

Alternative Investments in the Institutional Portfolio

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In recent years, the flow of funds into alternative investments for pension funds, endowments, and foundations has experienced a dramatic increase. Unfortunately, the very fact that hedge funds and managed futures have only recently come into prominence during the last decade, has meant that they generally have only recently been considered as substitutes or as additions to other more “traditional” private equity based alternative investment forms.

This study provides an analysis of the risk and return benefits of hedge funds and managed futures investments, along with other principal “traditional” alternative investment assets (e.g., real estate, private equity, private debt, commodities), when considered as part of an investor’s overall portfolio. Both traditional Markowitz efficient frontiers with and without investment restrictions as well as the risk and return performance of portfolios constructed from adding alternative investments to established U.S. stock and bond portfolios are evaluated.

The results from this analysis support previous results which showed from historical data, the benefits of managed futures, hedge funds, and traditional alternative investments as additions to stock and bond portfolios as well as the benefits of adding various managed futures, hedge funds to mixed portfolios already containing investments in stock and bond investments. Analyses of the Sharpe ratios of various efficient frontier portfolios indicate that depending on various assumed constraints, such as required stock and bond investment, that an allocation of at least 10-20% to both traditional alternative investments and managed futures and hedge funds may be deemed appropriate. As important, using various methods of ex ante return forecasts consistent with the underlying risk (e.g., variance-based return premia), results show that hedge fund and more illiquid private equity/debt based alternative investment vehicles must be included with traditional stock and bond investment to obtain the maximum risk and return benefits. Lastly, risk and return relationships between traditional and alternative investments in periods of extreme return movement in a traditional stock/bond portfolio are described. Results show the importance of considering the expected market conditions when deriving asset allocations.

Alternative Investments in the Institutional Portfolio

I. Introduction

The past decade has witnessed a dramatic increase in institutional investment in both domestic and international investible assets. While most of this investment remains dedicated to traditional stock and bond investment, an increasing portion has been invested in various forms of alternative investment vehicles.¹ For many institutional investors, alternative investments are viewed primarily as private, illiquid, alternative investments including venture capital, leveraged buyout, distressed securities, private equity, private debt, oil and gas programs, and timber or farmland. However, other alternative investment vehicles, such as hedge funds and managed futures, have also witnessed a dramatic increase in investment and often provide access to investment not easily available from traditional stock and bond investment or from traditional alternative investment vehicles such as private equity or private debt.² Unfortunately, the very fact that hedge funds and managed futures have only recently come into prominence has meant that they have only recently been considered as substitutes for or as additions to other traditional alternative investment forms.

This study provides an analysis of the risk and return benefits of various hedge funds and managed futures investments along with other principal “alternative” investment assets (e.g., real estate, private equity, commodities) as stand-alone investments or as part of an investor’s diversified stock/bond portfolio. Both traditional Markowitz efficient frontiers with and without investment restrictions as well as the risk and return performance of portfolios constructed from adding alternative investments to established U.S. stock and bond portfolios are evaluated. The Markowitz efficient frontier determination is conducted using alternative methods of risk and return forecasting including 1) historical returns and 2) the construction of ex ante return forecasts in which expected returns are based on an assumed return to risk relationship; that is, ex ante return forecasts constructed from an assumed Sharpe ratio of 0.66 and historical standard deviations are used as inputs into the Markowitz portfolio optimization model.³ The latter approach reduces the impact of historically high (low) abnormal returns from influencing the allocation process.

The results from this analysis support previous results [Schneeweis and Spurgin, 1998b] which showed from historical data, the benefits of managed futures, hedge funds, and traditional alternative investments as additions to stock and bond portfolios as well as the benefits of adding various managed futures, hedge funds to mixed portfolios already containing investments in stock, bond, commodity, real estate, private equity and private debt. Analyses of the Sharpe ratios of various efficient frontier portfolios indicate that depending on various assumed

¹ For instance, over three trillion dollars is now estimated to be invested in the mutual fund industry. The Goldman Sachs/Frank Russell Report cites a growth from a negligible investment in alternative investments in the early 1990’s to over \$152 billion investment in alternative assets by tax-exempt institutions in 1999.

² Managed Accounts Reports cites an increase in managed futures from less than \$ 1 billion in 1980 to almost \$35 billion in 1999 while hedge fund investment is now estimated to be over \$200 billion.

³ Academic research [Black and Litterman, 1992; Chopra and Ziemba, 1993; Connor, 1997] have all focused on the sensitivity of risk and return efficient frontiers to alternative forms of return and risk parameter estimation. In this paper, the return forecast model used is based on the simple assumption of a linear relationship between return and variance that is well proxied from historical data and that historical variance is an adequate proxy for future risk. Research is presently being conducted on alternative return forecast and variance forecast models in the determination of ex ante efficient frontiers of traditional and alternative investment portfolios.

constraints, such as required stock and bond investment, that an allocation of at least 10-20% to both traditional alternative investments and managed futures and hedge funds may be deemed appropriate.⁴ As important, using various methods of ex ante return forecasts consistent with the underlying risk (e.g., variance based return premia), results show that alternative investment vehicles must be included with traditional stock and bond investment to obtain the maximum risk and return benefits. Thus traditional stock and bond investment must be supplemented with managed futures and hedge fund products as well as more traditional alternative investments such as commodity investment and private debt or equity investment to obtain the maximum risk and return benefits. Lastly, risk and return relationships between traditional and alternative investments in periods of extreme return movement in a traditional stock/bond portfolio are described. Results show the importance of considering the expected market conditions when deriving asset allocations.

II. Alternative Investment Vehicles in Institutional Money Management

In recent years, considerable theoretical as well as empirical research has been conducted, which has supported the inclusion of a wide variety of alternative investment classes, in addition to stock and bonds, as part of investors' total investment portfolio. Academic research has provided theoretical arguments that due to various market imperfections in information, market liquidity, and the like, alternative investments, such as private equity, private debt, real estate, may offer unique risk and return opportunities not easily available through traditional asset investment [Schneeweis and Pescatore, 1999]. In addition, recent academic research [Schneeweis, Kazemi and Martin, 2001] has also indicated that market conditions may exist which permit various forms of investing common to hedge funds and managed futures to provide unique return scenarios. Lastly, even commodity investment may offer returns not easily accessible through traditional stock and bond investment.

For instance, Schneeweis and Spurgin [1998c] examined various multi-factor models in describing the return performance of a wide variety of mutual funds, hedge funds, and commodity trading advisors (CTA). In their study, the impact of market factors (index returns, absolute value returns, and intramonth standard deviation) designed to capture CTA/hedge fund trading opportunities (e.g., arbitrage, overvalued markets) and trading styles (technical or fundamental) on forecasting of CTA and hedge return performance are assessed. Since various managed futures and hedge fund investment strategies (e.g., market neutral, short selling) are expected to capture both upside and downside return potential in the underlying asset markets, the performance of the absolute value as well as the nominal value of existing cash (e.g., government bond position) and futures-based commodity indices (e.g., GSCI) are used as determinants of managed futures and hedge fund returns. The results of that analysis indicated that hedge funds and managed futures strategies may provide unique access to certain return opportunities under various market environments that cannot be obtained from traditional stock and bond investment. Similarly, Schneeweis and Spurgin [1997c] also showed that various CTA and hedge fund energy based investment provide risk and return opportunities not available from a wide range of traditional commodity investments or real estate investments.

Simply put, institutional investors must consider the wide range of available investments in the alternative investment area and determine the relative degree to which they offer unique

⁴ For various means to test for significant differences in Sharpe ratios see FAJ, May/June 1997.

return opportunities to the traditional stock and bond portfolio. While product and security design is constantly changing (e.g., swaps, structured notes, commodity linked bonds), the fundamental sources of return that accrue to investment remains the essentially the same (Schneeweis and Spurgin, 1998c]. However, because of changes in the investment vehicles, the actual return stream to the investor may also change. For example, securitization of residential real estate lending has made investment in such real estate based equity securities (e.g., REITs) reflect more of a traditional investment than an investment in illiquid and credit-sensitive instruments. Assessment of the risk and return impacts for the hedge fund, managed futures as well as illiquid private equity based alternative vehicles to traditional stock and bond investment is therefore necessary for the manager seeking an optimal allocation of investible capital.

III. Data and Methodology

In this study, the relative monthly risk/return performance of traditional stock and bond indices, traditional forms of alternative investments such as real estate, commodity, venture capital, buyout funds and distressed debt and relatively new forms of alternative investment available through hedge fund and CTA investment are examined. Among the various forms of traditional alternative investment reported in the recent Goldman Sachs-Frank Russell survey [2002], the two greatest amount of institutional capital committed to alternative investments were leveraged-buyout and venture capital. Descriptions of the equity, fixed income, managed futures and hedge funds subindices, private equity, private debt, commodity and other alternative investment classes are presented in an Appendix I and II.⁵ Returns for all data series are expressed as monthly holding period returns. The test period 1990-2001 permits analysis of hedge funds, which began trading in the early 1990s. Statistical tests include presentation of descriptive risk and return characteristics and return correlations between each of the asset classes primary and sub-indices.

A wide variety of potential data indices exist for managed futures, hedge funds, as well as private equity, private debt, or venture capital. For the purposes of this study, Evaluation Associates Capital Markets (EACM) hedge fund indices as well as the Wilshire leveraged buyout, mezzanine and venture indices are used.⁶ While for many hedge funds, the returns are based primarily on exchange traded vehicles such that valuation is based on transaction-based pricing similar to most stock and bond pricing, for some strategies, as well as private debt, private equity and distressed securities, transaction based pricing does not readily exist. While it is not the purpose of this study to offer an independently determine return indices for private market debt or equity, it is important to understand that a private market based index may not represent the performance of any one private market partnership. For the purposes of this study, the Wilshire private market indices are used. The specifics of their leveraged buyout index are given in Nesbitt and Reynolds [1997]. In brief, Wilshire constructs an index based on publicly traded asset with similar characteristics to the assets in the index. The firm then re-engineers the capital structure of the index to make the index reflect that of the constituent private market

⁵ For each of presentation, we have not included results on the impact of oil/gas or timber partnerships in results. Again, there are numerous alternative investment forms including bank debt, and other alternative asset investments. The purpose of this paper is to focus primarily on the use of managed futures and hedge funds as alternatives to other alternative investments when considered as part of an overall portfolio.

⁶ For a review of the relative tracking error of alternative CTA and hedge fund indices see Schneeweis and Spurgin, 1996b, 1998.

assets. As a result, the correlations of their indices are similar to that of the primary market used to capture the return performance. For instance, a “buyout index” is viewed as a “supercharged” equity opportunity where the focus is on additional return rather than portfolio diversification. For the other Wilshire index (venture capital) used in this study, a similar index construction based on publicly traded assets with similar characteristics to the assets in the index is used.⁷

This form of index creation differs from that used by other studies [Philips, 1995] which use an internal rate of return based on vintage year comparisons from data made available from Venture Economics. Since we are primarily concerned with short-term valuation commensurate with viewing assets in an alternative tradeoff structure, we focus on a constructed index approach, which reflects actual market valuations.⁸

In order to offer an initial comparison of the inclusion of the various alternative assets to an existing stock and bond portfolio, the following alternative asset and stock and bond portfolios are constructed:⁹

- U.S. Portfolio I: 50% S&P 500 and 50% Portfolio Lehman Brothers
- Portfolio II: 80% Portfolio I and 10% NAREIT, and 10% GSCI
- Portfolio III: 80% Portfolio I and 15% EACM, and 5% Trad Alt
- Portfolio IV: 80% Portfolio I and 15% EACM100, 2.5% Trad Alt, 2.5% GSCI
- Portfolio V: 80% Portfolio I and 20% EACM100

Asset allocation across alternative investments as well as across alternative investments and stock and bond indices (with and without investment restrictions) is conducted using Markowitz efficient frontier estimation. The Markowitz efficient frontier risk/return tradeoff determination is conducted using alternative methods of risk and return forecasting including 1) historical returns and 2) returns based off of an assumed Sharpe ratio of .66.¹⁰ The latter approach reduces the impact of historically high (low) returns influencing the allocation process.

As discussed above, for purposes of determining ex ante returns, various methods of return forecast determination were conducted (Results of other alternative methods are given in Schneeweis and Spurgin, 1998b). For instance for both the alternative investment set and for the all asset set, a linear regression was conducted of historical returns on historical variance for the period 1990-1998. The intercept and the slope parameters of that regression and the standard

⁷ Constructed Wilshire benchmarks were regressed against HFR and EACM relevant indices (distressed and event-risk). Results show that while the correlation of the benchmark indices are less than .6, when the constructed Wilshire indices are ranked against the relevant HFR and EACM indices, the returns follow similar patterns; that is the lowest return grouping for the relevant Wilshire index is the lowest return group for the relevant HFR index. It is also important to point out, that the Wilshire index may reflect actual return better than fund based indices, which may include either survivor bias or selection bias.

⁸ The use of a surrogate index for private equity valuation is consistent with research [British Venture Capital Assoc., 1997] which has indicated that leverage buyout, venture capital and distress debt outside the U.S., (as in the U.S.) are also highly correlated with the underlying primary markets.

⁹ Traditional Alternative portfolio is an equal weighted portfolio of Wilshire venture capital, mezzanine, and leverage buyout index returns

¹⁰ Academic research [Black and Litterman, 1992; Chopra and Ziemba, 1993; Connor, 1997] have all focused on the sensitivity of risk and return efficient frontiers to alternative forms of return and risk parameter estimation. In this paper, the return forecast model used is based on the simple assumption of a linear relationship between return and variance that is well proxied from historical data and that historical variance is an adequate proxy for future risk. Research is presently being conducted on alternative return forecast and variance forecast models in the determination of ex ante efficient frontiers of traditional and alternative investment portfolios.

deviation for the period 1990-1998 were used to obtain the expected monthly returns of the various assets.

Lastly, it is important to point out that of the above portfolios, only those portfolios containing traditional alternatives (private debt, private equity) may be regarded as nontradable. Similarly, the EACM and its reported subindices can be obtained via over-the-counter (OTC) index creation. The GSCI, REIT, and various stock and bond indices are similarly available through various exchange or OTC instruments.

The first analysis of efficient frontier compositions encompasses a wide range of alternative assets indices and subindices using EACM, Goldman Sachs Commodity, and REITs, venture capital and leveraged buyout indices:

- EACM Long/Short Equity (L/S Equity)
- EACM Convertible Bond Hedge (ConvHedge)
- EACM Bond Hedge (BondHedge)
- EACM Rotational (Rotational)
- EACM Bankruptcy (Bank)
- EACM Multi-Strategy (Multi)
- EACM Domestic Long (DOM Long)
- EACM Domestic Opportunity (Dom Opp)
- EACM Global International
- EACM Global Asset Allocation (Glob AA)
- NAREIT (REIT)
- Wilshire Leveraged Buyout
- Wilshire Venture Capital
- Goldman Sachs Commodity Index (GSCI)

The second analysis of efficient frontier compositions encompasses both traditional and alternative investments general investment indices as follows:

- S&P 500
- Lehman Brothers Gov./Corp. Bond Index
- EACM 100
- NAREIT (REIT)
- Wilshire Leveraged Buyout
- Wilshire Venture Capital
- Goldman Sachs Commodity Index (GSCI)

The Markowitz optimization is conducted using the “solver” routine in Excel. Thus, all results are easily reproducible by readers. Tests are conducted on an above described alternative asset selection set and the above described asset set (alternative assets and traditional stock and bond investment) under the assumptions of no investment constraints and historical variance and covariance parameter estimates. However, the expected asset returns were also determined after regressing historical returns on historical variance and then using the resulting linear model parameters (with ex ante variance equal to historical variance)¹¹.

¹¹ Some assets such as the Goldman Sachs Commodity Index have an exceptionally low return to historical variance. This is not unexpected since assets with low correlation to the traditional stock and bond portfolio may be priced

In the second analysis indices, which capture the overall asset classes are used, a constrained optimization is also run with 1) at least 50% investment in the relevant stock indices (S&P 500), and a 30% investment in the Lehman Brothers Gov./Corp. Bond. Efficient frontiers are determined using both historical return, variance, and covariance parameter estimates and with historical variance and covariance parameter estimates, however, the expected asset returns were also determined after regressing historical returns on historical variance and then using the resulting linear model parameters to forecast expected return.

Lastly, risk and return relationships between traditional and alternative investments in periods of extreme return movement in a traditional stock/bond portfolio are described. Returns for an equally weighted S&P 500/Lehman Brothers Gov./Corp. Bond portfolio are determined and returns ranked from low to high. Returns are segmented into three (Worst third, Mid Third, and Best Third) and the average monthly returns and correlations in those three segmented ranked returns periods determined. Results show wide variation in the expected return and correlation relationships between traditional stock/bond portfolio returns and alternative investments in extreme stock/bond return periods. Thus, results indicate the importance of considering the expected market conditions when deriving tactical asset allocations between traditional and alternative investments.

IV. Results

Descriptive Characteristics

Traditional investment practice generally equates expected returns with expected risk as proxied by a security's return variance. As shown in Exhibit 1 and 2, hedge funds and traditional alternative investment offer improved risk and return opportunities when considered as stand-alone investments (Exhibit 1) or as an additions to stock, bond or stock and bond portfolios (Exhibit 2). As shown in Exhibit 2, the Sharpe ratios of Portfolios III-V, which include alternative investments (EACM 100) and traditional alternatives, dominate the Sharpe ratios of the cited stock and bond portfolio. The graphical representations of the risk and return relationships shown in Exhibits 1 and 2 are also given in Exhibits 3a and 3b.

As shown in Exhibit 4, the low correlation between stock, bond markets, and a wide variety of alternative investments makes the results (improved risk and return opportunities) for the inclusion of various hedge fund strategies and traditional alternative investments consistent across a wide variety of stock and bond portfolios. It is important to note the high correlation between the Wilshire indices and that of the S&P 500 and other stock market indices. This is consistent with the construction of the indices as sensitive to underlying equity markets. In addition, it is important to note the high level of correlation between each of the represented stock indices.

Comparisons of stand-alone return/risk performance and correlations, however, do not offer information as to the possible impacts of combining asset groupings in portfolios. In the next

relative to their correlation and not their variance. As a result the GSCI receives an abnormal boost in the return when OLS variance based model was used because of the high historical variance. Therefore, for this particular index the historical return was used instead of the forecasted one. Results for the portfolios with the forecasted return for GSCI are also available upon request.

section, asset allocations based on minimizing risk (standard deviation of the portfolio) at various levels of expected return are given.

Portfolio Benefits: Markowitz Portfolios

Markowitz based efficient frontier determination is conducted using various alternative methods of return forecasting and results compared to performance results using historical returns. As is well known, Markowitz portfolio construction requires estimates of the mean returns, variances and covariances of the sample set. Of greater importance, is the fact that efficient frontier asset allocations have been shown to be highly sensitive to return forecasts [Chopra and Ziemba, 1993] as well as various assumed constraints. In this study, tests are conducted on two sets of securities. The first set consists of traditional alternative assets (e.g., private equity and debt) as well as new forms of alternative asset investment (e.g., hedge funds).

The second set consists both of traditional stock and bond investments as well as traditional alternative and hedge fund strategies. Portfolio asset allocation is determined under various assumptions as to required investment in stock, bond or alternative investments. Results are also presented in which asset allocations are determined where the EACM 100 is used as an index for a wide variety of hedge fund strategies. For the purpose of this analysis, tests were conducted using both historical parameter estimates and an alternative return forecast determined from the historical relationship between the samples' mean return and variance.

The actual benefits of the inclusion of managed futures, hedge fund products, and traditional alternative investments are shown in Exhibit 5. As shown in Exhibit 5, using either historically determined risk and return parameters as well as alternative return forecast models, an alternative investment, which includes both 'traditional' alternative investments (e.g. venture capital, leveraged buyouts) as well as hedge funds offers a wide range of risk and return opportunities. We also examined the case, where the share in the portfolio of each of the EACM indices is at most 10%. The results appear in Panel B of Exhibit 5 and show a very diverse portfolio composition, including most of the hedge funds especially in the low risk portfolios.

As shown in Exhibit 6, using either historically determined risk and return parameters as well as alternative return forecast models, a portfolio of both traditional alternative investments (e.g. venture capital, leveraged buyouts) and hedge funds (EACM 100) offers improved risk and return opportunities under no required U.S. stock and bond investment as well as under required U.S. stock and bond investment. More importantly, based on the maximum reported Sharpe ratio, an asset allocation of ten to twenty per cent to a portfolio of mixed alternative assets may be regarded as optimal under historical conditions as well as alternative return forecast scenarios.

In summary, results show that, as expected, as the risk level is reduced, additional assets are added to the portfolio. As important, when a tangency portfolio (e.g., Sharpe Ratio) is analyzed, results show that the lower risk portfolio which includes a wider range of traditional as well as new alternative asset forms is the preferred tangent portfolio (e.g., highest Sharpe ratio). In Exhibit 6, when return forecasts are used instead of historical returns, results are similar in that the lower risk portfolio, which includes a wider range of traditional as well as new alternative asset forms, is the preferred tangent portfolio (e.g., highest Sharpe ratio). The basis for this differential is due primarily to the fact that assets with high ex post abnormal returns (positive alpha) are given the same intercept as other assets and a return which is a function of their own historical variance. This adjusts historical return to returns which are consistent with a traditional risk (standard deviation) and return relationship.

Traditional and Alternative Asset Investment Return in Periods of Extreme Stock/Bond Return Movement:

Return Performance in Periods of Extreme Stock/Bond Portfolio Return

The results shown in Exhibits 1-6 indicated that various hedge fund strategies may offer unique return benefits to “long only” investments and traditional alternative benchmark indices. However these results reflect the risk and return benefits of alternative investments over a wide variety of market return environments. Previous research [Schneeweis, 1996; Schneeweis et al., 1996b] has shown that the risk and return characteristics of various alternative investment strategies relative to the risk and return pattern of a typical stock/bond portfolio are conditional on the return environment of the stock/bond portfolio.

In Exhibit 7a-7c, the average monthly return of alternative investments grouped into three groups (of thirty-six months) determined after ranking on the return of the equal weighted S&P 500/Lehman Gov./Corp. bond portfolio for the period, 1990-2001 is given. Results again confirm previous academic research [Schneeweis, 1996; Schneeweis et al., 1996b] that during periods of extreme market movement (positive or negative) in the S&P 500 and Lehman Gov./Corp. bond portfolio, other international stock and bond markets as well as long only traditional alternative investment products (private equity, etc.) also experienced similar positive or negative returns. Only those asset investments (Global Asset Allocators, Relative Value) for which the underlying return process offers the potential for positive returns in economic conditions which result in negative returns for stock/bond portfolio may provide downside risk protection as well as provide positive returns in markets in which a typical stock/bond portfolio performs well.

In order to evaluate the actual performance of the wide variety of alternative asset strategies one must also examine sub-strategies within a particular alternative asset classification. For instance, within the Event category of hedge funds, domestic opportunity offer positive returns across all three stock/bond portfolio return classifications while, in contrast, more equity sensitive fund strategies (global/international and domestic long) offer higher positive returns in periods of extreme positive stock/bond return and offer negative returns in periods of extreme negative stock/bond return.

V. Implications of Results

In this paper, the benefits of adding managed futures and hedge fund products to traditional stock, bond, and traditional alternative investment portfolios are shown. The primary results are as follows:

Under past (e.g., historical) market environments, a portfolio of hedge funds and managed futures offers improved risk and return opportunities when considered as additions to a traditional stock and as well as mixed portfolios (stocks, bond, and traditional alternative investments, private debt, private equity etc.).

Under forecasted return relationships consistent with general market conditions, a portfolio of hedge funds and managed futures offers improved risk and return opportunities when considered as additions to a traditional stock and as well as mixed asset portfolios (stocks, bond, and traditional alternative investments (private debt, private equity etc.). For instance, to

minimize the risk of the full stock, bond, and traditional alternative asset portfolio, an asset allocation of ten per cent to a portfolio of hedge funds and managed futures may be regarded as optimal.

Under alternative market conditions (e.g., extreme low/high returns of the stock and bond portfolio), the benefits of a portfolio of hedge funds and managed futures have a greater impact on risk reduction and return enhancement. More importantly, the portfolio of hedge funds and managed futures offers managed portfolio returns not obtainable through other traditional stock and bond investments and/or traditional alternative investments (e.g., GSCI, REITS).

The benefits of a portfolio of hedge funds and managed futures are not sensitive to the globalization of the stock and bond portfolio. The high correlation between international stock markets as well as the high correlation between international bond markets, especially in periods of extreme market movements, makes the results (improved risk and return opportunities) for the inclusion of a portfolio of hedge funds and managed futures consistent across a wide variety of traditional asset portfolio holdings. Moreover, traditional alternative investment vehicles must be supplemented with other futures/options based managed futures and hedge fund products to obtain the maximum risk and return benefits of alternative investment products. However, the degree of benefit will depend on the prevailing market environment and the degree to which that market environment is anticipated.

Future research on the degree to which subsets of the managed futures and hedge fund investments offer similar or alternative investments to the overall portfolio results is, of course, required. Moreover, analysis of alternative methods of forecasting return, variance, and correlation relationships between alternative investments and traditional stock and bond investments is required.

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Appendix I:

Traditional Alternative Investments:

Mezzanine financing: (e.g., investment in the subordinated debt of privately owned companies) or other non-senior private debt. The debtholder often participates in equity appreciation through direct conversion features, or indirect equity stakes such as rights, warrants, or options). Index Used - No direct publically available index available - Salomon Brothers Extended High Yield Market index which tracks the performance of below investment grade corporate bonds issued in the United States.

Private equity: Illiquid or restricted equity investments in companies including Buyout Funds, venture capital, and other special situations.- Wilshire venture capital and buyout Index

Real Estate: Investment in real estate properties via publicly traded securities (REITS) - Available indices from NCREIF

Additional Alternative Investments: Commodity, Managed Futures, and Hedge Fund Indices

Goldman Sachs Commodity Index (GSCI) is an arithmetic measure of the performance of actively traded, dollar-denominated nearby commodity futures contracts. As of January 9, 1995, there were 22 commodities in the index. The weights assigned to individual commodities are based on a five-year moving average of world production. Weights are determined each July and are made effective the following January. All contracts are rolled on the fifth business day of the month prior to the expiration month of the contract. Subindices are calculated for agricultural, energy, industrial, livestock, and precious metals contracts. Two versions of the indices are available: a total return version, which assumes that capital sufficient to purchase the basket of commodities is invested at the risk-free rate, and a spot version, which only tracks movements in the futures prices. This study uses the total return measure.

Evaluation Associates Capital Management (EACM):

Relative value: Balanced, or hedged, long and short positions with subindices such as *Long/Short equity* (long undervalued equities/short overvalued equities usually on an equal dollar bases); *Convertible hedging* (long convertible bonds or preferred, short underlying common); *bond hedging* (yield curve arbitrage or long/short debt positions); *Rotational* (multiple relative value strategies, including all of the above).

Event Driven: (Corporate transactions and special situations) subindices including *Deal Arbitrage* (long/short equity securities of companies involved in corporate transactions; *Bankruptcy/Distressed* (long undervalued securities of companies usually in financial distress or operating under Chapter 11). Multi-strategy includes deal funds dealing in both deal arbitrage and bankruptcy.

Equity Hedge Funds: Long and short securities with varying degrees of exposure and leverage such as *Domestic Long Equity* (long undervalued US equities; short selling is used sparingly); *Domestic Opportunistic Equity* (long and short U.S. equity with ability to be net short overall) and *Global International* (primarily long undervalued equities with the ability to use short selling opportunistically)

Global Asset Allocations (including CTAs): Opportunistically long and short multiple financial and/or non financial assets. Sub-indices include *Systematic* (long or short markets based on trend-following or other quantitative analysis) and *Discretionary* (long or short markets based on qualitative/fundamental analysis often with technical input)

Short selling: Short sale of U.S. equities with expectation of price declines.

Appendix II: Traditional Investments

S&P 500

Russell 2000

REITS

Lehman Brothers Government/Corporate Bond

GSCI

Exhibit 1
Descriptive Statistics of Index Performance, 1990-2001

	Avg annual RTN	STDEV	Monthly MIN	Monthly MAX	Information Ratio	Sharpe Ratio	Correlation S&P 500
Traditional Assets							
S&P500	12.9%	14.6%	-14.5%	11.4%	0.88	0.51	1.00
Russell 2000	11.0%	18.9%	-19.4%	16.5%	0.58	0.29	0.71
Lehman Brothers Gov./Corp. Bond	8.1%	4.2%	-2.5%	4.2%	1.91	0.62	0.28
NAREIT	10.1%	12.1%	-10.4%	10.0%	0.83	0.38	0.36
T-Bill	5.4%	0.4%	0.2%	0.7%	14.48		0.02
Traditional Alternative Assets							
Leveraged Buyout	6.7%	45.6%	-40.7%	37.5%	0.15	0.03	0.77
Venture Capital	20.1%	46.4%	-32.8%	42.7%	0.43	0.32	0.65
Mezzanine Debt Rtn	9.7%	28.7%	-27.2%	22.8%	0.34	0.15	0.78
Trad. Alt. Portfolio	13.0%	38.9%	-31.9%	34.0%	0.33	0.20	0.76
Hedge Fund Indices							
EACM 100 Index	13.8%	4.3%	-4.5%	5.5%	3.22	1.95	0.39
Relative Value Index	10.2%	3.3%	-6.1%	2.8%	3.07	1.43	0.08
<i>Long/Short Equity</i>	8.8%	3.1%	-2.4%	3.6%	2.82	1.08	-0.11
<i>Convertible Bond</i>	10.7%	4.6%	-5.0%	5.0%	2.30	1.13	0.14
<i>Bond Hedge</i>	6.4%	4.5%	-7.1%	2.9%	1.44	0.23	0.10
<i>Rotational</i>	14.6%	6.5%	-14.0%	4.1%	2.23	1.40	0.05
Event Driven Index	12.8%	5.2%	-7.5%	5.0%	2.48	1.43	0.47
<i>Arbitrage</i>	9.6%	6.1%	-11.1%	5.9%	1.59	0.69	0.46
<i>Bankruptcy</i>	14.0%	6.6%	-8.2%	9.9%	2.11	1.29	0.33
<i>Multistrategy</i>	14.8%	5.2%	-8.3%	5.1%	2.83	1.79	0.43
Equity Hedge Fund Index	17.6%	10.3%	-9.8%	14.2%	1.70	1.18	0.60
<i>Domestic Long</i>	16.3%	15.1%	-15.1%	15.8%	1.08	0.72	0.67
<i>Domestic Opportunity</i>	17.9%	10.0%	-5.1%	15.2%	1.79	1.24	0.20
<i>Global International</i>	17.3%	11.1%	-9.2%	11.8%	1.56	1.07	0.61
Global Assets Allocators	16.7%	10.2%	-5.4%	12.0%	1.64	1.10	0.10
Commodity Index							
GSCI	3.39%	18.49%	-12.17%	22.94%	0.18	-0.11	-0.04

Exhibit 2
Descriptive Statistics of Portfolio Performance (1990-2001)

	Avg annual RTN	STDEV	Monthly MIN	Monthly MAX	Information Ratio	Sharpe Ratio
Portfolio I	10.7%	8.1%	-6.3%	7.4%	1.32	0.65
Portfolio II	10.2%	7.2%	-6.6%	5.7%	1.41	0.65
Portfolio III	11.6%	8.3%	-7.3%	7.6%	1.40	0.74
Portfolio IV	11.3%	7.5%	-6.6%	6.9%	1.50	0.78
Portfolio V	11.4%	6.9%	-5.9%	6.7%	1.65	0.86

Where

	US Equity	Salomon Bond	NAREIT	GSCI	EACM 100	Traditional Alternative
Portfolio I	50.0%	50.0%				
Portfolio II	40.0%	40.0%	10.0%	10.0%		
Portfolio III	40.0%	40.0%			15.0%	5.0%
Portfolio IV	40.0%	40.0%		2.5%	15.0%	2.5%
Portfolio V	40.0%	40.0%			20.0%	

Exhibit 3a: Return and Risk Tradeoff (1990-2001)

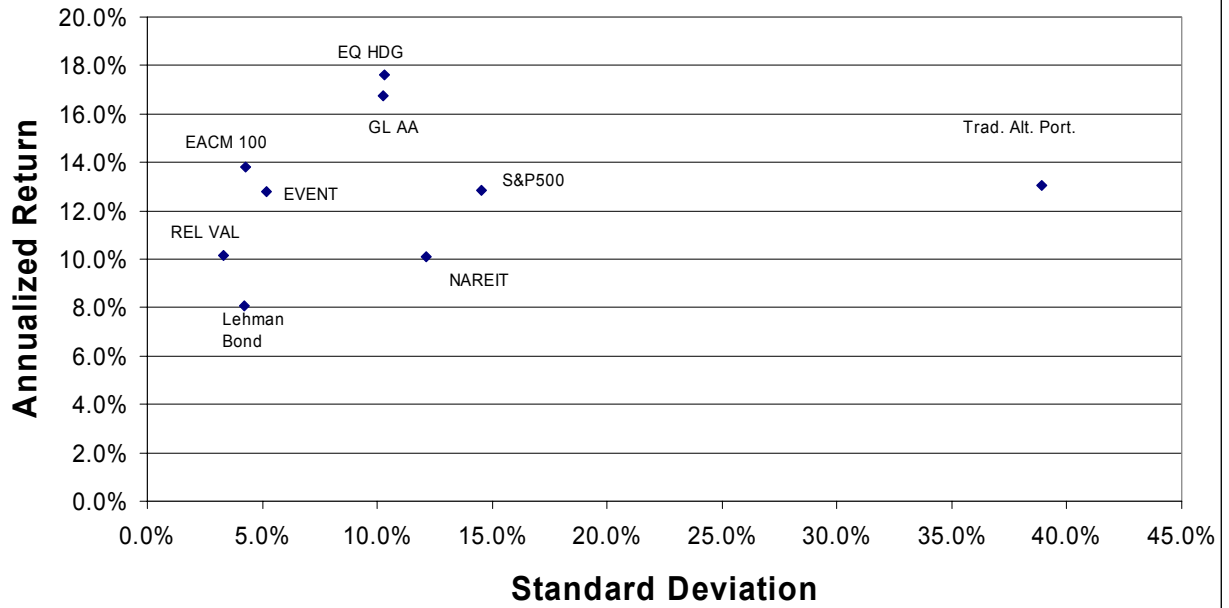


Exhibit 3b: Return and Risk Tradeoff (1990-2001)

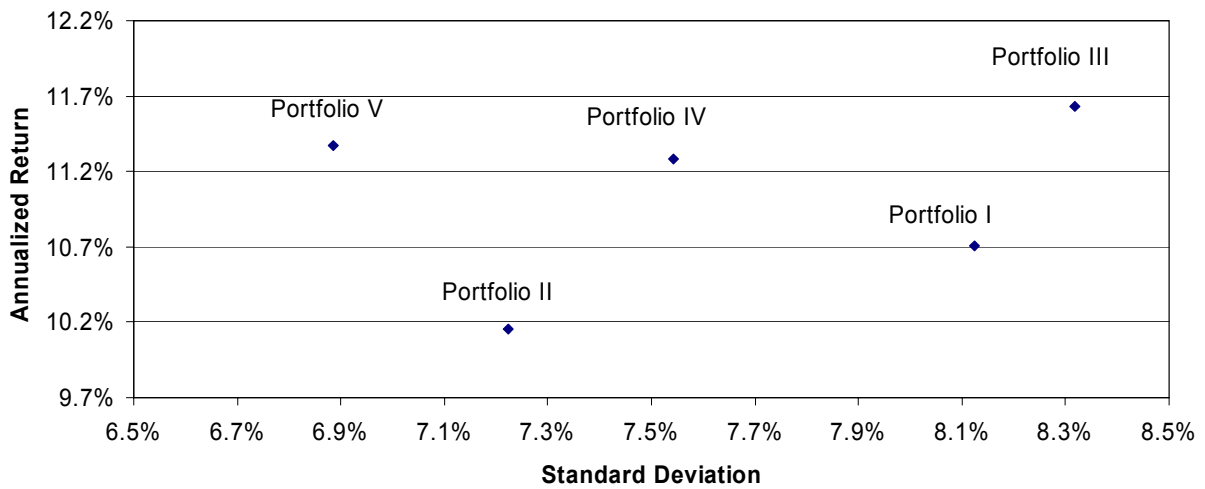


Exhibit 5: Optimal Allocations for alternative asset portfolio based on risk tolerance criteria (1990-2001)

Panel A: Optimal Weights using historical risk, return, and correlation data

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	REIT	LBO	Venture Capital	Lng/Sht Equity	Convert Hedge	Bond Hedge	Rotat	Bankruptcy	Multi-Strategy	Domest. Long	Domest. Opport.	Global Int'l	Asset Allocat	GSCI
0.12%	3.47%	1.54%	0.32			20.09%				12.04%						67.87%	
0.07%	2.65%	1.43%	0.37			13.76%				31.72%						54.51%	
0.03%	1.73%	1.28%	0.49			0.28%				44.31%				24.46%		30.95%	
0.01%	1.00%	1.00%	0.56				32.71%	14.73%		7.62%		29.15%		4.79%		11.00%	

Panel B: Optimal Weights using historical risk, return, and correlation data, and constraints of 10% for EACM

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	REIT	LBO	Venture Capital	Lng/Sht Equity	Convert Hedge	Bond Hedge	Rotat	Bankruptcy	Multi-Strategy	Domest. Long	Domest. Opport.	Global Int'l	Asset Allocat	GSCI
0.12%	3.46%	1.32%	0.25	8.52%	1.48%	10.00%		10.00%		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
0.07%	2.65%	1.28%	0.32	3.28%		6.72%	10.00%	10.00%		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
0.03%	1.73%	1.10%	0.38	6.38%			10.00%	10.00%	6.30%	10.00%	10.00%	10.00%	7.32%	10.00%	10.00%	10.00%	10.00%
0.02%	1.45%	1.00%	0.38	13.41%			10.00%	10.00%	10.00%	10.00%	10.00%	10.00%		10.00%	2.38%	10.00%	4.21%

Panel C: Optimal Weights using historical risk, and correlation data, and with Sharpe-based return forecasts (Sharpe Ratio = 0.66)

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	REIT	LBO	Venture Capital	Lng/Sht Equity	Convert Hedge	Bond Hedge	Rotat	Bankruptcy	Multi-Strategy	Domest. Long	Domest. Opport.	Global Int'l	Asset Allocat	GSCI
0.80%	8.94%	2.13%	0.24	0.05%	60.06%	1.70%	0.03%	0.02%	0.08%	0.93%	4.18%	27.60%	0.13%	0.06%	5.06%	0.13%	0.17%
0.06%	2.32%	1.14%	0.30			13.43%	13.04%			38.59%						34.94%	
0.02%	1.42%	0.95%	0.36	12.85%		3.91%	34.37%	8.58%	5.80%	10.05%						12.77%	11.66%
0.01%	1.00%	0.80%	0.35	1.38%	3.67%		58.60%	18.73%	2.03%	5.76%						4.23%	5.60%

Exhibit 6: Optimal Allocations for traditional and alternative asset portfolio based on risk tolerance criteria (1990-2001)

Panel A: Optimal weights with no allocation constraints: Historical risk, return, and correlation data

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	SP500	Bond	LBO	Venture Capital	GSCI	REIT	EACM 100
0.50%	7.07%	1.73%	0.18				48.18%			51.82%
0.08%	2.83%	1.27%	0.29				13.20%			86.80%
0.04%	2.00%	1.18%	0.37				6.36%			93.64%
0.02%	1.42%	1.11%	0.47				1.52%			98.48%

Panel B: Optimal weights with constraint of at least 50% SP500, 30% Lehman Bond

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	SP500	Bond	LBO	Venture Capital	GSCI	REIT	EACM 100
0.20%	4.47%	1.15%	0.16	50.00%	30.00%		14.13%			5.87%
0.08%	2.83%	0.99%	0.20	50.00%	30.00%		2.14%			17.86%
0.06%	2.45%	0.90%	0.19	50.00%	30.08%			10.08%		9.84%
0.05%										

**Panel C: Optimal weights with constraint of at least 50% SP500, 30% Lehman Bond
Sharpe-based return forecasts (Sharpe ratio = 0.66)**

Variance Criteria	Monthly StDev	Monthly Return	Sharpe Ratio	SP500	Bond	LBO	Venture Capital	GSCI*	REIT	EACM 100
0.20%	4.47%	1.34%	0.20	50.00%	30.00%		14.40%	5.60%		
0.08%	2.83%	1.15%	0.25	50.00%	30.00%		2.44%	17.56%		
0.06%	2.45%	1.04%	0.24	50.00%	30.00%			10.38%		9.62%
0.05%										

**Exhibit 7a: Average Monthly Return of Alternative Investment with Stock/Bond P
in Worst, Mid, and Best 48 Ranked Return Months:
Returns Ranked on Stock/Bond Portfolio (1990-2001)**

	all	bottom	mid	top
S&P 500	1.1%	-3.4%	1.4%	5.3%
FRUSL 2000	1.0%	-3.1%	1.8%	4.4%
Lehman Bond	0.7%	-0.1%	0.8%	1.3%
NAREIT	0.9%	-0.6%	1.5%	1.7%
US TREAS	0.4%	0.4%	0.4%	0.5%
LBO Index	1.4%	-9.5%	3.0%	10.9%
Venture Capital Index	2.4%	-7.0%	2.9%	11.3%
Mezzanine	1.1%	-6.0%	2.3%	7.1%
Trad. Asset Port.	1.7%	-7.5%	2.7%	9.8%
EACM100	1.1%	0.4%	1.5%	1.4%
REL VAL	0.8%	0.7%	1.0%	0.8%
L/S Equity	0.7%	0.6%	1.0%	0.5%
ConvHedge	0.9%	0.8%	0.8%	1.0%
BondHedge	0.5%	0.3%	0.8%	0.5%
Rotational	1.2%	1.2%	1.3%	1.0%
EVENT	1.0%	0.2%	1.5%	1.4%
Arb	0.8%	-0.1%	1.2%	1.2%
Bank	1.1%	0.3%	1.7%	1.3%
Multi	1.2%	0.4%	1.6%	1.5%
EQ HEDG	1.4%	-0.7%	1.9%	3.0%
DomLong	1.4%	-2.0%	1.9%	4.1%
DomOpp	1.4%	0.7%	1.5%	2.0%
GI/Int	1.4%	-0.8%	2.1%	2.9%
GLOB AA	1.3%	0.6%	2.1%	1.4%
GSCI	0.4%	0.5%	0.5%	0.2%
Stk/Bnd Port	0.9%	-1.8%	1.1%	3.3%

Exhibit 7b: Average Monthly Returns in Worst, Mid, and Best 48 Ranked Return Months: Returns Ranked on Stock/Bond Portfolio (1990-2001)

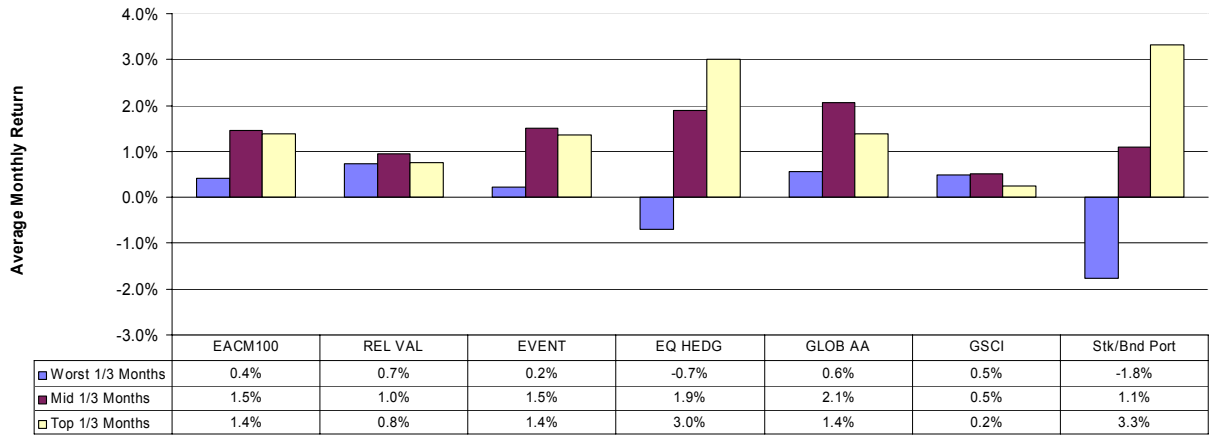


Exhibit 7c: Average Monthly Returns in Worst, Mid, and Best 48 Ranked Return Months: Returns Ranked on Stock/Bond Portfolio (1990-2001)

