

# Life and Death of Hedge Funds: Introduction and Overview

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# Outline

- 1 What are hedge funds and what do they do?
  - Who needs hedge funds and hedge fund research?
  - Is it easy to analyze hedge fund performance and risk?
- 2 How do hedge funds perform while alive?
- 3 What are the reasons and consequences of hedge fund death?
- 4 Conclusion

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# What Are Hedge Funds?

- **Investment pools nearly unregulated by authorities**
  - HFs cannot be offered or advertised to the general public;
  - they are sold via private placement
- **High fees:**
  - management fee: 1.5% of the assets
  - incentive fee: 20% of profits
    - it is paid if  $NAV > HWM$  at a year end
    - high-water mark (HWM) is the highest previously reached level of the net asset value (NAV)
- **Average minimum investment is US\$1 million** [*according to Barclays database*]
- **The first hedge fund was started by Alfred W. Jones in 1949**
  - Equity Long Short fund

# What Do Hedge Funds Do?

- **Hedge fund performance should be independent from the general market**
- **Dynamic investment strategies**

Emerging markets: Russia, China, India, Brazil...

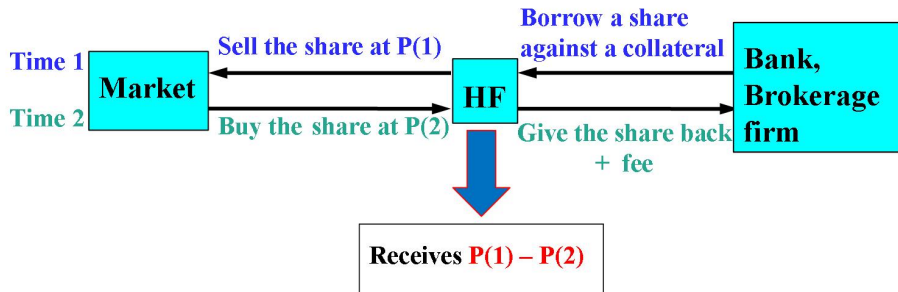
Illiquid assets: buildings, art, movie production...

Using leverage: borrow at a low rate and invest at a higher rate

Short selling: sell what you do not have

Derivative trading: payoff is a function of a value of another asset

# Short Selling of Stocks - a Simplified Example



**Profit if  $P(1) > P(2)$ , Loss if  $P(1) < P(2)$**

# Investment Strategies of Hedge Funds

- **Directional: betting on trends**
  - equity long/short (over 70% of all hedge funds)
  - fixed income
  - global macro
  - currency
- **Relative value: betting on relative mispricing of securities**
  - capital structure arbitrage (convertible arbitrage)
  - fixed income arbitrage
  - volatility arbitrage
- **Event driven: betting on special events**
  - merger arbitrage
  - corporate reorganization/restructuring/spin-offs

# Who Needs Hedge Funds and Hedge Fund Research?

- **High net-worth individuals**

- less than 100 investors in a fund
- more than 5 million net-worth

- **Funds of funds (and, thus, smaller investors)**

- the only way in many countries to access hedge fund for small investors

- **Insurance companies, pension funds, banks**

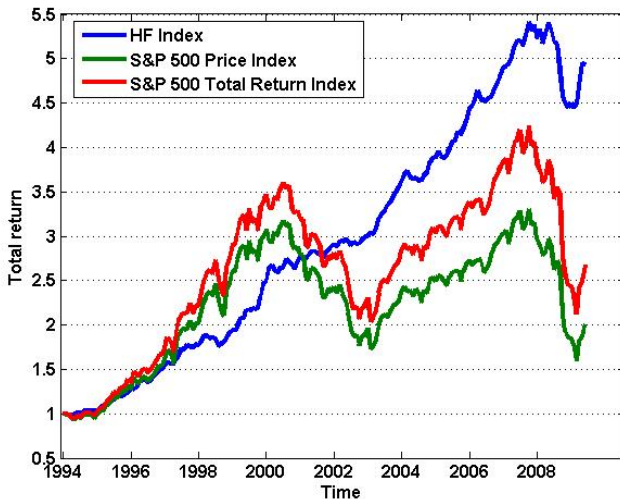
- portfolio diversification

- **All market participants**

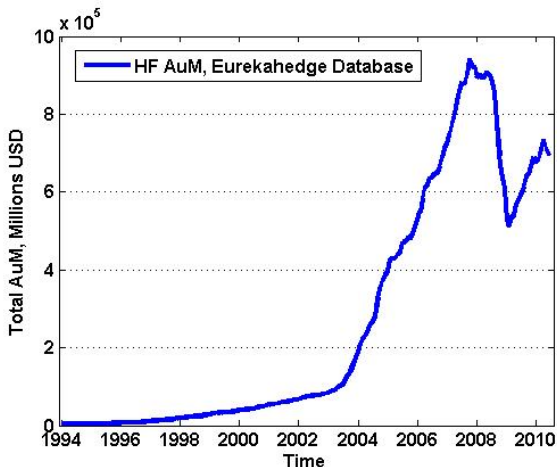
- hedge funds provide liquidity
- hedge funds eliminate market inefficiencies (?)
- hedge funds increase market volatility (?)



# Do Hedge Funds Outperform the Market?



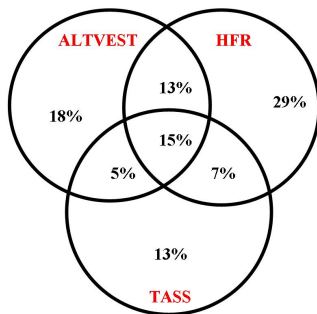
# Total Assets under Management (AuM) in the Hedge Fund Industry



# Where Can One Obtain Information about Hedge Funds?

## • Major database vendors:

- Altvest (Morningstar)
- Barclay
- CISDM
- Eureka hedge
- Hennessee
- HFN
- HFR
- TASS



# What Information is Available?

## • Details of hedge funds

- fund name
- address
- manager name(s)
- fees (performance fee, management fee, redemption fee)
- style

## • Details of holding investment company

- name
- address
- legal structure

## • Performance information

- monthly returns net of all fees
- AuM (incomplete)

# Is This Information Reliable?

## Need to Control for Biases!

### ● Self-selection bias

- poorly performing funds do not report
- extremely well performing funds do not report (LTCM)
- **problem: even the direction of the bias is difficult to assess, and not possible to control for it!**

### ● Back-filling bias

- hedge funds backlist their past good performance
- "pre-cooking" of hedge funds into "back yards" of companies
- **correction: disregard first 12-24 reported returns**

### ● Survivorship bias

- exit returns are not observed
- **partial solution: using returns of funds of funds**

### ● Self-reported styles

### ● Return smoothing

## Example 1: Self-Reported Styles: Global Macro HF Indices in Different Databases

- Monthly returns' descriptive statistics

|        | Altvest | Hennessee   | HFR   | TASS        |
|--------|---------|-------------|-------|-------------|
| Mean   | 0.91    | <b>0.54</b> | 0.82  | <b>1.13</b> |
| Median | 0.62    | 0.30        | 0.68  | 1.07        |
| STD    | 2.31    | 2.19        | 2.07  | 3.16        |
| Min    | -4.15   | -7.52       | -6.40 | -11.55      |
| Max    | 7.42    | 6.72        | 6.82  | 10.60       |

- Correlation of monthly returns

|           | Hennessee | HFR  | TASS        |
|-----------|-----------|------|-------------|
| Altvest   | 0.75      | 0.79 | <b>0.53</b> |
| Hennessee |           | 0.86 | 0.76        |
| HFR       |           |      | 0.73        |

## Example 1 continued

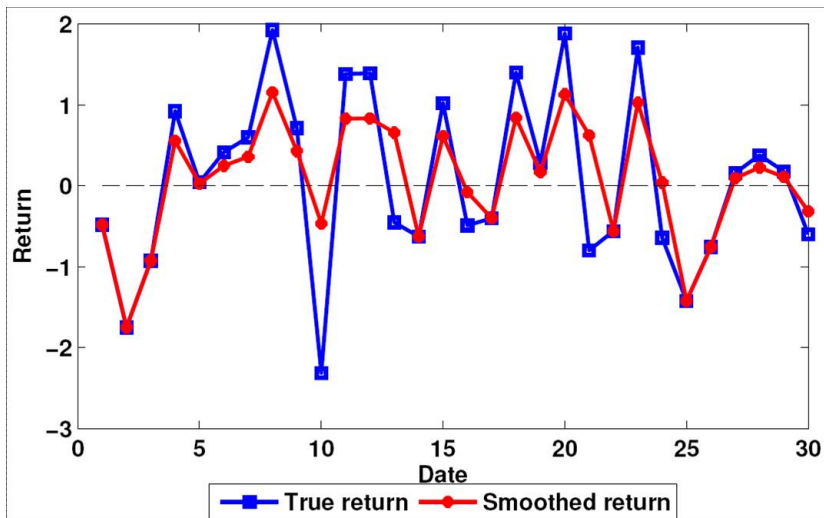
- Databases do not represent the complete industry
- Style migration
- Empirical styles from factor models can be very different from reported styles

## Example 2: Return Smoothing: How Are Returns Smoothed?

- Large positive returns in one month are understated
  - illiquid securities
  - discretion in valuation
- The unreported parts are used in order to compensate for losses during subsequent months



## Example 2: Return Smoothing: How Are Returns Smoothed?



## Example 2: Return Smoothing: What Are the Implications?

- Returns are serially correlated
- The mean return is correctly reported
- The return standard deviation is understated
- The variance-based risk measures indicate more favorable risk-return tradeoff
  - For example, the Sharpe Ratio:

$$\text{Sharpe\_Ratio} = \frac{\text{Expected\_Return} - \text{Risk\_free\_Rate}}{\text{Return\_Standard\_Deviation}}$$

## Example 2: Return Smoothing: How Can One Control for It?

- Assume the true unobserved HF return process:

$$r_t = \alpha + X_t' \cdot \beta + \epsilon_t$$

- where:
  - $r_t$  is a hedge fund return at time  $t$
  - $X_t$  is the matrix of risk factors
  - $\beta$  is the vector of factor loadings
  - $\alpha$  is the hedge fund abnormal return
  - $\epsilon_t$  is a normally distributed error term

## Example 2: Return Smoothing: How Can One Control for It?

- The reported returns are smoothed:

$$\tilde{r}_t = \theta_0 r_t + \theta_1 r_{t-1} + \dots + \theta_k r_{t-k}$$

- Smoothing weights:

$$\theta_j \in [0, 1], \quad j = 0, \dots, k, \quad \text{and} \quad \sum_{j=0}^k \theta_j = 1$$

- Resulting observed returns

$$\tilde{r}_t = \alpha + \sum_{j=0}^k \theta_j \cdot X'_{t-k} \cdot \beta + \eta_t$$

$$\eta_t = \theta_0 \epsilon_t + \theta_1 \epsilon_{t-1} + \dots + \theta_k \epsilon_{t-k}$$

## Example 2: Return Smoothing: What is the Empirical Evidence?

- Positive serial correlation in monthly hedge fund returns
- When modeling hedge funds, one should always control for serial correlation using, e.g., MA(q) residual structure
- The number of significant lags is 2 on average but can vary with the liquidity of a hedge fund
- Funds following less liquid strategies have larger serial correlation and it is significant up to a higher order
  - illiquid securities holdings
  - usage of stale prices, as the market values of the holdings are not always available
  - usage of a model to estimate returns for assets that are not traded

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# What Drives Hedge Fund Performance?



# What Drives Hedge Fund Performance?





## How to Measure Hedge Fund Performance?

- **Alpha** is the abnormal return that a hedge fund earns in excess of the fair compensation for risks taken (net of fees)
- If alpha is **positive**, hedge fund managers have skill and deserve high fees
- If alpha is **negative**, hedge funds do not even earn normal returns to compensate investors for risks taken
- **Problem:** hedge fund holdings are not disclosed and the risks taken are not known!

# How to Measure Hedge Fund Performance?

- If one wants to estimate an alpha, one needs to control for hedge fund risk-taking
- Thus, one needs to know factors, which can vary with fund style, and control for all possible biases in the data
- A positive alpha can be documented if not all hedge fund risk factors are taken into account
- **Problem:** we do not have reliable models of hedge fund performance

# Models for Hedge Funds:

## Linear Models with Constant Factor Loadings I

- Assume the true (unobserved) HF return process:

$$r_t = \alpha + \sum \beta_i \cdot F_{i,t} + \epsilon_t$$

- where
  - $r_t$  is a hedge fund return (in excess of a risk-free rate) at time  $t$
  - $F_{i,t}$  is a value of the  $i$  –  $th$  factor at time  $t$
  - $\beta_i$  is a specific loading on the  $i$  –  $th$  factor
  - $\alpha$  is the hedge fund abnormal return **alpha**
  - $\epsilon_t$  is an error term

# Models for Hedge Funds:

## Linear Models with Constant Factor Loadings II

- **Linear factors**

- CAPM Sharpe (1964) CAPM

- FF3 Fama and French (1993) three factor model

- AN8 Agarwal and Naik (1999) eight factor model

- **Non-linear factors**

- HMCAPM Favre and Rinaldo (2003) higher-moment-adjusted CAPM

- FH7 Fung and Hsieh (2004) seven factor model

- **Hedge-fund-index based factors**

- JMN Jagannathan, Malakhov, and Novikov (2006) index model

## Models for Hedge Funds: Empirical Evidence

- Average performance of these models is rather poor based on monthly returns of individual hedge funds

|                  | Mean Alpha | STD  | % Positive Alphas | Mean Adj. $R^2$ (%) |
|------------------|------------|------|-------------------|---------------------|
| <b>CAPM</b>      | 0.75       | 0.87 | 55                | 16                  |
| <b>HMCAPM</b>    | 0.87       | 1.18 | 51                | 18                  |
| <b>FF3Factor</b> | 0.58       | 0.83 | 46                | 25                  |
| <b>AN8Factor</b> | 0.46       | 0.84 | 37                | 26                  |
| <b>FH7Factor</b> | 0.63       | 0.82 | 44                | 25                  |
| <b>JMN</b>       | 0.12       | 0.83 | 15                | 31                  |

## Models for Hedge Funds: Why Such Poor Performance?

- Regime changes: different betas during the internet bubble (October 1998 to March 2000) or financial crises (2007-2010)

$$r_t = \alpha + X_t(\beta + \tilde{\beta} \cdot \mathbb{I}_{t_1 \leq t \leq t_2}) + \epsilon_t$$

- Asymmetric sensitivity to factor returns

$$r_t = \alpha + X_t^+ \beta^+ + X_t^- \beta^- + \epsilon_t$$

$$X_t^+ = \begin{cases} X_t, & \text{if } X_t > 0 \\ 0, & \text{otherwise} \end{cases} \quad X_t^- = \begin{cases} X_t, & \text{if } X_t \leq 0 \\ 0, & \text{otherwise} \end{cases}$$

- Return non-linearities that are not captured by linear methods
  - returns on option positions
  - dynamic exposure to risk-factors

## Models for Hedge Funds: Dynamic Factor Loadings

- Factor loadings are time varying

$$r_t = \alpha + X_t' \beta_t + \epsilon_t$$

$$\beta_t = \beta_0 + \phi \beta_{t-1} + Z_t' \lambda + \eta_t$$

- Problem:** lack of data for reliable estimation
  - average hedge fund has 5 years of monthly reported returns
- Whether an alpha is truly an **abnormal** return or a **normal** return on unknown risk-factors is still an open question...

## Hedge Fund Alpha: Empirical Evidence

- On average, hedge funds **do not outperform** the general market
- At most, hedge fund managers make up for their fees
- However, the performance of the **top funds** cannot be attributed to pure luck: the best HF managers **do have an alpha**, which more than offsets the fees
  - bootstrap analysis under the  $H_0$  of no alpha
  - the right tail of the actual alpha distribution is significantly longer than that of the simulated one



# Is Alpha Predictable?

- **Persistence analysis of alpha (manager skill)**

- If a hedge fund has an alpha larger than the industry median in one period, is it likely to have a higher alpha in subsequent period?
- Empirical evidence
  - maximum persistence at the quarterly horizon (due to return smoothing?)
  - little persistence at longer (yearly) horizons

- **High time variation in alphas**

- e.g. funds of hedge funds seem to have positive alpha during the internet bubble

- **Smart money effect**

- fund flow chases outperforming funds
- past performance (alpha) influences future flow
- fund flow adversely impacts future performance (decreasing return to scale)

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## Key Questions Related to HFs Death

- **Why do HFs disappear from databases?**
  - Liquidation
    - poor performance over (on average) 6 months
    - high outflow, lost of assets
    - large negative shock
  - Closure for new investments
    - fund reaches the optimal asset level
    - does not accept new investors
    - does not need to advertise any more
  - Other reasons
- **What are the consequences for investors?**
  - loss of value (-50%, -100%?)
  - delays in repayments
- **Need to forecast HF liquidation**

# Predicting HF Liquidation: Commonly Used Econometric Approaches

- **Logit/Probit model**

- estimate liquidation probability
- determine factors significantly influencing this probability

- **Proportional hazard rate model**

- estimate changes in a hazard rate relative to a baseline case
- determine factors significantly influencing this rate

## Predicting HF Liquidation: Empirical Evidence

- **Liquidation probability decreases in:**
  - performance (return, alpha, alpha t-stat)
  - performance relative to the style/industry average
  - size
  - fund flow
  - general market performance
- **Liquidation probability increases in:**
  - risk (STD, VaR, tail risk)
  - excess flow to fund from the same style

## Predicting HF Liquidation: Logit/Probit Models

- Observed variable

$$y_{i,t} = \begin{cases} 1, & \text{if } y_{i,t}^* > 0 \text{ HF } i \text{ is liquidated at date } t \\ 0, & \text{otherwise} \end{cases}$$

- Latent process

$$y_{i,t}^* = X'_{i,t}\beta + \eta_{i,t}$$

- Probability to be estimated

$$Pr(y_{i,t} = 1) = F(X'_{i,t}\beta)$$

- Distributional assumptions

$$F(X'_{i,t}\beta) = \begin{cases} \frac{1}{1 + \exp(-X'_{i,t}\beta)}, & \text{(logit)} \\ \Phi(X'_{i,t}\beta), & \text{(probit)} \end{cases}$$

# Predicting HF Liquidation: Cox Proportional Hazard Rate Model

- A semi-parametric model
- Hazard rate specification

$$h_i(t) = h_0(t) \cdot \exp(X_i' \beta)$$

- $h_i(t)$  is a hazard rate
- $h_0(t)$  is the baseline hazard rate, taking any unknown form
- for two observations with characteristics  $X_i$  and  $X_j$

$$\frac{h_i(t)}{h_j(t)} = \exp((X_i - X_j)' \beta)$$

- The model can be extended to time varying covariates

## Predicting HF Liquidation: Institutional Complications

- Investment companies control several HFs
- Origination and liquidation decisions are interrelated for those HFs
- Relative position of a HFs within its company matters more than its absolute position



# Predicting HF Liquidation: Institutional Complications

| Variable                                   | Coefficient               | z-statistic | Coefficient | z-statistic |
|--|---------------------------|-------------|-------------|-------------|
| Constant                                   | -42.799                   | -1.341      | -84.202**   | -1.975      |
| Average fund return                        | -0.053**                  | -1.966      | -0.006      | -0.155      |
| Return standard deviation                  | 0.019                     | 1.411       | 0.004       | 0.221       |
| Value relative to the HWM                  | -0.268                    | -0.761      | 0.244       | 0.537       |
| Log AuM                                    | -0.197***                 | -5.686      | -0.012      | -0.260      |
| Percentage flow                            | -1.945***                 | -3.328      | -1.641***   | -2.817      |
| Management fee                             | -0.085                    | -1.057      | -0.043      | -0.534      |
| Incentive fee                              | -0.005                    | -0.542      | 0.001       | 0.043       |
| Fund starting date                         | 0.022                     | 1.368       | 0.042**     | 1.972       |
| Number of existing funds                   | -0.240***                 | -9.307      | -0.344***   | -11.037     |
| Relative to an average<br>within a company | Average fund return       |             | -0.143**    | -2.299      |
|  | Return standard deviation |             | 0.048       | 1.547       |
|  | Value relative to the HWM |             | -2.258***   | -2.768      |
|  | Log AuM                   |             | -0.630***   | -7.893      |
|  | Percentage flow           |             | -0.161      | -1.431      |
|  | Management fee            |             | -0.263**    | -2.435      |
|  | Incentive fee             |             | -0.012      | -0.565      |
|  | Notice period             |             | -0.014**    | -2.040      |
|  | Fund starting date        |             | -0.094***   | -2.739      |
|  | McFadden R-squared        | 0.125       |             | 0.191       |
| Estrella R-squared                         | 0.136                     |             | 0.210       |             |
| Log-Likelihood                             | -939.952                  |             | -868.878    |             |

## Performance of HFs over their Life

|   | All Funds |        |        | Single-Fund Families |        |        | Multi-Fund Families |        |        | p-value |
|---|-----------|--------|--------|----------------------|--------|--------|---------------------|--------|--------|---------|
|   | All       | Live   | Dead   | All                  | Live   | Dead   | All                 | Live   | Dead   |         |
| <b>Average over one year after start</b>          |           |        |        |                      |        |        |                     |        |        |         |
| Return  | 1.477     | 1.426  | 1.514  | 1.825                | 1.529  | 1.995  | 1.369               | 1.399  | 1.345  | 0.000   |
| Excess return over the HF industry average        | 0.394     | 0.431  | 0.367  | 0.746                | 0.583  | 0.839  | 0.284               | 0.391  | 0.202  | 0.000   |
| Assets under management                           | 38.133    | 50.223 | 29.442 | 19.743               | 26.446 | 15.906 | 43.873              | 56.432 | 34.198 | 0.000   |
| <b>Average over one year prior to liquidation</b> |           |        |        |                      |        |        |                     |        |        |         |
| Return  |           |        | 0.430  |                      |        | 1.002  |                     |        | 0.230  | 0.000   |
| Excess return over the HF industry average        |           |        | -0.585 |                      |        | -0.053 |                     |        | -0.772 | 0.000   |
| Assets under management                           |           |        | 78.354 |                      |        | 49.264 |                     |        | 88.566 | 0.001   |

## What return is missing, after HF stops reporting to databases? -50%? -100%?

- **Match FoFs with HFs, which can potentially constitute their portfolios**
  - Use HFs with at least 36 reporting returns and estimate their loadings

$$R_{i,t} = [r_t]\beta_i + \epsilon_{i,t}$$

- Use those matches, in which one HF is missing in months 37

$$R_{i,T+1} = [r_{L,T+1}, r_{E,T+1}]\beta_i + \epsilon_{i,t}$$

- Reconstruct missing returns

$$\hat{r}_{E,T+1} = (R_{i,T+1} - [r_{L,T+1}]\hat{\beta}_i) / \hat{\beta}_{E,i}$$

## What return is missing, after HF stops reporting to databases? Empirical Evidence

- **Average exit return is not significantly different from mean return of alive HFs**
  - It is not -50%!!!
  - Exit return of funds with **positive** mean return over 6 months prior to exit is **2.65% \*\*** per month
  - Exit return of funds with **negative** mean return over 6 months prior to exit is **-0.78%**
- **Other factors influencing exit return**
  - STD of HF returns prior to the delisting
  - Serial correlation of HF returns
  - Fund exposure to different risk-factors
  - Delisting frequency

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## So, What Do We Know? Part I

- **Hedge funds manage tremendous amount of money and gain popularity**
- **They become relevant to retail customers through banks' and pension funds' exposure**
- **They are nearly unregulated by authorities**

## So, What Do We Know? Part II

- **But!** Hedge fund performance is difficult to assess
  - lack of data
  - scarce information on proprietary investment strategies
  - data biases
  - poorly performing models

# Is Anything Left to Be Done?

## A Lot! Part I

- **What are "true" risks of hedge funds?**
- **Do hedge funds do anything beyond buy and hold?**
- **Can investments in hedge funds improve portfolios consisting of standard asset classes?**
  - should e.g. pension funds invest in hedge funds?



# Is Anything Left to Be Done?

## A Lot! Part II

- **Do hedge funds eliminate market inefficiencies?**
  - what is their influence on financial markets?
  - can hedge funds amplify financial instability?
- **Should hedge funds be more regulated and/or forced to disclose their strategies/holdings?**
- **Will the hedge fund industry survive and/or be changed after the market downturn?**
  - UCITS III funds as an alternative?

# From a Hedge Fund Prospectus...

## Definition

"The nature of the Fund's investments involves certain risks and the Fund utilises investment techniques (such as leverage, short selling and the use of derivatives) which may carry additional risks. An investment in Shares therefore carries substantial risk and is suitable only for persons which can assume the risk of losing their entire investment".