Diversifying among Hedge Fund Strategies: An Alternative Frontier

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ABSTRACT

The goal of this study is to create optimal portfolios of hedge funds. This paper discusses the different investment styles within the hedge fund universe along with their specific risk, return, and correlation characteristics. Markowitz's portfolio selection model is used to create an efficient frontier to determine the best way for an investor to allocate capital among hedge fund strategies. The results demonstrate a strong case for diversification among hedge fund styles according to one's risk preferences.

OVERVIEW

In recent years, hedge funds have become increasingly popular. They have proven to be a good place to invest during current periods of market decline and high volatility. Hedge fund managers' freedom to pursue a wide spectrum of alternative investment strategies involving the use of derivatives, short selling, and leverage has been relatively successful during the bear market. Additionally, by focusing on absolute performance rather than benchmarks, hedge funds are capable of generating superior returns in virtually any type of market environment. Hedge fund performance was strong throughout the bull market of the 90s, and according to Van Hedge Fund Advisors, hedge funds returned an average of .2% last year. This compares favorably to traditional equity indices such as the S&P 500, which was down 23% for the year. Furthermore, for each month last year that the S&P 500 fell, hedge funds either posted gains or preserved capital by incurring smaller losses.[1]

The strong comparative performance of hedge funds over the past few years has fueled enormous growth within the industry. The industry's assets under management reached over $600 billion last year, which represents nearly a 75% increase over the past two years. In addition to the amount of managed capital, the number of hedge funds has been increasing as well. In 1997, there were approximately 1200 hedge funds, while today the total estimate is 7500.[2]

The industry's rapid growth has attracted numerous investors' attention. Traditionally these alternative investment vehicles were not available to many investors.

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[1] www.vanhedge.com

[2] www.vanhedge.com

They were almost exclusively organized as private partnerships offered only to institutional investors, companies, and high net worth individuals. Most did not register with the Securities and Exchange Commission, and were therefore not required to disclose data on their financial performance or transactions to the public. But now, the playing field has changed. A popular new breed of hedge fund, called fund of funds, is reaching out to the retail investor. Funds of hedge funds are registered funds that spread their exposure across a group of unregistered, private hedge funds. Because they are registered with the SEC, they are able to offer lower investment minimums and sign up a larger number of investors. They offer other advantages as well, such as reduced lock-up periods and better liquidity. However, these benefits must be compared with the extra layer of fees that they charge. Overall funds of funds have significantly impacted the hedge fund industry by opening the way for a new class of investors.[3]

As hedge funds enter the investment mainstream, investors greet them with heightened interest. They want to know how they can optimally allocate their capital within the hedge fund universe. This increased investor interest coupled with recent academic research supporting the inclusion of alternative investment classes in an investor's total portfolio has provided good reason to pursue a study to determine the most efficient way to make such investments. This article provides an analysis of the risk and return benefits of different types of hedge funds and develops a diversification strategy that determines how best to invest in a portfolio of hedge funds.

[3] See Colter [2003] and Lhabitant [2002] for a detailed discussion of Fund of Funds.

INTRODUCTION

Hedge funds can significantly improve the mean-variance characteristics of an investor's traditional portfolio. Hedge funds' ability to generate absolute returns along with their exposure to a wide variety of risks contributes to their unique risk and return profiles. Additionally, they generally have low, and sometimes negative, correlations with traditional assets. Because of these unique characteristics, hedge funds are being considered as complements to traditional investment strategies used to improve total portfolio performance.[4]

In recent years, there has been much research conducted which demonstrates the benefits of including hedge funds in the traditional portfolio. Jaeger's [2001] study has shown that hedge funds dramatically improve the efficient frontier of the traditional portfolio, producing significantly higher returns with substantially lower risk. In another study of efficient frontiers, Lamm [1999] demonstrated that hedge funds offer superior portfolio enhancing characteristics and should be a central part of an investor's spectrum of investments. Schneeweis, Spurgin, & Karavas' [2001] analysis of the efficient frontier confirms Jaeger's and Lamm's findings and suggests that an asset allocation of 10 to 20 percent to a portfolio of mixed alternative assets may be regarded as optimal.

For these reasons, hedge funds have become an increasingly popular investment choice. However, they are not a recent phenomenon. Alfred Jones is credited with starting the first hedge fund in 1949. The term "hedge fund" originated from Jones' long-short strategy that he used to hedge market risk. The investment styles of hedge funds have changed significantly since Jones' time. Over the past 50 years, a multitude of new

[4] See Lamm [1999], Jaeger [2001], and Schneeweis, Spurgin, & Karavas [2001]

strategies have been developed. Today, Jones' market hedged long-short strategy is only a subset of the hedge fund universe.[5]

On the most basic level, hedge funds can be classified into two different categories: directional and non-directional. Hedge funds that are non-directional are considered "market neutral" and do not depend on the direction of the market. On the other hand, directional hedge funds use strategies based on anticipated movements in the market. These strategies are generally designed to exploit short-term market inefficiencies.[6] This article will examine the strategic differences in much greater detail in later sections.

The wide variety of hedge fund strategies that exist today account for the very different risk and return profiles that persist among different hedge funds. Research has shown that style affiliation is an important determinant of the risk exposure and return outcome for different hedge funds. Brown and Goetzmann's [2003] analysis showed that stylistic differences contribute to approximately 20% of the cross-sectional variability in hedge fund returns. This means that managers take different amounts of risk depending on the style of hedge fund they manage.

Many investors tend to overlook these facts. Bein and Wander [2002] claim that many investors make this fundamental mistake when attempting to include hedge funds in their traditional portfolio. They argue that investors tend to view all hedge funds under the same asset class label, which assumes that they all have comparable risk and return characteristics. In reality, all hedge funds are not the same. In fact, they are very different.

[5] Fung and Hsieh [1999], Lhabitant [2002], Eichengreen et al. [1998]
[6] Fung and Hsieh [1999], BARRA [2001]

Lhabitant and Learned [2002] argue that an investor could significantly reduce his portfolio risk by choosing hedge funds wisely across different styles, so they do not move up and down in lockstep. They claim that a portfolio made up of hedge funds with different risk and return profiles offers more controlled exposure and allows investors to diversify away specific risk of holding hedge funds.

The purpose of this study is to create such portfolios and examine the risk, return, and correlation characteristics of the portfolio components. While much of the existing research in the alternative investment arena focuses on the diversification benefits gained by including hedge funds in traditional asset portfolios, the goal of this paper is to demonstrate how to add these alternative investments most effectively. The rest of this article is organized as follows. Section 2 introduces the data and describes the methodology. Section 3 analyzes the characteristics of different hedge fund strategies. Section 4 presents the results of the Markowitz efficient frontier determination and discusses the portfolio components. Section 5 concludes.

DATA

For the purpose of this study, the data are taken from Hedge Fund Research, Inc (HFRI), a hedge fund information provider. The HFRI Monthly Performance Indices are broken down into 33 different categories by strategy. Funds are classified into different categories based on the descriptions in their offering memorandums. The indices are equally weighted and are based on over 1400 funds that are listed on the internal HFR database. Unlike asset weighted, equally weighted indices reduce the bias towards larger funds and present a more general description of performance of the hedge fund industry.

Additionally, HFRI Indices present a clear picture of the hedge fund universe by addressing the survivorship bias problem. Since 1995, they have been adjusted to include funds that have liquidated or closed.[7]

The HFRI Indices were launched in 1994 and have data back to 1990. The funds in the database represent over $260 billion in assets. Many hedge fund managers use these indices as a benchmark for their own funds.[8]

While HFR is a highly regarded data provider, the infrastructure of performance data for alternative investment strategies is still undeveloped and there are number of important data biases that should be discussed.[9]

1. *Self-reporting bias*: Hedge fund managers have the option of posting their performance data, but they are not required to do so. Participation is voluntary and only a certain number of funds choose to contribute. Some managers, with low returns, may choose not to report for performance reasons. If we assume that it is poor performers who do not report, then the historical returns of those that do report would be over-estimated. However others, with high returns, may opt not to report to preserve an exclusive reputation and limit their size. Since non-reporting funds are by definition unobservable, it is difficult to know whether self-reporting bias has a positive or negative impact on the calculated indices.

2. *Survivorship bias*: When unsuccessful managers exit the industry (and the

[7] www.hfr.com
[8] www.hfr.com
[9] This section provides a summary of hedge fund data biases, which are discussed at great length in Fung and Hsieh [2000], Amenc, Martellini, and Vaissie [2002], and Lhabitant [2002].

representative index), the funds that remain in the database tend to be those that have performed better than the average of the whole population. This leads to survivorship bias and the question whether or not the database represents the true returns of any particular strategy or only the returns of the successful managers.

3. *Selection bias*: The managers and sub-strategies selected for inclusion in an index has a significant influence on the index characteristics. If the selection criteria differ from one database to the next, there can be considerable difference in index performances. This is referred to as selection bias, and if it occurs, the data provided from different databases may not be representative of the same management universe.

4. *Instant history bias*: Instant history bias is a result of adding new funds to a database. When a fund is added, all or part of is historical data is recorded ex-post in the database. Since funds want to display the most positive performance possible, it is likely that the average performance displayed by funds during their incubation period will be higher than that of funds that have belonged to the corresponding database for a long period of time.

These biases affect every hedge fund database. However, it is not clear whether the overall bias is upward or downward. Many believe that the net bias is slightly upward and that historical data are slightly overstated. Despite the imperfect nature of

hedge fund performance data, most researchers agree that they are accurate enough to serve as the basis of academic studies.[10]

METHODOLOGY

Of the 33 HFRI monthly indices, 16 are examined in this article. The indices studied have been limited for two reasons. Only indices that provide data back to 1990 have been included, and sub-categories have been eliminated so that any particular fund is not accounted for twice. The 16 indices studied in this article are the following: Convertible Arbitrage, Distressed Securities, Emerging Markets, Equity Hedge, Equity Market Neutral, Equity Market Neutral: Statistical Arbitrage, Equity Non-Hedge, Event Driven, Fixed Income, Fund of Funds, Macro, Market Timing, Merger Arbitrage, Relative Value Arbitrage, Sector and Short Selling. These 16 indices are representative of the heterogeneity of investment style in the hedge fund universe. Please refer to Appendix I for definitions of the different hedge fund strategies provided by HFR.

Monthly return data for the 16 indices from January of 1990 to February of 2003 are used to calculate the annualized mean and standard deviation.[11] After computing the risk and return profile for each strategy, the efficient frontier of hedge funds is constructed using standard mean-variance analysis. First the correlation and covariance matrix are calculated, and then Markowitz optimization is conducted using the "solver" tool in Excel. This procedure produces efficient combinations of strategies that represent optimal hedge fund portfolios for any given return. The efficient frontier is built from

[10] Purcell and Crowley [1999]
[11] The terms standard deviation, risk, and volatility are used interchangeably throughout this article.

this data, and it can be used to design portfolios of hedge funds with superior risk and reward characteristics.

EVALUATING HEDGE FUND STRATEGIES

In order for an investor to effectively allocate capital among hedge funds, it is important to understand the sources of return and risk exposure underlying each investment style. While the 16 different hedge fund styles evaluated in this article have very diverse risk and return profiles, it is useful to start with a framework from which to examine each strategies unique characteristics.

As stated earlier, hedge funds are often classified as directional or non-directional. However, these two categories do not fully encompass the heterogeneity within the hedge fund universe. In this analysis, each investment strategy will be classified as directional, non-directional, or event driven. Furthermore, the directional category will be broken down into security selection and convergence strategies. The purpose of this classification system is to identify and group together those hedge funds whose characteristics fall within the same range. This will make the diversification benefits of each strategy more transparent.

Directional strategies attempt to earn rewards by making bets on the movement of the market. The nature of these strategies implies a higher level of correlation with the market. Therefore, directional hedge funds are exposed to a large potential upside at the expense of a high level of risk. Including these hedge funds in a portfolio can enhance the expected return but will not diversify away the risk.[12] Funds in this category include Macro, Emerging Markets, Sector, Equity Non-Hedge, and Equity Hedge. True to

[12] Amenc, Martellini, and Vaissie [2002]

definition, the data shows that these strategies offer large returns at high levels of risk (see Exhibit 1). Of the 16 strategies, the directional funds offer the highest returns ranging from 14.74% (Emerging Markets) to 20.19% (Sector) and the highest levels of risk ranging from 8.73% (Macro) to 15.64 (Emerging Markets).[13]

Non-directional strategies offer lower returns but greater stability. These hedge funds do not depend on the direction of the market and have a low, or sometimes negative, exposure to market risk. They earn returns from pursuing a variety of arbitrage opportunities aimed at exploiting structural market anomalies. Non-directional strategies can be broken down even further into convergence or security selection strategies.[14]

Hedge funds that employ convergence strategies, such as Convertible Arbitrage and Equity Market Neutral: Statistical Arbitrage, make bets that two securities or market prices will get closer over time. Security selection hedge funds attempt to exploit the misvaluation of specific securities. This type of hedge fund includes Equity Market Neutral and Relative Value. Fixed Income (Total) can also be included in this group because it encompasses a number of strategies, the majority of which are non-directional, such as Fixed Income: Arbitrage, Convertible Bonds, and Mortgage Backed. As expected, the non-directional strategies are on the low end of the risk spectrum. Their volatilities range from 3.27% (Equity Market Neutral) to 4.05% (Equity Market Neutral: Statistical Arbitrage), and their returns fall between 9.57% (Equity Market Neutral: Statistical Arbitrage) and 13.10% (Relative Value). In terms of constructing a portfolio,

[13] Short-selling is excluded from the analysis of directional hedge funds. While it is a directional strategy, it moves against the market, which makes it different from the other funds in this category. The unique characteristics of the short-selling strategy will be discussed later in the paper.
[14] BARRA [2001]

these funds present enormous diversification strength in their ability to reduce the overall level of risk.[15]

Event driven strategies are based on anticipated events and focus specifically on companies involved in special situations, such as spin-offs, mergers and acquisitions, bankruptcy reorganizations, and share buybacks. Event driven funds are put in their own category, because their investment style is largely affected by the uncertainty about a particular event or situation rather than by the absolute direction of the market. For example, merger arbitrageurs, whose strategy is to go long the acquiree (whose stock generally appreciates) and go short the acquirer (whose stock generally depreciates), are mainly impacted by deal flow, not by market returns. However, they are not completely non-directional because there is still a small amount of market-related risk in their portfolio. A declining equities market or a bleak economic outlook can jeopardize corporate transactions, which can be considered a source of risk for a Merger Arbitrage fund.[16] Other funds in this category include Distressed Securities, Event Driven, and Market Timing.

Overall event driven strategies have moderate risk and return profiles. They fall between the directional and non-directional funds, right in the middle of the 16-strategy spectrum. Their returns range from 11.18% (Merger Arbitrage) to 14.64% (Distressed Securities) with volatilities between 4.48% (Merger Arbitrage) and 6.93% (Market Timing).

There are some strategies that are less easily classified within this framework. The Short Selling hedge fund is a prime example of a unique case. While Short Selling is

[15] Amenc, Martellini, and Vaissie [2002]
[16] Lhabitant [2002]

a directional strategy, its characteristics are very different than most directional hedge funds. This is because short-sellers make bets against the market by selling borrowed assets in anticipation of a price decline. While the Short Selling strategy has the worst risk and return profile, it can offer substantial diversification benefits when included in a portfolio. It is the only investment that is negatively correlated with all the others, and it can be considered a pure diversifier in the context of a hedge fund portfolio.[17]

Fund of Funds is another type of hedge fund that cannot be classified into a particular category. By definition, it is a combination of a number of different hedge funds. They try to achieve a diversified portfolio by investing in multiple funds. Their goal is to significantly reduce the risk associated with investing in just one fund. A Fund of Funds' manager can choose to invest in multiple funds in one strategy, or they can diversify across strategies. One would expect the volatility to be low with moderate returns. However, the data shows that volatility is only moderate (5.9%) and returns are fairly low (10.33%). This is most likely due to the extra layer of fees associated with investing a fund of funds.[18]

HEDGE FUND EFFICIENT FRONTIER

The Markowitz efficient frontier of hedge funds determines the components of the minimum variance portfolio for any given return. According to the data in this study, the efficient frontier lies between 11% and 20.19% (see Exhibit 5). For returns lower than 11%, there is always a superior portfolio that offers a higher expected return and lower risk. And, for returns greater than 20.19%, no portfolios exist because it is impossible to

[17] Amenc, Martellini, and Vaissie [2002]
[18] For a more in depth discussion of the advantages and disadvantages associated with Fund of Funds, see Lhabitant [2002]

achieve a return greater than the highest expected return of any investment strategy in this data sample. Thus, optimal portfolios of hedge funds can only be created for any return within that range.

The results of generating the efficient frontier show that multiple strategies make up each efficient portfolio. However, some strategies are never included in the optimal portfolios. Emerging Markets, Equity Non-Hedge, Fund of Funds, and Event Driven are not part of any point on the frontier. This is because of their risk, return, and correlation characteristics. Emerging Markets, Equity Non-Hedge, and Fund of Funds have sub-optimal risk-return profiles. There is always a strategy that offers a higher return and a lower level of risk. Event Driven, however, does not have an inferior risk-return profile. In fact, it offers a higher return and lower standard deviation than the Market Timing strategy, which is included in multiple frontier portfolios (see Exhibit 7). This is because Market Timing has a lower correlation to almost every other strategy relative to Event Driven. Therefore, Market Timing offers more diversification benefits to a hedge fund portfolio.

The minimum risk portfolio has a standard deviation of 1.87% and a return of 11%. This is an extremely low level of risk for a relatively high expected return. The profile of this portfolio by far supercedes the characteristics of any one particular strategy. In fact the entire efficient frontier lies above the risk and return coordinates for each individual strategy (see Exhibit 6). It is obvious that diversification among strategies has its benefits.

This minimum risk portfolio includes the following 8 strategies: Convertible Arbitrage, Equity Market Neutral, Equity Market Neutral: Statistical Arbitrage, Fixed

Income, Market Timing, Merger Arbitrage, Relative Value, and Short Selling. There are a few interesting points about this portfolio. First, it includes a number of non-directional and event driven strategies. This is not surprising considering the objective of Markowitz optimization is to minimize the variance of the portfolio. Therefore a majority of the less volatile strategies are included. Second, short selling is the only directional strategy included. It should be noted that the short selling strategy is included in a majority of the portfolios on the efficient frontier. This is because of its strengths as a diversifier, as it is negatively correlated with all of the other strategies (see Exhibit 4).

As you move up the frontier, the efficient portfolios include more and more directional strategies and the portion allocated to non-directional funds decreases. This is because of the higher expected returns of the directional strategies. By the middle of the frontier at a return of 15.5%, 6 strategies are included in the portfolio, 3 directional (Equity Hedge, Macro, and Sector), 1 non-directional (Relative Value), 1 event driven (Distressed Securities), and Short Selling, the pure diversifier. The portfolio is relatively overweight in the directional strategies (66.92%), but the volatility is only 4%, because it has included other lower risk strategies.

To reach the top of the efficient frontier, one must invest in all directional strategies. The portfolios at this end are mainly composed of Macro and Sector funds. This is because those two strategies have two of the highest expected returns. This higher return, however, comes with additional risk. The final point on the frontier reaches 20.19% return and 14.32% volatility. This point represents the Sector funds coordinates, which has the highest return for all of the strategies.

CONCLUSION

The results of this study demonstrate the importance of diversifying within the hedge fund universe. Each portfolio on the efficient frontier has a risk-return profile that is superior to any individual strategy. By investing in strategies with different profiles, an investor can obtain a hedge fund portfolio with enhanced performance characteristics.

These portfolios differ according to one's risk preferences. As described above, the more risk-averse investors will diversify mainly between non-directional and event-driven strategies, while the more aggressive investors will spread their exposure primarily among directional strategies. The different combinations will get you to different places on the efficient frontier, but they all represent efficient portfolios. The creation of these optimal portfolios demonstrates the importance of diversification across different styles as an effective way to allocate capital to hedge funds.

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Appendix and Exhibits

Appendix I: HFR Strategy Definitions

Convertible Arbitrage involves purchasing a portfolio of convertible securities, generally convertible bonds, and hedging a portion of the equity risk by selling short the underlying common stock. Certain managers may also seek to hedge interest rate exposure under some circumstances. Most managers employ some degree of leverage, ranging from zero to 6:1. The equity hedge ratio may range from 30 to 100 percent. The average grade of bond in a typical portfolio is BB-, with individual ratings ranging from AA to CCC. However, as the default risk of the company is hedged by shorting the underlying common stock, the risk is considerably better than the rating of the unhedged bond indicates.

Distressed Securities strategies invest in, and may sell short, the securities of companies where the security's price has been, or is expected to be, affected by a distressed situation. This may involve reorganizations, bankruptcies, distressed sales and other corporate restructurings. Depending on the manager's style, investments may be made in bank debt, corporate debt, trade claims, common stock, preferred stock and warrants. Strategies may be sub-categorized as "high-yield" or "orphan equities." Leverage may be used by some managers. Fund managers may run a market hedge using S&P put options or put options spreads.

Emerging Markets (Total) funds invest in securities of companies or the sovereign debt of developing or "emerging" countries. Investments are primarily long. "Emerging Markets" include countries in Latin America, Eastern Europe, the former Soviet Union, Africa and parts of Asia. Emerging Markets - Global funds will shift their weightings among these regions according to market conditions and manager perspectives. In addition, some managers invest solely in individual regions. Emerging Markets - Asia involves investing in the emerging markets of Asia. Emerging Markets - Eastern Europe/CIS funds concentrate their investment activities in the nations of Eastern Europe and the CIS (the former Soviet Union). Emerging Markets - Latin America is a strategy that entails investing throughout Central and South America.

Equity Hedge investing consists of a core holding of long equities hedged at all times with short sales of stocks and/or stock index options. Some managers maintain a substantial portion of assets within a hedged structure and commonly employ leverage. Where short sales are used, hedged assets may be comprised of an equal dollar value of long and short stock positions. Other variations use short sales unrelated to long holdings and/or puts on the S&P 500 index and put spreads. Conservative funds mitigate market risk by maintaining market exposure from zero to 100 percent. Aggressive funds may magnify market risk by exceeding 100 percent exposure and, in some instances, maintain a short exposure. In addition to equities, some funds may have limited assets invested in other types of securities.

Equity Market Neutral investing seeks to profit by exploiting pricing inefficiencies between related equity securities, neutralizing exposure to market risk by combining long and short positions. One example of this strategy is to build portfolios made up of long positions in the strongest companies in several industries and taking corresponding short positions in those showing signs of weakness.

Equity Market Neutral: Statistical Arbitrage utilizes quantitative analysis of technical factors to exploit pricing inefficiencies between related equity securities, neutralizing exposure to market risk by combining long and short positions. The strategy is based on quantitative models for selecting specific stocks with equal dollar amounts comprising the long and short sides of the portfolio. Portfolios are typically structured to be market, industry, sector, and dollar neutral.

Equity Non-Hedge funds are predominately long equities although they have the ability to hedge with short sales of stocks and/or stock index options. These funds are commonly known as "stock-pickers." Some funds employ leverage to enhance returns. When market conditions warrant, managers may implement a hedge in the portfolio. Funds may also opportunistically

short individual stocks. The important distinction between equity non-hedge funds and equity hedge funds is equity non-hedge funds do not always have a hedge in place. In addition to equities, some funds may have limited assets invested in other types of securities.

Event-Driven is also known as "corporate life cycle" investing. This involves investing in opportunities created by significant transactional events, such as spin-offs, mergers and acquisitions, bankruptcy reorganizations, recapitalizations and share buybacks. The portfolio of some Event-Driven managers may shift in majority weighting between Risk Arbitrage and Distressed Securities, while others may take a broader scope. Instruments include long and short common and preferred stocks, as well as debt securities and options. Leverage may be used by some managers. Fund managers may hedge against market risk by purchasing S&P put options or put option spreads.

Fixed Income (Total) includes the following:
Fixed Income: Arbitrage is a market neutral hedging strategy that seeks to profit by exploiting pricing inefficiencies between related fixed income securities while neutralizing exposure to interest rate risk. Fixed Income Arbitrage is a generic description of a variety of strategies involving investment in fixed income instruments, and weighted in an attempt to eliminate or reduce exposure to changes in the yield curve. Managers attempt to exploit relative mispricing between related sets of fixed income securities. The generic types of fixed income hedging trades include: yield-curve arbitrage, corporate versus Treasury yield spreads, municipal bond versus Treasury yield spreads and cash versus futures. *Fixed Income: Convertible Bonds* funds are primarily long only convertible bonds. Convertible bonds have both fixed income and equity characteristics. If the underlying common stock appreciates, the convertible bond's value should rise to reflect this increased value. Downside protection is offered because if the underlying common stock declines, the convertible bond's value can decline only to the point where it behaves like a straight bond. *Fixed Income: Diversified* funds may invest in a variety of fixed income strategies. While many invest in multiple strategies, others may focus on a single strategy less followed by most fixed income hedge funds. Areas of focus include municipal bonds, corporate bonds, and global fixed income securities. *Fixed Income: High-Yield* managers invest in non-investment grade debt. Objectives may range from high current income to acquisition of undervalued instruments. Emphasis is placed on assessing credit risk of the issuer. Some of the available high-yield instruments include extendible/reset securities, increasing-rate notes, pay-in-kind securities, step-up coupon securities, split-coupon securities and usable bonds. *Fixed Income: Mortgage-Backed* funds invest in mortgage-backed securities. Many funds focus solely on AAA-rated bonds. Instruments include: government agency, government-sponsored enterprise, private-label fixed- or adjustable-rate mortgage pass-through securities, fixed- or adjustable-rate collateralized mortgage obligations (CMOs), real estate mortgage investment conduits (REMICs) and stripped mortgage-backed securities (SMBSs). Funds may look to capitalize on security-specific mispricings. Hedging of prepayment risk and interest rate risk is common. Leverage may be used, as well as futures, short sales and options.

Fund of Funds invest with multiple managers through funds or managed accounts. The strategy designs a diversified portfolio of managers with the objective of significantly lowering the risk (volatility) of investing with an individual manager. The Fund of Funds manager has discretion in choosing which strategies to invest in for the portfolio. A manager may allocate funds to numerous managers within a single strategy, or with numerous managers in multiple strategies. The minimum investment in a Fund of Funds may be lower than an investment in an individual hedge fund or managed account. The investor has the advantage of diversification among managers and styles with significantly less capital than investing with separate managers

Macro involves investing by making leveraged bets on anticipated price movements of stock markets, interest rates, foreign exchange and physical commodities. Macro managers employ a "top-down" global approach, and may invest in any markets using any instruments to participate in expected market movements. These movements may result from forecasted shifts in world economies, political fortunes or global supply and demand for resources, both physical and

financial. Exchange-traded and over-the-counter derivatives are often used to magnify these price movements.

Market Timing involves allocating assets among investments by switching into investments that appear to be beginning an uptrend, and switching out of investments that appear to be starting a downtrend. This primarily consists of switching between mutual funds and money markets. Typically, technical trend-following indicators are used to determine the direction of a fund and identify buy and sell signals. In an up move "buy signal," money is transferred from a money market fund into a mutual fund in an attempt to capture a capital gain. In a down move "sell signal," the assets in the mutual fund are sold and moved back into the money market for safe keeping until the next up move. The goal is to avoid being invested in mutual funds during a market decline.

Merger Arbitrage, sometimes called Risk Arbitrage, involves investment in event-driven situations such as leveraged buy-outs, mergers and hostile takeovers. Normally, the stock of an acquisition target appreciates while the acquiring company's stock decreases in value. These strategies generate returns by purchasing stock of the company being acquired, and in some instances, selling short the stock of the acquiring company. Managers may employ the use of equity options as a low-risk alternative to the outright purchase or sale of common stock. Most Merger Arbitrage funds hedge against market risk by purchasing S&P put options or put option spreads.

Relative Value Arbitrage attempts to take advantage of relative pricing discrepancies between instruments including equities, debt, options and futures. Managers may use mathematical, fundamental, or technical analysis to determine misvaluations. Securities may be mispriced relative to the underlying security, related securities, groups of securities, or the overall market. Many funds use leverage and seek opportunities globally. Arbitrage strategies include dividend arbitrage, pairs trading, options arbitrage and yield curve trading.

Sector (Total) includes the following:
Sector: Energy is a strategy that focuses on investment within the energy sector. Investments can be long and short in various instruments with funds either diversified across the entire sector or specializing within a sub-sector, i.e., oil field service. *Sector: Financial* is a strategy that invests in securities of bank holding companies, banks, thrifts, insurance companies, mortgage banks and various other financial services companies. *Sector: Healthcare/Biotechnology* funds invest in companies involved in the healthcare, pharmaceutical, biotechnology, and medical device areas. *Sector: Metals/Mining* funds invest in securities of companies primarily focused on mining, processing and dealing in precious metals and other commodities. Some funds may employ arbitrage strategies on a worldwide basis. *Sector: Real Estate* involves investing in securities of real estate investment trusts (REITs) and other real estate companies. Some funds may also invest directly in real estate property. *Sector: Technology* funds emphasize investment in securities of the technology arena. Some of the sub-sectors include multimedia, networking, PC producers, retailers, semiconductors, software, and telecommunications.

Short Selling involves the sale of a security not owned by the seller; a technique used to take advantage of an anticipated price decline. To effect a short sale, the seller borrows securities from a third party in order to make delivery to the purchaser. The seller returns the borrowed securities to the lender by purchasing the securities in the open market. If the seller can buy that stock back at a lower price, a profit results. If the price rises, however, a loss results. A short seller must generally pledge other securities or cash with the lender in an amount equal to the market price of the borrowed securities. This deposit may be increased or decreased in response to changes in the market price of the borrowed securities.

Exhibit 1

INVESTMENT CHARACTERISTICS (1/1990- 2/2003)

STRATEGY	RETURN*	RISK**
HFRI Convertible Arbitrage	11.71%	3.39%
HFRI Distressed Securities	14.64%	6.32%
HFRI Emerging Markets (Total)	14.74%	15.64%
HFRI Equity Hedge	18.36%	9.32%
HFRI Equity Market Neutral	10.23%	3.27%
HFRI Equity Market Neutral: Stat Arb	9.57%	4.05%
HFRI Equity Non-Hedge	15.58%	14.82%
HFRI Event Driven	14.39%	6.84%
HFRI Fixed Income (Total)	11.04%	3.63%
HFRI Fund of Funds	10.33%	5.90%
HFRI Macro	17.60%	8.73%
HFRI Market Timing	13.15%	6.93%
HFRI Merger Arbitrage	11.18%	4.48%
HFRI Relative Value	13.10%	3.78%
HFRI Sector (Total)	20.19%	14.32%
HFRI Short Selling	6.42%	22.61%

**As measured by annualized mean*
***As measured by standard deviation*

Exhibit 2

RISK-RETURN for HEDGE FUND STRATEGIES (1/1990- 2/2003)

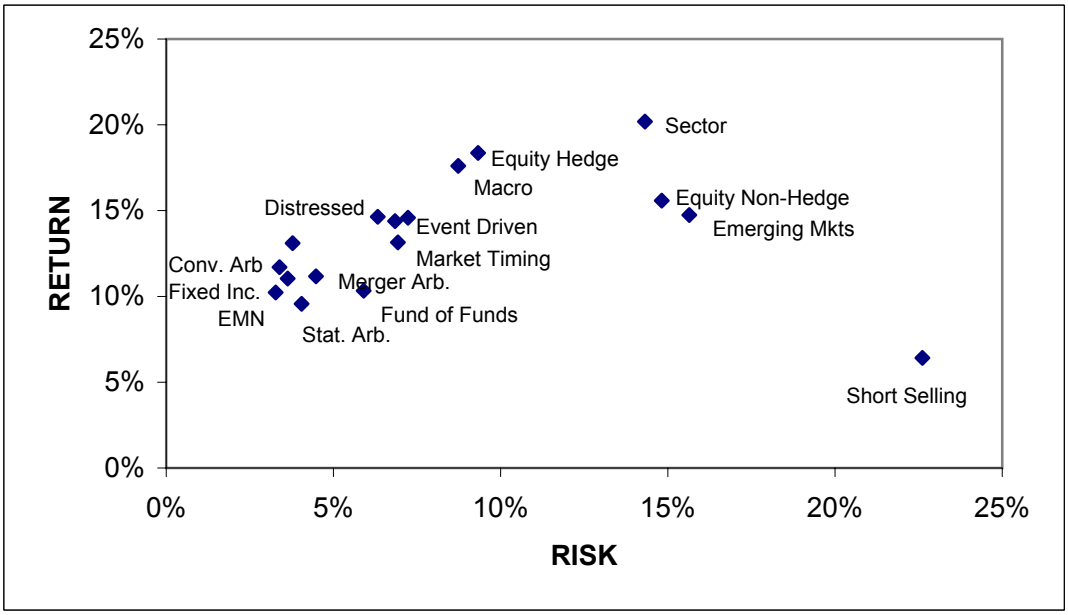
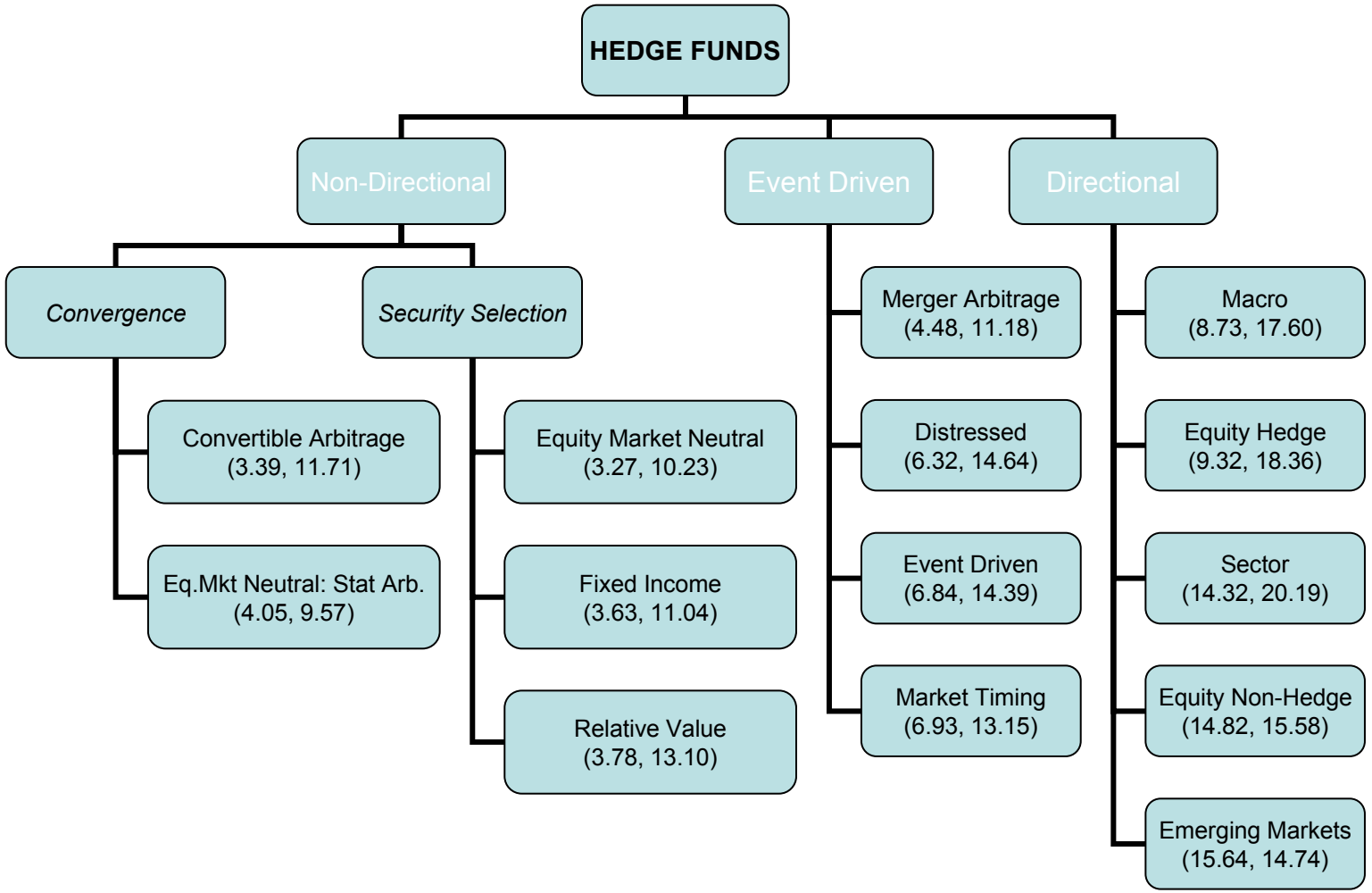


Exhibit 3

CLASSIFICATION of HEDGE FUND STRATEGIES



NOTES: Short Selling and Fund of Funds are not included. They are discussed as unique strategies in Section 3.

Risk and return characteristics are listed as coordinates in order of ascending risk for the strategies in each category.

Exhibit 4

CORRELATION MATRIX (1/1990- 2/2003)

	Convert. Arb.	Dist. Sec.	Emerging Mkts.	Equity Hedge	Eq. Mkt. Neutral	EMN Stat. Arb.	Eq. Non Hedge	Event Driven	Fixed Income	Fund of Funds	Macro	Market Timing	Merger Arb.	Relative Value	Sector	Short Selling
Convert. Arb.	1.00															
Distressed Sec.	0.57	1.00														
Emerging Mkts.	0.43	0.63	1.00													
Equity Hedge	0.45	0.58	0.64	1.00												
Eq. Mkt. Neutral	0.13	0.18	0.07	0.34	1.00											
EMN: Stat Arb	0.16	0.29	0.28	0.36	0.52	1.00										
Eq. Non-Hedge	0.46	0.62	0.69	0.89	0.19	0.41	1.00									
Event Driven	0.60	0.78	0.69	0.76	0.20	0.40	0.80	1.00								
Fixed Income	0.46	0.68	0.62	0.54	0.19	0.38	0.62	0.65	1.00							
Fund of Funds	0.47	0.58	0.73	0.75	0.32	0.25	0.63	0.64	0.54	1.00						
Macro	0.40	0.46	0.59	0.57	0.22	0.23	0.55	0.54	0.54	0.71	1.00					
Market Timing	0.28	0.34	0.52	0.69	0.17	0.36	0.73	0.51	0.34	0.51	0.49	1.00				
Merger Arb.	0.44	0.51	0.43	0.47	0.19	0.36	0.51	0.72	0.33	0.34	0.27	0.26	1.00			
Relative Value	0.55	0.70	0.49	0.52	0.21	0.26	0.51	0.64	0.57	0.48	0.36	0.25	0.43	1.00		
Sector	0.36	0.50	0.59	0.83	0.24	0.27	0.82	0.66	0.50	0.69	0.46	0.69	0.38	0.43	1.00	
Short Selling	-0.35	-0.47	-0.57	-0.79	-0.10	-0.29	-0.87	-0.63	-0.46	-0.50	-0.39	-0.72	-0.37	-0.38	-0.80	1.00

Exhibit 5
HEDGE FUND EFFICIENT FRONTIER (1/1990- 2/2003)

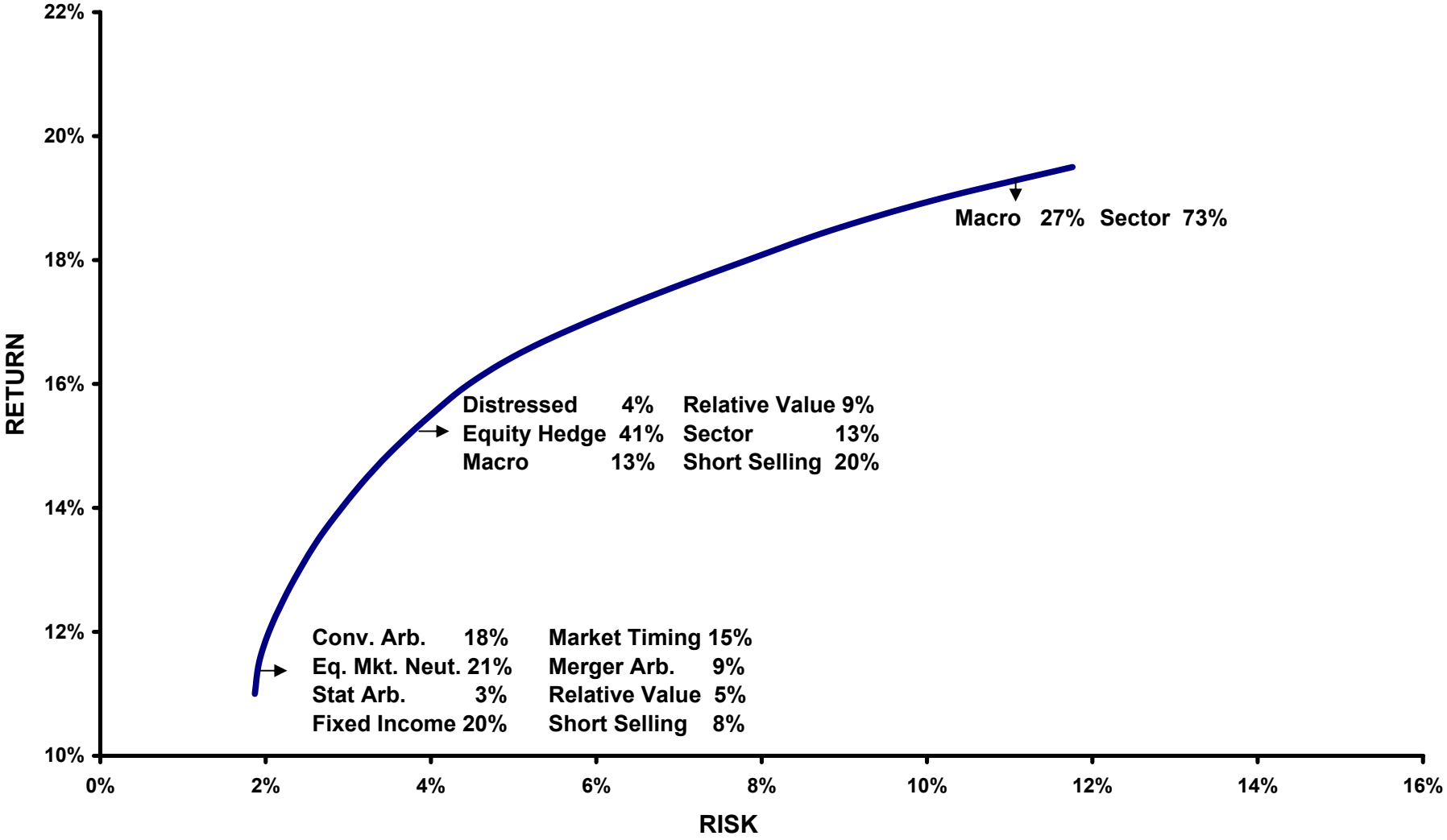


Exhibit 6

HEDGE FUND EFFICIENT FRONTIER and RISK-RETURN for HEDGE FUND STRATEGIES (1/1990- 2/2003)

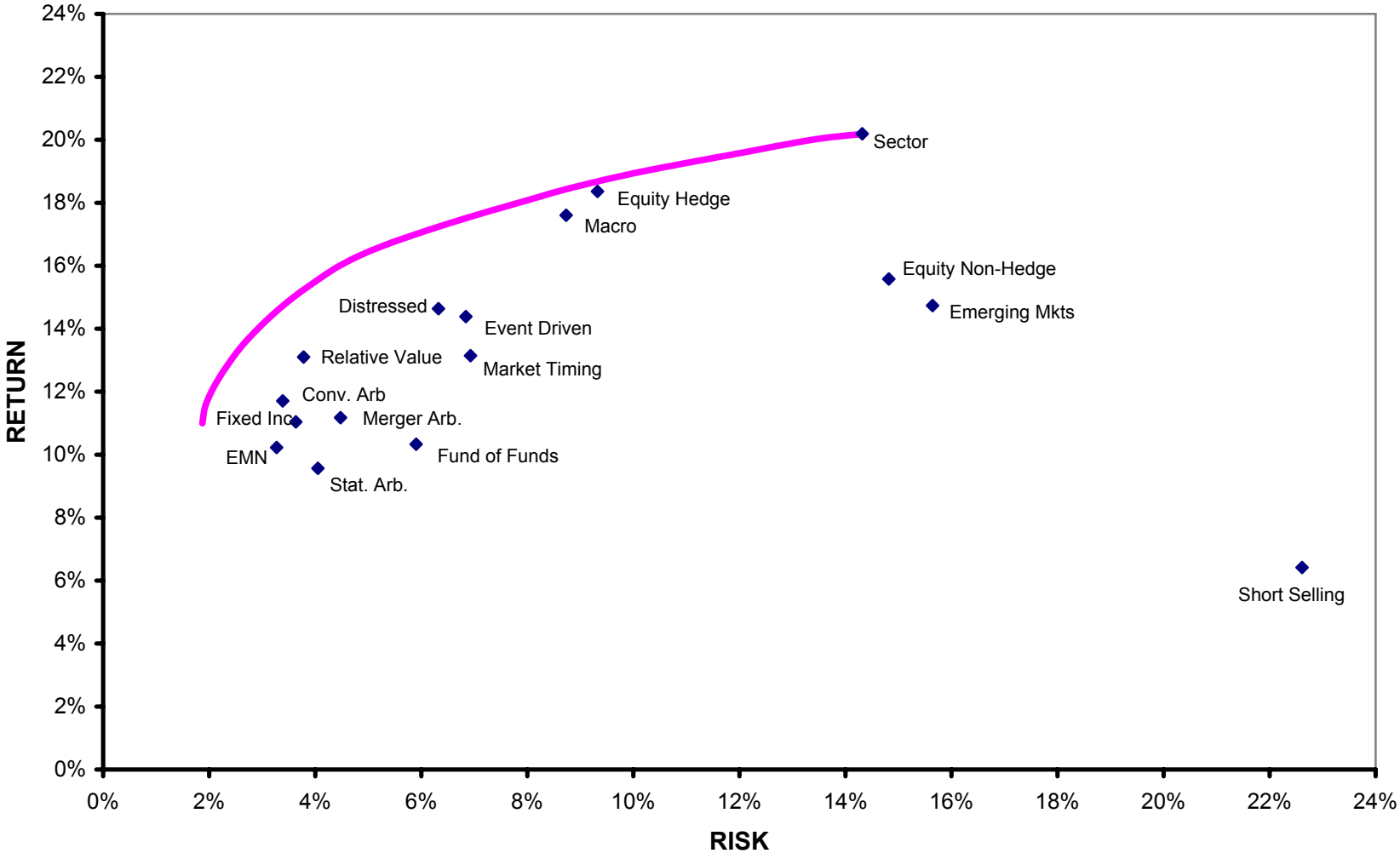


Exhibit 7

SELECTED PORTFOLIOS on the HEDGE FUND EFFICIENT FRONTIER (%)

Portfolio Return	Portfolio Risk	Conv. Arb.	Dist. Sec.	Equity Hedge	Eq. Mkt. Neutral	EMN Stat Arb.	Fixed Income	Macro	Mkt. Timing	Merger Arb.	Relative Value	Sector	Short Selling
11.00	1.87	17.88			21.43	3.04	20.36		15.00	9.39	4.87		8.02
11.50	1.92	16.70		0.27	16.50		14.43		17.62	7.65	15.97	1.84	9.02
12.00	2.04	16.27		5.26	11.37		10.53		17.43	5.81	19.67	2.97	10.69
12.50	2.21	15.83		10.23	6.18		6.66		17.26	3.95	23.41	4.10	12.37
13.00	2.41	15.26		14.22	1.73		2.26	1.23	16.78	2.43	27.10	5.18	13.83
13.50	2.64	12.37		18.61				3.11	14.90		29.52	6.41	15.09
14.00	2.92	5.08	0.93	23.44				5.51	11.54		29.26	7.90	16.33
14.50	3.23		1.96	28.45				7.97	7.34		27.20	9.57	17.50
15.00	3.59		2.62	34.10				10.73	1.42		21.08	11.54	18.52
15.50	4.00		4.21	40.18				13.35			8.97	13.39	19.91
16.00	4.46		1.54	45.91				16.78				15.21	20.56
16.50	5.08			44.79				21.69				16.74	16.78
17.00	5.89			42.66				26.59				18.23	12.51
17.50	6.82			40.54				31.50				19.72	8.24
18.00	7.83			38.42				36.40				21.21	3.97
18.50	8.89			35.19				40.50				24.30	
19.00	10.18			17.18				33.90				48.91	
19.50	11.76							26.72				73.28	
20.00	13.57							7.40				92.60	