



Understanding Skewness and Kurtosis in Hedge Fund Return Distributions

Why Hedge Fund Returns Aren't Normal

Hedge fund returns tend to have “**fat tails**”, meaning their return distributions often exhibit **higher kurtosis** (more extreme outliers) than a normal (Gaussian) distribution would predict.

Academic studies (e.g. by Fung & Hsieh, Lo, Agarwal & Naik, and others) have shown:

- Hedge fund return distributions depart significantly from normality.
- Many exhibit negative skewness (more frequent large losses) and high kurtosis (fat tails).
- This pattern is strongest in macro, event-driven, and fixed-income arbitrage strategies.

What “fat tails” Mean

A “fat-tailed” distribution has:

- More frequent extreme outcomes (both gains and losses).
- Higher probability of very large losses than the normal model suggests.
- In finance, this means that standard deviation (volatility) underestimates true risk - because extreme events occur more often than models like the normal distribution predict.

Why Hedge Funds Show Fat Tails

1. Leverage

Hedge funds often use leverage, which magnifies both gains and losses - producing heavier tails.

2. Nonlinear strategies

Many hedge funds use derivatives (options, structured products, etc.) that introduce *nonlinear payoffs* - leading to **asymmetry** (skewness) and **excess kurtosis**.

3. Liquidity and crowding effects

During stress, funds may be forced to sell similar assets simultaneously - creating sudden, large losses ("liquidity cascades").

4. Hidden risks and stale pricing

Illiquid positions (e.g. private credit, distressed assets) may appear smooth most of the time, then suddenly reprice - another source of fat tails.

5. Return smoothing

Reported returns may be artificially "smoothed" month to month, but when reality catches up, jumps are larger than expected.

Importance of Skewness and Kurtosis in a Hedge Fund Portfolio Context

Skewness

Skewness measures asymmetry in the return distribution. A **positive** Skewness means more frequent small losses and fewer but larger gains (a long right tail). A **negative** Skewness means more frequent small gains and occasional large(r) losses (a long-left tail).

Kurtosis

Kurtosis measures tailness (how heavy the tails are compared to a normal distribution). A **positive** Kurtosis (leptokurtic) indicates fat tails (more extreme outcomes), whereas a **negative Kurtosis** (platykurtic) indicates thin tails (fewer extreme outcomes).

Positive Skewness: desirable, since it means potential for large(r) upside and limited downside.

Negative Kurtosis: desirable to a degree because it indicates fewer extreme outcomes (less tail risk).

Interpreting the Combination of a Hedge Fund Portfolio

- **Positive skewness + negative kurtosis:** Ideal scenario.
- **Upside potential** exists (long right tail), while **downside risk** and extreme events are limited.

Summary Table For Quick Reference

Measure	Positive Value	Negative Value	Portfolio Implication
Skewness	More change of large(r) gains (good)	More change of large(r) losses (bad)	Positive skew = desirable
Kurtosis	Fat tails = more extremes (bad)	Thin tails = fewer extremes (good)	Low/negative kurtosis = desirable

→ A positively skewed, negatively kurtotic return distribution is usually favorable.

It implies **asymmetric upside potential** with **lower tail risk** — a combination consistent with what investors want: *limited downside, possible big upside, and low probability of extremes.*

Why It Does Not Happen Naturally

1. **Diversification alone isn't enough**
 - Simply holding many assets can reduce overall volatility but does **not guarantee favorable skewness or low kurtosis.**
 - Some assets or strategies may have inherent negative skew or fat tails (high kurtosis).
2. **Random combination can still produce undesirable distribution.**
 - If returns are correlated in tail events, extreme losses can occur even in diversified portfolios.
 - The portfolio could end up with negative skewness or high kurtosis despite diversification.

How To Achieve Positive Skewness and Negative Kurtosis

1. Manager Selection

- Choose managers or strategies with consistent returns and controlled tail risk.
- Generally, avoid strategies that exhibit high negative skewness and high positive Kurtosis (more changes of larger losses and extreme fat tails).

2. Portfolio Construction

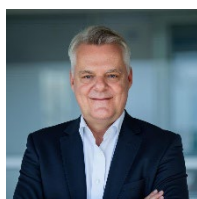
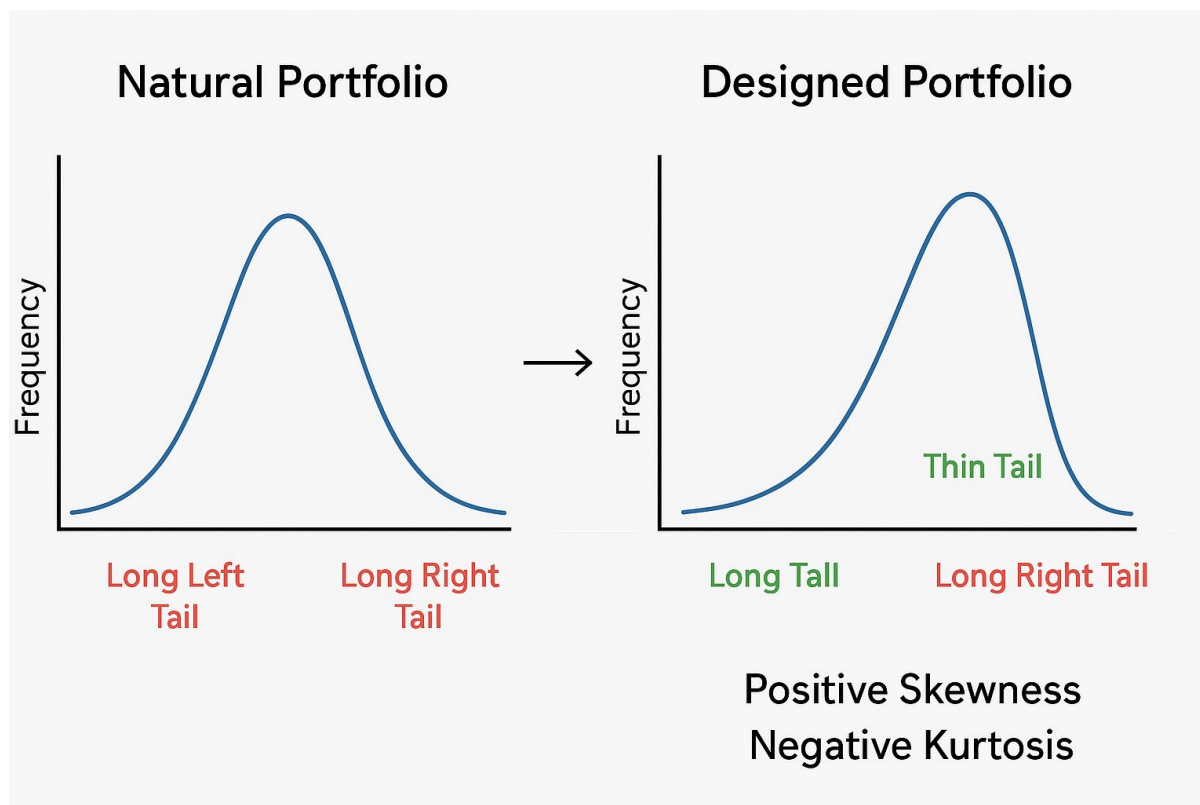
- Combine multiple uncorrelated sources of alpha to smooth returns.
- Allocate systematically to balance upside opportunities with downside protection.
- Size positions accordingly based on tail-risk measures (like Conditional VaR, Expected Shortfall, stress testing).

3. Risk Management

- Use overlays or hedge strategies to reduce exposure to tail events.
- Regularly review positions and adjust position sizing based on tail-risk measures, while controlling leverage to minimize exposure to fat-tail losses.

Key Insight

- Fat tails often emerge not just from the strategy design itself, but from position concentration and leverage that magnify losses during extreme events.
- A positively skewed, negatively kurtotic portfolio is a result of skillful design, **not just diversification**.
- The “shape” of a portfolio’s return distribution is **not accidental** — it’s the cumulative effect of **manager selection, allocation, position sizing, and risk discipline**.



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