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INTRODUCTION TO HEDGE FUNDS

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1 Scope and Purpose

1.1 Scope

This white paper gives an overview to Hedge Funds, with a focus on risk management issues. We define and explain the general characteristics of Hedge Funds, their main investment strategies, risk models employed and address the problems in Hedge Fund modelling. We also survey current Hedge Funds available on the market, those that have been withdrawn and briefly argue the cases supporting and opposing Hedge Fund usage.

1.2 Purpose

The purpose of this white paper is to provide an informed analysis of Hedge Funds. This informational analysis will be of value not only to finance professionals but also academics and more generally to any person broadly interested in finance.

This paper will be of interest to:

- Professionals working within the Financial Risk Management field, in particular:
 - Hedge Fund and Mutual Fund Managers
 - Quantitative Analysts
 - ”Front” and ”Middle” Office banking functions e.g. Treasury Management
- Regulators concerned with Hedge Fund Financial Risk Management
- Private and Institutional Investors
- Academic Researchers in the area of Financial Risk Management
- General Finance community

A unique value of this whitepaper, compared to other Hedge Fund literature freely available on the internet, is that this review is fully sourced from *academic* references (such as peer reviewed journals) and is thus a bona fide study.

2 Background

According to the European Central Bank [13], the Hedge Fund industry is growing rapidly with a total of US \$1 trillion worth of assets under their control globally. A Hedge Fund's size is typically less than US \$100 million, with nearly half under US \$25 million [13]. They represent a small percentage of the asset management industry (see [13]) yet they exert a disproportionately massive influence on the financial and economic sector in relation to their size (see Fung [11]). This is due to Hedge Funds generally using dynamic and leveraged trading strategies, which is in contrast to Mutual Funds that typically engage in buy-and-hold strategies.

Thus it is apparent Hedge Funds have a significant influence in financial markets, yet knowledge of them is relatively little, partly due to the secrecy exercised by the Hedge Fund industry. Hence a study of Hedge Funds will be of interest to most members of the Finance and Academic community.

In this whitepaper we introduce Hedge Funds, attempting to firstly propose a definition for Hedge Funds as no common consensus has yet been agreed within the Finance community. We then explain the common investment strategies applied by Hedge Funds e.g. event driven, long-only investment. In the next section, we survey the main risk models applied to analysing Hedge Funds whilst also discussing the difficulties in actually measuring Hedge Fund risks. Finally we finish by surveying current Hedge Funds available on the market and famous Hedge Funds that have been withdrawn.

It is important to note that knowledge and performance of the Hedge Fund industry is guarded with substantial secrecy. Consequently, the quality of information used in any Hedge Fund study, including academic ones, can never be as good as those for other investment products e.g. Mutual Funds (see Fung [11], Fung [10], Do et al. [4]).

3 Introduction to Hedge Funds

Within the investment industry, many fund types exist: Hedge Funds, investment trusts, unit trusts etc... yet the term Hedge Fund has no explicit definition. In fact the European Central Bank states in its report on Hedge Funds [13] that no common Hedge Fund definition exists. Defining a Hedge Fund is in fact more problematic than it appears. To appreciate the difficulty in defining a Hedge Fund, it is instructive to know its brief history.

3.1 Brief History of the Hedge Funds Industry

According to Fung [10], the first ever Hedge Fund was formed by Albert Winslow Jones in 1949, so called as the main investment strategy was to take hedged equity investments. By hedging (the act of removing risk in some investment by taking an investment in another (typically related) investment) Winslow was able to eliminate some market risks.

Hedge Funds then became first well-known after an article in *Fortune*(1966) mentioning Jones's fund significantly outperforming other Mutual Funds [10]. Although this article initiated wide interest in Hedge Funds, their popularity diminished as it fell victim to the bear markets of 1969-70 and 1973-4. A decade later (1986), interest was revived by Robertson's infamous Tiger Fund [10], which achieved compound annual returns of 43% for 6 years after all expenses. Fung in [10] corroborates the impact that the publicity of Robertson's Fund had on the Hedge Fund industry by showing the rapid expansion of Hedge Funds and CTA funds (commodity trading advisor funds (similar to Hedge Funds)) from 1985-97.

With numerous Hedge Fund investors and the fact that Hedge Funds were virtually unregulated compared to other funds, a multitude of new Hedge Fund trading strategies evolved, including the use of derivatives e.g. options. Now all these funds came to be known as Hedge Funds yet many of them were using investment strategies beyond simply "hedging" that A.Winslow first employed (see paper later and [13] for more details). To complicate matters further, as Hedge Fund strategies developed so also did funds other than Hedge Funds begin employing Winslow's equity hedging strategy, thus hedging was no longer unique to Hedge Funds. Today, the word "hedge" in Hedge Funds has become a misnomer, more of a historical hangover from Alfred Winslow rather than a description.

3.2 A Definition of Hedge Funds

As the European Central bank states [13]:

"there is no common definition of what constitutes a Hedge Fund, it can be described as an unregulated or loosely regulated fund which can freely use various active investment strategies to achieve positive absolute returns".

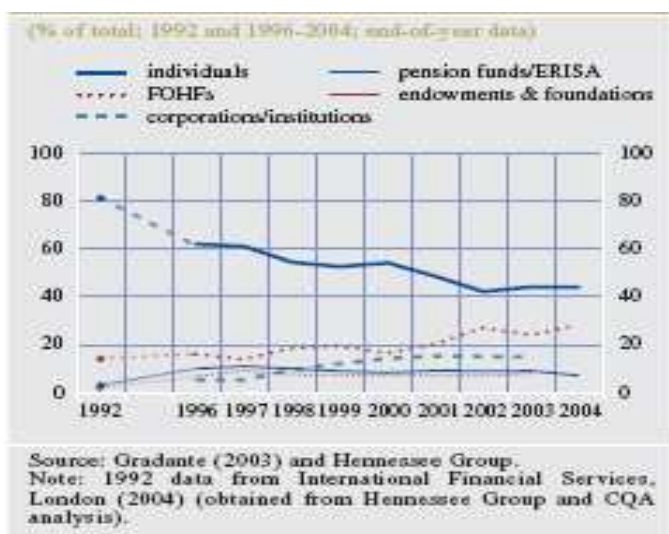
As the European Central Bank implies, a Hedge Fund is difficult to define partly

because of a lack of clarity of agreement on its term and also due to its diverse trading spectrum. They are typically characterised by high leveraging, derivatives trading and short selling compared to Mutual Funds. One way of defining a Hedge Fund is by comparing the similarities and differences with Mutual Funds. In a sense Hedge Funds are similar to any other portfolio investment in 3 respects:

- they are funded by capital from investors, rather than bank loans or other sources of capital
- they invest in publicly traded securities e.g. equities and bonds
- the capital is "managed" or invested by expert fund managers

The key difference between Hedge Funds and Mutual Funds lies in the degree of regulation, the level and variety of risky investment strategies. Whereas Mutual Funds are required to adhere to strict financial regulations, including the types and levels of risks, Hedge Funds are free to pursue virtually any investment strategy with any level of risk.

Secondly, Hedge Fund investors are typically high net worth (very wealthy) individuals or institutional investors e.g. pension funds [13], partly because Hedge Funds typically require high minimum investment amounts. A graph taken from the European Central Bank [13] shows the composition of Hedge Fund investors from 1992-2004.

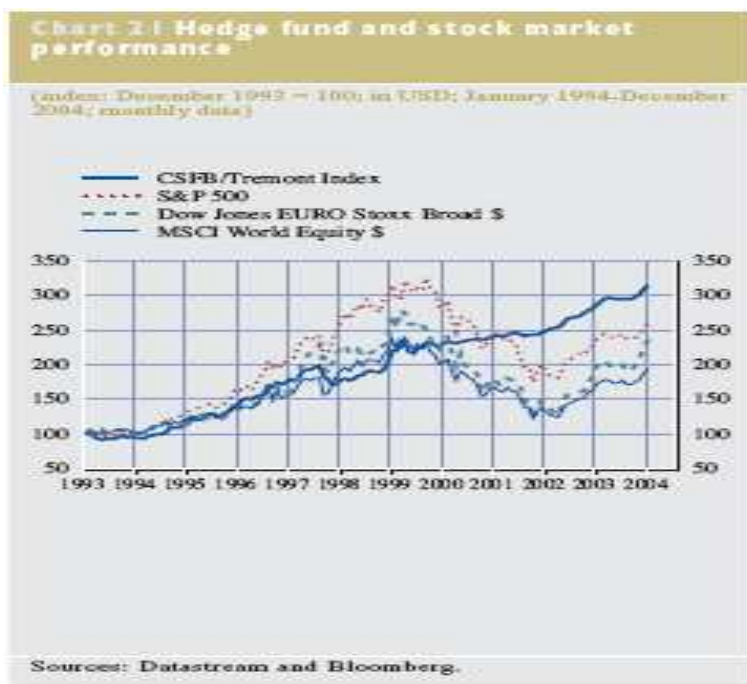


Mutual funds on the other hand, are typically targetted at the general public and will accept any investor who can meet the minimum investment amount. Hedge Funds in fact are banned from advertising and in some cases the investors are required to be "accredited".

A third key difference is the fund portfolio composition. As Fung [10] states, the majority of Mutual Funds are composed of equities and bonds. Hedge fund portfolio compositions are far more varied, with possibly a significant weighting in non-equity/bond assets e.g. derivatives.

A fourth key difference is that the historical return characteristics and distribution

of Hedge Funds tend to differ significantly from Mutual Funds. For example, Capocci et al. [2] and Getmansky [14] demonstrate that Hedge Funds empirically display serial correlation in returns. According to Brown [1], Hedge Funds do not perform significantly better than most investment funds; Hedge Funds between 1989-95 earned 300 basis points below the S&P 500. However, other studies conclude that Hedge Funds produce excess market returns (see [2],[4]). A graph below from [13] gives the performance of Hedge Funds compared to key indexes. The CSFB/Tremont index is a Hedge Fund index, the "equivalent" of the FTSE-100 for UK stocks.



3.3 Hedge Fund Performance Benchmark Targets

With Mutual Funds only 1 type of performance benchmark typically exists; the fund is expected to match or excel a particular index e.g. FTSE-100 index, S&P 500 index. This is an example of a relative return target, which some Hedge Funds adopt as their benchmark. However for Hedge Funds another benchmark exists called absolute return targets.

An absolute return target is the typical benchmark choice for Hedge Funds and is the opposite of relative return. It is a fixed return target and the fund is expected to match/excel it regardless of the overall market performance. Hedge fund managers use two main approaches to achieve absolute return targets: Market Timing and the Non-Directional approach.

Market Timing

this approach takes positions by anticipating the market trend or direction (either moving up/down). This approach potentially offers high returns, as demonstrated by

Georg Soros in his Quantum Fund when speculating on the British Pound in 1992.

Non-Directional

An example of Non-Directional is A.Winslow's Hedge Fund; it is a fund that eliminates some market risks, hence it can be considered non-directional, whilst also benefitting from relative price movements of assets. According to Fung [10] the non-directional approach has evolved over the last decade and is continuing to develop.

3.4 Hedge Fund Organisation

Hedge Funds typically prefer to concentrate their efforts on the key activity of maximising investment return, so non-essential operations are outsourced e.g. "back office" functions. Actual trading transactions too are outsourced to "Prime Brokers". Prime brokers are banks or securities firms, offering brokerage and other financial services to large institutional clients e.g. Pension Funds. It is also worth noting that Hedge Funds typically reside "offshore" to take advantage of more favourable tax treatments and regulations.

3.5 Fund of Hedge Funds (FOHF)

A Fund of Hedge Funds is simplistically a Mutual Fund that invests in multiple Hedge Funds e.g 15-25 different Hedge Funds, furthermore F3 funds or fund of FOHF also exist. All these funds provide diversification benefits and a method of investing in Hedge Funds without requiring the skill to personally assess Hedge Funds individually. Also, FOHF normally have significantly lower minimum investment levels compared to a standard Hedge Fund, thus increasing investment access to the general public.

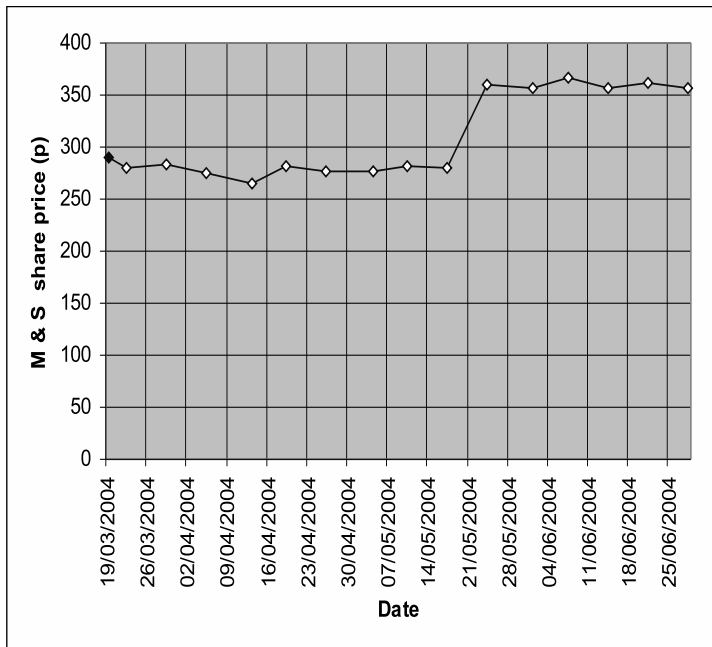
4 Hedge Fund Investment Strategies

The investment strategies employed by various Mutual funds are well documented, ranging from value investing to buying growth stocks, with each having particular risk and return implications. On the contrary, Hedge Fund investment strategies are far less well documented and the variety of strategies are greater than for Mutual Funds. Consequently, there is no widely accepted categorisation of Hedge Fund strategies, for example, Stonham in [21] identifies 14 Hedge Fund strategy categories whereas Fung [10] only has 7.

We now describe the 7 main Hedge Fund investment strategies as given by Fung [10], which in turn are taken from MAR (Managed Account Reports (one of the oldest sources of global managed futures information)). The advantage of applying such strategy categorisation is that different Hedge Fund return characteristics can be explained by them (see [10]).

4.1 Event Driven

An event driven strategy means a position is taken to take advantage of price moves arising from new market information release or events occurring. A good example of such a strategy is to capitalise on merger and acquisition announcements, which cause the target company's share price to rise. An example is given below; Mark's and Spencer's share price rose on announcement of a takeover by Philip Green at the end of May 2004.



4.2 Global

The Global strategy is an all-round category for funds that invest in assets beyond those based in their home market. Other than that, no more specific technique is associated with this. A typical example would be a Hedge Fund investing in an emerging market such as India.

4.3 Global/Macro

The Global/Macro strategies utilise macroeconomic analysis to capitalize on asset price changes that are strongly linked to macroeconomics e.g. currencies, bonds, stock indices, and commodities. As the name implies, this strategy is applied on a global scale. For example, George Soros Quantum Fund reputedly made US\$1 billion in 1 day on September 1992 by speculating the British Pound would exit the European Exchange Rate Mechanism.

4.4 Market Neutral

Market neutral investment refers to funds that hedge against market risk factors, thereby becoming "neutral" to the market. This strategy profits by speculating on relative price movements between assets or indexes. Examples of this method include long-short equity, stock index arbitrage, fixed income arbitrage. A good example of the long-short equity method is the classic 1949 A.W. Jones Hedge Fund, who took long and short positions in equities.

4.5 Sector

Sector Hedge Fund investing concentrate on investing in specific sectors e.g. airlines, telecoms, utilities sectors etc... . The investment instrument itself can be a variety of types e.g. short selling, long and leveraged positions.

4.6 Short Selling and Long-Only

Short selling and long-only Hedge Funds are those funds which will *only* invest by shorting or going long respectively.

5 Hedge Fund Risk Models

The necessity for Hedge Fund risk modelling and management originates from 2 areas:

- Hedge Funds experiencing some of the greatest losses ever witnessed by the investment community
- new regulatory pressure enforcing more stringent Hedge Fund risk management.

Firstly, Hedge Funds have been responsible for numerous catastrophic losses, causing them to completely collapse and initiate a contagion effect by affecting numerous economic and financial sectors. The most notorious example of such a catastrophic loss being the Long Term Capital Management Hedge Fund, which lost US\$2.1 Billion [21] and almost brought down the entire US financial system.

Secondly, as already mentioned, Mutual Funds are tightly regulated whereas Hedge Funds face little regulation. However, as Hedge Funds have gained public attention and therefore more investment interest, this along with spectacular Hedge Fund disasters have prompted increased Hedge Fund regulation.

It was not until after the 1997 Asian Currency Crisis though that *regulators* became interested in regulating Hedge Fund activities [11]. The IMF (International Monetary Fund) initiated a study on the market influence of Hedge Funds by Eichengreen [5]. This study described Hedge Funds activities and the potential problem of the market impact of Hedge Funds.

Moreover in 2004, the Securities and Exchange Commission now required Hedge Fund managers and sponsors to register as investment advisors under the Investment Advisor's Act of 1940. This greatly increases the number of requirements placed on Hedge Funds e.g. keeping records and creating a code of ethics. For more information on SEC regulation visit the SEC website <http://www.sec.gov/>.

Major International Initiatives to address concerns related to hedge funds

Date	Entity	Report	Description
Jan. 1999	Basel Committee on Banking Supervision (BCBS)	Banks' Interactions with Highly Leveraged Institutions (HLIs) Sound Practices for Banks' Interactions with HLIs	The aim of the reports was to encourage prudent management of risks generated from banks' interactions with highly leveraged institutions.
Mar. 1999	International Swaps and Derivatives Association (ISDA)	ISDA 1999 Collateral Review	Measures to reduce risks associated with collateralisation were suggested.
Mar. 1999	Institute of International Finance (IIF)	Report of the Task Force on Risk Assessment	
Apr. 1999	US President's Working Group on Financial Markets (PWG)	Hedge Funds, Leverage and the Lessons of LTCM	Review of the near-collapse of LTCM and the analysis of further sources of remaining systematic vulnerabilities. Recommendations include increased transparency through enhanced disclosure of hedge funds.
June 1999	Counterparty Risk Management Policy Group I (CRMPO)	Improving Counterparty Risk Management Practices (Corrigan report)	The report made recommendations on how to improve counterparty risk management practices and suggested a possible format for regulatory reporting relating to HLIs.
Nov. 1999	International Organization of Securities Commissions (IOSCO)	Hedge Funds and Other HLIs	Focus on risk management issues relating to securities firms and the need for greater transparency in the hedge fund sector.
Jan. 2000	BCBS	Banks' Interactions with HLIs: Implementation of Basel Committee's Sound Practices Paper	Issues which need further work were identified – for example, measurement of potential future credit exposures.
Feb. 2000	A group of five of the largest independent hedge fund managers	Sound Practices for Hedge Fund Managers	Response to PWG Report, addressing the PWG recommendation to develop and publish sound practices for risk management and internal controls.
Apr. 2000	Financial Stability Forum (FSF)	Report of the Working Group on HLIs	The report concentrated on systemic risk posed by HLIs and their impact on market dynamics. Measures enhancing prudent firm behaviour and market discipline were brought forward.
Mar. 2001	BCBS and IOSCO	Review of Issues Relating to HLIs	Senior managers have reinforced their oversight of HLI activities, and information flows from HLI have improved. Competitive pressures should not erode credit standards.
Mar. 2001	FSF	Progress in Implementing the Recommendations of the Working Group on HLIs	Strengthened counterparty risk management and regulatory oversight acknowledged, but counterparty risk measurement and stress tests need further work. Disclosure by HLIs has slightly improved, but the progress remains inconsistent.
Apr. 2001	Multidisciplinary Working Group on Enhanced Disclosure	Final Report to BCBS, Committee on the Global Financial System (CGFS) of the G-10 Central Banks, International Association of Insurance Supervisors (IAIS), IOSCO	The report seeks to improve the state of financial disclosures and to promote a level playing-field in disclosure for all financial intermediaries, irrespective of the type of activities.
Aug. 2002	UK's Financial Services Authority (FSA)	Hedge Funds and the FSA (Discussion paper No. 16)	The FSA has initiated an evaluation of the current regulatory framework of hedge fund activities.
Aug. 2002	Alternative Investment Management Association (AIMA)	Guide to Sound Practices for European Hedge Fund Managers	
Mar. 2003	UK's FSA	Hedge Funds and the FSA: Feedback Statement on Discussion Paper No.16	The decision was that no amendments to the current UK regulatory framework of hedge fund activities are required.

Major International Initiatives to address concerns related to hedge funds (cont'd)			
Date	Entity	Report	Description
Sep. 2003	Staff Report to US Securities and Exchange Commission (SEC)	Implications of the Growth of Hedge Funds	Concerns about the rapidity of hedge fund industry growth and its opaqueness led to the proposal to require hedge fund managers to register with the SEC under the Investment Advisers Act of 1940 and to comply with certain disclosure requirements.
Aug. 2003	Managed Funds Association (MFA)	Sound Practices for Hedge Fund Managers: Update	Update of February 2000 report by five large hedge fund managers.
Jan. 2004	European Parliament	Resolution on the Future of Hedge Funds and Derivatives	The desire to bring offshore hedge funds onshore led to the proposal to introduce a pan-European, lightly regulated regime for "sophisticated alternative investment vehicles", benefiting from a common EU-wide passport.
June 2005	UK's FSA	Wider-range Retail Investment Products (Discussion paper No. 3); Hedge funds: a Discussion of Risk and Regulatory Engagement (Discussion paper No. 4)	The purpose of DP 3 is to assess whether the present regulatory regime that applies to retail investment products is still appropriate in light of existing/new products (incl. hedge funds). The aim of DP 4 is to identify potential risks posed by hedge funds and to stimulate debate.
July 2005	Counterparty Risk Management Policy Group II (CRMPG)	Toward Greater Financial Stability: a Private Sector Perspective	Review of the June 1999 report.
Aug. 2005	Managed Funds Association (MFA)	Sound Practices for Hedge Fund Managers	Update and expansion of August 2003 and February 2000 reports.

We now describe some of the quantitative risk models employed in modelling Hedge Fund risks.

5.1 Markowitz 's Portfolio Theory

Markowitz's Portfolio Theory (from hereon MPT) is typically applied to assets/portfolios whose return probability distributions approximate to a Normal distribution. Although this approximation is not strictly correct for Hedge Funds, it is still a workable risk model. In fact Fung and Hsieh in [9] apply it to rank Hedge Fund performances.

Markowitz in [17] assumes a portfolio's expected return is equal to the weighted average of the assets' expected returns and that portfolio risk is equal to the variance of these returns (or in other words the portfolio return's variance). Thus MPT proposes for any portfolio consisting of N assets:

$$\text{Expected portfolio return } \mu_p = \sum_{i=1}^N w_i m_i$$

$$\text{Risk or Variance of portfolio return} = \sum_{i=1}^N \sum_{j=1}^N \sigma_{ij} w_i w_j$$

where:

N=number of assets in a portfolio

i=index number for asset i

μ_i =expected return for asset i

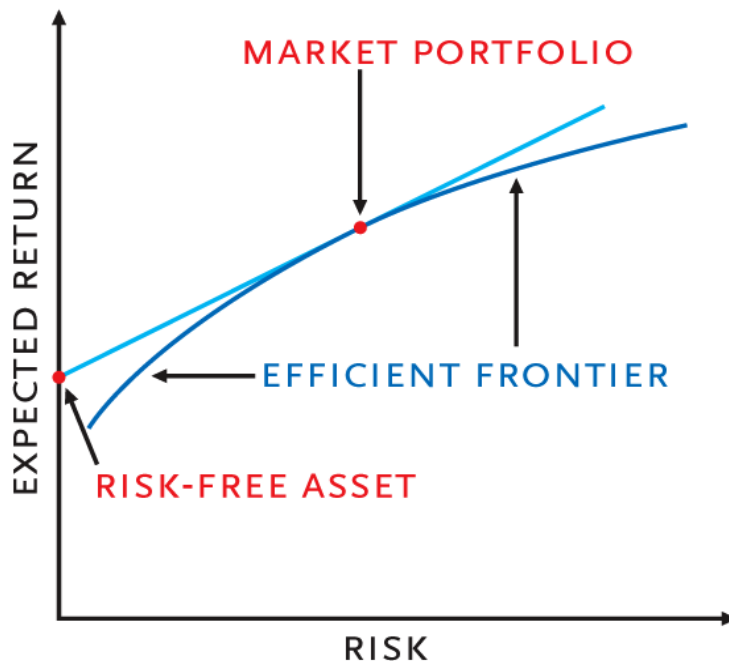
σ_{ij} =covariance of asset i with asset j

σ_{ii} =variance of asset i
 w_i =weighting or fraction of asset i in the portfolio, subject to constraints:

$$0 \leq w_i \leq 1$$

$$\sum_{i=1}^N w_i = 1$$

MPT also introduces the idea of an efficient frontier. For a given set of funds or assets available to invest in, an upper concave boundary exists on the maximum portfolio returns possible as risk or variance increases. Furthermore this concave relation between risk and return incorporates the theory of expected utility concavely increasing with risk.



Notice that MPT shows that some funds can perform lower than the risk free rate. Naturally one wishes to choose the market portfolio which maximises return for a given level of risk/volatility as shown.

5.2 CAPM (Capital Asset Pricing Model)

Capocci and Hubner [2] state that in the 1980s CAPM and its variants (e.g. Jensen's measure) were applied to Hedge fund risk measurement. The CAPM model, based on MPT, was invented by Sharpe [19]:

$$R_a = R_f + \beta(R_m - R_f) + \varepsilon$$

R_a =expected return of the asset

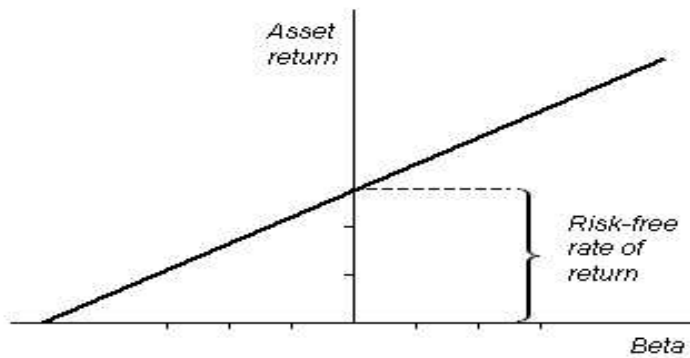
R_f =risk-free rate of return

$R_m = \text{expected market return}$
 $\varepsilon = \text{error term}$

$$\beta = \frac{\sigma_{am}}{\sigma_{mm}}$$

where $\sigma_{am} = \text{market and asset's covariance}$
 $\sigma_{mm} = \text{market's variance}$

The CAPM model is applied generally in finance to determine a theoretically appropriate return of an asset. It presumes that investors must be compensated for investing in a risky asset in 2 ways 1)time value of money and 2)risk itself. The time value of money is accounted for by the risk-free rate R_f whereas the return from risk arises from $\beta(R_m - R_f)$. The term $(R_m - R_f)$ represents the expected risk premium, which is the return obtained above the risk-free rate for investing in a risky asset. The beta term can be considered the "sensitivity" of the asset's risk to market risk (both measured by variance). Consequently more "sensitive" assets ought to produce higher returns by CAPM. The graph below shows how asset return is linearly related to beta and that no beta implies a risk-free rate of return.



5.3 Sharpe Ratio and the Modified Sharpe Ratio

The Sharpe Ratio, invented by Sharpe [20], is based on MPT's risk measure (variance):

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

$R_p = \text{portfolio expected return}$
 $\sigma_p = \text{portfolio return's standard deviation}$

The Sharpe ratio can be interpreted as "(Return - Risk-free rate)/risk" since Sharpe considers standard deviation to be a risk measure. The Sharpe ratio provides a portfolio risk measure in terms of the quality of the portfolio's return at its given level of risk. A discussion on the Sharpe ratio can be found at Sharpe's website (www.stanford.edu/wf-sharpe/).

Fung and Hsieh in [12] and [9] use a modified version of the Sharpe ratio to rank Hedge Fund performance so to specifically cater for Hedge Fund return distributions. This is

simply the Sharpe ratio without subtracting the risk free rate from the numerator:

$$\text{Modified Sharpe Ratio} = \frac{R_p}{\sigma_p}$$

5.4 Jensen's Alpha and Treynor ratio

Based on CAPM, Jensen formulated a portfolio risk measure to quantify portfolio returns above that predicted by CAPM called α :

$$\alpha = R_p - [R_f + \beta_p(R_m - R_f)]$$

R_p =above CAPM predicted portfolio return

β_p =portfolio's beta

One can interpret α as a measure of "excess returns" or portfolio manager's investment ability or i.e. "beating the market".

The Treynor ratio is a lesser well known portfolio ratio measure, similar to the Sharpe ratio, but assesses portfolio performance on a CAPM model basis:

$$\text{Treynor Ratio} = \frac{R_p - R_f}{\beta_p}$$

β_p = portfolio β

R_p =portfolio return

Like the Sharpe ratio, the Treynor ratio can be interpreted as the "quality" of portfolio return for the given level of risk but risk measured on a CAPM theory basis.

5.5 Three Factor Model of Fama and French

The CAPM model is a single factor model that compares a portfolio with the market as a whole. Fama and French modified this model in [6] to take into account 2 empirical observations about asset classes that tend to have higher returns:

- small sized companies
- value stocks (companies with high book to market value)

Having a higher return associated with them implies a higher risk premium associated with them. The 3 factor model accounts for these higher premiums with the following equation:

$$R_a = R_f + \beta_{p1}(R_m - R_f) + \beta_{p2}SMB + \beta_{p3}HML + \varepsilon$$

ε =error term

SMB=difference in return for small and large sized companies

HML=difference in return for high book to market value and low book to market value companies

$\beta_{p1}, \beta_{p2}, \beta_{p3}$ are regression slopes

Essentially the 3 factor model is a multiple linear regression equation. Jagadeesh and Titman in [16] modify the CAPM model by adding a momentum to account for return. Fung and Hsieh in [7] apply both these models to long/short equity hedge funds, giving regression results.

5.6 Sharpe's Asset Class Factor Model

Sharpe in [18] invented an asset factor model for risk measurement of Mutual Funds but Fung and Hsieh in [8] have applied it to Hedge Funds. This model essentially suggests that most Mutual Fund performances can be replicated by a small number of major asset classes e.g. large capitalisation growth stocks, large capitalisation value stocks, small capitalisation stocks etc... . Using Fung and Hsieh [8] notation Sharpe's model is:

$$R_p = \sum_k w_k F_k + \epsilon$$

subject to:

$$w_k = \sum_j x_j \lambda_j$$

$$\epsilon = \sum_j x_j \epsilon_j$$

R_p =portfolio return

j =asset class

k =total number of asset classes

x_j =weighting of asset class j

λ_j =factor loading for asset j (change in fund return/change in asset j return)

ϵ_j =error term for asset j

Thus Hedge Fund return is a weighted average of a small number of asset classes, rather than a weighted average of a large number of individual asset returns as in MPT.

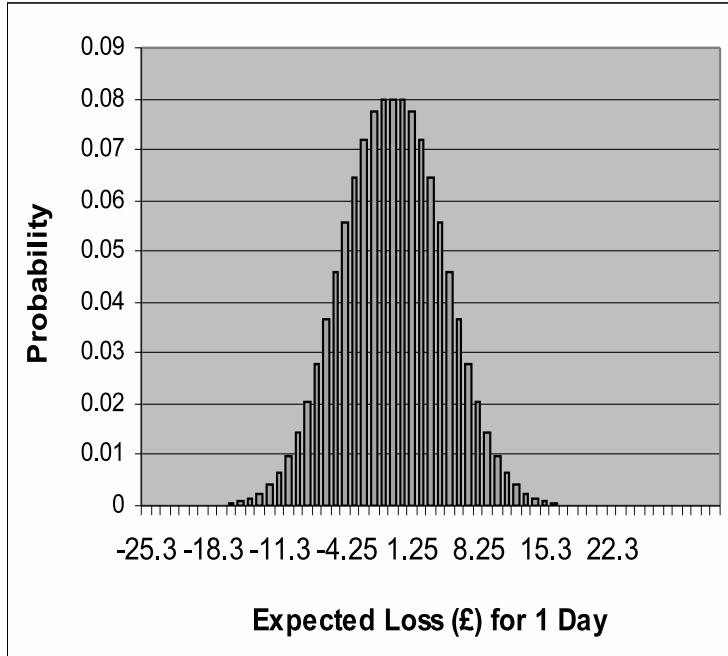
5.7 VaR (Value at Risk)

VaR (value at risk) was invented by JP Morgan in 1994 as a general risk management tool and has now become the industry standard for risk. It has become a popular and important risk measure primarily because of the Basel Committee, who standardise international banking regulations and practises. Gupta and Liang in [15] applied VaR to Hedge Funds, specifically for assessing a Hedge Fund's sufficient capital adequacy.

VaR tells us in monetary terms how much one's portfolio can expect to lose, for a given cumulative probability and for a given time horizon. For example, for a cumulative probability of 99% over a period of 1 day, the VaR amount would tell us the amount by which one would expect the portfolio to lose e.g.\$100. Mathematically we express this as:

$$\Pr[\text{portfolio loss} \leq \text{VaR}] = 0.95\%$$
$$\Pr[\text{portfolio loss} \leq \$100] = 0.95\%$$

Note that $\Pr[\dots]$ denotes "cumulative probability of $[\dots]$ " and is measured over the same time period as the loss.



VaR can be calculated by simulation using historical data or some mathematical formula. VaR can also be calculated by the "variance-covariance method" (also known as the delta-normal method) but makes unrealistic assumptions about portfolio returns e.g. returns are normally distributed.

6 Problems with Hedge Fund Risk Modelling

Most portfolio risk measures make unrealistic modelling assumptions, particularly with respect to the assumed return probability distributions for mutual funds. Risk measurement assumptions become even more unrealistic for Hedge Funds. We now explain the difficulties in Hedge Fund risk measurement.

6.1 Non-Normal Return Distribution

As stated by Do et al.[4], Hedge Fund returns do not approximate to normal distributions, thus popular portfolio risk measures (which assume a normal distribution) are inappropriate e.g. Sharpe ratio. Furthermore Fung in [10] shows that the empirical probability distribution of monthly returns for Hedge and Mutual Funds differ significantly.

Fung [10] proposes the reason for a non-normal return distribution is a result of the diverse trading strategies employed by Hedge Funds. Fung firstly suggests that Mutuals engage in buy-and-hold strategies whereas Hedge Funds engage in much more shorter term trading strategies. Secondly, Hedge Funds apply substantial leveraging, whereas Mutuals have limited or strict regulation on leveraging. Additionally, the relatively regulation-free investment environment of Hedge Funds leads to complex management strategies and high performance incentives -these all affect Hedge Fund returns.

6.2 Investment Strategy and Return Distribution

It has been empirically observed that different investment strategies significantly alter the return distribution, particularly the means and standard deviation. For example standard deviation, a common risk metric, varies from a low 2.1% in market neutral funds to 16.3% in Global/Macro funds [10]. Consequently, it has been argued it would be better to apply separate risk measures for each Hedge Fund type (according to its strategy), rather than treating all Hedge Funds as part of 1 homogenous class.

6.3 Hedge Fund Failure Rate

Hedge fund survival rates are significantly lower than other funds [13] and substantially vary; cumulative failure rates after 7 years range from 32-66% depending on the Hedge Fund's size . The table below from the European Central Bank [13] describes this:

Table 6 Hedge fund failure rates

Cumulative failure rates, %	1995-2002 ¹⁾			1994-1998 ²⁾
	by capital under management			
	≤ 500m	500-150m	> 150m	
1-year	3.5	3.8	2.0	1.5
2-year	8.5	10.2	2.8	4.6
3-year	11.8	20.4	2.9	19.6
4-year	18.9	34.5	3.6	33.0
5-year	23.7	38.7	3.6	42.3
6-year	27.2	53.0	3.6	-
7-year	32.0	66.0	3.6	-

Sources: 1) Hedges (2004a). 2) US President's Working Group on Financial Markets (1999), p. A-5.

Note: For the methodologies applied, please consult the indicated sources.

Thus the inclusion of non-existent Hedge Funds poses a problem when assessing the overall performance of Hedge Funds (similar to the survivorship bias issue with Mutual Fund performance).

7 Hedge Funds Available On The Market

7.1 Close Man Hedge Fund

Close Man Hedge Fund is an absolute return Hedge Fund. This fund applies the market neutral investment strategy (specifically fixed income arbitrage) by investing solely in Capital Guaranteed Bonds issued by The Royal Bank of Scotland. Thus the fund is theoretically insulated from market risks but can still benefit from price movements using a variety of techniques. For this particular fund, Close Man will engage in leveraging and using swaps (a type of derivative) to boost returns.

See Close Man's website [http : //www.closefm.com/](http://www.closefm.com/) for more detail.

7.2 RAB Capital

RAB Capital is a unique Hedge Fund in that it is one of the few UK Hedge Funds (or more specifically FOHF) that is listed on the London Stock Exchange (ticker symbol RAB.L). Their funds are accessible to the general public rather than high net worth individuals, although RAB warns "These funds are not appropriate for a novice investor". They specialise in a variety of absolute return funds, some of which employ the long-only investment strategy, where assets are bought on the basis that they are considered undervalued.

See RAB Capital's website [http : //www.rabcap.com/](http://www.rabcap.com/) for more detail.

7.3 Thames River Capital

Thames River Capital is an absolute return based Hedge Fund, offering a range of regulated and unregulated funds. Each fund uses various investment strategies, ranging from Global strategies (see Global Emerging Market Fund) to market neutral strategies using high leverage.

See Thames River Capital's website [http : //www.thamesriver.co.uk/](http://www.thamesriver.co.uk/) for more detail.

7.4 Ikos Hedge Fund

The founder and co-owner of her own hedge fund has made Elena Ambrosiadou one of the richest women in Britain according to the 2006 Sunday Times Rich List. This hedge fund engages in "program trading" whereby trades are executed according to a computer program. This method of trading has the advantage removing any subjective decision making from speculation but can also result in investments that one would strongly and intuitively disapprove. Ikos focus on exchange rate investing but also speculate in equities.

For more information on Ikos see [http : //www.ikosam.com/](http://www.ikosam.com/).

8 Famous Hedge Funds Withdrawn From The Market

All major funds are susceptible to collapsing, however, in the case of Hedge Funds this is more frequent and the losses tend to be substantially higher. It is therefore quite informative to understand some of the spectacular Hedge Fund losses. We now describe some Hedge Funds that were previously available on the market but have now ceased trading.

8.1 George Soros's Quantum Fund

Perhaps the most famous Hedge Fund investor is Soros, who in 1 day made US\$1 billion on Sept 6, 1992 by short selling the British pound. In 1992, England was part of the ERM (European Exchange Rate Mechanism) and Soros was able to anticipate the currency devaluation of the British Pound. Consequently by employing the Global/Macro investment strategy, Soros managed to net a profit of US\$1 billion in 1 day. However years later, his fund suffered massive losses; in 1998 Russia's defaulting crisis created a loss of US \$2 billion. Then in 2000 Soros withdrew from Hedge Fund investing.

8.2 Long Term Capital Management (LTCM)

Perhaps the most notorious Hedge Fund collapse was in September 1998; LTCM announced it had lost 44% of its investors' capital in August alone (US\$2.1 Billion) [21]. For a detailed case study of LTCM see Stonham in [21],[22].

LTCM began trading with over \$1 billion of investor capital. LTCM applied the Hedge Fund strategy of market neutral investment; LTCM used the method of fixed income arbitrage, taking advantage of temporary changes in prices.

The market neutral strategy was successful from 1994-98 but in 1998 Russian financial markets fell into crisis. However, LTCM speculated that the situation would quickly return back to normal again, so LTCM took large, unhedged positions. Unfortunately, Russia began defaulting on its debts in Aug 1998, causing LTCM to experience losses approaching \$4 billion as it was significantly exposed to Russian government bonds. The US Federal Government then devised a rescue plan for LTCM to avert a major US financial crisis and panic.

8.3 Robertson's Tiger Management Fund

Robertson's Hedge Fund invested by going long on undervalued stocks whilst simultaneously short selling what he considered overvalued stocks. For years this strategy was extremely successful, giving annual returns of 43% from 1980-86, so he continued applying this strategy during the technology boom. During the tech boom, Robertson rightly considered many stocks to be overvalued and so began short selling such stocks with the expectation overvalued stocks would eventually fall. Yet during the tech boom a speculation bubble formed, causing the overvalued stocks to continue to rise beyond

expectation. Consequently Robertson's fund collapsed in 2000 after heavy losses, just *before* the speculative bubble itself collapsed.

9 The Case For and Against Hedge Funds

Despite the potential to provide substantial returns, it would appear conclusive that Hedge Funds ought to be abolished or at least highly regulated. However the issue is far more complex than one assumes. We now elaborate on the benefits and disadvantages of Hedge Funds.

9.1 The Case for Preserving Hedge Funds

Hedge Funds actually provide an economic benefit to markets, in particular they aid price discovery. It has been argued that Hedge Funds do not engage in "herd-mentality" trading. Instead they take contrarian positions, unlike Mutual Funds, and they buy/sell assets according to an asset's perceived fair value.

A second Economic benefit of Hedge Funds is that they aid competition and the Economic concept of the "invisible hand" [3]. Hedge Funds thrive on market inefficiencies. As traders do not have instantaneous and costless access to market information, asset mispricing or an arbitrage opportunities must occur e.g. an asset trading in 2 different markets may have different prices. Hedge Funds take advantage of such arbitrage opportunities and so push prices to their no-arbitrage price.

Another important Economic benefit of Hedge is liquidity provision. Hedge Funds typically investing in risky assets, so providing much needed capital for investments that many investors would not consider.

Hedge Funds rather than increase risk can actually reduce overall risk. Firstly, Hedge Funds take on more risky investments, thereby absorbing or sharing some of the risk that would otherwise be absorbed by other funds. Additionally they're more willing to invest in volatile markets, thereby absorbing the effects of market shocks.

Hedge Funds are important as an investment product in itself. They provide sophisticated investors with another vehicle for high returns that would not be available in traditional Mutual Funds [3]. They also provide diversification (a method of reducing risk without reducing return by investing in more than 1 asset) as they represent a new investment group.

A second benefit from a investor's perspective is that Hedge Funds can provide "absolute" returns. Hedge Funds can achieve this because they pursue a variety of sophisticated investment strategies. Traditional Mutual Funds are limited in trading strategies due to heavy regulation.

9.2 The Case Against Hedge Funds

Rather than aid market functioning, Hedge Funds have been criticized for doing more harm than good. Firstly, rather than contrarian investing, Hedge Funds engage in "herding" [3]. Notable examples include the 1992 ERM crisis and the 1997 Asian Currency Crisis.

Secondly, it was suggested Hedge Funds provide much needed capital by investing in risky assets. Yet Hedge Funds have been blamed for exhausting liquidity in the market [3]. Due Hedge Funds typically taking large positions and the trading strategies they pursue, they are unable to make trades without causing a massive price moves due to illiquidity (Fung supports this idea in [11]). Additionally, Hedge Funds usually heavily leverage, increasing the likelihood of illiquidity within the fund e.g.LTCM. However, Gupta in [15] investigates capital adequacy using VaR (value at risk) measures and concludes that most Hedge Funds are adequately funded.

Thirdly, Hedge Funds can prevent efficient market functioning by causing market price distortions, rather than aiding price discovery. Large volume trades can cause significant price movements, rather than price movements occurring due to company/economic fundamentals. Fung in [11] cites such examples as the 1992 ERM Crisis but concludes that Hedge Funds overall do not distort prices beyond their company/economic fundamentals.

The Hedge Fund as a viable alternative investment product has also been heavily disapproved. For instance some quotes from leading academics on Hedge Funds:

"If you want to invest in something where they steal your money and dont tell you what theyre doing, be my guest., Eugene Fama.

"If there's a license to steal, it's in the hedge fund arena", Burton Malkiel.

In an article in Forbes (May 14 2004) Bernard Condon claims that "You would do better giving your money to a monkey" than investing in Hedge Funds. As a managed investment product Hedge Funds command the highest management fees, typically around 20%, compared to mutual funds that normally charge around 1%. Additionally Hedge Fund investors have tougher withdrawal constraints.

Secondly as Fama mentions, Hedge Funds have poor transparency. Regulatory bodies such as the SEC don't dictate the same strict rules for Hedge Funds that it does for Mutual Funds. There are no rules on publishing records on asset holdings and financial performance. Lack of transparency increases the chances of investors being unable to effectively risk assess Hedge Funds.

Finally, Hedge Funds have a higher failure rate than Mutual Funds and thus a higher credit risk. Hedge Fund face less regulation on leveraging and investment strategies, thus are susceptible to a higher probability of default e.g. LTCM. Consequently there is less likelihood of capital recovery.

10 Conclusion

Hedge Funds are clearly a complex and unique investment product that can produce extraordinary gains as well as losses. They have and continue to thrive on the unregulated aspects of the business, spawning a variety of innovative investment techniques. It has only been in the past 10 years that regulatory bodies have focussed on Hedge Fund regulation to avert previous Hedge Fund disasters e.g. LTCM.

Despite the clear necessity to understand such a powerful investment, knowledge and understanding of the Hedge Fund industry remains relatively poor. There is no consensus on what specifically defines a Hedge Fund, very little literature is devoted to Hedge Fund risk modelling and their various investment techniques. Consequently there is a large scope for future research into Hedge Fund risk management.

References

- [1] S.J. Brown. Hedge funds: Omniscient or just plain wrong. *Pacific-Basin Finance Journal*, 2001.
- [2] D. Capocci and G. Hubner. Analysis of hedge fund performance. *Journal of Empirical Finance*, 2004.
- [3] Taylor A. Danielsson, J. and J. Zigrand. Highwaymen or heroes:should hedge funds be regulated? a survey. *Journal of Financial Stability*, 2005.
- [4] Faff R. Do, V. and J. Wickramanatake. An empirical analysis of hedge fund performance: The case of australian hedge funds industry. *Journal of Multinational Financial Management*, 2005.
- [5] Mathieson D. Chadha B. Jansen A. Kodres L. Eichengreen, B. and S. Sharma. Hedge fund and financial market dynamics. *International Monetary Fund*, 1998.
- [6] E.F. Fama and K.R. French. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 1993.
- [7] W. Fung and D.A. Hsieh. *JOURNAL OF INVESTMENT MANAGEMENT*.
- [8] W. Fung and D.A. Hsieh. *The Review of Financial Studies*.
- [9] W. Fung and D.A. Hsieh. Is mean-variance applicable to hedge funds? *Economic Letters*, 1998.
- [10] W. Fung and D.A. Hsieh. A primer on hedge funds. *Journal of Empirical Finance*, 1999.
- [11] W. Fung and D.A. Hsieh. Measuring the market impact of hedge funds. *Journal of Empirical Finance*, 2000.
- [12] W. Fung and D.A. Hsieh. Performance characteristics of hedge funds and commodity funds: Natural vs. spurious biases. *Journal of Financial and Quantitative Analysis*, 2000.
- [13] T. Garbaravicius and F. Dierick. Hedge funds and their implications for financial stability. *European Central Bank, Occasional Paper Series*, 2005.
- [14] Lo A.W. Getmansky, M. and I. Makarov. An econometric model of serial correlation and illiquidity in hedge fund returns. *Journal of Financial Economics*, 2004.
- [15] A. Gupta and B. Liang. Do hedge funds have enough capital?a value-at-risk approach. *Journal of Financial Economics*, 2005.
- [16] N. Jagadeesh and S. Titman. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, 1993.
- [17] H Markowitz. Portfolio selection. *Journal of Finance*, Vol. 7, No. 1, pp. 77-91., 1952.

- [18] W.F. Sharpe. *Journal of Portfolio Management*.
- [19] W.F. Sharpe. Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 1964.
- [20] W.F. Sharpe. Mutual fund performance. *Journal of Business*, pp. 119-138, 1966.
- [21] P. Stonham. Too close to the hedge:the case of long term capital management lp part one:hedge fund analytics. *European Management Journal*, Vol. 17,p282-289, 1999.
- [22] Paul Stonham. Too close to the hedge: The case of long term capital management. part two: Near-collapse and rescue. *European Management Journal*, Volume 17, Issue 4 ,Pages 382-390, 1999.