

**EDHEC Alternative  
Investment Days  
2007**

Bringing Academic Insights to  
Alternative Investment

**16:30-18:00  
Stream 2F:  
Liability-Driven Investing with Hedge Funds**

Chairman:

**Fons Lute**, CIO, Blue Sky Group

Speaker:

**Lionel Martellini**, Professor of Finance and Scientific Director, EDHEC Risk and Asset Management Research Centre

Panellists:

**Roger Gray**, CIO, Hermes Pensions Management Ltd

**John Noorlander**, Head of Portfolio Strategy & Risk Management, Helvetia Insurance

**Justin Simpson**, Managing Director, Head of Structured Products, Morgan Stanley Investment Management

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# Liability-Driven Investing with Hedge Funds

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# Overview

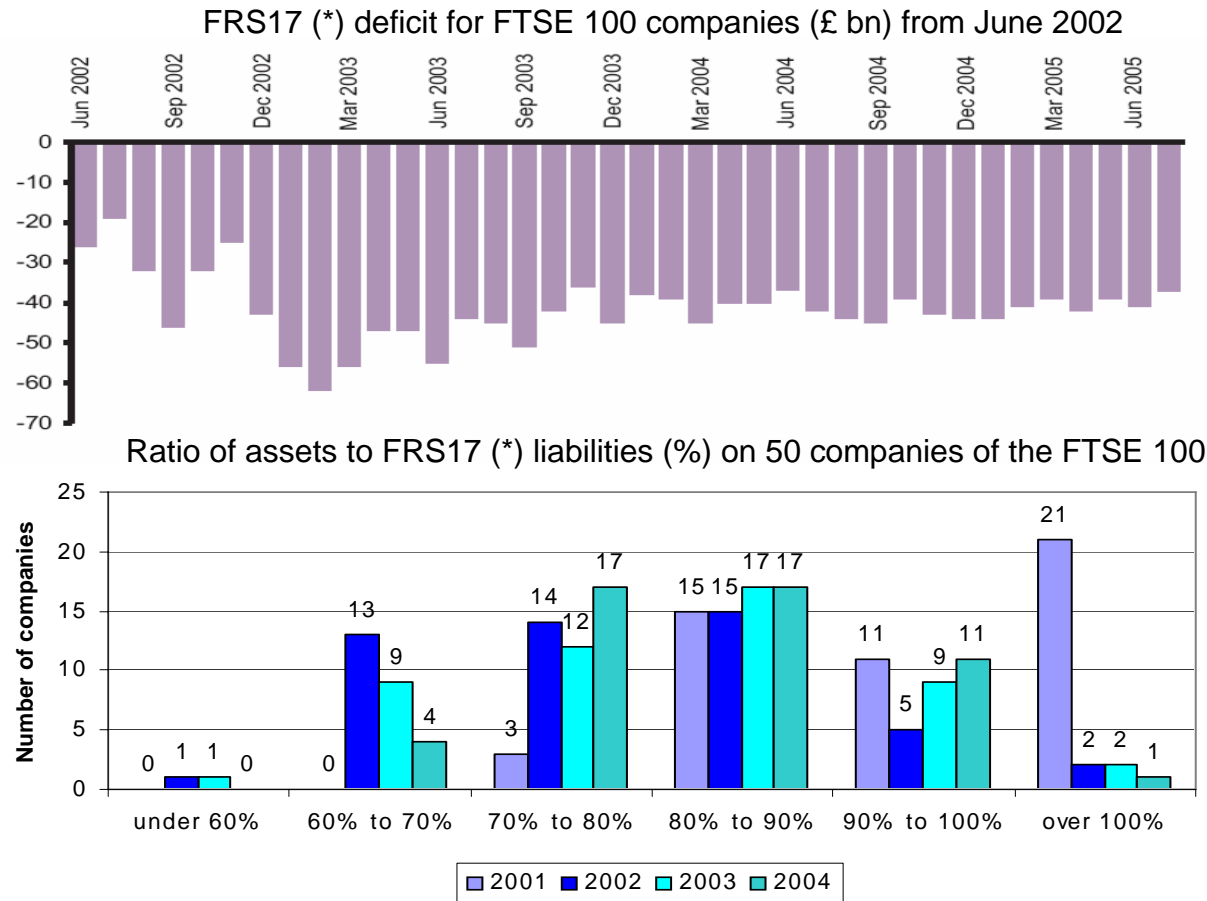
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- The Need for Alternative Investments in Institutional Portfolios
- The History and Prehistory of ALM Techniques
- The Place of Hedge Funds in LDI
- Optimizing the Performance-Seeking Portfolio with HFs
- A Simple Experiment

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- The Need for Alternative Investments in Institutional Portfolios
  - The History and Prehistory of ALM Techniques
  - The Place of Hedge Funds in LDI
  - Optimizing the Performance-Seeking Portfolio with HFs

# AI in Institutional Portfolios

## *Remember the Pension Fund Crisis in the UK?*



Source: Accounting for Pensions Survey 2005, 2004, 2003, Lane, Clark and Peacock Actuaries & Consultants. (\*) Under new accounting standards FRS17, assets are valued at market value and liabilities are discounted with an AA corporate bond discount rate; the surplus or deficit of the scheme will appear in the balance sheet of the sponsor company. Before FRS17, the liabilities were discounted at a fixed rate (transition period: 2001-2005).

# AI in Institutional Portfolios

## *New Investment Vehicles*

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- The situation has improved recently, but institutional investors are still actively seeking new forms of investment strategies to further diversify their stock and bond holdings.
- As far as hedge funds are concerned, an average 51% of European institutional investors are already exposed to such alternative investment strategies according to the EDHEC European Alternative Diversification Practices Survey (2006).
- Allocation to hedge funds have been estimated to represent, on average, 7% of their global assets.

# AI in Institutional Portfolios

## *HF's and LDI*

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- One of the main findings of the survey is that institutional investors would be willing to increase their allocation to hedge funds provided they could increase their comfort level with respect to the role of hedge funds in asset-liability management,
- This comes at a time when liability-driven investment strategies has become an increasing force, without always a clear understanding of what exactly lies behind these words.

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- The Need for Alternative Investments in Institutional Portfolios
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# The History and Prehistory of ALM

## *A (Very) Brief History of ALM*

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- Cash-flow matching & immunization
  - Cash-flow matching: involves a perfect match between the cash flows from the portfolio of assets and the commitments in the liabilities; inflation-linked instruments are often used in that perspective.
  - Immunization: to the extent that perfect matching is not possible, this technique allows the residual interest rate risk created by the imperfect match between the assets and liabilities to be managed in an optimal way.
  - AM counterpart: investing in risk-free asset.
- Surplus optimization
  - In a concern to improve the profitability of the assets, and therefore to reduce the level of contributions, it is necessary to introduce into the strategic allocation asset classes (stocks, nominal bonds) that are not perfectly correlated with the liabilities.
  - AM counterpart: investing in optimal risky portfolio.

# The History and Prehistory of ALM

## *Separating Risk and Performance Management*

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- One key feature of surplus optimization is that we assign two conflicting goals in the design of the optimal allocation decisions:
  - On the one hand, managing (liability) risk;
  - On the other hand, managing performance expectations.
- We have evidence that these two conflicting objectives are best managed when handled separately.
- This simple prescription is known in academia as a *fund separation theorem*, and it provides conceptual justification to the liability-driven investment solutions that have recently been developed in industry practice.

# The History and Prehistory of ALM

## *LDI Solutions and the Fund Separation Theorem*

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- Optimal portfolio strategy

$$w^* = \frac{1}{\gamma}(\sigma\sigma')^{-1}(\mu - r\mathbf{1}) + \left(1 - \frac{1}{\gamma}\right)(\sigma')^{-1}\sigma_L$$

- We thus obtain a two (three) funds separation theorem
  - The first portfolio is the standard (AM) optimal efficient portfolio.
  - Amount invested is inversely proportional to the investor's Arrow-Pratt coefficient of risk-aversion.
  - The second portfolio is a liability-hedging portfolio: it can be shown to have the highest correlation with the liabilities; alternatively, it is a portfolio that minimizes the local volatility of the funding ratio.


$$\sigma_F^w = \left( (w'\sigma - \sigma_L')^2 + \sigma_{L,\varepsilon}^2 \right)^{1/2}$$

# The History and Prehistory of ALM

## *LDI Solutions*

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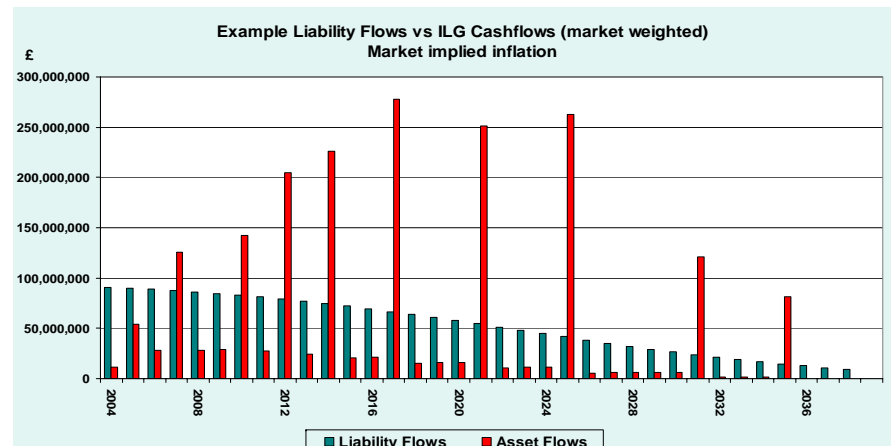
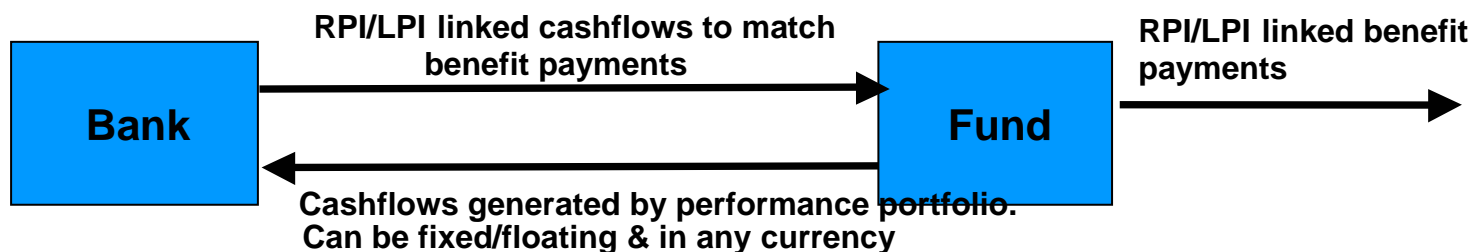
- Building block # 1
  - It involves cash-flow or duration matching: use derivatives (interest rates and inflation swaps) along with traditional fixed-income instruments to manage the interest rate risk (immunization/dedication).
  - Leverage is usually employed in this leg.
  - This part is customized with respect to the liability structure of the client.
- Building block # 2
  - It is a performance seeking portfolio.
  - There is a need for risk management, and not only asset management, in performance seeking portfolio.
  - This legitimates the use of absolute return strategies and non-linear payoffs.

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# The Place of Hedge Funds in LDI

## *Hedge Funds in LMP*

- Hedge funds are not particularly useful in liability-matching portfolios, in a situation when financial risks can be satisfactorily hedged with cash and derivatives instruments such as inflation and interest rate swaps.



# The Place of Hedge Funds in LDI

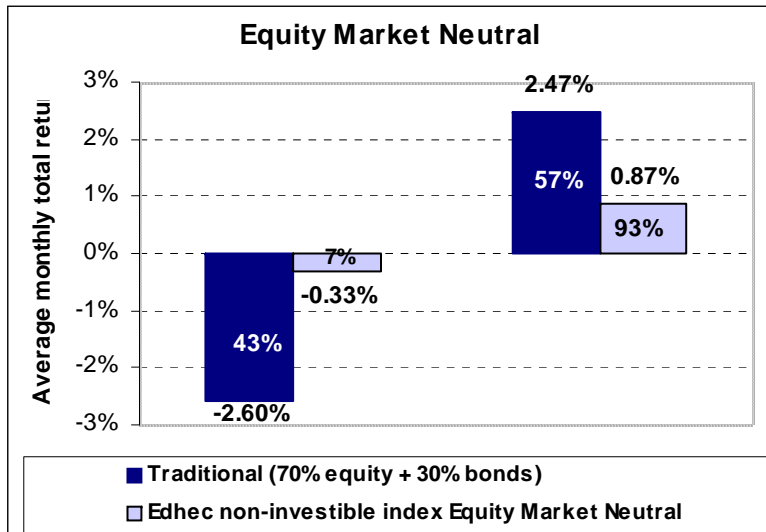
## *Hedge Funds in PSP*

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- On the other hand, hedge funds can be particularly useful in performance-seeking portfolios.
- In the case of investment in a leveraged position in liability-matching portfolio, the natural benchmark is given by the cost of leverage; this justifies a focus on absolute return strategies.
- More generally, the key question is: how to get access to equity (and bond) risk premium without all the associated downside risks? In this context, hedge funds offer a convenient solution because they can be used to deliver consistent diversification benefits.

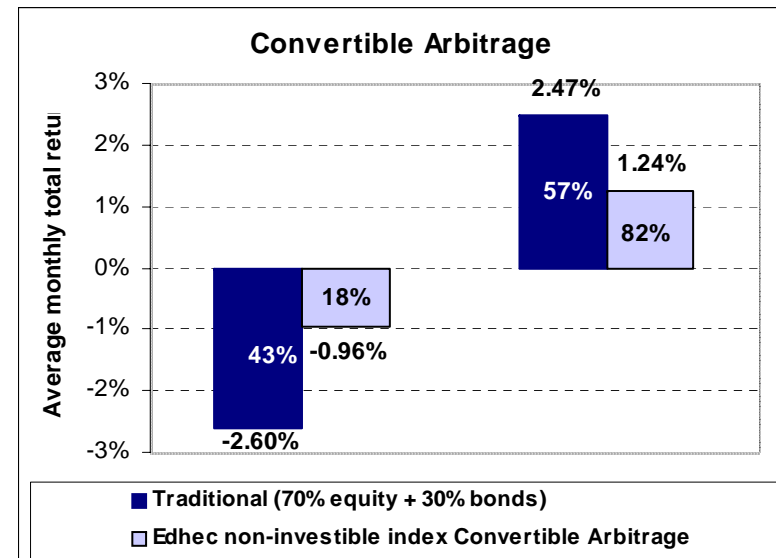
# The Place of Hedge Funds in LDI

## *Stand-Alone Absolute Return Benefits*



*Active portfolio management with an absolute return focus implies opposing a risk management process on the downside to an idea generation process of the upside*

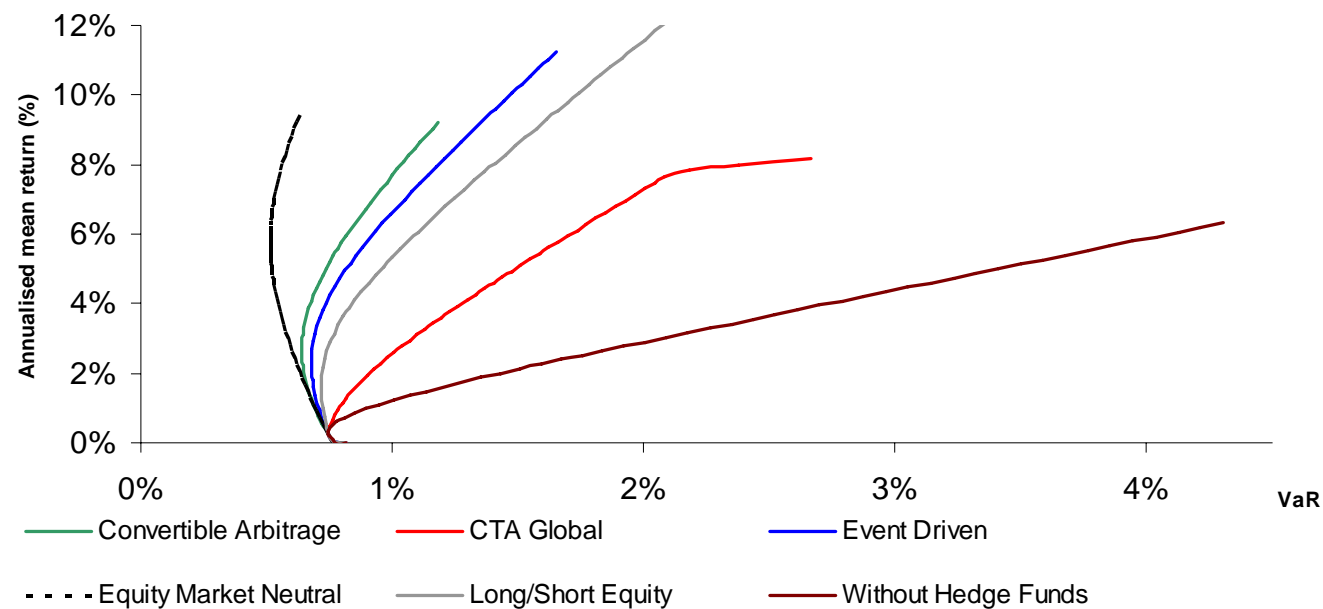
*With traditional asset classes, negative returns are (at least) as numerous and large as positive returns; on the other hand, hedge funds returns offer a non-linear payoff*



# The Place of Hedge Funds in LDI

## *Diversification Benefits of Hedge Funds*

Mean-VaR Efficient Frontiers (based on Cornish-Fisher Expansion)



Mean-VaR Efficient Frontiers based on Edhec Hedge Fund Indices and MSCI Equity and Bond World Indices over the Period 1997-2005

# The Place of Hedge Funds in LDI

## *Selection of Hedge Fund Strategies*

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- In fact the situation is more complex, and not all hedge fund strategies are equally suited for diversifying stock and/or bond portfolios.
- For example, we do not expect long-short equity, which contains lots of TEF, to help diversify a stock portfolio.
- Based on a formal quantitative analysis (see next slide), we have found that the following mix is well suited for the purpose of diversifying a stock versus a bond portfolio.

<b>Equity Diversifier</b>	<b>Bond Diversifier</b>
Convertible Arbitrage	Convertible Arbitrage
CTA Global	Equity Market Neutral
Equity Market Neutral	Event Driven
	Long/Short Equity

# The Place of Hedge Funds in LDI

## *Optimal Mixing with Stocks and Bonds*

*With MSCI World Stock Index*

	Convertible Arbitrage	CTA Global	Event Driven	Equity Mkt Neutral	Long Short Equity
Covariance Beta	0.06	-0.11	0.27	0.06	0.38
Cokurtosis Beta	0.10	-0.26	0.36	0.07	0.38

*With Lehman Global Treasury Bond Index*

	Convertible Arbitrage	CTA Global	Event Driven	Equity Mkt Neutral	Long Short Equity
Covariance Beta	-0.06	1.51	-0.34	0.05	-0.37
Cokurtosis Beta	-0.12	1.27	-0.36	0.08	-0.08

Co-moments of Hedge Fund Index Return Distribution with Respect to Stock and Bond Returns,  
based on Edhec Hedge Fund Indices with Respect to MSCI World Equity and Lehman Global Treasury Bond Index over the  
Period 01/1997-12/2005

	No diversification potential
	Low diversification potential
	High diversification potential
	Very high diversification potential

### **Interpretations (improvement of portfolio moments)**

Decrease in portfolio 2<sup>nd</sup> moment (volatility)  $\Leftrightarrow$  beta covariance  $< 1$

Decrease in portfolio 4<sup>th</sup> moment  $\Leftrightarrow$  beta cokurtosis  $< 1$

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# Optimizing PSPs with HFs

## *Example of Application*

Assets	Liabilites
<ul style="list-style-type: none"> <li>➤ Stocks</li> <li>➤ Bonds</li> <li>➤ TIPS</li> </ul>	<ul style="list-style-type: none"> <li>➤ TIPS +300 basis points p.a.</li> </ul>

	Stocks	Bonds	TIPS
<b>Stocks</b>	1		
<b>Bonds</b>	0.24	1	
<b>TIPS</b>	-0.05	0.52	1
<b>Mean</b>	<b>10.4%</b>	<b>5.8%</b>	<b>4.3%</b>
<b>Volatility</b>	<b>16.5%</b>	<b>8.5%</b>	<b>6.58%</b>

For mean return & volatility on stocks and bonds, we have used Dimson, Marsh & Staunton (\*) 1900-2000 estimates (see table 6-1 page 79 (bonds – US: 2.1% real + 3.3% inflation + 0.4% credit spread) and table 34-1 page 311 (stocks - world)); for volatility on TIPS, and for correlation matrix, we have used Kothari and Shanken (\*\*) 1953-2000 estimates (see table 3 page 59 and table 4 page 62); for estimated mean return on TIPS = inflation + real short term (or 3.3%+1% - US)

(\*) Dimson, E., P., Marsh and M., Staunton, Triumph of the Optimists, 2002, Princeton University Press.

(\*\*) Kothari, S., and Shanken, J., 2004 (Jan./Feb.), Asset Allocation with Inflation-Protected Bonds, Financial Analysts Journal, pages 54-70.

# Optimizing PSPs with HFs

## *Diversification Benefits*

- Introducing Hedge Funds leads to volatility reduction

	<b>0% HF</b>	<b>5% HF</b>	<b>15% HF</b>	<b>25% HF</b>	<b>35% HF</b>
<b>Stocks</b>	16.50%	15.62%	13.75%	11.99%	10.34%
<b>Bonds</b>	8.50%	7.98%	7.21%	6.70%	6.18%
<b>TIPS</b>	6.58%	6.58%	6.58%	6.58%	6.58%

- Do not mix hedge funds with TIPS, because TIPS portfolio is the liability matching portfolio.
- Impact based on Amenc, Goltz and Martellini (2005).
- Robustness tests available.
- We kept the long-term mean parameters unchanged.
- Generate 10,000 scenarios over 10Y horizon.

# Optimizing PSPs with HFs

## *Results*

- Highest position in TIPS (here they form 100% of the LMP due to their perfect correlation with liabilities).
- TIPS position decreases as HF are introduced.
- Expected relative shortfall and extreme loss probabilities decrease.

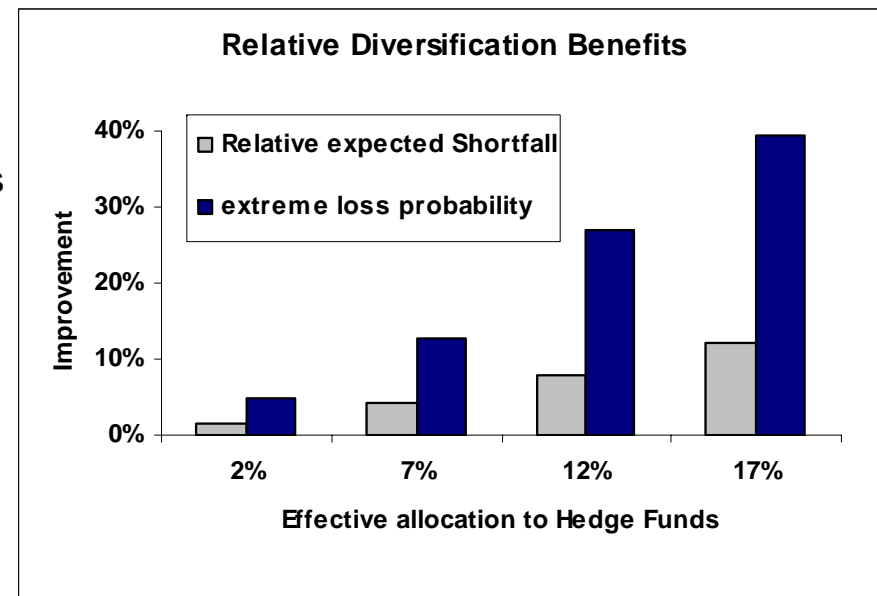
	<b>Stocks</b>	<b>Bonds</b>	<b>TIPS</b>	<b>exp.rel. SF</b>	<b>Prob(SF&gt;25%)</b>
<b>0% HF</b>	15.71%	29.11%	55.19%	17.81%	19.58%
<b>5% HF</b>	16.93%	24.90%	58.17%	17.57%	18.66%
<b>15% HF</b>	18.24%	29.20%	52.55%	17.04%	17.09%
<b>25% HF</b>	27.83%	18.39%	53.78%	16.42%	14.29%
<b>35% HF</b>	32.89%	14.49%	52.62%	15.66%	11.89%

# Optimizing PSPs with HFs

## Results

Stocks	Bonds	TIPS	Hedge Funds	relative SF reduction	Relative extreme loss probability reduction
15,71%	29.11%	55.19%	0.00%	-	-
16,09%	23.66%	58.17%	2.09%	1.36%	4.70%
15,51%	24.82%	52.55%	7.12%	4.36%	12.72%
20,88%	13.79%	53.78%	11.56%	7.82%	27.02%
21,38%	9.42%	52.62%	16.58%	12.09%	39.27%

- TIPS are not diversified with Hedge Funds
- Reasonable effective allocation to HF
- Important relative benefits
- Extreme risk highly reduced



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