smaller downside deviation than the typical “upward” standard deviation. This smaller divisor means a relatively higher Sortino ratio when compared to the Sharpe ratio. If the Sortino ratio is lower than the Sharpe ratio, then the fund or index might be riskier than the Sharpe ratio alone implies.

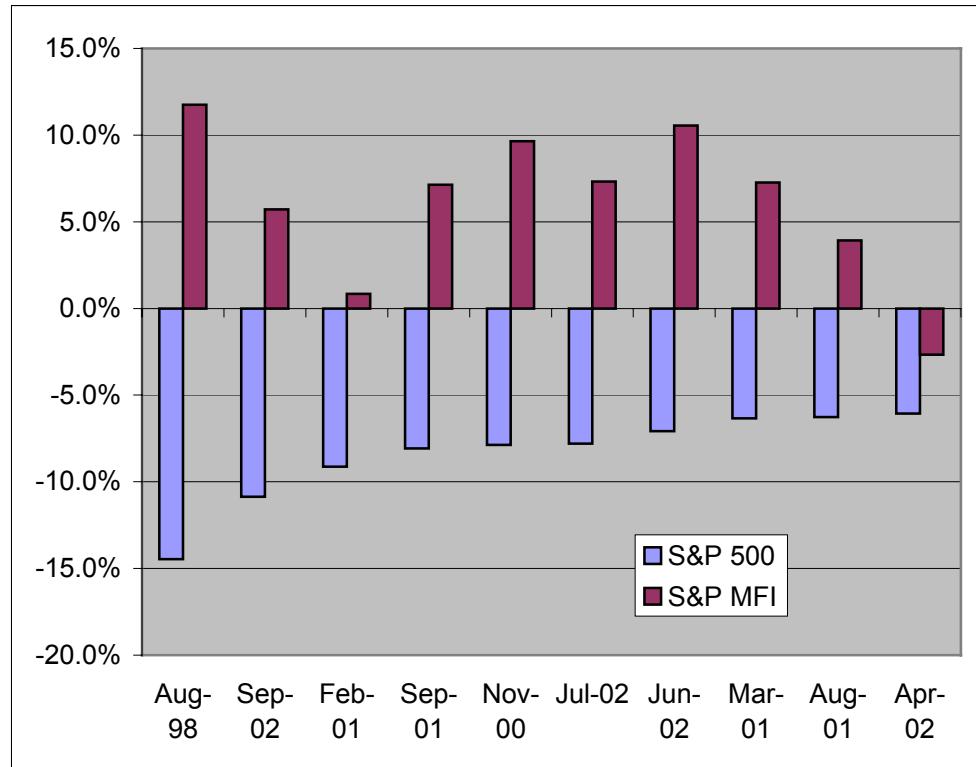
TABLE 4.4 Sortino Ratios of Select Indices

	S&P MFI	Barclay CTA Index	S&P HFI
Annualized Sortino Ratio (5.0%)	0.83	0.40	2.30
Annualized Sharpe Ratio (5.0%)	0.56	0.28	1.31

4.1.3 Performance in Down Equity Markets

Managed futures can provide downside protection in that they historically have tended to generate large and positive returns in down equity markets. However, there is no guarantee of this going forward. As seen in Graph 4.2, in the 10 months that the S&P 500 had its worst returns, the S&P MFI had positive returns.

**GRAPH 4.2 S&P MANAGED FUTURES PRO FORMA INDEX
PERFORMANCE DURING 10 WORST S&P 500 MONTHS (1/98-12/02)**



4.1.4 Correlations with Indices and Other Asset Classes

As shown in Table 4.5 the S&P MFI is highly correlated with both the CSFB/Tremont Managed Futures Index (.95) and the Barclays CTA Index (.82). However, it has a relatively low correlation with the MLM Index produced by Mt. Lucas Management. The MLM Index is based on the daily closing prices of 25 U.S.-traded futures contracts and would reflect these individual contract's trading patterns, as opposed to managed futures programs. The S&P 500 has approximately similar correlations with all the managed futures indices presented. Interestingly, the S&P MFI has correlations with the Lehman Aggregate Bond Index (0.39) and the S&P 500 (-0.45) that are similar in magnitude but in opposite directions.

**TABLE 4.5 CORRELATION OF RETURNS OF S&P MANAGED FUTURES
PRO FORMA INDEX WITH OTHER INDICES AND ASSET CLASSES**

	S&P MFI	Barclay CTA Index	MLM Index	CSFB/Trem ont M gd Futures Index	VIX
S&P MFI	----	0.82	0.36	0.95	0.44
S&P Hedge Fund Pro Forma Index*	0.12	0.04	0.04	-0.02	-0.21
S&P Hedge Fund Pro Forma Managed Futures	0.96	0.75	0.42	0.93	0.50
S&P Commodity Index	0.16	0.13	-0.28	0.16	-0.21
U.S. T-Bills	0.03	-0.13	0.25	-0.05	0.05
Lehman Aggregate Bond	0.39	0.25	0.17	0.48	0.28
Merrill U.S. High Yield	-0.34	-0.22	-0.20	-0.38	-0.43
S&P 500	-0.45	-0.38	-0.37	-0.46	-0.73
S&P Global 1200	-0.44	-0.39	-0.35	-0.46	-0.70

* Combines S&P Hedge Fund Pro Forma Index (fund reported returns for 1/98-9/02) with S&P Hedge Fund Index (actual returns 10/02-12/02).

Appendix 1. Statistical Concepts

1. Kolmogorov-Smirnov Test Procedure

The Kolmogorov-Smirnov (K-S) test is a non-parametric test for differences between cumulative distributions. In the K-S test, we create a sample cumulative distribution of returns for a fund and compare this to the cumulative distribution of returns of the universe. The K-S test accepts or rejects the hypothesis that they belong to the same distribution, based on the maximum vertical distance between the two distributions. The K-S test is generally more efficient than the chi-square test for goodness of fit for small samples and can be used for very small samples where the chi-square test does not apply. The K-S test procedure is as follows:

Let X_1 to X_n be a random sample from a population with cumulative distribution function $F(x)$ corresponding to the distribution of a continuous random variable. Suppose $F_0(x)$ denotes a completely specified cdf (cumulative distribution function), such as for example $N(10, 4)$ or $M(1, 1/2)$.

Suppose we wish to test $H_0: F(x) = F_0(x)$ for all x versus $H_1: F(x) \neq F_0(x)$ for at least one x . Let $F_n(x)$ denote the empirical cdf of the random sample, i.e., $F_n(x) = (\text{No. of } X_i \text{ in the sample } \leq x) / n$. The empirical cdf is a step function which has jumps at $X(i) = 1$ to n each of size $1/n$. Then, $F_n(x) \rightarrow F_0(x)$.

Consider the test statistic $D = \sup_{-\infty < x < \infty} \{|F_n(x) - F_0(x)|\}$, where \sup denotes supremum. Suppose we plot $F_n(x)$ and $F_0(x)$ on the y-axis versus x on the x-axis, D will represent the value of the largest vertical distance between $F_n(x)$ and $F_0(x)$. The supremum on the right side of the formula for D occurs either at an $X(i)$ value, i.e., at a jump-point of $F_n(x)$, or at a value just to the left of one of the $X(i)$'s. $F_0(x)$ is the true distribution of X , then $F_n(x)$ must be close to $F_0(x)$. Therefore, the largest vertical distance between $F_n(x)$ and $F_0(x)$ must be small under H_0 . At level of significance α , we reject H_0 if $D \geq d_\alpha$, where $H_0(D \geq d_\alpha) = \alpha$. The critical values d_α can be obtained from the statistical tables.

Appendix 2. Calculation Algorithm for S&P Managed Futures Index

We describe the S&P MFI calculation algorithm under five different scenarios. The index value is calculated from the NAVs of the underlying funds as follows.

2.1 Index Level Calculation

Index calculations for the NAV and GAV index are performed when the constituent funds do not change.

NAV Index: $\sum_{1 \text{ to } F} (\text{Shares}_i) (\text{NAV}_i / \text{Divisor})$

GAV Index: $\sum_{1 \text{ to } F} (\text{Shares}_i) (\text{GAV}_i / \text{Divisor})$

where

F = Number of funds in the index;

Shares_i = Number of shares allocated to fund at last rebalancing to initiate index participation at the appropriate weight;

NAV_i = NAV of the fund;

Divisor = Initial translation factor to start index at 1000;⁷

GAV_i = GAV of the fund.

2.2 Annual Rebalancing

The following calculations are performed for the S&P MFI annual rebalancing.

I (index capital) = $\sum_{1 \text{ to } F} (\text{Shares}_F) (\text{NAV}_F)$

For all funds within the index: Shares_{ra} = $(S_r / F) / \text{NAV}_F$

where

F = Number of funds in the index;

Shares_F = Current fund shares;

NAV_F = NAV of fund at annual finalization;

Shares_{ra} = Fund shares after rebalance.

2.3 Swapping a Fund

When a fund is replaced by a new fund, the index is recalculated. The original fund is dropped and the new fund is added.

Shares_n = $(\text{Shares}_{rb})(\text{NAV}_r / \text{NAV}_n)$

where

Shares_n = Shares of new fund;

Shares_{rb} = Fund shares before rebalance;

NAV_r = NAV of current fund to be replaced;

NAV_n = NAV of new fund.

2.4 Addition of a Fund

When a new fund is added to the index, capital is taken from the existing funds proportionate to their current weights. This procedure does not involve the deletion of any current fund.

$$I \text{ (index capital)} = \sum_{1 \text{ to } F} (\text{Shares}_i) (\text{NAV}_i)$$

$$\text{New fund: Shares}_n = [I/(F + 1)] / \text{NAV}_n$$

$$\text{For all existing funds in the index: Shares}_{ra} = (\text{Shares}_{rb})[F/(F + 1)]$$

where

F = Number of funds in the index pre-rebalance;

Shares_i = Number of shares allocated to fund at last rebalancing to initiate index participation at the appropriate weight;

Shares_n = Shares of new fund at addition;

Shares_{ra} = Fund shares after rebalance;

Shares_{rb} = Fund shares before rebalance;

NAV_n = NAV of new fund at time of addition.

2.5 Deletion of a Fund

When a fund is deleted from the index, its capital is allocated to the remaining funds proportionate to their current weights. This procedure does not involve the addition of any new fund.

$$I \text{ (index capital)} = \sum_{1 \text{ to } F} (\text{Shares}_i) (\text{NAV}_i)$$

$$S_{rm} = (\text{Shares}_{rm})(\text{NAV}_{rm})$$

$$\text{For all existing funds in the index: Shares}_{ra} = \text{Shares}_{rb} [I/(S - S_{rm})]$$

where

F = Number of funds in index pre-rebalance;

S_{rm} = Capital invested in the removed fund;

Shares_{ra} = Fund shares after rebalance;

Shares_{rb} = Fund shares before rebalance;

Shares_{rm} = Shares of removed fund;

NAV_{rm} = NAV of removed fund.

Recommended Readings

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