Discovering new paths to fully funded

Dynamic ALM strategies

Objective

- Enable trustees and sponsor companies to develop a plan with their consultants that targets fully funded situation within a defined time period while minimising contributions
- Bring together the needs and wishes of trustees and financial directors:
  - making sure that full funding is achieved as quickly as possible
  - while minimising the contributions needed (taking into account any constraints)
  - and as the funding ratio improves, making sure that a higher and higher level of funding ratio is protected

Dynamic ALM: Cutting edge De&Re-Risking strategy(1)

- Our dynamic ALM (DALM) models are a generalization of the academic concept of TPPI (Time Varying Proportion Portfolio insurance) to the presence of liabilities and to the use of more than 2 asset classes
- Two ingredients for the DALM approach
  - The Liability Hedging Portfolio (LHP)
  - The Performance Seeking Portfolio (PSP)
- Risk management is done through protecting a chosen level of funding ratio. The protection level can go up when the funding ratio improves
- The investment in the PSP depends not only on risk-aversion & market conditions, but also on the margin for error (i.e. how far is the actual funding ratio from the funding ratio we are trying to protect)
- Research has shown that the optimal allocation between the two components varies over time, depending on the realised funding ratio and the protected funding ratio

Dynamic ALM: Cutting edge De&Re-Risking strategy(2)

- The success of a risk controlled strategy depends on:
  - Use of a suitably-designed strategy (risk based as opposed to forecast based) to dynamically allocate between the LHP & the PSP
  - Use of suitably-designed «building blocks»
    - LHP that is a good match for liabilities
    - PSP with relevant risk-return characteristics (in particular downside protection)
  - Use of parameter values in the model that allow us to meet the relevant objectives & constraints even in the most adverse scenarios

Design methodology of Dynamic ALM

- Liabilities analysis
- Use of appropriate techniques for the generation of stochastic scenarios for each asset class, for the yield curve and the liabilities
- Create the building blocks
  - Best stochastic match for LHP
  - Combine assets by pairs and find the best parameters to construct the PSP
- Find optimum parameters in stochastic environment for the design of the Dynamic ALM solution that best fits the pension fund liabilities stream and particular constraints, to ensure risk is properly managed no matter the scenario (i.e. even if the future does not look like the past!)
- Analysis of the distribution of the funding ratio, necessary contributions, surplus, expected return, volatility, max drawdown, etc...

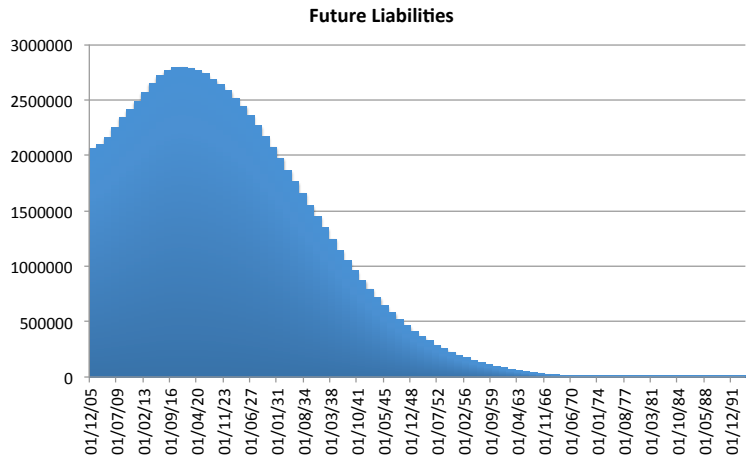
Simulation methodology (1)

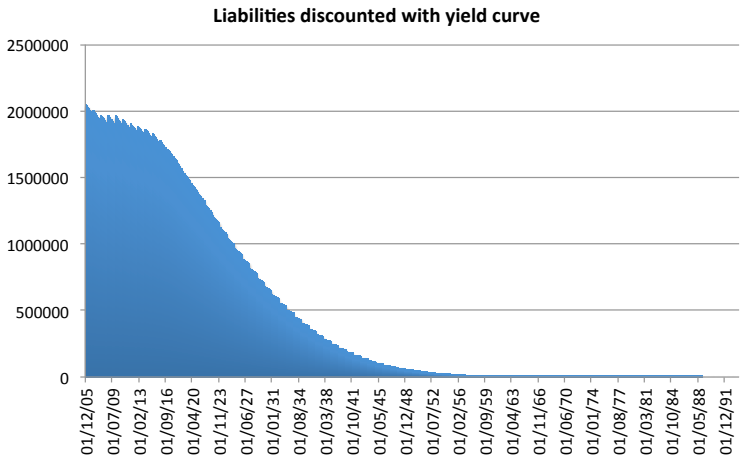
- Filtered Historical Simulations (FHS)
  - Barone-Adesi, Bourgoin and Giannopoulos (1998) and Barone-Adesi, Giannopoulos and Vosper (1999)
  - Combines an appropriate model-based treatment of volatility with a non parametric specification of the probability distribution of asset returns
  - Model for stochastic volatility belongs to the EGARCH family, allows taking into account the asymmetry (leverage effect) in the model for conditional volatility
  - Mostly used for extreme risk modeling (VaR approaches)

Simulation methodology (2)

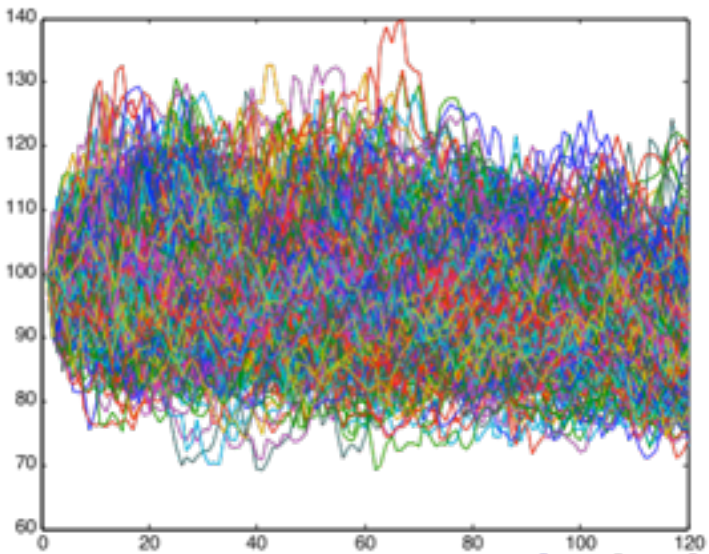
- Interest of FHS
  - Able to generate deviations that exceed those found in the original return data
  - Reproduces volatility clusters observed in real data
  - Keeps fat tails observed in empirical distributions
  - Does not involve theoretical assumptions on return distributions
  - Keeps the dependence structure embedded in the empirical data by bootstrapping at the same dates for all assets each time

Analysing the liabilities



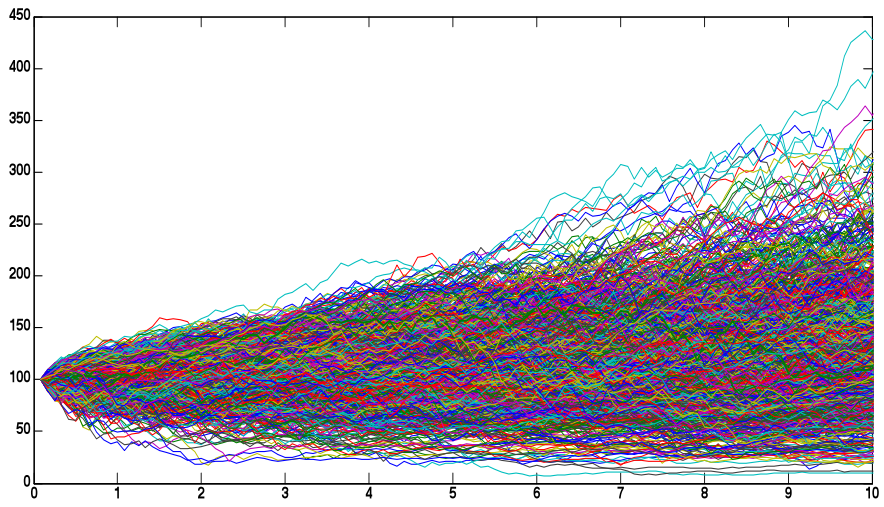


- From a static to a stochastic approach to liabilities

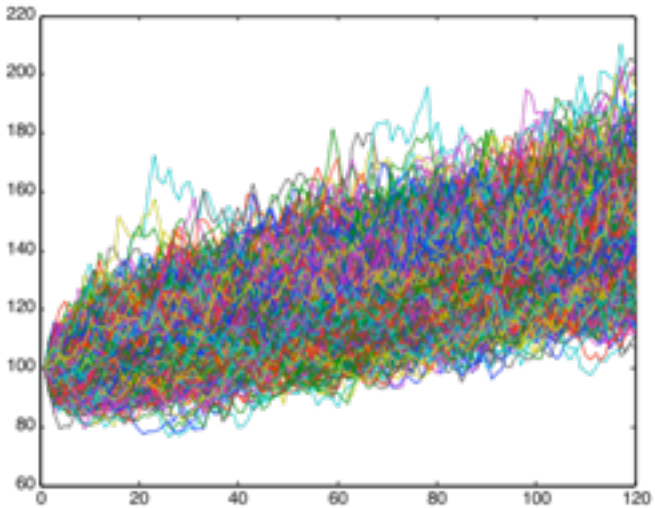


Generating scenarios for the asset classes

Example of large cap equities, 1000 Scenarios



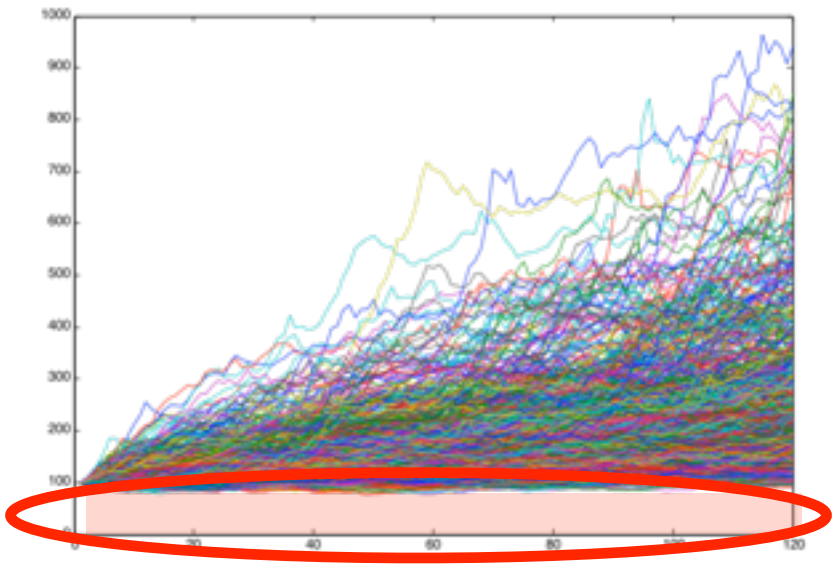
Example of 12,5 year duration bonds, 1000 Scenarios

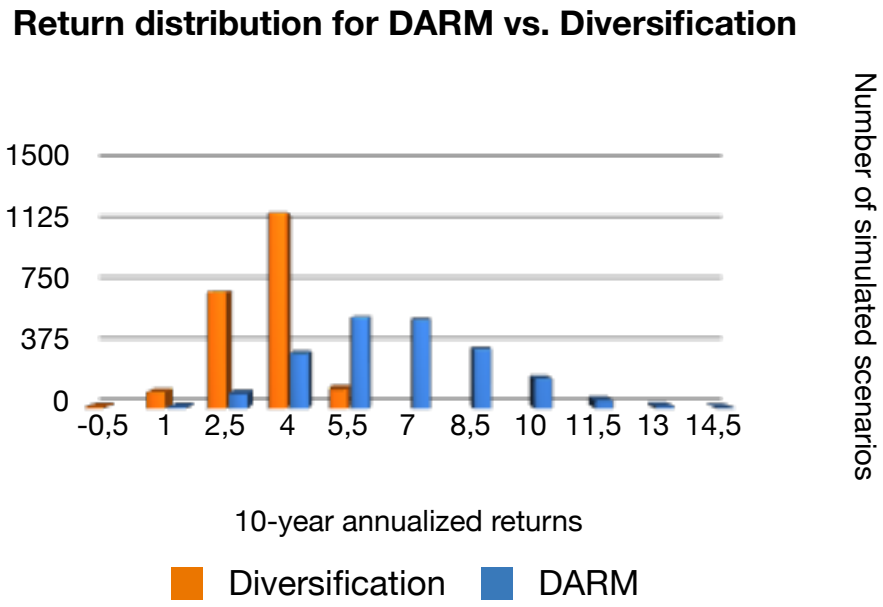


10 years horizon

- Generate 1000 scenarios for each asset class, allowing for more extreme risk that what history has shown us

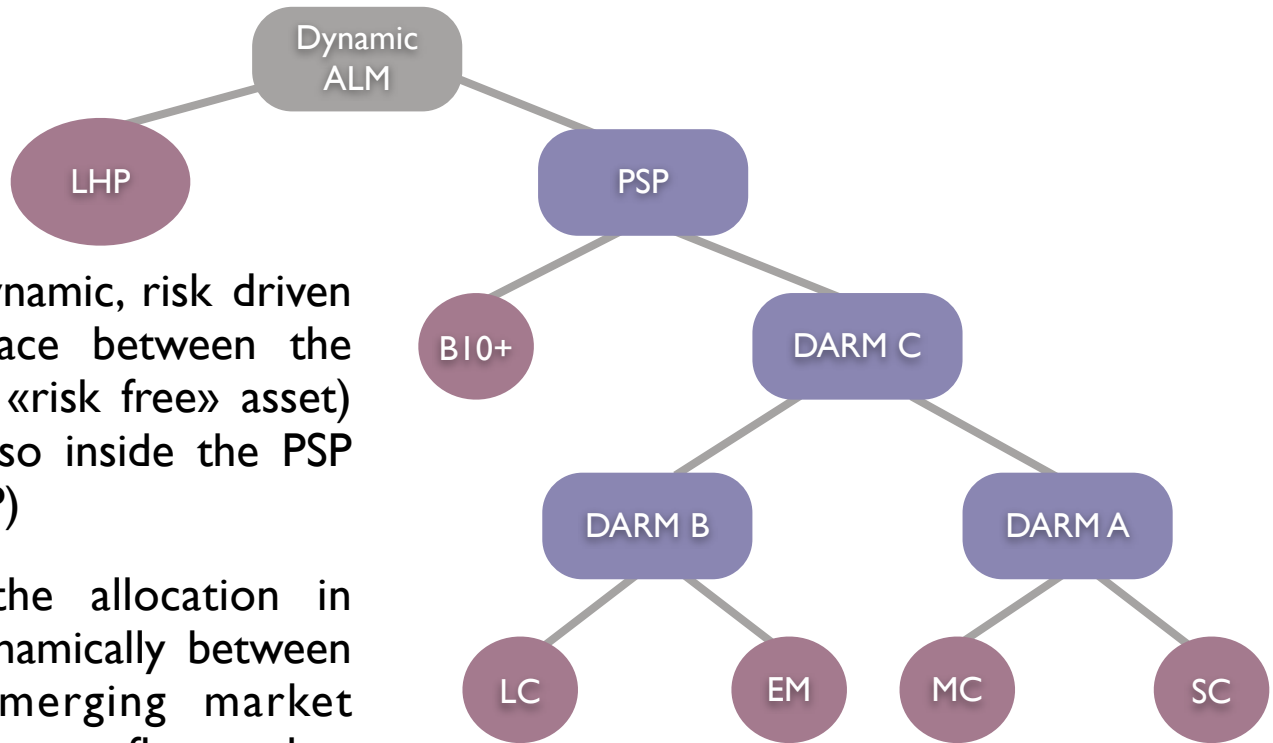
Constructing the best PSP





- The best PSP has embedded asymmetric risk management, it aims at maximising performance under draw-down constraints
- It uses the same technology as Dynamic ALM in an asset only world (DARM)

Building the Dynamic ALM portfolio



- Example of how dynamic, risk driven allocations take place between the LHP (pension fund «risk free» asset) and the PSP but also inside the PSP (and potentially LHP)
- As an example, the allocation in DARM B varies dynamically between large cap and emerging market equities based on a floor that preserves the value of large cap equities («risk free» asset in this situation); DARM A, C and the PSP work in a similar way

Common critics of dynamic risk-controlled strategies

- Lack/decrease in market liquidity during crises makes it difficult to implement dynamic allocations quickly enough to protect the asset/liability couple
  - true for any strategy, bespoke solutions are key
- The more volatile the risky asset, the more frequent the reallocation
  - rebalancing frequency is market independent (unless stop-loss), as parameters are time and state-variant
- If the risky asset price fell a long way, the fund would completely move into the LHP
  - The fund would move into the LHP (very much like in an LDI approach); if the LHP is a perfect hedge for liabilities, new risk budget will come from new contributions; if there is some risk left in the LHP, new risk budget will come from a positive move of assets with respect to liabilities and/or from new contributions

About the Alternatives

- Most common approaches currently used:
  - **Traditional LDI** takes the financial risks away by hedging the liabilities, BUT the funding gap is then only filled by contributions AND 100% funded situation might not be good enough given all the other risks that lay with the liabilities (mortality, life expectancy, inflation...)
  - **Long term fixed allocation** based on risk and return expectations needs accurate forecasts over the investment horizon and is not compatible with short-term constraints; when proven wrong, they require higher and higher returns and can lead to virtually infinite contributions
  - **De-risking** or systematical switching from «growth» assets to «matching» assets when funding level improves on a «flight» plan to fully funded can be as bad as fixed allocation and can also lead to virtually infinite contributions

Case study with a US pension plan

- The aim of the study was to determine the «best» asset allocation strategy for the US pension plan
- «Best» is defined as the strategy that enables the company to comply with pension regulation (Pension Protection Act) while minimising contributions
- The results of the study are presented in a stochastic environment

Case study with a US pension plan

- Regulatory constraints (PPA):
  - if the Funding Ratio falls under 100% at any given date, the deficit should be amortised over the next 7 years
  - given the amortisation scheme, any difference (positive or negative) should also be amortised over 7 years
- Internal constraint:
  - if the Funding Ratio falls under 80%, an immediate (end of the year) exceptional contribution is made such that the Funding Ratio becomes 80%

Strategies

- We compare 4 strategies:
  - (1) Fixed allocation 50% Corporate Bonds 10+ (same duration as liabilities) + 50% Equities (rebalanced on a monthly basis), allocation by traditional ALM
  - (2) Traditional LDI: 100% invested in Corporate Bonds 10+ (duration protection only)
  - (3) Fixed allocation between bonds and equities 50/50 (strategy 1) coupled with a de-risking strategy: as FR improves by 2% (absolute), the allocation to equities decreases (to note: once the allocation to equities has decreased, it never increases again)
  - (4) DALM: dynamic allocation between the LHP (Liability Hedging Portfolio) and the PSP (Performance Seeking Portfolio) with a dynamic allocation between Corporate Bonds and Equities

Results

- Results of the case study were produced in a stochastic universe; the various asset classes used as well as the yield curve and the liabilities of the pension fund have been modelled with a FHS approach (Filtered Historical Simulations)
- The model has allowed to produce 1000 scenarios for each of the asset classes, yield curve and liabilities
- Each strategy has been analysed for the 1000 different scenarios
- Results are presented by quartiles for each of the strategies

Results and comparative advantage

Funding ratio - end of 10 years					
Scenarios	Q 97.5%	Q 75%	Q 50%	Q 25%	Q 2.5%
(1) Traditional diversification 50%/50%	1,95	1,41	1,19	1,01	0,84
(2) Traditional LDI	1,38	1,06	1,01	0,97	0,85
(3) Strategy 50/50 -> 100% Bonds	1,43	1,08	1,02	0,98	0,86
(4) DALM	2,21	1,44	1,22	1,04	0,88

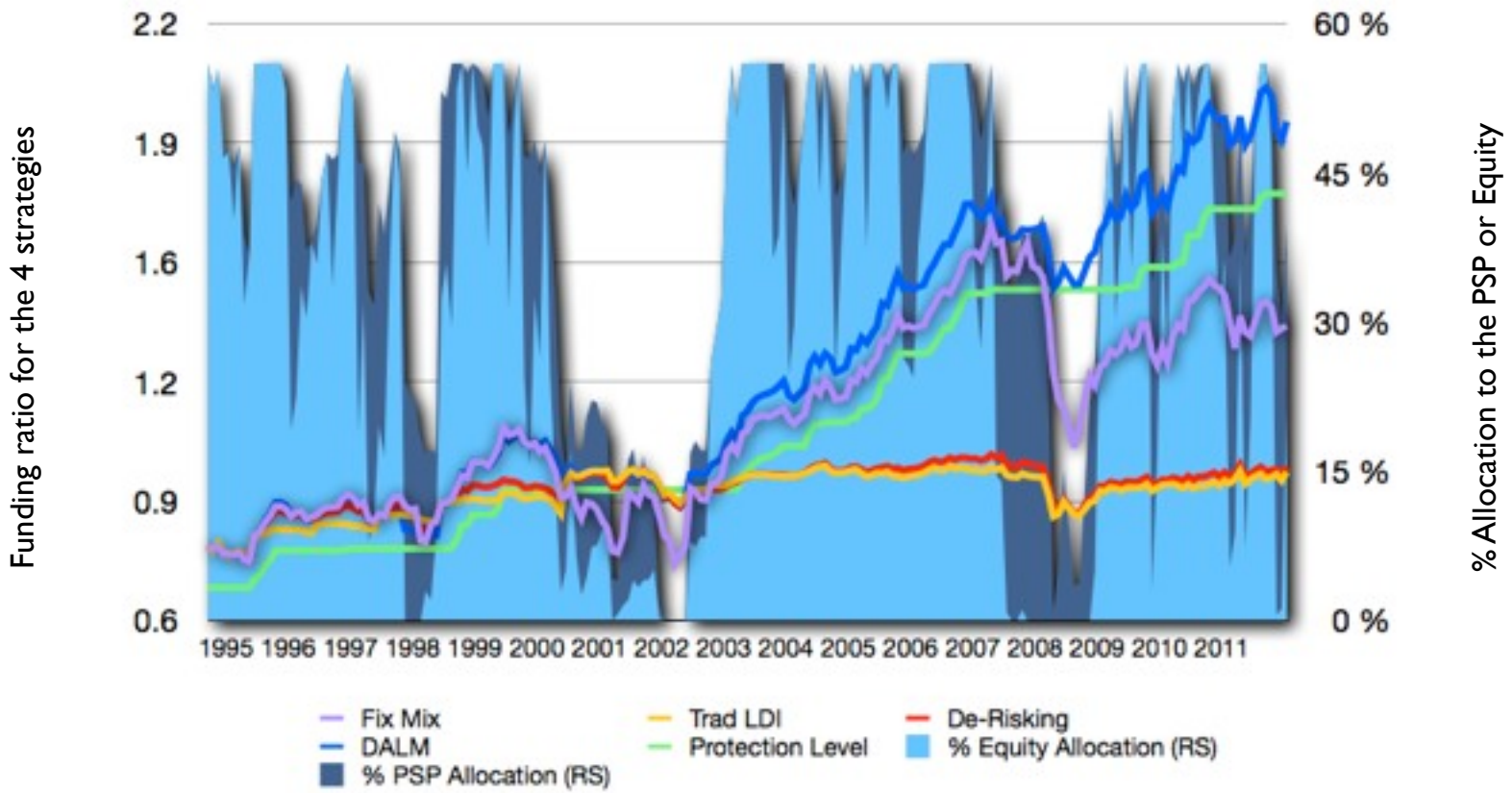
- Table showing the funding ratios obtained for each strategy (quartile format) after 10 years. They take into account the contributions made by the sponsor company
- How to read the results: the number 1,22 in the last row, column Q50% means that for the DALM strategy, funding ratios obtained in 50% of the scenarios are above or equal to 1,22
- As expected, the worst strategy in terms of funding ratios is the traditional LDI in 97,5% of the cases; with this strategy, the funding ratio increases only with contributions (market impact limited)
- There is a statistical dominance of DALM strategy compared to the three others.

Results and comparative advantage

Cumulated contributions (PV) - end of 10 years					
Scenarios	Q 2.5%	Q 25%	Q 50%	Q 75%	Q 97.5%
(1) Traditional diversification 50%/50%	0	37,9	100	176,2	372,8
(2) Traditional LDI	51,6	94,5	104,7	123,4	203,2
(3) Strategy 50/50 -> 100% Bonds	0,9	48,3	95,4	145,1	281,8
(4) DALM	0	24,7	64,6	114,4	211,8

- Table showing the present value of the contributions that have been necessary to obtain the funding ratios showed in the previous table after 10 years
- How to read: the number 100 in the first row, column Q50% means that in 50% of the scenarios, the present value of contributions for the fixed allocation strategy is 100
- As expected, the most expensive strategy in 50% of the scenarios is the hedging strategy (traditional LDI); this strategy is the most interesting in only 2,5% of the most extreme scenarios
- The DALM strategy that allows to have at the end of the 10 year period the best funding ratios is also the least expensive in 97,5% of the scenarios; in 2,5% of the most extreme scenarios, the cost of the strategy is only slightly greater than the LDI strategy

Back-test: Funding ratio and protection level (till July 2012)



- Funding ratio achieved with DALM strategy greater than those obtained by any other strategy
- Funding ratio protection floor worked well for DALM strategy (but not perfectly since LHP was only hedging duration, thus not a perfect hedge): a higher and higher funding ratio protection is achieved.

Back-test: Statistics

Statistics (%)	Corporate Bonds 10+	Equity Portfolio	Performance Portfolio	(1) Fixed Allocation 50%/50%	(2)Traditional LDI	(3) Strategy 50%/50%->100% Bonds	(4) DALM
Annual Returns	8,58	7,31	12,8	8,36	8,58	8,96	11,02
Volatility	9,34	17,52	12,91	10,99	9,34	9,14	9,63
Max DD	-22,54	-55,66	-29,52	-36,55	-22,54	-23,75	-26,21
Sharpe Ratio	0,71	0,3	0,84	0,58	0,71	0,76	0,94
Contributions (% assets)				37,01	28,45	23,24	25,90

- Results obtained with DALM strategy over the period required contributions of 25,9% of initial assets over the period, compared with 23,24% for de-risking, 37,01% for fixed allocation and 28,45% for LDI

Conclusion

- It is possible to successfully manage ex-ante risk constraints while delivering better long term performance, as long as we allow for a dissymmetric management of returns
- The management of risk budgets can be used as a very effective tool by underfunded pension schemes to get back to a fully-funded situation while minimising contributions (the DALM approach requires 30% to 50% less contributions than any other available approach)
- Counter to common intuition, risk management is more an unexpected source of return than a cost

Publications

- "In defence of pro-cyclicality", Investment & Pensions Europe, April 2012, Adina Grigoriu
- "Risk Control through Dynamic Core-Satellite Portfolios of ETFs: Applications to Absolute Return Funds and Tactical Asset Allocation", The Journal of Alternative Investments, Fall 2010, pp. 47 – 57, Noel Amenc, Felix Goltz, Adina Grigoriu
- "The EDHEC European ETF Survey 2010" – An EDHEC-Risk Institute Publication, May 2010, Felix Goltz, Adina Grigoriu, Lin Tang
- "Constructing Absolute Return Funds with ETFs – A Dynamic Risk Budgeting Approach", Institutional Investor Journal, Fall 2008, Vol. 2008, No. 1: pp. 37 – 46, Noel Amenc, Felix Goltz, Adina Grigoriu

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