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Hedge Funds from the Institutional Investor's Perspective

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Abstract

As a consequence of entering a more mature stage, the hedge fund industry has extended its investor base to institutional investors, who are now faced with a large number of product offerings including not only single hedge funds, but also funds of funds and, more recently, investable indexes. Although the existing literature seems to concur on the interest of hedge funds as valuable investment alternatives, there still remain a large a large number of institutional investors who wonder whether they should invest in hedge funds, and more importantly, how they should do it. In order to address these questions, this chapter looks at the risk factors in hedge fund strategies and attempts to assess the diversification benefits investors can expect from allocating part of their wealth to hedge funds. In addition, this chapter structures the different uses of hedge funds by proposing a separation into the tasks of alpha management and beta management. For both of these tasks, indexes that give a true and fair view of particular hedge fund strategies are a necessary tool for the investor. Therefore, this chapter also considers construction methods that allow designing investable hedge fund indexes that keep all defining properties for a good index. Finally, a simplified approach that allows institutional investors to use such indexes in order to optimally exploit the diversification properties of different hedge fund strategies is presented.

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Foreword

While a large proportion of institutional investors have started to invest part of their wealth with hedge funds, an outstanding question is how access to hedge funds should optimally be gained. In order to address this question, this chapter first reviews the characteristics of hedge fund strategies. This includes looking at the risk factor exposure and diversification benefits of hedge funds, as well as their different uses in the context of a core-satellite approach to institutional money management. It then goes on to discuss the challenges involved in the practical implementation of a sound investment process that allows institutional investors to optimally exploit the diversification properties of different hedge fund strategies. This approach is based on construction of investible hedge fund indexes and their use for simplifying the integration of hedge funds in the investor's strategic asset allocation.

Introduction

With currently almost one trillion US dollars in assets under management, hedge funds have seen impressive growth over the past decade and providers of such investment vehicles do not lack arguments why investors should try to gain exposure to hedge funds.[1] From an initial phase, where some high net worth individuals invested in hedge funds, the industry made it into the mainstream as more and more institutional investors have started allocating to, or at least looking at, hedge funds as a distinct asset class.

The interest from institutional investors comes at a time when they try and find solutions to recover after having been dramatically affected by downturns in the equity market. This is especially true for institutions where declining interest rates have increased liabilities at the same time as assets were reduced. These market events, in addition to questioning the current investment practices of institutional investors in general, and pension funds in particular, have put the emphasis on alternatives to stocks and bonds, such as hedge funds.

From a conceptual standpoint, hedge funds are nothing but vehicles that allow investors to gain an access to the benefits of very active investment strategies which previously were only accessible to investment banks through proprietary trading activities. Hedge funds can be seen as the ultimate organisational form for such strategies since they have a flexible legal structure, are only lightly regulated, and give strong incentives for manager performance. This organisation allows for liberty in investment decisions such as using derivatives, short selling and leverage, and investing in illiquid securities. The most important characteristic of a hedge fund is probably that the manager typically does not have to tie his performance to that of a reference benchmark, such as a market index or a peer group of managers. This is a notable difference to most mutual funds.[2]

The classic argument of hedge fund providers for investing in such structures is the claim that they provide investors with access to skilled managers. Sophisticated (institutional) investors are usually cautious with regards to this argument, as is anyone who believes that markets are efficient most of the time; and thus hard to beat even by skilled individuals. A more widely accepted proposition is that because hedge funds offer risk and return characteristics that are different from traditional investment opportunities, they enable investors to diversify their portfolio. This claim understands the different types of risks hedge funds are exposed to as an opportunity for diversification.

In addition, recent academic research has put forward some more subtle arguments in favour of hedge funds. First, hedge funds that dynamically shift their holdings between different asset classes allow investors to access the benefits of dynamically constructed portfolios while simply using well-known static portfolio construction tools (see e.g. Bansal, Dahlquist and Harvey (2004)). Second, hedge funds may allow investors to take risks that which are only held by a small number of people and thus perceive particular high risk premiums (for more on this *segmented markets hypothesis*, see e.g. Cochrane (1997)). In fact, while a large portion of the population holds stock market risk, even though to a lesser degree in the case of small cap and emerging market stocks, hedge fund managers may have access to less widely held instruments whose risks are more attractively rewarded.
For the institutional investor, the reasons behind potential benefits of hedge funds are only of second order importance. His first and foremost questions are whether these benefits exist and how they can be achieved. These questions are the focus of the present chapter. Therefore, we address the topic of immediate interest and ask if investors can benefit from including hedge funds in their global portfolio. In practice, different approaches

[1] According to the 2004 Alternative Fund Service Review Survey, as reported in the weekly publication International Fund Investment, issue 116, May 17th, 2004

[2] It should however be noted that absolute return benchmarks (such as risk-free rate plus x basis points) are typically used. Furthermore, benchmarking of hedge fund returns though peer grouping is becoming more and more common practice.

of investing into hedge funds exist. Strategic (inclusion of hedge funds styles in the strategic benchmark) and tactical (timing of style exposure) allocation and manager selection are seen as non-exclusive ways of capturing the benefits of hedge fund exposure. Likewise, providers of hedge fund products offer different ways of access to this asset class. In addition to choosing one or several single hedge funds, institutional investors may place their wealth with one or several fund(s) of funds, i.e., in managed portfolios of single hedge funds. More recently, investable hedge fund indexes have appeared, trying to build on the passive investing argument that a lot of institutional investors are familiar and comfortable with from their equity portfolios. In light of this multitude of usages and means of access to hedge funds, this chapter asks what form the inclusion of hedge funds should take.

In the rest of the chapter, we look at the most widely used hedge fund strategies, notably three equity based strategies (Equity Market Neutral, Long/Short Equity, Event Driven), one with focus on fixed-income instruments (Convertible Arbitrage) and one that uses all types of assets including currencies and commodities (CTA /Global Macro). According to CSFB Tremont, these five strategies made up 91 percent of assets under management in the hedge fund industry at the end of 2003. Likewise, in the CISDM hedge fund database, funds in these strategies constitute 85 percent of total assets under management by single hedge funds. As a proxy for the return on these hedge fund strategies, we use the *Edhec Alternative Indexes*.[3] Each of these indexes can be thought of as the best one-dimensional summary of the information contained in competing hedge fund indexes for the corresponding strategy.[4] To represent stocks and bonds, we choose the MSCI World indexes for equity and for sovereign bonds. This has the advantage of including the benefits of international diversification in the stock and bond returns. The sample period we consider starts in January 1997, which is the starting date for Edhec Alternative Indexes, and ends in August 2004.[5]

The chapter is organised as follows. Section one considers the risks involved in hedge fund strategies. Section two documents the diversification properties that stem from these risk factors and looks at the resulting benefits. Section three structures the different usages of hedge funds by separately discussing the tasks of alpha and beta management. Section four shows how hedge fund indexes can be used in either of these tasks and discusses some of the problems linked to such indexes and section five describes a simplified way of benefiting from the diversification properties of hedge funds in an optimal way. Finally, some conclusions are provided.

1. Risks in Hedge Fund Strategies

1.1. Characteristics of hedge fund returns

A common claim among promoters of hedge fund products is that these investment vehicles generate “absolute returns”. This term is used to describe investment strategies that constantly generate positive returns above the riskfree rate, whatever the prevailing economic conditions and without being exposed to major drawdowns of the stock or bond markets. Such a proposition is obviously tempting to investors for two reasons. First, as a direct consequence of stable performance, such a strategy will exhibit low levels of volatility. Second, such an absence of exposure to extreme market events as well as to market rallies means that the correlation of returns with stock and bond investments will be low, leading to potential diversification benefits.

Looking at historical returns data, investors can easily see, however, that hedge funds are definitely not absolute return investments that deliver positive returns every month. Table 1 reports a number of summary measures of returns for hedge funds as well as for stocks and bonds. It is apparent that returns show significant dispersion even though that dispersion is lower than for traditional asset classes, and notably stocks. The upper lines of table 1 show the most basic performance measures, i.e., the mean return, volatility and the Sharpe ratio of the respective index. The Sharpe ratio states the expected return over the risk free rate earned per unit of expected risk, where risk is defined as the standard deviation of returns. One observes that all hedge fund indexes have Sharpe ratios that are largely superior to both stock and bond indexes. In addition, one sees that the Sharpe ratios of about 1.3 for the strategies that are strongly related to the equity market (Event Driven and Long/Short Equity) are notably lower than those obtained from Equity Market Neutral and non-equity related strategies (Convertible Arbitrage and CTA/Global Macro). In addition, from the first and second line of Table 1, it becomes clear that the good Sharpe ratios of the hedge fund indexes come from extremely low volatility. In fact four out of five strategies have volatilities that are below bond returns volatility, in some cases about half as high as bond returns volatility.

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[3] In the case of Global Macro and CTA, we construct a portfolio that is equal weighted in the indexes for these two strategies.
[4] For more information, see www.edhec-risk.com , where monthly data on Edhec Alternative Indexes can be downloaded, as well as Amenc and Martellini (2003).
[5] Monthly returns data over the sample period is collected from the edhec-risk.com website and from DataStream, respectively.

Table 1: Summary Statistics. *The table shows performance measures and summary statistics calculated for 5 Edhec indexes, MSCI World Equity, MSCI World Sovereign Bonds. Based on monthly returns for the period 01:1997-08:2004*

	Equity Market Neutral	Convertible Arbitrage	CTA/ Global Macro	Event Driven	Long/ Short Equity	MSCI World Equity	MSCI World Bonds
Annualised Mean Return	10.4%	12.0%	12.0%	11.8%	12.8%	6.7%	6.5%
Annualised Volatility	2.2%	3.8%	4.2%	6.1%	7.6%	16.2%	7.0%
Sharpe Ratio (Risk free rate=3%)	3.4	2.3	2.1	1.4	1.3	0.2	0.5
% of Month with negative returns	5%	14%	18%	21%	30%	45%	46%
Minimum monthly Return	-1.1%	-3.2%	-2.9%	-8.9%	-5.5%	-13.8%	-3.3%
Sortino Ratio (MAR = 3% p.a.)	2.81	0.96	1.22	0.50	0.75	0.16	0.52
Modified Value-at-Risk (99%)	0.6%	2.6%	3.4%	7.2%	4.4%	11.8%	3.7%

Table 1 also reports downside risk measures. These give a more direct idea of how hedge funds fulfil the claim of being capital preservers. It can be seen that the percentage of months with negative returns for hedge funds differs impressively from that of stocks and bonds. The hedge fund indexes have negative returns between 5% to 30% of the months over this period, while both stocks and bonds show negative returns in almost half of the months studied. This also gives a completely different picture of the riskiness of bonds than what was suggested through low volatility estimates. Looking at the magnitude of the most negative return further reveals that the hedge fund indexes did not have over the sample period any "crash" months, which stands in sharp contrast to stocks which posted a dramatic –13.8% in October 1998. For Equity Market Neutral, Convertible Arbitrage and CTA/Global Macro returns in the worst month are even more favourable than they are in the worst months for bonds. The Sortino ratio, which replaces the volatility in the Sharpe ratio with a measure of downside deviations from a target returns, confirms the superiority of hedge funds over traditional asset classes. The Sortino ratios for hedge fund indexes are uniformly superior to the MSCI World index, even though this index is not exposed to drawdowns of stocks in a particular country, but already diversifies between the stock markets of all developed economies of the world. In addition, four out of five hedge fund strategies show higher Sortino ratios than the bond index and one strategy (Event Driven) has a Sortino ratio that is comparable to bonds. Estimates of the monthly Value-at-Risk (VaR), i.e. the maximum monthly loss with 99% confidence, are indicated in the last line of table 1[6]. These estimates reveal that the maximum loss expected for three out of five hedge fund strategies is comparable to that expected for the bond index. The Equity Market Neutral index has an extremely low VaR estimate of 0.6%. On the other hand, the Event Driven index has a VaR estimate that is considerably higher than that for bonds but still lower than the VaR estimate for the stock index. While the performance measures reported here seem to be favourable for the different hedge fund strategies, the considerable variation of their returns shows that they do not deliver riskless or "absolute" returns.

A more fundamental reason for the claim that hedge funds deliver absolute returns, is that, allegedly, hedge funds offer positive returns over the riskfree rate without being exposed to market risk. The rationale is that the excess return generated by hedge funds constitutes a remuneration of manager skill, or alpha, rather than a reward for taking on risks. However, this conclusion depends on specific assumptions, that are not necessary valid. In order for the riskfree rate to be a good benchmark of hedge fund returns, a given hedge fund investment must have a zero exposure to market risk and market risk must be the only existing rewarded risk factor. In other words, the single factor CAPM must hold and the investment's beta has to be zero. As a matter of fact, beta neutrality is not given for most hedge fund strategies. Even the strategies that claim to be market neutral usually have a low beta, but rarely have a beta of zero. More importantly, there is a consensus among academics and practitioners that multiple rewarded risk factors exist in financial markets. This has led to the development of multifactor models such as those commercialised by Barra or APT. The most salient risk factors in addition to the market factor are the value and small cap factors used in the Fama-French three-factor model. In addition, changes in volatility and credit spreads have been found to have an impact on asset returns. Therefore, the excess return above the risk-free rate would only be a measure of skill for a manager if the given investment has zero exposure to all these risk factors. A growing literature on risk factors for hedge fund strategies shows that these investments are exposed to a wide range of risk factors (see e.g. Fung and Hsieh (1997) or Agarwal and Naik (2004)). These risk factors tend to be different from the ones traditional asset classes are exposed to. What is more, they tend to differ among different hedge fund strategies. It turns out that the risk factor exposure actually explains some of the favourable properties of hedge funds as an investment vehicle.

[6] See section two of this chapter for details on our VaR calculation.

The argument of absolute returns distracts the attention from the risks inherent in hedge funds. This is not helpful for an investor who seeks to understand the precise nature of risks of a given strategy. Funds of hedge funds, for example, typically show low realised volatility or low levels of target volatility. This low volatility is linked a lot more to diversification between different hedge fund strategies (and their different underlying risk factors) than to low volatility of the component single hedge funds. Furthermore, it is well know that simple risk measures such as volatility do not allow the dynamic and non-linear dimensions of hedge fund risks to be accounted for (see for example Lo (2001)). Likewise, low correlation does not mean that hedge funds offer "absolute returns". The low correlation of hedge fund returns with equity and bond returns can be linked to their exposure to these risk factors that are different from the risk factors driving stock and bond returns.

1.2. Exposure to risk factors

After stating that hedge fund returns are varying as a function of the varying risk premia related to the risk factors they are exposed to, it is appropriate to analyse in detail how different hedge fund strategies are exposed to multiple risk factors.

The general features of a hedge fund include a number of risk/return characteristics that are directly linked to the investment freedom hedge fund managers enjoy. The possibility to invest in derivatives, for example leads to non-linear risk exposures. The dynamic nature of the strategies followed by hedge funds leads to the same effect, even if no derivatives are used. The example of event driven strategies illustrates this point. Merger arbitrage is probably the most well known example of an event driven strategy. Merger arbitrage managers bet on the realisation of merger deals that have been announced but have not been concluded definitely. These managers actually take positions that are not dissimilar to a short put position on the equity market (see Mitchell and Pulvino (2001)). This amounts to stating that the returns of merger arbitrage hedge funds do depend on the returns of the equity market, albeit in a non-linear way. In rising equity markets, performance of merger arbitrage funds is usually constant and positive, but in adverse equity market conditions returns become negative and dependent upon the market return. This is because merger arbitrage strategies bet on the realisation of merger deals and collect a risk premium from insuring the risk of deal failure, which arises with higher probability in down markets.

In addition to allowing investors to gain non-linear exposure to risk factors, hedge funds may provide access to additional sources of risk. As an example, take volatility risk. A buy-and-hold position in a stock index will not be exposed to a risk of changes in expected or realized volatility. The value of an option on this index, on the other hand, depends crucially on the level in volatility and the option position is thus exposed to changes in volatility over time. A call option, that gives its holder the right, but not the obligation, to buy the underlying index, will rise in value if volatility rises, as the chances of obtaining very positive outcomes in the index is higher. That the chances of very negative outcomes increases as well with an increase in volatility does not matter to the option holder as any outcome below the exercise price leads to an option payoff of zero, irrespective of how negative it is.

In order to obtain a more precise idea of the risks factors underlying each strategy and the nature of the dependency, we look at correlation coefficients of hedge fund index returns with a number of risk factors. We specify ten factors that constitute sources of risk in financial markets. For factors related to equity markets, we use the change in implied volatility of equity index options as measured by the VIX index, the value vs. growth and small cap vs. large cap returns differentials and equity market returns as measured by the returns of the S&P 500 index. Factors reflecting the conditions in the bond markets are the term and the credit spread, mean and volatility of Treasury bond returns and Treasury Bill returns. In addition, we consider exposure to commodity prices. Appendix 1 describes the proxies used for each factor in more detail.

The following table shows the risk factors that influence each strategy. It shows the correlation coefficients for factors to which the hedge fund strategy has significant exposure.

Table 2: Risk Exposure of Hedge Fund Strategies. *The table shows the dependency of strategy returns on 10 risk factors. First, we run a univariate OLS regression of strategy returns onto factor values. Factors with slope coefficients that are significantly different (with a p-value of 5%) from zero are kept; the others are discarded. Correlation coefficients are reported for the factors we keep. The data used are end of month values for the time period 01:1997 to 08:2004.*

	Equity Factors				*Bond Factors*					*Others*
	Change in VIX	Value vs. Growth	Small Cap vs. Large Cap	S&P 500 Return	Term Spread	Credit Spread	Bond return	Historical Volatility of Bond Returns	T-Bill 3 months	Commodity Index
Equity Market Neutral	-0.22	-	0.25	0.42	-0.45	-0.34	0.20	-	0.48	-
Convertible Arbitrage	-	-		0.19	-0.18	-	-	-	0.23	-
Long/Short Equity	-0.51	-0.21	0.32	0.74	-0.17	-0.32	-	-	0.17	-
Event Driven	-0.55	-	0.33	0.65	-	-0.23	-	-	-	-
CTA / Global Macro	-	-	-	-	-	-	0.45	-0.28	-	0.21

From this table, one sees immediately that most strategies are exposed to equity market risk (S&P 500 Return). In fact, all strategies except CTA/Global Macro have a significant and positive exposure to the market return. Looking at the equity-based strategies (Equity Market Neutral, Long/Short Equity and Event Driven), one notes that the small-caps versus large caps spread has a positive and significant impact, suggesting that part of the returns of these managers comes from holding small cap stocks and taking on the associated risks. This can be explained by the fact that it is harder to implement short position on small cap stocks than is the case for large cap stocks, so that most equity hedge fund managers end up with a long position in the small cap versus large cap spread. Likewise, changes in market volatility impact on the returns of all three equity-based strategies. For the case of Event Driven, this is consistent with the above-mentioned description of these strategies (notably merger arbitrage) as a position in a put option. The sign of the correlation coefficient is negative, as expected, since a short put position looses money in times of rising volatility. It can be seen that Long/Short Equity and Equity Market Neutral managers have the same type of exposure to volatility risk. This shows that short Vega strategies, as described above, may be employed by a wide number of Equity Market Neutral Managers. For Long/Short Equity, there is a negative relation with the value vs. growth differential, suggesting that a systematic long/short strategy that buys growth stocks and sells value stocks explains part of the returns of Long/Short Equity managers.

Interestingly, all equity-based strategies are negatively affected by the credit spread, i.e., the difference in yield-to-maturity between corporate and treasury bonds. This suggests that managers following these strategies hold long positions in stocks with high exposure to default risk and short positions in stocks with low credit risk; which is somewhat consistent with them holding long positions in the small cap versus large cap spread. The yield of T-Bills affects a number of strategies since these can benefit from an increase in short-term interest rates due to their short positions. A number of strategies benefit from flattening of the yield curve, or high bond market returns. Low levels of bond returns volatility typically negatively influence CTA/ Global Macro managers. Their returns also depend on prices in commodity markets.

The conclusion from analysing the characteristics of hedge fund strategies and testing their exposure to risk factors is that hedge funds, rather than being absolute return vehicles, clearly show significant exposure to a variety of risk factors. However, rather than seeing this as a drawback, an investor may actually derive benefits from such multiple risk exposures. Hedge fund strategies offer return characteristics that are undeniably different from investments in stocks and bonds. The resulting question for an investor is how this can be used to improve the diversification of his overall portfolio. Therefore, the impact of adding such strategies to a diversified portfolio is analysed in the following section.

2. Diversification Benefits

The motivation behind investing in hedge funds becomes immediately clear from the relatively favourable risk and return characteristics shown in table 1. More precisely, hedge funds exhibit both low volatility and low downside risk, while achieving returns that are considerably above those for bonds. Investors looking for capital preservation would naturally favour investments that generate stable positive returns. The assessment of the stand-alone benefits would ultimately suggest that an investor should replace its stock and bond portfolio by a portfolio of hedge funds.

However, instead of looking at investing in hedge funds from a standalone basis as an alternative to stocks and bonds, a more pertinent question is to ask what benefits arise from investing in hedge funds in a portfolio context, as an addition to stocks and bonds. From a practical perspective, any investor tries to avoid dramatic shifts in his allocation, since these lead to high transaction costs. Furthermore, most investors are only beginning to build up experience in the area of hedge fund investing and are thus unwilling to allocate more than a small part to this new type of investment vehicle. From a theoretical perspective, the choice between investment opportunities has to take into account portfolio effects. It is indeed well known that adding a stock with low returns and high volatility to a portfolio of stocks may provide benefits if it has low correlation with the existing components. Therefore the focus is on mixing, not on choosing between alternatives. We now turn to an analysis of funds in the portfolio context. From table 2 above, it can be seen that hedge funds offer risk exposure that differs from those an investor can achieve by holding stocks and bonds, and thus have low correlation with these assets. Therefore, adding hedge funds to a portfolio composed of such traditional assets allows for diversification benefits, which are analysed in more detail below.

2.1. Conditional Correlations

It is a well-known empirical fact that the dependencies of financial assets are neither constant over time nor across states of the world. In other words, these correlations are both time- and state-dependent. In particular, dependencies tend to be higher in times of market downturns and it has been shown that correlations between equity markets in different countries increases significantly in negative environments (see Longin and Solnik (1995)). Therefore, diversification benefits assessed over the whole time period may not reflect the benefits investors get in times of market turmoil, that is when they are most valuable. In other words, the unconditional diversification benefits may not hold conditionally as dependence conditional on down markets may be higher than unconditional dependence.

Table 3 assesses the dependence in two states of the equity market, namely negative or positive returns. The results are shown both with hedge fund indexes and with equity market indexes for different countries. The Beta with the MSCI World index was chosen as the measure of dependence. This can be justified by the fact that beta gives an idea of the marginal risk of an asset, i.e., of its contribution to the volatility of a portfolio and therefore it has a more direct interpretation than the correlation coefficient when assessing diversification benefits.

Table 3: Conditional Betas*. Betas with the market conditional on market returns. Based on monthly returns for the period 01:1997 – 08:2004. "Up" indicates months with positive of the MSCI World index, "Down" indicates months with negative returns for the MSCI World index.*

	Up	Down		Up	Down
Equity Market Neutral	0.06	0.06	MSCI Japan	0.35	0.55
Convertible Arbitrage	0.09	0.07	MSCI Germany	1.16	1.34
CTA/Global Macro	0.09	0.09	MSCI USA	1.05	0.79
Event Driven	0.13	0.33	MSCI Emerging Markets	0.67	1.22
Long/Short Equity	0.28	0.34	MSCI France	0.99	1.02
			MSCI UK	0.65	0.86

Table 3 shows betas calculated using the returns during months with positive returns ("Up") and negative returns ("Down") for the MSCI World index. From a comparison of the values for hedge funds (the two left hand columns) with the values for international equity (the two right hand columns), two conclusions can be drawn. First, the betas of hedge funds with the world equity market are significantly lower than the betas of country indexes. Most betas for hedge fund strategy are actually lower than 0.1 while the minimum of the betas for country indexes is 0.35. Second, the down market betas of hedge funds stay below 0.4 for all strategies, which is still lower than the up market betas of international equity. More importantly, it should be noted that for most

international equity indexes betas significantly increase in down markets with respect to up market conditions. On the other hand, it is worth noting that four out of five hedge fund strategies have remarkably stable betas over the two market states. This lets us conclude that the diversification benefits of hedge funds hold in down markets and that diversification effects from hedge funds are more stable across different states of the market than those from international equity. In this respect, hedge funds constitute an answer to the bad conditional correlations of stock market investments in different countries.

2.2. Higher Moments

It has been stated that diversification benefits arise from low correlation, or low contribution to the volatility of the final portfolio. Likewise the standard performance measures used to report the summary measures for hedge fund returns essentially rely on the mean and volatility of the returns series. The exclusive focus on these dimensions poses problem, since it is well known that asset returns are not fully described by their mean and volatility (i.e., the first two moments of the return distribution). It is only under the restrictive assumption of normally distributed returns that the first two moments are a sufficient statistics for the whole distribution. For a normal distribution, the skewness coefficient (measure of asymmetry) is zero and the kurtosis (thickness of the tails) is three. Normally distributed returns are symmetric around the mean and extreme events such as returns above or below 3 standard deviations away from the mean have minuscule probability of occurrence (about 0.1%). This stands in sharp contrast with empirical properties of actual asset returns. For example, asymmetry is especially pronounced for option strategies or hedge funds using the latter and manifests itself in a skewness coefficient (third moment) different from zero. Likewise, extreme market events such as the 1987 stock market crash have emphasized the importance of considering the kurtosis (or fourth moment) of the return distribution.

Table 4 shows summary measures of the distributional properties of the monthly returns of hedge fund indexes and stock and bond indexes. The values for skewness and for the kurtosis in excess of three (the value of a normal distribution) show that asymmetry and fat tails are present in the distribution of returns of all hedge fund strategies. The Event Driven index exhibits the most pronounced differences from normality. Returns are left skewed with a coefficient of –2.1 and kurtosis is 10.4 higher than that of a normal distribution. This shows that the annualised mean returns of 12% and a standard deviation of 6% only give a very incomplete picture of the returns distribution. Investors take on the risk of extreme events (as shown by the kurtosis coefficient) and left-skewed returns. From the interpretation of event driven strategies as a short put position, these distributional properties seem particularly plausible. It can also be seen that the excess kurtosis and skewness of hedge fund index returns are more pronounced than those of stock and bond index returns. The two lower lines of table five reports the results of a formal test for normality, the Bera Jarque statistic and the associated probability. Statistically significant deviations from normality are noted with two asterisks. It can be seen that normality is rejected for three out of five hedge fund strategies but not for stocks or bonds.

Table 4: Deviations from Normal Distribution: *The table shows skewness and excess kurtosis coefficients as well as the Bera Jarque test statistic and associated probability levels for 5 Edhec indexes, MSCI World Equity, MSCI World Sovereign Bonds. Statistically significant deviations from normality at the 5% level are noted with two asterisks. Based on monthly data for the period 01:1997-08:2004*

	Equity Market Neutral	Convertible Arbitrage	CTA/ Global Macro	Event Driven	Long/ Short Equity	MSCI World Equity	MSCI World Bonds
Skewness	0.5	-1.1	0.2	-2.1	0.0	-0.6	0.5
Excess Kurtosis	0.6	2.4	1.5	10.4	1.0	0.1	-0.1
Bera Jarque	4.0	32.8	7.0	410.3	2.6	5.7	2.9
Probability	14%	0 **	0.03 **	0 **	27%	6%	24%

Since it is widely accepted that investors have a non-trivial preference over higher moments of the returns distribution, it is crucial to assess how an asset contributes to the different moments of the portfolio's return distribution. The betas for all four moments can be calculated. The second moment beta is the contribution of an asset to the second moment (volatility) of the portfolio when a small fraction of this asset is added. This corresponds to the standard CAPM beta commonly used in investment analysis. The third moment beta and fourth moment beta give the contribution to the portfolio's third and fourth moments. The table below shows values for the different betas for the most important hedge fund strategies, when adding these to a portfolio of equities or bonds. In general, the lower the beta for a given strategy, the higher the diversification benefits when adding this strategy to a portfolio of traditional assets. In a recent paper, Martellini and Ziemann (2004) have offered a detailed study of higher moment beta estimates and their interpretation in the context of portfolio analysis. In particular, they show that the addition of a small fraction of new asset (e.g., a hedge fund) to a

portfolio leads to a decrease in portfolio second moment (respectively, increase in portfolio third moment and decrease in portfolio fourth moment) if and only if the second moment (respectively, third moment and fourth moment) beta is less than 1 (see Martellini and Ziemann (2004) for more details).[7]

Table 5: Higher Moment Betas *of returns of several hedge fund strategies (as represented by EDHEC Alternative Indexes) with stock and bond returns (as represented by the MSCI World indexes for sovereign bonds and equity). Based on monthly returns for the period 01/1997 to 08/2004. The arithmetic average of returns for the CTA and Global Macro Indexes has been calculated to form an aggregate "CTA/Global Macro" index.*

	Convertible Arbitrage	CTA/ Global Macro	Event Driven	Long/ Short Equity	CTA/ Global Macro	MSCI World Bonds	MSCI World Equity
2nd Moment Beta with Equity	0.05	0.06	0.26	0.37	0.03	-0.08	1.00
2nd Moment Beta with Bonds	-0.07	0.00	-0.11	-0.05	0.23	1.00	-0.41
3rd Moment Beta with Equity	0.10	0.07	0.46	0.37	-0.09	-0.19	1.00
3rd Moment Beta with Bonds	-0.26	-0.07	-0.47	-0.68	0.42	1.00	-1.68
4th Moment Beta with Equity	0.11	0.07	0.36	0.38	-0.04	-0.11	1.00
4th Moment Beta with Bonds	-0.04	0.03	-0.05	0.06	0.33	1.00	-0.30

It can be seen that adding hedge funds to a portfolio of stocks and bonds not only allows volatility to be reduced (because of low correlation) but also allows asymmetry to be improved and extreme risks to be reduced (because of favourable co-kurtosis and co-skewness). Looking at such betas may help investors to choose the strategies they should invest in, depending on the initial portfolio they hold. For example, long/short equity appears to be a good diversifier for a bond investor, but not so much so for a stock investor, as consistent with intuition. As suggested by these diversification properties, the improvement in terms of risk and return from adding hedge fund strategies can be substantial.

2.3. Risk-Return Trade-Off

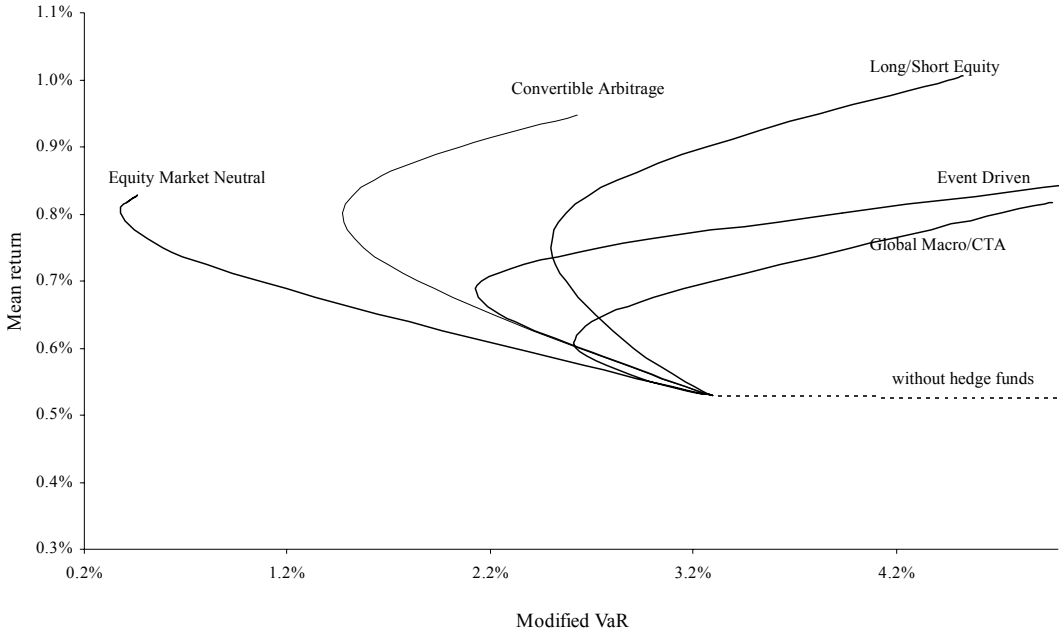
Broadly speaking, investors may gain benefits from including hedge funds in a broad portfolio of assets if the returns behave differently from the returns of the assets already included. The conditional betas from above suggest that hedge funds offer more stable diversification tools than international equity. Looking at higher order co-moments showed that hedge funds dispose of risk reducing properties when one considers skewness and kurtosis in addition to portfolio volatility.

The ultimate motivation for investors to include hedge fund strategies in his portfolio is an improvement of the risk return trade-off they face. Here, we assess the benefits of including hedge funds in a portfolio of stocks and bonds. As above, the proxies for stock and bond returns ate the MSCI World indexes. It is appropriate to stress that use of such worldwide indexes gives a conservative estimate of the diversification benefits from including hedge funds, as the stock and bond components of the portfolio are themselves already diversified across countries.

In order to address this question, we compute efficient frontiers using a risk measure that takes into account the first four moments of the returns distribution. To this end, we compute a Modified Value-at-Risk, which gives an estimate of the expected loss at a 99% confidence level. The Modified VaR is derived by using a critical value, which has been modified depending on the skewness and kurtosis of the returns distribution (for details on the Modified VaR see Zangari (1996)). Figure 1 shows the efficient frontiers in the mean / Value-at-Risk plane.

[7] The condition that an increase in portfolio skewness follows from a third moment beta lower than 1 is only valid in case the skwness of the portfolio is negative. When the skewness of the portfolio is positive, then the condition is that the the third moment beta is greater, as opposed to lower, than one.

Figure 1: Efficient Frontiers in Mean Value-at-Risk Plane, *The graph shows the resulting risk-return trade-off when a hedge fund strategy is added to the investor's asset menu of stocks and bonds. Value-at-Risk is estimated using a Cornish-Fisher expansion. The indexes used for hedge fund strategies are the 5 Edhec indexes. Stock and bond returns are proxied for by the returns of the MSCI World Equity and the MSCI World Sovereign Bonds index. Based on monthly returns data for the period 01:1997-08:2004.*



The line labelled "without hedge funds" shows portfolios that minimise the VaR of portfolio returns for a given level (mean) of returns. The other lines show this same frontier when it is possible for the investor to include different hedge fund strategies. It is easy to see that the risk/return trade-off achieved in the case with hedge funds is more favourable to the investor: The efficient frontier shifts in north-westerly direction, suggesting that hedge funds offer diversification benefits by means of their favourable co-moments with portfolios of traditional assets. The investor's opportunity set is improved in an important way as can be seen by the magnitude of the shift of the frontier compared to the case where only stocks and bonds are considered.

Also, from this figure, it is evident that the different strategies do not offer the same potential for diversifying a stock and bond portfolio. In fact, some strategies serve as return enhancers, i.e., they allow the investor to achieve higher returns for given levels of risk. Such is the case for CTA/Global Macro, Event Driven and Long/Short Equity strategies. On the upper right hand side of the graph, it can be seen that portfolios including these strategies offer particular high returns for high levels of risk. This may be appealing to investors that look at enhancing their returns. On the other hand, some strategies allow investors to significantly decrease risk levels. Such is the case for Equity Market Neutral and Convertible Arbitrage. These results are consistent with the statistical properties examined above in the sense that they emphasise the differences in diversification properties across styles.

3. Separating Alpha and Beta Management

3.1. Alpha and Beta Benefits

Acknowledging that hedge fund strategies are exposed to a range of risk factors allows one to establish that they may provide the investor with two types of rewards, just like in the case of any active investment strategy.

Modern portfolio theory suggests that excess return on a risky portfolio compared to the risk-free rate, as measured on a given sample, can, in general, come from three distinct sources, as described in the following equation:

Excess return on the portfolio = normal return + abnormal return + statistical noise

The first term, the "normal" return (or beta benefits), corresponds to the market's fair reward for the risks to which the portfolio is exposed. It is therefore a premium (or premium vector) for the risk(s), which can be evaluated with the help of a single factor model like the CAPM or with the help of a more general, multifactor model, justified on the theoretical side through equilibrium (Merton (1973)) or arbitrage (Ross (1976)) arguments.

As suggested by the analysis of risk factor exposure above, hedge funds offer different types of beta benefits, including:
• Traditional beta benefits, emanating from exposure to stock and bond returns
• "Alternative" beta benefits, emanating from exposure to other risk factors in equity markets (small cap vs. large cap spread, value vs. growth spread, implied volatility, etc.) and in the bond markets (term spread, credit spread, bond returns volatility, etc.)
• Other "alternative" beta benefits, such as commodity price levels, currency rates, etc.

While the first type of beta benefit does not improve the investor's set of investment choices, the two latter beta benefits expand the investor's risk taking opportunities.

The second term, the "abnormal" return (or alpha benefits), represents the fruit of the portfolio managers' expertise. Portfolio managers, through superior information or better ability to process commonly available information, sometimes manage to obtain additional profits that are not strictly justified in terms of exposure to rewarded risks. While the existence of such alpha, or skill term, is sometimes questioned, alternative betas should be regarded as more reliable, as they correspond to a fair reward for an exposure to a variety of risk factors (the volatility, or notably the credit, market).

In addition, as stated in the introduction, hedge funds have a range of organisational features that allow the manager to fully exploit his skill and thus offer ideal conditions for alpha generation. In particular, In fact, according to the fundamental law of active management, the performance of an active manager defined as the information ratio depends on the quality of the bets the manager takes, the number of bets he takes, and the tracking error constraints he faces (Grinold and Kahn (2000)). Therefore, the absence of a tracking error constraint allows a hedge fund manager to fully exploit his talent and ultimately increases the information ratio if manager talent is there.

Just as in the case of beta benefits, different sources of alpha may be distinguished:
• Alpha from security selection
• Alpha from timing the exposure to different risk factors

Since hedge funds offer both alpha and beta benefits, they constitute a diversification tool for strategic asset allocation decisions, but also a potential source of outperformance. This dual character of hedge fund benefits fits perfectly into the modern investment process that separates management of alphas and betas by organising the portfolio into a core and a satellite. The core-satellite approach separates beta management (choice and construction of a benchmark) and alpha management (management of active risk). This approach is used by institutional investors because of the following advantages it offers:

- Lower management fees of a passive core and an active satellite as compared to an active global portfolio with tight tracking error constraints (see for example Amenc, Malaise and Martellini (2004)).

- Access to specific expertise of specialised managers for alpha management (boutique managers or specialists) and beta management (index funds or passive mandates).
- Improved risk management by means of distinguishing the asset allocation decision in the core from the alpha generation in the satellite (relative risk management).

Below, we look at how hedge funds can be used in the separate tasks of beta and alpha management.

3.2. Beta Management

The beta exposure an investor wants to have for his portfolio defines his benchmark. The objective of such a benchmark is not to track a given index but rather to define the risk and return properties the investor considers as optimal over a long horizon. The risk return profile that is sought by the investor typically depends on his liabilities and/or on his preferences. The construction of a benchmark usually relies on a mix of generic indexes. In the case of hedge funds but also in the case of traditional asset classes, the investor may be confronted with two situations:

- If he does not dispose of the necessary expertise in terms of asset allocation, he will choose a global index. This index is supposed to represent the risk/return characteristics of a given asset class.
- If he wants to find the portfolio with the optimal risk/return trade-off, he will make an allocation decision among a subset of indexes. These indexes are supposed to be fully representative of the risks that the investor wants to be exposed to over a long investment horizon.

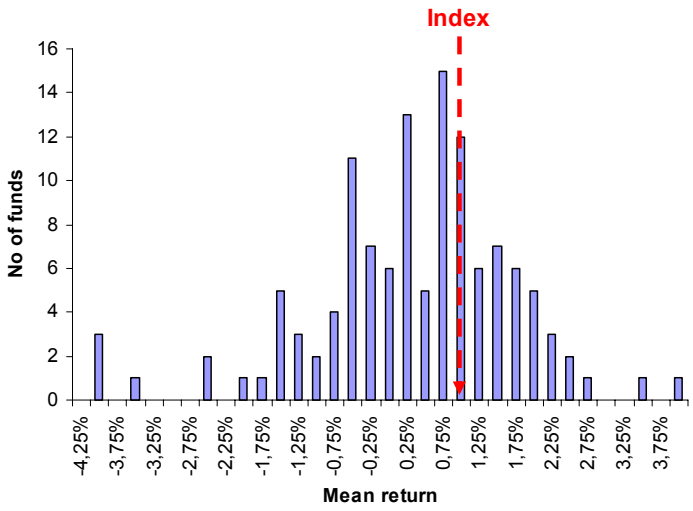
It has been shown that the benchmark or the strategic allocation of an investor constitutes the principal source of performance and of the risk of the portfolio over long investment horizons. This is a well-known result for funds investing into traditional asset classes but has been confirmed in the case of funds of hedge funds.

Indexes seem to be the natural investment vehicle for beta management. In equity investing, decisions such as transition management or management of cash inflows are usually dealt with by using index products. Likewise market timing and tactical asset allocation strategies are typically implemented with index futures or tracking funds. It is thus natural to associate beta management with indexes. However, investors may also choose to capture hedge funds' risk exposure by investing into single hedge funds or funds of funds. However, it turns out that the investor has good reasons to use indexes in his allocation decisions for two reasons.

Investing into a fund of hedge funds or choosing a portfolio of single hedge funds himself, the investor necessarily reduces his coverage of the hedge fund universe to a very limited proportion of the population. Typically, this is something that is done deliberately, as investors or fund of funds managers hope to select the good funds and avoid the bad funds. This selection decision, however, should be separated from the asset allocation decision, since the aim is no longer to optimise the risk return trade-off but to create outperformance, i.e., create alpha benefits.

In addition, it should be underlined that selection of funds leads to a major risk for the investor. Large dispersion in the returns of funds in a given hedge fund strategy can be observed historically (see figure 2). Therefore, choosing only a few funds may leave the investor with returns that no longer resemble the aggregate return of managers following that strategy. An investment in hedge fund indexes, on the other hand, protects the investor from this selection risk. Just like indexes for stocks or bonds, these indexes deliver the "normal" returns of the asset class or investment style.

Figure2: Cross-Sectional Dispersion of Long/Short Equity Hedge Fund Returns*, Distribution of mean return of funds in this strategy. The red arrow indicates the mean return of the Edhec Alternative Index for Long/Short Equity. Based on monthly returns for the period01/1998 - 12/2003 of 123 Long/Short Equity hedge funds in the CISDM database.*



In addition to a selection bias, a fund of hedge fund leaves the investor with an exposure to different hedge fund strategies that is a result of the fund manager's choice rather than the investor's choice. While the resulting allocation may not be optimal for a given investor, it also varies over time according to rebalancing done by the fund of funds. Therefore, in order to be in control of his allocation, the investor would prefer using hedge fund indexes.

The choice of including hedge funds in a portfolio does not mean that hedge funds belong to the satellite while traditional investments make up the core portfolio. The diversification benefits along with the risk factor exposure of hedge funds show that these investment vehicles have their place in the investor's core portfolio. Since hedge funds give access to the betas and risk premiums of additional risk factors, their inclusion is an explicit allocation choice that modifies the investor's benchmark, and not an attempt to enhance returns above the benchmark by adding a satellite component. In other words, allocation to hedge funds modifies the benchmark and in this respect adds no tracking error.

3.3. Alpha Management

Hedge funds have a privileged place in the satellite portfolios of institutional investors today. There are a number of reasons for this. First and foremost, investors that wish to maximise the use of their tracking error budget naturally wish to dispose of funds that are very active and above all, that generate positive alpha. In addition, since hedge funds have low correlation with the risks inherent in traditional asset classes, hedge fund portfolio can more easily be ported onto a different portfolio since strategic allocation of the overall portfolio may not be too significantly influenced. This is referred to as *portable alpha* benefits of hedge funds (see for example Fung and Hsieh (2004)).

For the purpose of alpha management, investors frequently turn to funds of funds in order to gain exposure to hedge funds. These funds of funds typically justify their fees by adding value from three sources:

- Fund picking, i.e. selection of the best single hedge funds
- Allocation between different hedge fund strategies
- Protection of principal through due diligence, risk monitoring and reporting

It is appropriate to underline that beta management is still important for these funds of hedge funds that concentrate on finding alpha benefits. They need to manage their strategy exposure when trying to avoid implicit style bets that result from manager selection.

A different way of generating alpha with hedge funds is by means of focusing on dynamically changing allocation to different hedge fund strategies. Such an investment strategy is a straightforward extension of dynamic allocation between different asset classes or investment styles that is known in the long-only universe as global tactical asset allocation programs. In a recent paper, Amenc, El Bied and Martellini (2003) provide encouraging evidence of predictability in hedge fund index returns through the use of (lagged) multi-factor models. With information on the past values of ten variables that proxy for market risk, volatility risk, default risk and liquidity risk, a significant amount of predictability is found for six out of nine hedge fund strategy indexes. Investors may take advantage of such predictability by using a timing strategy among various hedge fund strategies.

Obviously, some features of hedge fund investments prevent investors from actually implementing such a strategy. In particular, the absence of liquidity and the presence of lockup periods pose a problem. Therefore, inter-strategy tactical allocation offerings based on the predictability of hedge fund strategies have experienced little growth in the past. However, the availability of investable indexes that track the returns of different hedge fund strategies has encouraged the emergence of offerings of that kind.

4. Hedge Fund Indexes

For the tasks of strategic allocation and tactical allocation, investors need to rely hedge fund indexes that are both investable and representative. It has often been argued that two distinct purposes of indexes should be distinguished: an index can be used as a benchmark for investments in specific styles, instruments or locations; or it can be used as an investment vehicle. On the one hand, indexes that act as benchmarks have to be unambiguous, verifiable, accountable and representative. On the other hand, an investable index should enjoy the same properties, and, in addition, be investable. It is important to note that these requirements should be achieved at the same time: if an investable index fails at enjoying the defining properties for an index (unambiguous, verifiable, accountable and representative), it should not be called an index but rather a fund of hedge funds.

4.1. Representativity

Due to the scarcity of information, the logic of representativity through market capitalization is difficult to apply to hedge funds. As a result, finding a benchmark that is representative of a particular management universe is not a trivial problem. The different indexes available on the market are constructed from different data, according to diverse selection criteria and methods of construction, and they evolve at differing paces (see Amenc and Martellini (2003)). Because of this heterogeneity, investors cannot rely on competing hedge fund indexes to obtain a “true and fair” view of hedge fund performance. One serious problem is that existing hedge fund style indexes provide a somewhat confusing view of the alternative investment universe, because the collection of such indexes is neither collectively exhaustive, nor mutually exclusive. More specifically, hedge fund indexes are built from databases of individual fund returns, and therefore inherit their shortcomings in terms of scope and quality of data, which vary a lot among various data vendors. There are three main competing databases (TASS, CISDM, HFR) that are used by providers of hedge fund indexes. While all three databases are marred to some extend by the presence of the usual biases (survivorship, selection and instant history biases), they are far from being homogeneous in terms of population. For instance, HFR excludes managed futures from its databases while TASS and MAR take them into account. The majority of funds are present in one but not the other: of the 1,162 HFR funds and the 1,627 TASS funds, only 465 are common to both databases. 59% of the funds that are still in activity and 68% of the funds that no longer report to HFR are not part of the TASS database. Out of the 465 funds in common between the HFR and TASS databases, only 154 (or 33.1%) have been included in both databases at the same time.

As a result of the incompleteness and heterogeneity of hedge fund data, existing hedge fund indexes, which are built from that data, potentially suffer from the following two major shortcomings.

(i) Existing indexes are not fully representative.
In the one-factor CAPM world of the sixties and seventies, the notion of a good index was one that was representative of the value-weighted portfolio of all traded assets, and the real challenge was to provide investors with the closest approximation of the true market portfolio. The market cap logic, however, does not easily extend to the alternative investment universe. First, hedge funds are not submitted to reporting requirements so that information on the asset under management is very hard to gather with some degree of accuracy. This is the reason why all existing hedge fund indexes, to the notable exception of CSFB/Tremont, use an equally-weighted, as opposed to value-weighted, scheme. Beside, because of the lack of regulation on hedge fund performance disclosure, existing databases only cover a relatively small fraction of the hedge fund population. Probably only

a little more than half of existing hedge funds choose to self-report their performance to one of the major hedge fund databases. As simple evidence of the fact that existing indexes are not fully representative of the universe, it perhaps suffices to note that one of the most popular hedge fund indexes, the EACM 100, does not account for more than a tiny percentage of all existing hedge funds (100 among more than 7,000 funds).

(ii) Existing indexes are biased.
Most hedge fund indexes are based upon managers' self-proclaimed styles. Given that hedge fund managers jealously protect the secret of their investment strategies (the so-called black-box problem), relying on managers' self-proclaimed style is actually almost a necessity. The problem is that this procedure only makes sense under the following two conditions: a manager follows a unique investment style and a manager's self-proclaimed style matches the manager's actual trading strategies. Of course, none of these assumptions can be taken for granted. In particular, it is well documented that some significant style drift occurs; as opportunities eventually disappear in their original strategies, it is common practice for some hedge fund managers to start looking at other markets.

This diversity in selection criteria and methods of construction poses serious problems to investors. To see why, consider the return differences of competing indexes available on the market, reported in table 6. Significant performance differences for the same strategy are commonly observed between the different competing indexes. This phenomenon is particularly noticeable in periods of crisis (between August 1998 and October 1998). The heterogeneity of the information supplied by the different index providers is actually spectacular. More than 14% (on a monthly basis!) separates the performances of the CSFB and Altvest Global Macro indexes in October 1998. The increasing number of index providers and construction methods poses the problem of the heterogeneity of the data. It appears clearly that the competing hedge fund indexes do not today provide representativity and stability conditions that would allow investors a homogenous and relevant overview of hedge funds.

Table 6: Heterogeneity in competing hedge fund indexes. *Maximum return differences for indexes of competing providers in the same hedge fund strategy. The table indicates the maximum return difference between all pairs of indexes, the date of its occurrence and the indexes with the lowest and highest return in that month. Providers included are those included in computing the Edhec Alternative Indexes. Based on monthly returns for the period* 01/*1998 to 12/2003*

Hedge Fund Strategy	Max differences	Date	Lowest return	Highest return
Convertible Arbitrage	7.55%	Dec 01	EACM (-6.93%)	Hennessee (0.62%))
CTA	7.50%	Dec 00	Barclay (6.00%)	S&P (13.50%))
Global Macro	14.17%	Oct 98	CSFB (-11.55%)	Altvest (2.62%))
Equity Market Neutral	5.00%	Dec 99	Hennessee (0.20%)	Van Hedge (5.20%))
Event Driven	5.37%	Aug 98	CSFB (-11.77%)	S&P (-6.40%))
Long/Short Equity	9.51%	Feb 00	Altvest (3.50%)	CSFB (13.01%))

As a response to the needs of investors for more representative benchmarks, Edhec Risk and Asset Management Research Center has proposed an original solution by constructing an "index of indexes". Given that it is impossible to come up with an objective judgment on what is the best existing index, a natural idea consists of using some combination of competing indexes to reach a better understanding of what the common information about a given investment style would be. One straightforward method for obtaining a composite index based on various competing indexes would involve computing an equally-weighted portfolio of all competing indexes. This would obviously provide investors with a convenient one-dimensional summary of the contrasted information contained in competing indexes. In particular, because competing hedge fund indexes are based on different sets of hedge funds, the resulting portfolio of indexes would be more exhaustive than any of the competing indexes it is extracted from. We can push the logic one step further and use factor analysis techniques to extract the best possible one-dimensional summary of a set of competing indexes, and design indexes that can achieve the highest possible degree of representativity. This methodology, which is a natural generalization of the idea of taking a portfolio of competing indexes, was first introduced in Amenc and Martellini (2003), and has led to the design of so-called Edhec Alternative Indexes, which performance is posted on a dedicated web site (www.edhec-risk.com). These indexes have been used throughout this study to proxy the returns on various hedge fund strategies as they exhibit degrees of representativity and stability that are significantly higher than those of the indexes available on the market.

4.2. Investability

The concern over existing hedge fund indexes not being representative of the universe has been intensified by the recent launch of several investable hedge fund indexes. Indexes provided by S&P, HFR, CSFB/Tremont, FTSE or MSCI are among the best-known examples. The principal objective of these investable indexes is to allow abroad range of investors, access to alternative investment strategies at low cost. The objective of these indexes therefore differs from that of maximizing the representativity dimension by covering the largest possible number of funds. Instead, the priority is to choose a limited number of funds that are open to new investors and that guarantee a minimum investment capacity. In other words, these indexes are not intended to be used as a reference for the hedge fund market but to provide a convenient way of access to hedge funds. Obviously, the presence of these constraints suggests that investable hedge fund indexes will be even less representative of the universe than non-investable indexes. Investors, in the end, are left with investable products that are no longer indexes, which is unsatisfactory for both their beta management and their alpha management. For beta management, investable but non representative indexes mean that the risk and return of the investor's portfolio depends more on the quality of the provider's fund selection and the construction biases specific to the index than on the allocation decision of the investor. For alpha management through tactical allocation between hedge fund strategies, the mixture of strategies in a global index means that the investor cannot implement any bets between strategies. Likewise, strategy indexes that have a selection bias and do not represent the given strategy in a pure way deprive the investor of precise control of his strategy exposure. The success of investable hedge fund strategy indexes, and their differentiated positioning with funds of hedge funds, will therefore strongly depend on the capacity of index providers to improve the investability of their indexes without sacrificing the representativity dimension. This is not a trivial task because to be fully representative an index has to cover the whole universe or a whole strategy, including closed funds.

4.3. Reconciling Investability and Representativity

It is an interesting question whether designing investable indexes for hedge funds is a feasible task given the problems described above. In a recent academic study, Goltz, Martellini and Vaissié (2004) shed some light on this question by showing that it is possible to use the technique of factor replicating portfolios to construct representative indexes based on a limited number of funds. More precisely, representativity of portfolios of a small number of hedge funds is achieved by suitably selecting funds and optimally designing portfolios with the objective of replicating the common trend in hedge fund returns for a given strategy.

In what follows, we apply the same methodology to a case where the investor has access to a small database of hedge funds. This is important because in reality, an investor does not have access to the broad universe of funds included in a large database. Reasons for this include funds that are closed for new investment or may not be accessible for different reasons. Here, we use Lyxor database of 121 managed accounts.[8] This platform is widely used in the industry and guarantees high accessibility of the funds with daily liquidity in general.

The first question is how to best represent the common trend for a certain hedge fund strategy. Starting with the CISDM database of returns of 3,500 hedge funds, we are extracting the combination of individual funds that capture the largest possible fraction of the information contained in the data. Technically speaking, this amounts to using the first component of a Principal Component Analysis (PCA) of funds returns as a factor.[9] To this end, the natural selection criterion is the loading of individual funds on the *first principal component*. The higher the loading of a fund on the first principal component, the higher will be its contribution to the common trend in hedge fund returns following a given strategy. Given that the first *eigenvector* corresponding to the first principal component is determined as to maximize the variance of the corresponding linear combination of fund returns, high factor loadings will be allocated to funds which have been highly correlated with their group over the calibration period. Such funds should be the most representative of their group.

Selecting from Lyxor platform of managed accounts that is considerably smaller than the universe represented by the CISDM database, we then form factor replicating portfolios that track the principal component. As was suggested by Fung and Hsieh (1997) in a different context (hedge fund performance analysis), we keep in the selection stage only the funds in the Lyxor database that are highly correlated to the principal component (implicit factor) for which the replica is constructed. Having selected the funds, their portfolio weights are

[8] See http://www.lyxor.com for details on the managed account platform.

[9] The PCA of a time-series involves studying the correlation matrix of successive shocks. From a mathematical standpoint, it involves transforming a set of K correlated variables into a set of orthogonal variables, or implicit factors, which reproduces the original information present in the correlation structure. Each implicit factor is defined as a linear combination of original variables.

optimized so as to deliver the maximal correlation of the replicating portfolio returns with the corresponding principal component.

Using monthly returns data from October 2001 to September 2004, for each strategy, we choose eight to twelve funds that are closest to the first principal component extracted from the CISDM database and choose the portfolio weights that maximise correlation with the first principal component. We also constrain weights of individual funds to range from 5 to 20 percent. The correlation coefficients with the factor we try to replicate are reported in table 7.

Table 7: Representativity of Investable Indexes. *Correlation coefficients between returns of investable indexes and noninvestible indexes for a number of hedge fund strategies. Based on monthly returns for the period 10/2001 to 09/2004*

Investible Index	Correlation with First Principal Component
Convertible Arbitrage	0.912
CTA/Global Macro	0.963
Event Driven	0.866
Equity Market Neutral	0.626
Equity Long Short	0.937

For all strategies except Equity Market Neutral, the correlation of the replicating portfolios with the corresponding first principal component is close to 0.9. The portfolios of managed accounts created in this section can therefore be seen as investible indexes that capture the return characteristics of a large set of funds in the universe. This strongly suggests that representativity can be addressed with a very limited number of funds, provided that an adequate method that focuses on selecting representative funds is used in the design of the portfolios, as opposed to chasing high performing funds, which is a perfectly valid (albeit rather ambitious) objective for active funds of hedge funds, but not for providers of hedge fund indices.

5. Hedge Fund Diversification Benchmarks

There are different ways of using the type of investable hedge fund indexes presented in the section above. By their virtues of representativity of the risk exposure and return characteristics of a given hedge fund strategy, such indexes can be regarded as natural vehicles for beta management.[10] Therefore, they are an alternative to funds of hedge funds, which are perceived as alpha management vehicles, i.e., as parts of the satellite portfolio, with the aim of enhancing the return of an investor's portfolio with respect to a global benchmark representing the investor's strategic asset allocation.

When it comes to take advantage of hedge funds' diversification benefits in the design of the strategic asset allocation itself, investable hedge fund indexes may be used in different ways. One possible use of investable hedge fund indexes is that each institutional investor use consultants for defining a customized asset allocation on the basis of such index products. Alternatively, another approach consists of designing a limited number of benchmarks that can be used by different investors. Here, we construct such multi-strategy hedge fund benchmarks that would exhibit a persistent and robust factor exposure and meet the needs of different classes of investors. The design of these benchmarks again involves two separate steps, a selection stage and an allocation stage.

In particular, we construct two separate portfolios:

- Hedge Fund Equity Diversifier. This benchmark is the result of a selection of investible indexes from the previous section in order to diversify an equity portfolio.
- Hedge Fund Bond Diversifier. This benchmark is the result of a selection of investible indexes from the previous section in order to diversify a bond portfolio.

[10] While we emphasize in this section the use of these indexes in the context of strategic asset allocation decisions, it is worth noting that they may also be used in satellite portfolios for alpha generation purposes as investment vehicles in the context of tactical style timing strategies.

5.1 Selection

In the selection stage, we look at the diversification properties of different hedge fund strategies with respect to portfolios of stocks or bonds. As mentioned in section 2.2, it is important to look beyond the first and second order moments of hedge fund return distributions when searching for strategies allowing good diversification properties. As described in section 2.2, these higher moment betas allow establishing the impact of adding a given investible index to the stock or bond portfolio, i.e. its diversification properties. Considering the results from table 5, we select a sub-set of three strategies to construct the diversification benchmark aiming at diversifying equity-oriented portfolios and a sub set of four strategies to construct the diversification benchmark aiming at diversifying bond-oriented portfolios. Table 8 shows the result of the selection process. The investible indexes that are selected are marked "Yes" in the column corresponding to the respective diversifier benchmark.

Table 8: Strategies Entering the Equity and Bond Diversifiers

Investible Index	Equity Diversifier	Bond Diversifier
Convertible Arbitrage	Yes	Yes
CTA & Macro	Yes	No
Equity Market Neutral	Yes	Yes
Event Driven	No	Yes
Long/Short Equity	No	Yes

5.2 Optimisation

The next step in the construction of global buy-side indexes is to find the optimal allocation of the selected strategy indexes.

Our methodology is based on the following two key principles:
▪ *Principle 1: Because expected returns are notoriously hard to estimate with any degree of accuracy, we focus on minimizing the risk of an investor's overall portfolio (stock or bond).*
▪ *Principle 2: Because hedge funds are not normally distributed, the measure of risk used should be more general than volatility.*

We carried out a risk minimization calculation, where we use the VaR at a threshold of 95%, integrating the Cornish-Fisher correction that allows us to take into account investors' aversion to the extreme risks. Furthermore, we constrain the weight of the hedge fund portfolio to take on different values (5%, 15%, 25%, 35%) of the investor's global allocation, given that the remaining wealth is fully invested either in bonds or in stocks. It has actually been argued (Jagannathan and Ma (2003)) that the presence of portfolio constraints, in addition to avoiding corner solutions in optimization techniques, allows one to achieve a better trade-off between specification error and sampling error similar to what can be achieved by statistical shrinkage techniques (Ledoit and Wolf (2003, 2004)).

Tables 9A and 9B show the diversification benefits obtained from adding the diversification benchmarks to a stock or bond portfolio. The first column reports the performance statistics for the stock, respectively bond, index. The columns to the right report the same statistics when adding the diversifier with different weights.

Table 9A: Portfolio Performance when adding an equity diversifier *to the MSCI World Equity index. Summary statistics for a portfolio composed of the MSCI World Equity index and an optimal diversifier. Allocation in hedge funds (=optimal diversifier) ranges from 5 to 35%. The 0% case is reported for comparison purposes. The diversifier is constructed by minimising the 95% Cornish Fisher VaR of the overall portfolio. It is composed of investible indexes for Convertible Arbitrage, CTA/Global Macro and Equity Market Neutral. Weights of a single index are constraint to a maximum of 40% in the optimal diversifier. Based on monthly returns data from 10:2001 to 09:2004*

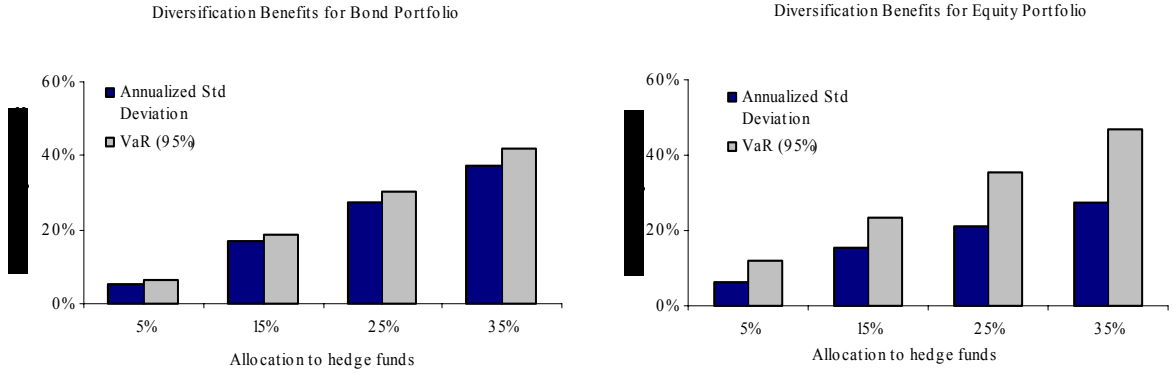
Allocation to hedge funds	0%	5%	15%	25%	35%
Annualized mean	2.0%	2.2%	2.7%	3.2%	3.7%
Annualized Std Deviation	15.0%	14.2%	12.5%	10.9%	9.4%
VaR (95%)	7.6%	7.1%	6.2%	5.3%	4.4%
Sharpe Ratio (Risk free rate=2%)	-0.03	0.015	0.057	0.111	0.184
Skewness	-0.56	-0.54	-0.49	-0.41	-0.30
Kurtosis	3.27	3.24	3.17	3.08	2.95

Table 9B: Portfolio Performance when adding a bond diversifier *to the Lehman Composite Global Treasury Index. Allocation in hedge funds (=optimal diversifier) ranges from 5 to 45%. The 0% case is reported for comparison purposes. The diversifier is constructed by minimising the 95% Cornish Fisher VaR of the overall portfolio. It is composed of Edhec investible indexes for Convertible Arbitrage, Event Driven, Equity Long / Short and Equity Market Neutral. Weights of a single index are constraint to a maximum of 30% in the optimal diversifier. Based on monthly returns data from 10:2001 to 09:2004*

Allocation to hedge funds	0%	5%	15%	25%	35%
Annualized mean	-0.3%	0.1%	0.9%	1.8%	2.6%
Annualized Std Deviation	3.3%	3.1%	2.8%	2.6%	2.4%
VaR (95%)	1.7%	1.5%	1.3%	1.1%	0.9%
Sharpe Ratio (Risk free rate=2%)	-0.71	-0.61	-0.38	-0.09	0.25
Skewness	-0.26	-0.23	-0.13	0.05	0.25
Kurtosis	2.40	2.51	2.82	3.24	3.65

From the numbers in these tables, it becomes clear that even with a small percentage allocated to hedge funds, an investor achieves diversification benefits that are economically important. For the case of an equity investor (see table 9A), including hedge funds with a weight of 15% in the suggested way considerably reduces monthly Value-at-Risk, volatility and increases the mean return of the portfolio he holds. For an equity investor who constrains hedge fund exposure to 15%, mean return increases by more than 30% (from 2% to 2.7%), while the risk is reduced by more than 15%, regardless of the definition of risk as either volatility (which reduces from 15% to 12.5%) Cornish Fisher VaR (which reduces from 7.6% to 6.2%). For a bond investor, the mean return improves slightly, while the risk declines by more than 12% in terms of VaR and by more than 15% in terms of volatility. The diversification benefits in terms of relative improvement of the risk statistics are indicated in Figure 3. The positive percentage values in figure three indicate by how much the respective risk measure decreases when adding the hedge fund diversification benchmark with the corresponding portfolio weight.

Figure 3: Diversification benefits in terms of relative improvement. *The bars in the charts indicate the percentage of improvement of two statistics of portfolio risk (annualized standard deviation and monthly Modified VaR) in comparison to the case where the portfolio contains no hedge funds. A decrease of the risk measure is indicated by a positive percentage of relative improvement. Based on the results indicated in Table 9 A (left hand graph) and 9 B (right hand graph).*



The results clearly show the diversification benefits of the proposed method. It is worth noting that the VaR measure takes into account the higher moments of the return distribution, and thus diversification benefits are shown to be robust to taking into account the extreme risks. Moreover, while the diversification benefits of hedge funds are commonly shown by studies that use hedge fund indexes that are not investible and thus not accessible to investors, the approach presented here relies on indexes that can be regarded as investible. The benefits obtained with these diversification benchmarks stem from the careful two-stage process, i.e., selection of the appropriate strategies and optimisation of portfolio composition.

Conclusions

This chapter argues that hedge funds, rather than being riskless investments, show considerable variation in their returns and are exposed to a range of risk factors. However, rather than seeing this as a drawback, institutional investors can actually benefit from this risk exposure. This is because the sources of risks driving hedge fund returns are in part fundamentally different from those driving stock and bond returns. Consequently, adding hedge funds to a diversified portfolio offers benefits in terms of an improved risk return trade-off. This is all the more remarkable since the diversification properties of hedge funds tend to be more stable than those of international equity and since hedge funds offer risk reduction opportunities even when the investor considers the influence of higher moments of the returns distribution. We also argue that hedge funds may be useful tools for institutional investors in both beta management and alpha management. In particular, truly representative hedge fund indexes find a variety of applications in those tasks. Therefore, we present a way of constructing investible yet representative indexes of hedge funds and show how these can be used in order to create diversification benchmarks. These benchmarks can be seen as an optimal complement to an investor's existing portfolio of traditional asset classes.

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Appendix

A.1. Definition of Risk Factors

For all risk factors, end-of-month values are obtained from Datastream for the period January 1997 to August 2004. The price indexes used are expressed in USD currency.

• *Change in implied volatility (VIX)*
The series used is the new VIX volatility index obtained from the CBOE. This index indicates the implied volatility of S&P 500 index options. The first difference of this series is calculated in order to obtain the change in VIX as a variable.
• *Commodity Index*
Monthly returns for the Goldman Sachs Commodity index are calculated.
• *Term Spread*
The difference between yields to maturity of the Lehman US Treasury index for the 5 - 7 years maturity segment and the Lehman US Treasury index for the 1 – 3 years maturity segment is calculated.
• *Credit Spread*
The difference between yields to maturity of the Lehman US Universal High Yield Corporate index and the Lehman US Treasury index for the 1 – 3 years maturity segment is calculated.
• *Value versus Growth*
The difference between the returns of the S&P 500 Barra Value index and the S&P 500 Barra Growth index is calculated.
• *Small Cap versus Large Cap*
The difference between the returns of the S&P 600 small cap index and the S&P 500 Composite index is calculated.
• *S&P 500 return*
Returns for the S&P 500 Composite index are calculated.
• *T-Bill 3 months*
The yield to maturity of the Merrill Lynch Treasury Bill for 3 months maturity is used.
• *US dollar*
The US dollar major currency index, calculated by the US Federal reserve Bank is used. This index expresses the value of the US dollar relative to a basket of major foreign currencies.

A.2. Description of Hedge Fund Strategies

Long Short Equity
Long/Short hedge managers have at their disposal a wide range of securities such as equity and equity derivatives (equity options, equity index options and futures, exchange-traded funds, contracts for difference, and swaps). The manager may attempt to profit from a double alpha strategy, i.e., generating alpha from both long and short stock positions independently. Occasionally, managers may also invest in a small number of relative value trades that attempt to profit from the price movement in one stock versus the price movement in another. Generally speaking, Equity Long/Short funds' net exposures of long positions minus short positions tend to have a positive bias. Therefore, they belong to the class of directional hedge fund strategies. This is due to the fact that these managers, most of them being originally long-only mutual fund managers, typically feel more comfortable at detecting undervalued stocks than overvalued stocks. Similarly, long/short managers, even those who target market neutrality, have unintended time-varying residual exposure to a variety of sectors or investment styles (growth or value, small cap or large cap) resulting from their bottom-up stock picking decisions.

Equity Market Neutral
Equity Market Neutral funds also frequently take both long and short positions in equities. Stock positions are usually diversified, so that no one position has a disproportionate effect on the portfolio. Related short positions hedge out much of the systematic risk in the long positions on either a dollar- or beta-adjusted basis so that the overall portfolio has a limited exposure to market movement.
This investment strategy is designed to exploit equity market inefficiencies and usually involves being simultaneously long and short matched equity portfolios of the same size within a country. Market neutral portfolios are designed to be either beta or dollar (or any other currency) neutral, or both. Therefore, these funds are non-directional. Many practitioners of market-neutral long/short equity trading balance their longs and shorts in the same sector or industry. By being *sector neutral*, they avoid the risk of market swings affecting some industries or sectors differently than others. More generally, well-designed portfolios typically control not only

for industry and sector, but also market capitalisation, style (growth versus value) and other exposures. Leverage is often applied to enhance returns.

Event Driven

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, recapitalisations and share buybacks.

The portfolio of some Event-Driven managers may shift in majority weighting between Merger Arbitrage (also known as 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. Event Driven strategies are usually classified as an own class alongside directional and non-directional strategies.

Convertible Arbitrage

Convertible securities are priced as a function of the price of the underlying stock, expected future volatility of equity returns, risk free interest rates, call provisions, supply and demand for specific issues, issue-specific corporate/Treasury yield spread and expected volatility of interest rates and spreads. Thus, there is large room for relative misvaluations.

Convertible arbitrage strategies attempt to exploit anomalies in prices of corporate securities that are convertible into common stocks such as convertible bonds, warrants or convertible preferred stocks. Roughly speaking, if the issuer does well, the convertible bond behaves like a stock, if the issuer does poorly, the convertible bond behaves like distressed debt. Convertible bonds tend to be under-priced because of market segmentation: investors discount securities that are likely to change types. Convertible arbitrage hedge fund managers typically buy (or sometimes sell) these securities and then hedge part or all of the associated risks by shorting the stock. The primary source of return is the current income generated by the arbitrage position. The convertible security pays a coupon and the short equity position generates interest income on the proceeds of the short sale if strategy is unleveraged. Because both of these return components are stable income, a lower volatility asset class is created. In addition, capital gains can be realized by managing the hedge ratios of these positions. Convertible Arbitrage naturally belongs to the non-directional strategies.

Global Macro and CTAs

Though this is not done commonly, it seems appropriate to regroup Global Macro and CTA funds as one type of strategy. This is because both of these strategies involve trend-following strategies that use a wide set of assets such as currencies, interest rate products and commodities. Global Macro strategies involve investing by making leveraged bets on anticipated price movements of markets worldwide. Macro managers usually employ a "top-down" global approach, trying to benefit from market movements due to shifts in world economies, political fortunes or global supply and demand forces. Exchange-traded and over-the-counter derivatives are often used to magnify these price movements.

CTAs are investment funds/companies and managed account programs taking long and short positions in cash, and derivative currency, commodity or interest rates products. Most funds trade exclusively spot assets, forwards and futures in their respective filed (currencies, commodities, fixed-income products). Options positions on either class of assets may also be taken. Due to the great flexibility of these two strategies, it is commonly accepted that they are hard to distinguish, which has led us to the regrouping.