

FRR, The French Pension Reserve Fund: The journey of a responsible investor from assets only to liability driven asset management

I/ A guided tour of the FRR, from assets only to liability driven investment

A/ The initial €150bn ambition

B/ And then came the Pension Reform 2010...

II/ The new risk based investment model

III/ Reinforcing ESG integration

A/ ESG framework

B/ Low carbon equities

C/ Tobacco exclusion

Key dates & figures

NAV end August 2018: € 34.3bn

Number of external asset managers: 60

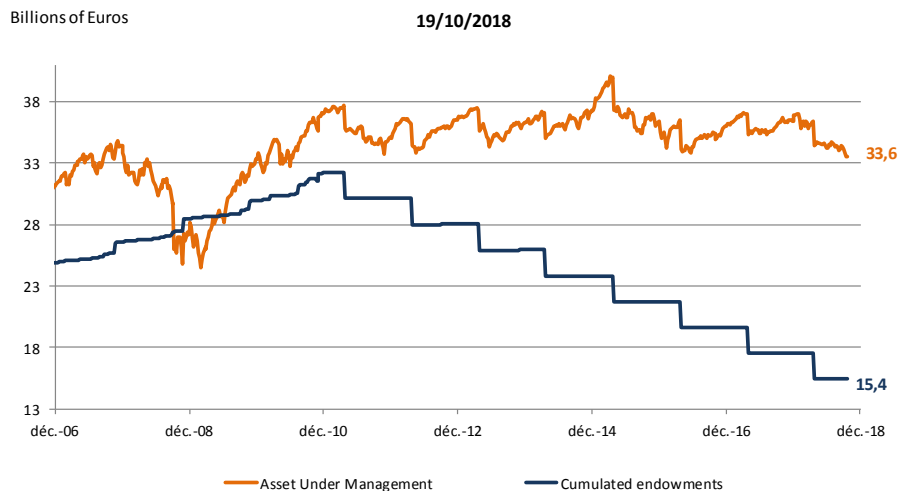
Number of employees: circa 50

Annual performance since June 2004: +4%

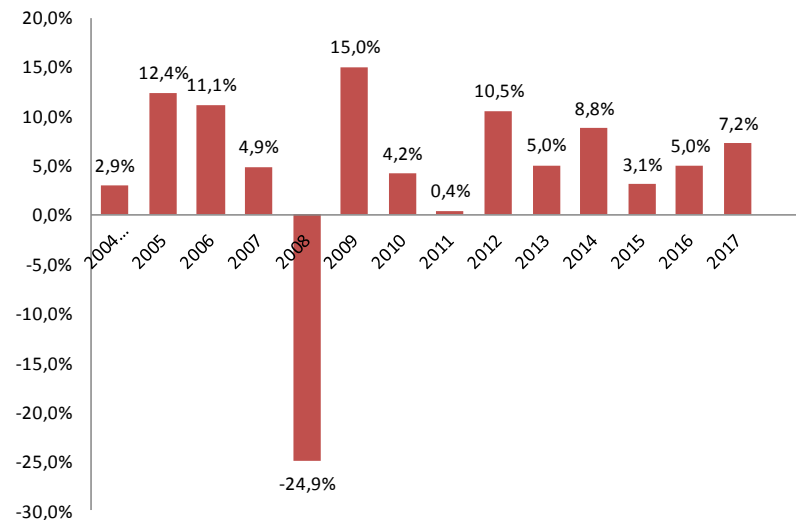
Annual performance since January 2011: +4,8%

FRR's Assets Under Management

Asset Under Management FRR



Annual performances

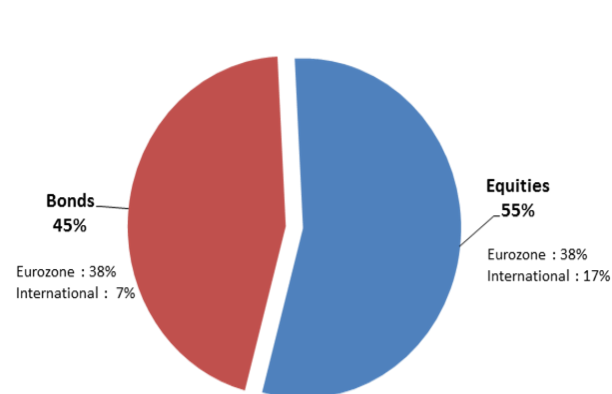


« Assets only » strategic allocations 2004 - 2010

Build-up time

April 2003 : 1st strategic allocation

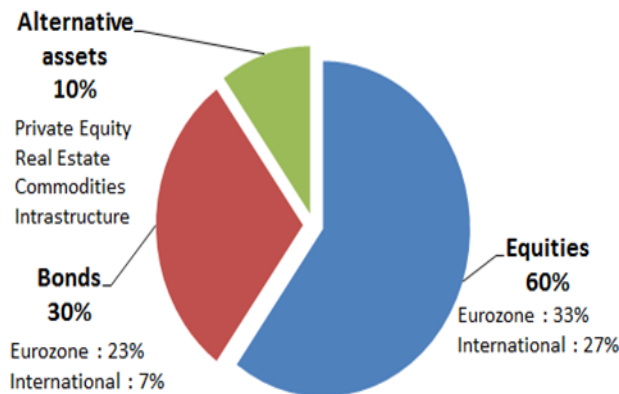
Investment horizon : 2020 - 2030



Portfolio diversification time

May 2006 : 2nd strategic allocation

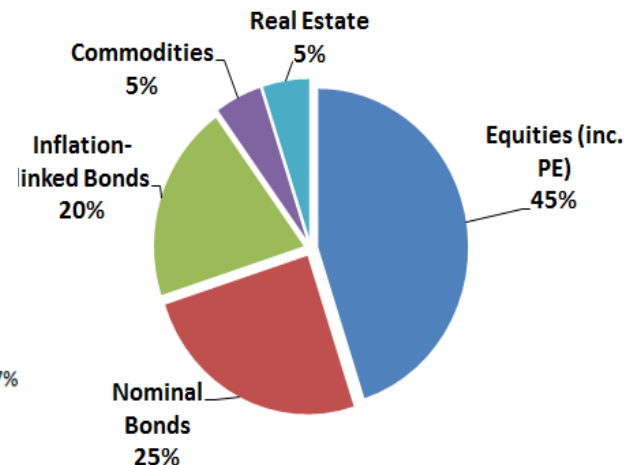
Investment horizon : 2030 - 2040



After the financial crisis

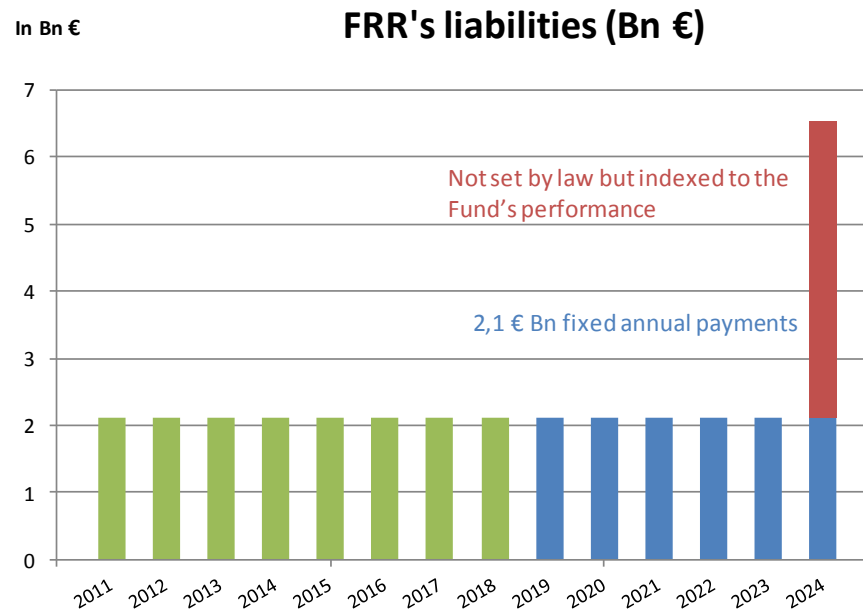
May 2009 : reduced risk and dynamic asset allocation

Investment horizon : 2030 - 2040



B) And then came the pension reform 2010 (defined liabilities)

- End of all new inflows
- Creation of a nominal liability schedule : annual payments to CADES* of €2,1bn from 2011 to 2024 [+ a variable payment to CNAV* from 2024]
- Shorter investment horizon : 2024



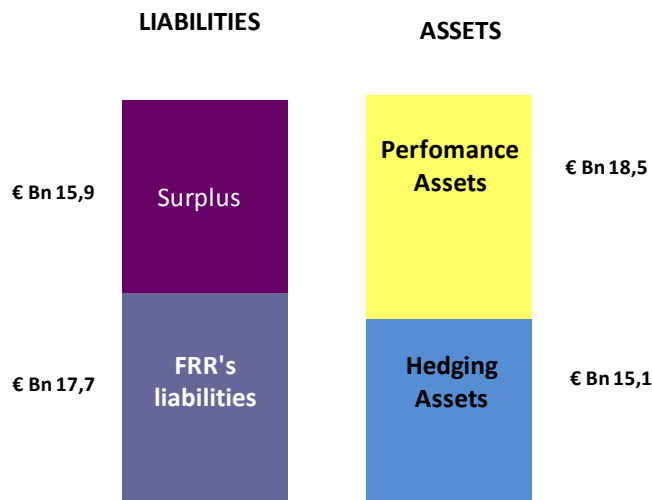
(*): CADES and CNAV are state-owned entities

« Going LDI » : Strategic allocations 2011 - 2017

Liability driven investment model since 2011.

Liability Hedging portfolio composed of French OATs, global govies, € and \$ denominated investment grade credit.

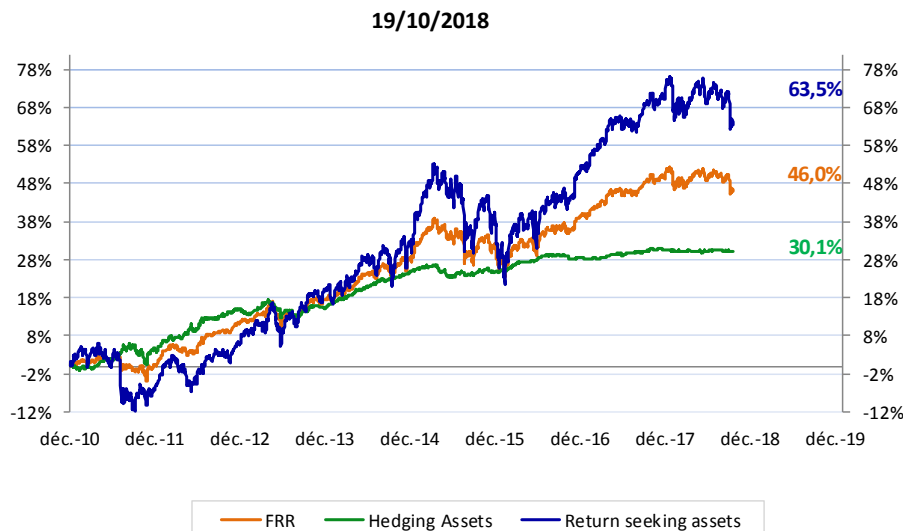
Performance Seeking Portfolio based on broad international diversification in equities (equity benchmark Eurozone, rest of the developed world, emerging markets), emerging market debt, € and \$ denominated high yield bonds, private debt.



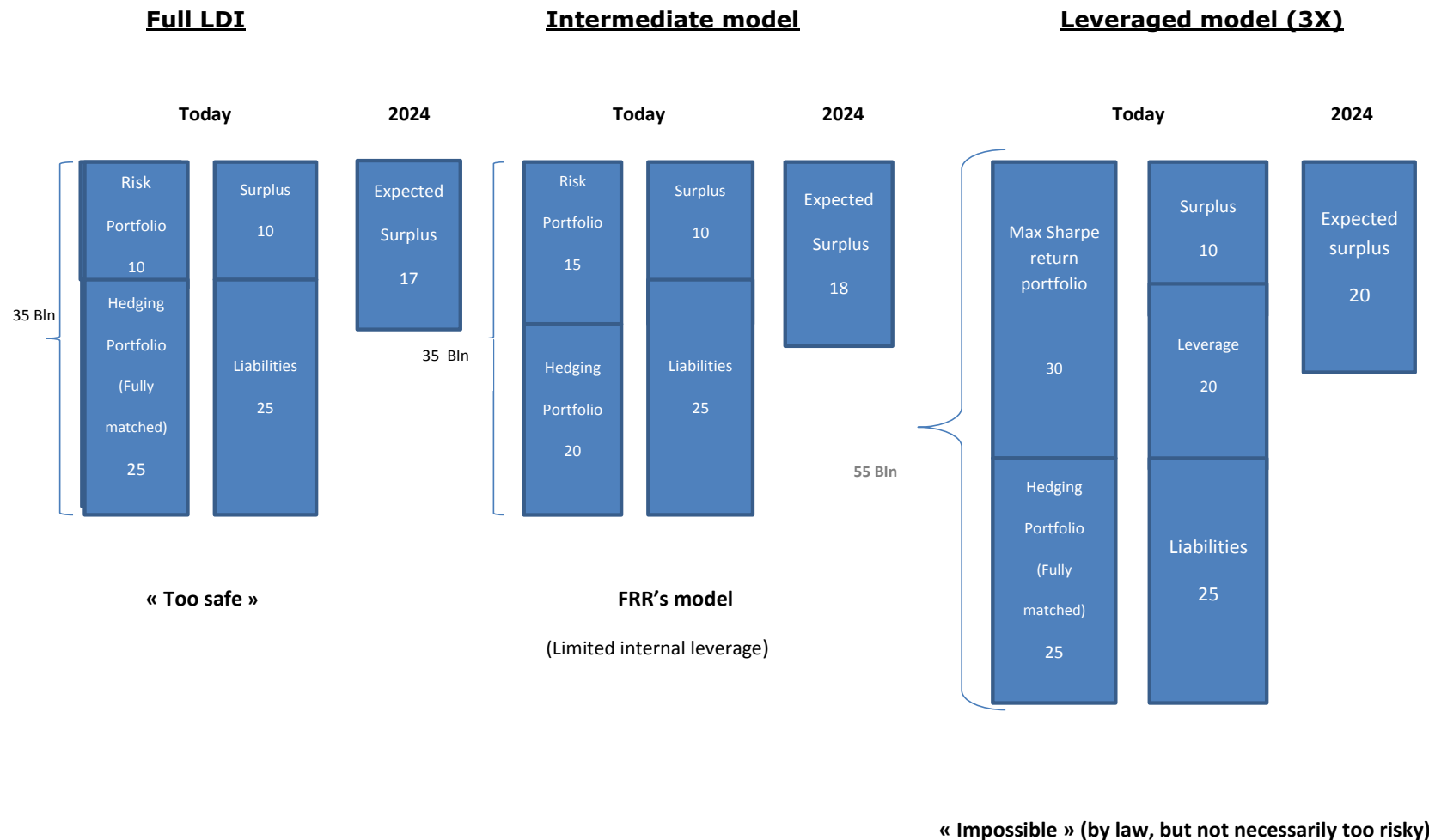
- Assets under management : €33,6 bn
- Funding ratio : 190 %
- Discount rate of liabilities : French government bonds zero-coupon yield curve

Data as of 19/10/2018, rounded figures

Performance of both asset classes since 12/31/2010



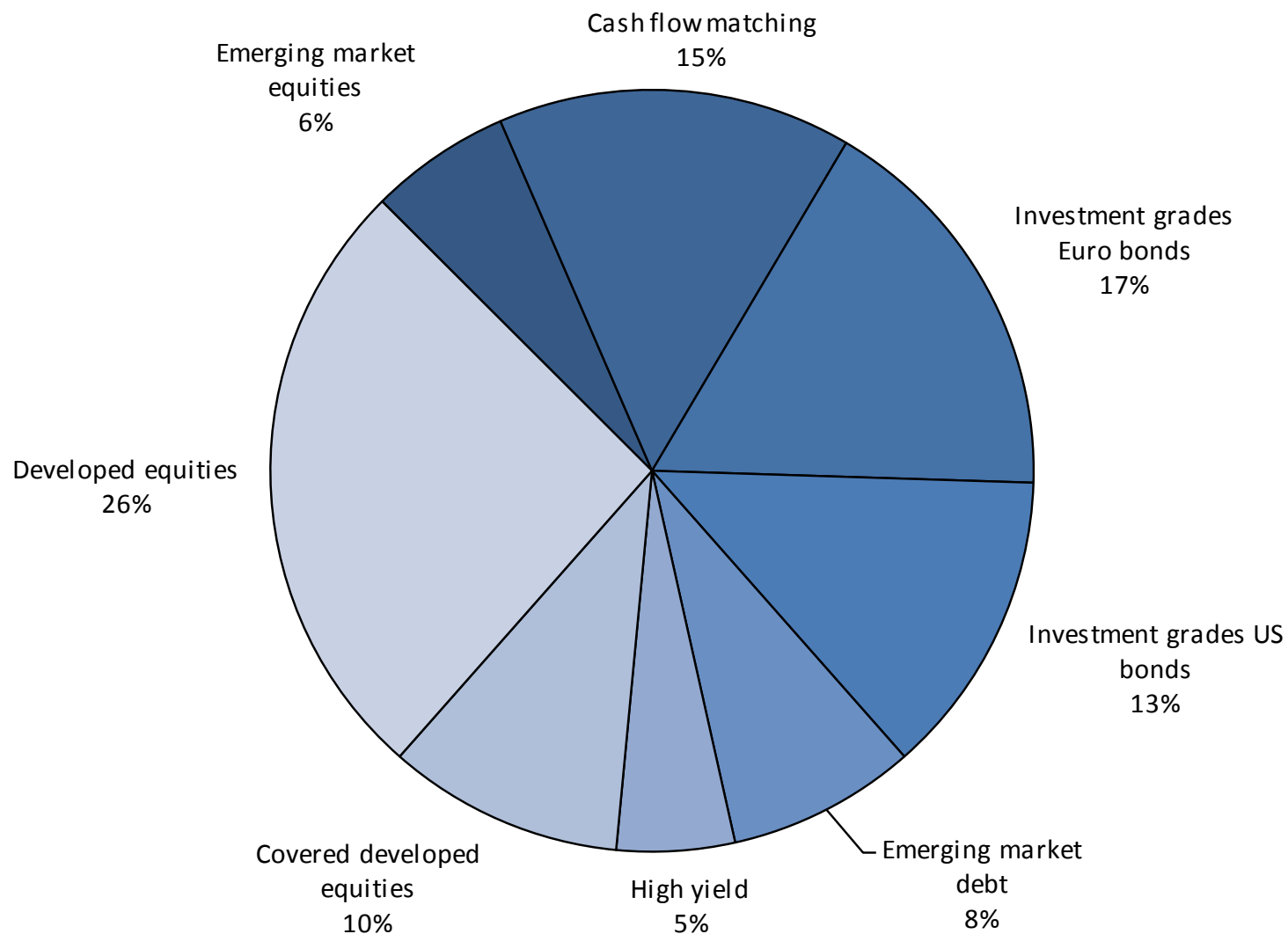
How to implement Liability Driven Investment, with or without leverage ? The 2010 question



Portfolio construction

- A risk budgeting approach to portfolio construction.
Main risk metrics = 2024 cVaR 99% (VMS 1%).
Optimisation on the median expected surplus in 2024
- Strategic asset allocation revised every year using state of the art methodologies. Mean-variance, static portfolio Monte Carlo simulations, dynamic portfolio Monte Carlo simulations, Student law distributions, regime switching log normal distributions. Nelson-Siegel modelling of sovereign yield curves and mean-reverting Vasicek model for credit spreads. HY debt and EMD defaults modelled with a Poisson law for their occurrence and a log-normal law for their intensity. Deterministic methods via stress tests
- Comprehensive studies conducted to increase portfolio diversification: hedge funds, long/short risk premia, cat bonds and insurance linked securities, illiquid asset classes (private debt, private equity, infrastructure, real estate)
- Extensive use of alternative beta strategies in equities
- Equity portfolio decarbonisation

2018 strategic asset allocation



Responsible investment framework

- Good internal governance : transparency on investment policies, results and portfolio composition
- ESG **integration** : assessing asset managers, ESG reports, ESG mandates
- Exclusions (**divestment approach**)
- Voting on all shares
- Monitoring of extra financial risks and allegations
- **Engagement** : direct engagement and collaborative engagement
- Tax issues and uncooperative jurisdictions
- Supporting international initiatives : UN-PRI (founding member), CDP, CDP water, Extractive Industries Transparency Initiative, ICGN, Montreal Carbon Pledge (Sept 2014), Coalition for Portfolio Decarbonisation (Sept 2014, first to join the four founding institutions), IIGCC
- Experimental mandates (SRI small and midcap European equities/ESG momentum, Funds of funds on environmental themes)
- **Impact investing**

Focus on a few investment approaches

A/ Looking for diversification

- The case for commodities...or lack thereof
- Private debt
- Put spread covered equities
- Long term illiquid asset classes : private equity, infrastructure, real estate

B/ The active /passive management debate

C/ Smart beta equities and factor investing

D/ Low carbon equities

- Cap weighed equity decarbonisation
- Smart beta equity decarbonization

E/ Tobacco exclusion

IRR = risk free rate + term premium + credit premium (– credit losses) + illiquidity premium – fees

Illiquidity premium = many heterogeneous components !

Complexity/potential legal risk/operational issues

+ lack of notoriety

+ implicit rating uncertainty

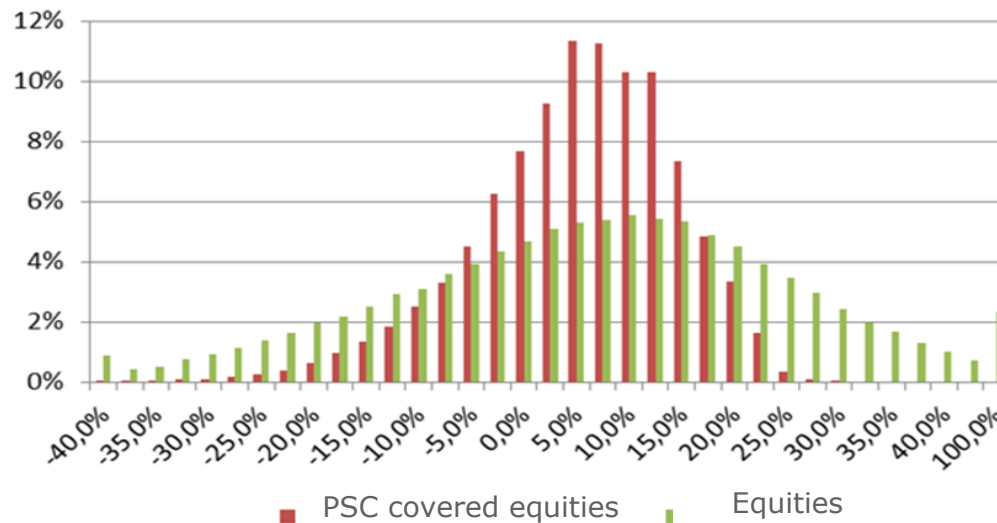
+ genuine illiquidity premium = compensation for higher costs and longer execution times incurred if one needs to liquidate or to exploit a sharp fall in another asset class, equities typically, and rebalance to a fixed weight portfolio.

However, no such opportunity cost for FRR : if equities go down, we will not be able to buy more equities because their fall actually reduces our surplus, i.e., our ability to take risk. So the illiquidity of certain hedging asset classes does not entail an opportunity cost for FRR in the face of a fall of the other asset classes.

Put Spread collar covered equities

- Enable to reach a better expected risk-adjusted return than an equity/bond composite in the foreseeable future (around 4% compared to around 3% for the composite)
- Cut the left-hand distribution tail at the expense of the right-hand tail

Performance distributions of covered equities and equities



- But remain correlated to equities

Investing in illiquids to extend investment horizons

FRR 1.0

2006 : Private equity - 4 mandates €1,5bn

2009 : Infrastructure : investment in one closed-ended fund (€50m)

2009-10 : Real Estate : RFP for 2 mandates for European RE assets – €1bn

FRR 2.0

2010 : French pension reform, shortening of FRR's investment horizon

→ decrease in size of PE commitments from €1.5bn to €1bn

→ interruption of RFP process for Real Estate mandates

FRR's €2Bn new illiquid investment programme

FRR 2.1 2015: €2bn programme for French assets

Private equity: innovation capital, development capital, transmission capital

No large LBOs

No distress or recovery capital

3 RFPs – circa €1000m - €400m funds of funds (3 mandates awarded), €185m capital innovation (3 mandates awarded), circa €400m capital development (underway)

Private debt: corporate debt and senior leveraged loans

4 mandates awarded December 2016 – €600m

Infrastructure: (equity) Investment in 3 closed-ended funds, majority French projects, total committed €140m

Real estate: (equity) Investment in one closed-ended fund, €200m committed

The active vs passive management debate (1)

- Passive management:
- the cost argument
 - the governance argument
 - the theoretical framework (market portfolio)

In defense of active management and fundamental research:

The plight of active management is that it has an heroic mission to accomplish but cannot be rewarded for it collectively

Active management is needed to determine prices and allocate capital but it cannot be rewarded at the global market level because the collective gross alpha is zero minus transaction costs

In contrast, passive management essentially free rides on active management

In terms of alpha distribution, alpha is not necessarily < 0 for active managers after costs because what we call passive management traditional beta, i.e. market cap indexed, is in fact an incomplete beta, that of the cap weighted indexes, which in certain cases represents only a small part of the total market

Example: S&P500 vs MSCI emerging markets

The active vs passive management debate (2)

Assuming the cap weighted indices are really comprehensive, indeed what the active managers will get collectively is the market performance less costs. And their performance will be even less with the growth of alternative beta if we call it passive management (which it is when it simply replicates indexes via systematic processes)

But then there is active management and active management investors

Retail investors are always on the losing end of the active management game. When they invest directly, they get everything wrong. Market timing, by jumping into the fray when the market is already frothy, only to leave it when it has suffered so much that it has reached its bottom. Stock selection, by getting attracted to popular, expensive stocks and risky high volatility punts

On the contrary, there are institutional funds, sovereign funds, smart money family offices that on average make money in their active management, be it in house or delegated to external managers

FRR's choice:

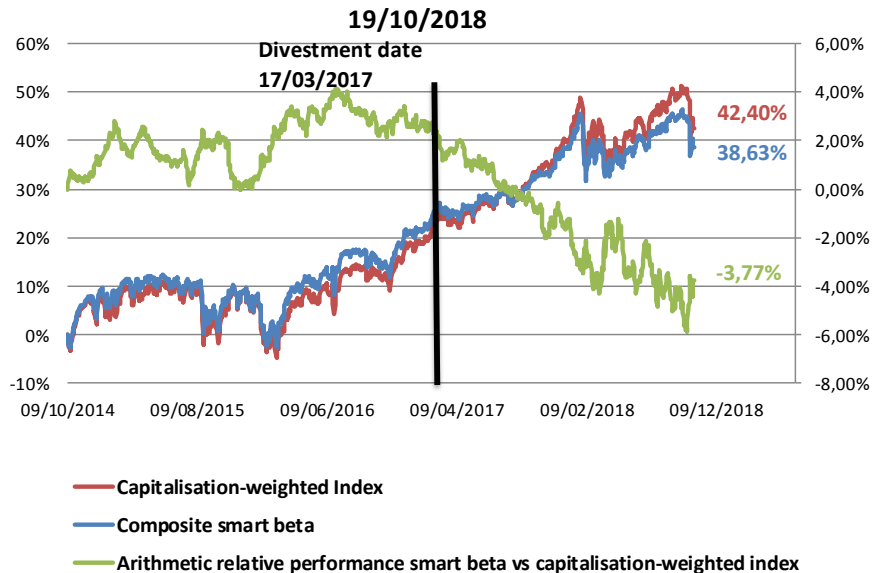
- active management for inefficient markets (small caps, Japan, EM) and for illiquid markets
- Smart beta and factor investing: deconstructing active management
- Smart beta composite of 4 indices and factor investing via the RAFI eurozone index and MSCI value momentum index

FRR's composite smart beta index

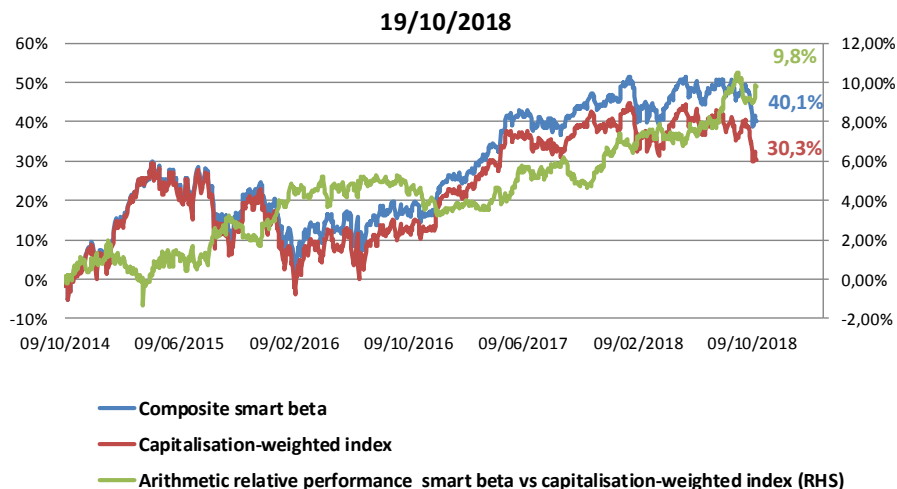
Equal weights composite of :

- Minimum Variance
- Edhec Risk Efficient
- Equal Risk Contributions
- RAFI

Smart Beta Composite vs Cap-Weighted North America
(Invested since 03/03/2014)



Smart Beta Composite vs Cap-Weighted Eurozone
(Invested since 22/05/2014)



The carbon risk

« *The main argument for reducing the carbon footprint is not about morals or ethics but financial risk* »

Julian Poulter, executive director, the Asset Owner Disclosure Project

The risks of portfolio decarbonisation

- Tracking Error ?
- What if the link between carbon reserves and greenhouse gas emissions is broken?
(carbon capture)

The Low Carbon Leaders index initiative

- Launch date : 16 September 2014
- LCL Europe
- LCL North America
- LCL Asia Pacific Ex-Japan

Low Carbon Leaders indices : methodology

EMISSIONS SCREEN

Select in the parent index the best 80% stocks in terms of carbon emission intensity (as a % of company turnover).

Keeping at least 70% of each sector's market cap.

RESERVES SCREEN

Select stocks with the lowest carbon reserves (as a % of company market cap).

Achieve at least a 50% reduction in carbon reserves from the parent index.

Stocks that pass both screenings are selected.

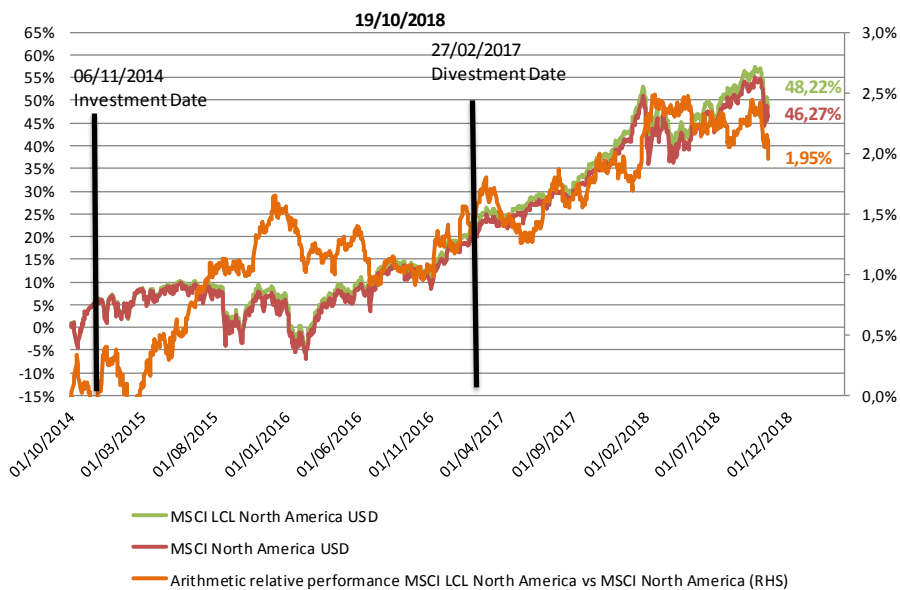
Weights are optimized (under constraints) in order to minimize ex-ante tracking error from the parent index (less than 0,7%)

Reduction in carbon footprint and reserves must still exceed 50%.

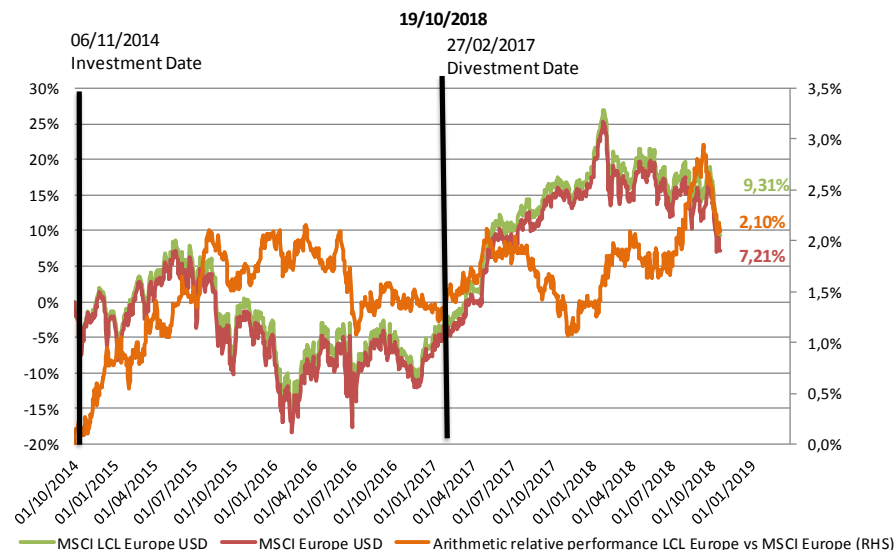
Performance comparisons

MSCI Low Carbon Leaders vs MSCI parent indices

Comparison MSCI LCL and MSCI North America



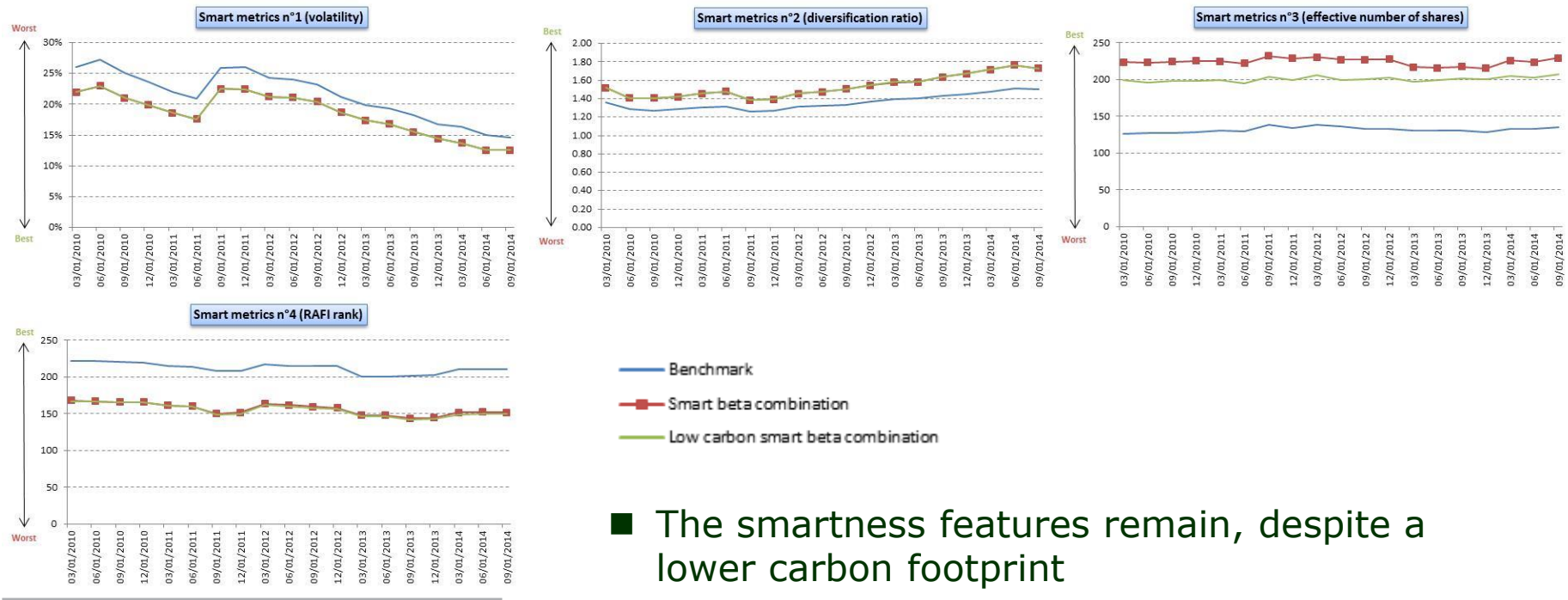
Comparison MSCI LCL Europe and MSCI Europe



'Smartness' of Decarbonised Strategies

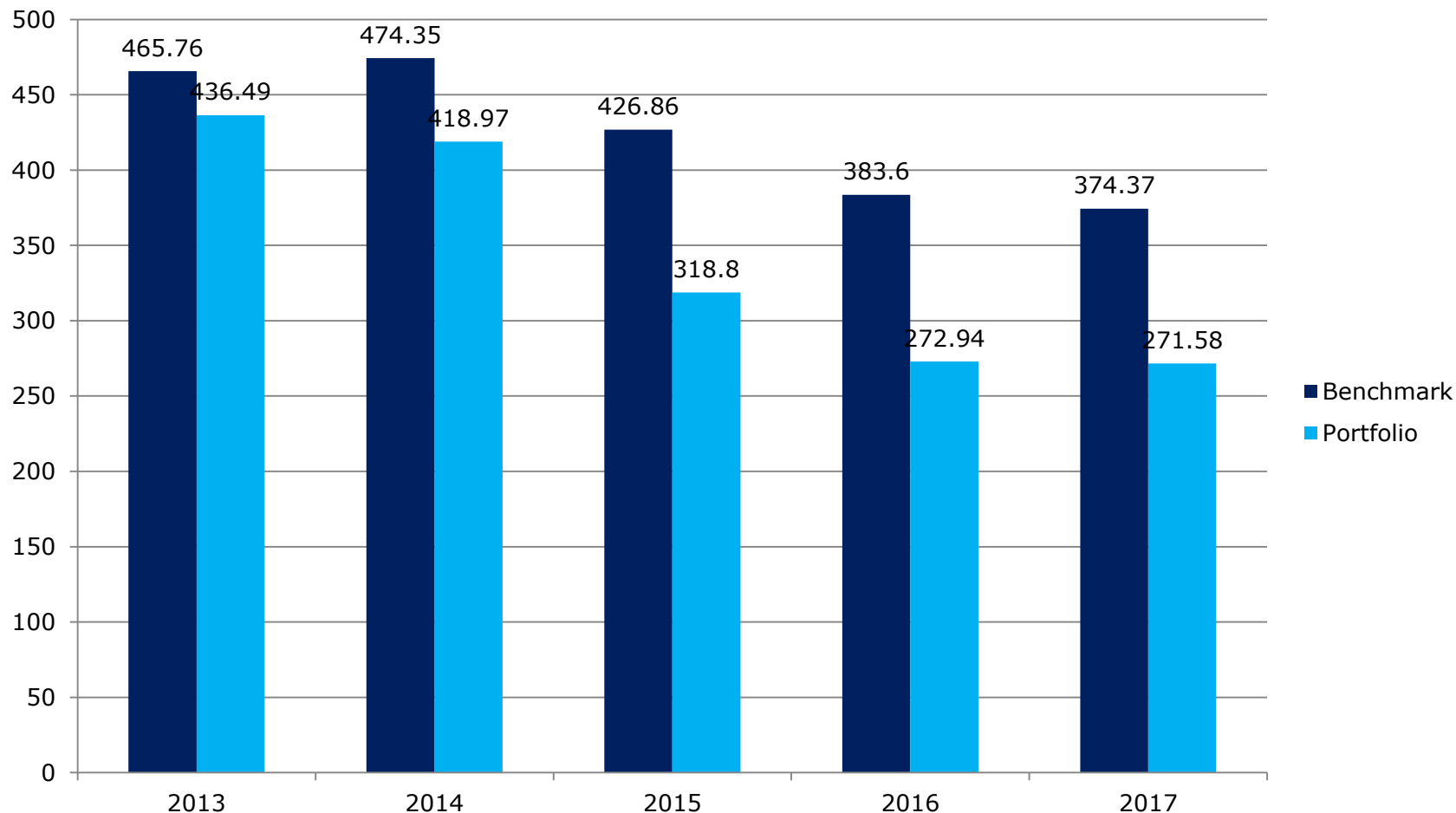
- Decarbonisation of a combination of four smart beta strategies
- Optimisation to lower carbon footprint (reserves and emissions)
- With significant reduction of carbon footprint (-50% / -50%) , delivers low TE levels:
 - 0,26% TE ex ante
 - 0.36% TE ex spot

Smartness of a Low Carbon Smart Beta Strategy



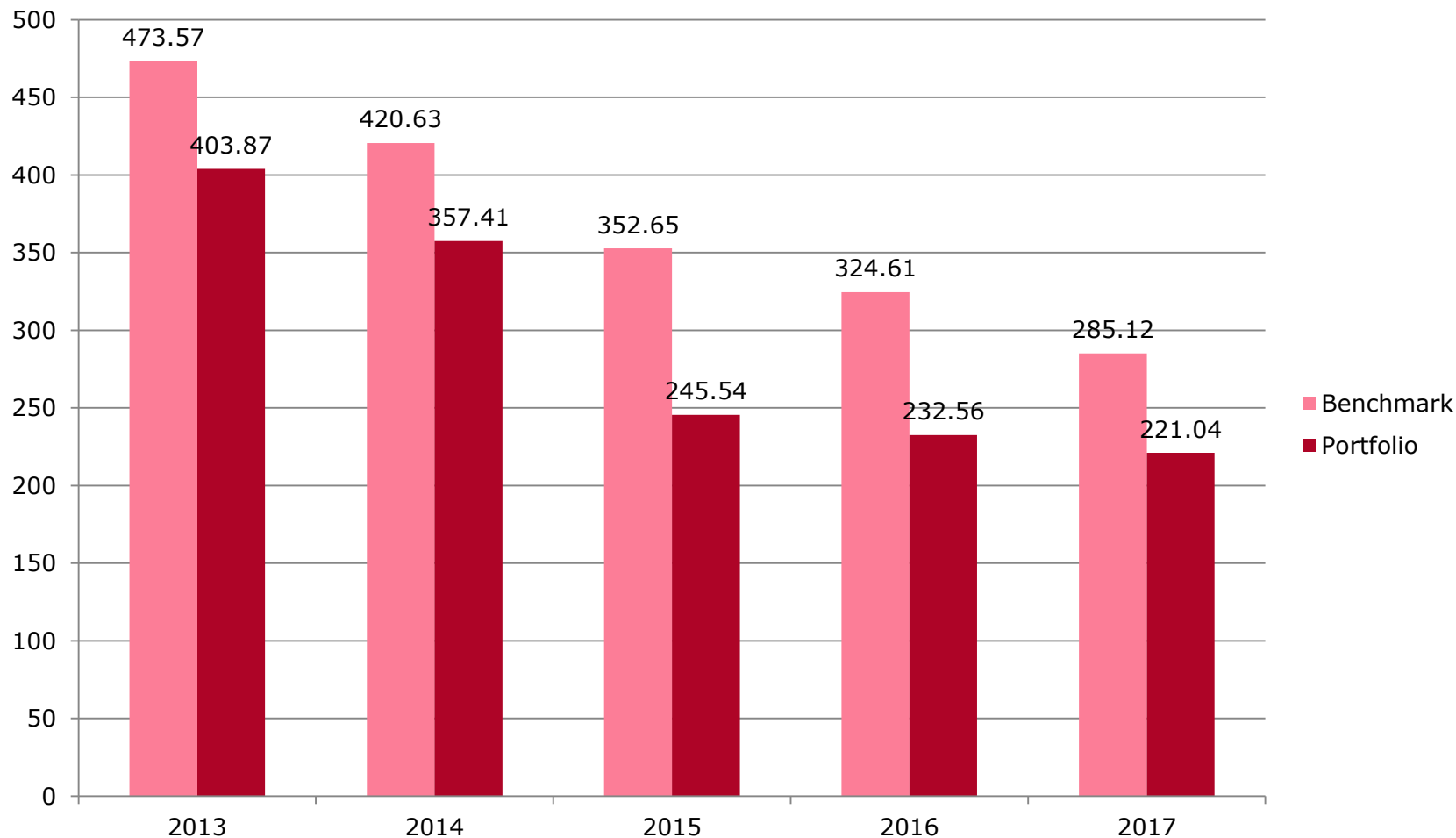
- The smartness features remain, despite a lower carbon footprint

CO₂ emissions* per million euro of company turnover



* Emissions covered : Scope 1 & 2 + scope 3 upstream first circle

CO₂ emissions* per million euro of company market capitalisation



* Emissions covered : Scope 1 & 2 + scope 3 upstream first circle

Divesting from the tobacco sector (1)

Strong rationale for excluding tobacco stocks on moral grounds

And legal grounds for a public entity like FRR (WHO 2005 treaty)

But : applying hard-headed investment logic to it can be sobering for investors.

Returns for tobacco have been absolutely outstanding. Between June 2004 and September 2016, the MSCI World Tobacco Index grew by a whopping 632% whereas the MSCI World Index went up 122%.

According to the Credit Suisse Global Investment Returns Yearbook 2015, from the Credit Suisse Research Institute, the tobacco sector was the star performer since 1900 with an annualized gain of 14.6%.

CalPERS (2016) : not having had tobacco in the portfolio over the last 15 years has cost around \$3 billion.

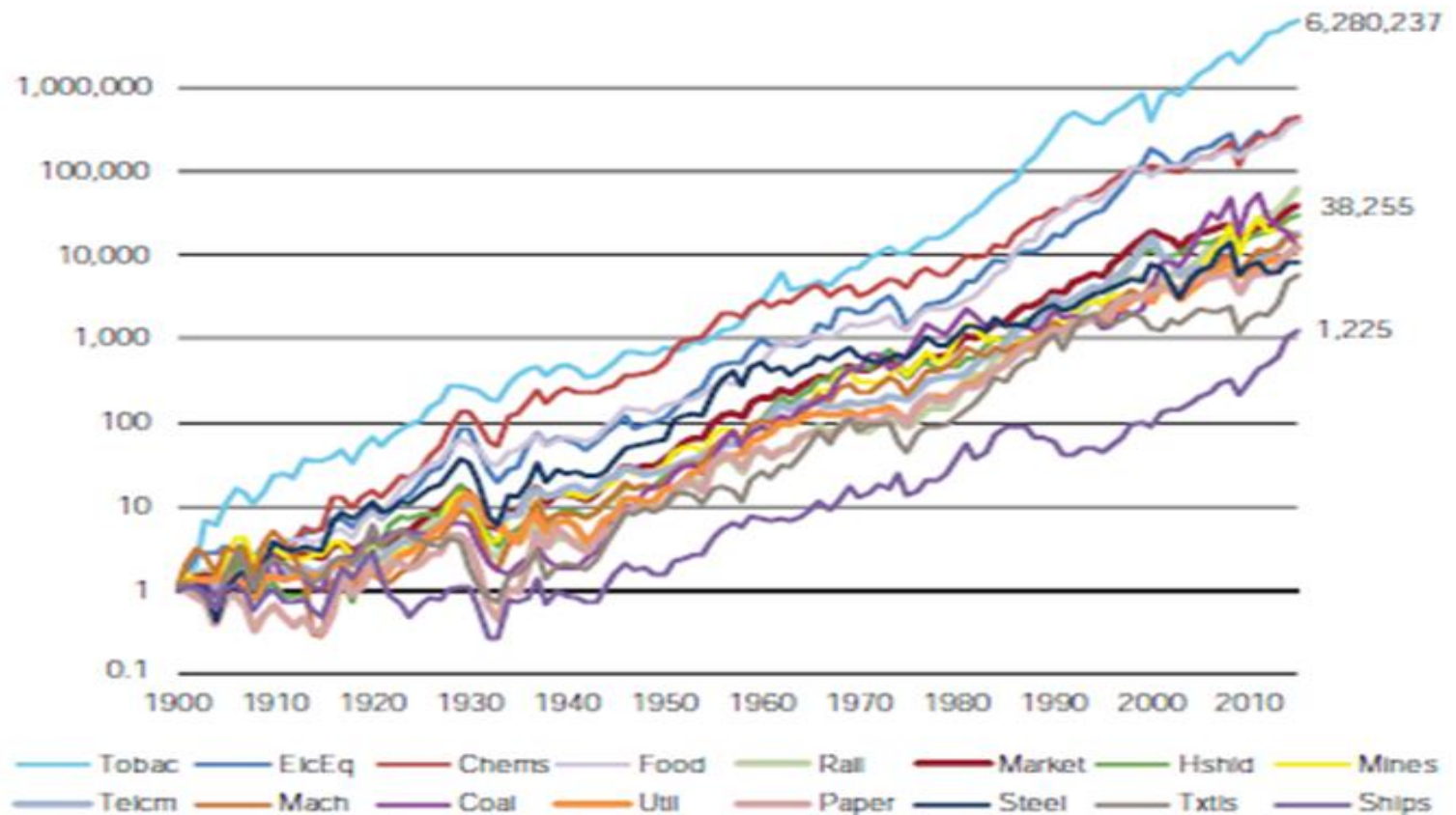
Norwegian GPF [Government Pension Fund Global] : tobacco exclusion, which started in 2006, has cost some \$2 billion

Divesting from the tobacco sector (2)

Long-run performance of industries in the USA

Source: Elroy Dimson, Paul Marsh and Mike Staunton; Cowles (1938), Ken French Industry data; DMS USA Index

Cumulative value of USD 1 invested in US industries at the start of 1900



Divesting from the tobacco sector (3)

Caveat : results may vary depending on the methodology used.

If one compares total returns, the difference is bigger than if one assumes, as is the case in real-life portfolios, that the dividends of high-yielding sectors, such as tobacco, are actually pooled with all dividends and reinvested in all sectors pro rata to their index weightings.

Risk factors going forward :

Tougher public health legislation on smoking, significant probability that more developed countries will take more measures against tobacco in the future.

France second country to remove branding from packaging for tobacco since January 1st 2017.

Taxes are always being increased on tobacco and regulations are increasingly restricting smoking in public spaces. "Just as we can see a shift away from using carbon-emitting energy sources, so there is a similar regulatory move away from tobacco consumption."

Divesting from the tobacco sector (4)

Tobacco and the stock market cycle :

As part of the food and beverage sector, tobacco has performed strongly as a low volatility, high dividend and stable growth sector since the start of the global financial crisis in 2007. As such, tobacco stocks have been valued at high multiples, as one of the darlings of the low volatility trend in portfolio management.

But this is changing. "There has been a formidable run for the low volatility, stable growth types of companies but it is coming to an end. Since July 2016 'low vol' companies carrying high multiples have struggled relative to the overall market."

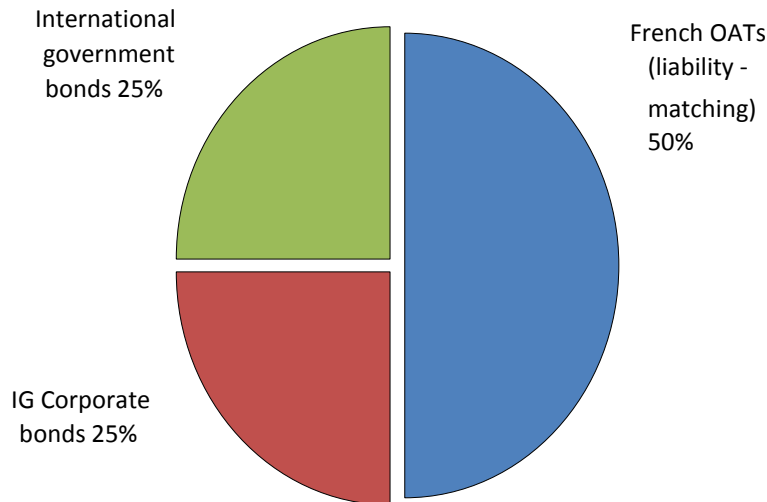
Selling the case for tobacco exclusion to the supervisory board : "There was a good debate, because it was easy to see the moral argument against tobacco stocks. And of course concerns about returns were expressed, so that argument was also discussed. We cannot promise the supervisory board that excluding tobacco companies will pay out in future, but we simply believe that the formidable returns of the past are not going to be repeated in the same fashion. In our view, that would be a very low probability scenario."

Engagement impossible with tobacco producers : it is typically the only thing that they do, so you would be asking them to stop their activities altogether.

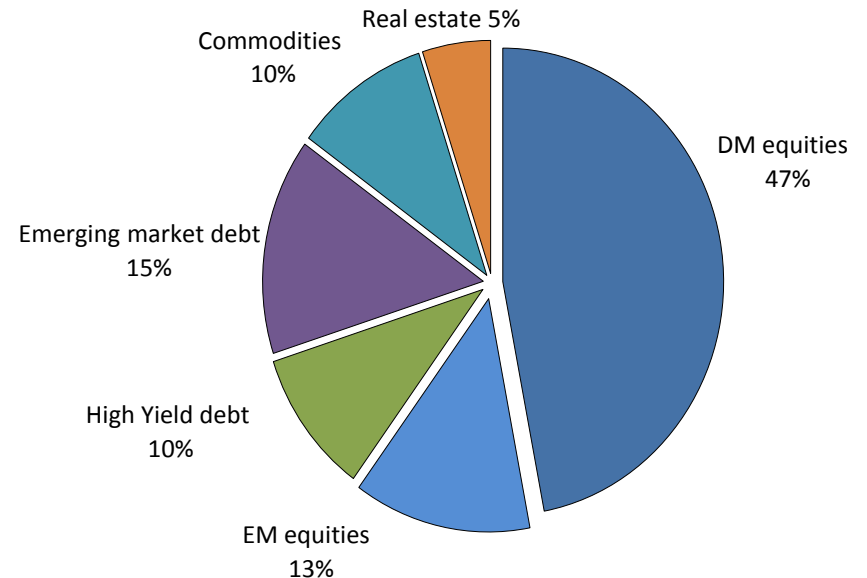
- FRR's strategic allocations 2011–2017
- FRR's beliefs on smart beta and factor investing

2011 strategic asset allocation

Liability-hedging portfolio: 62%



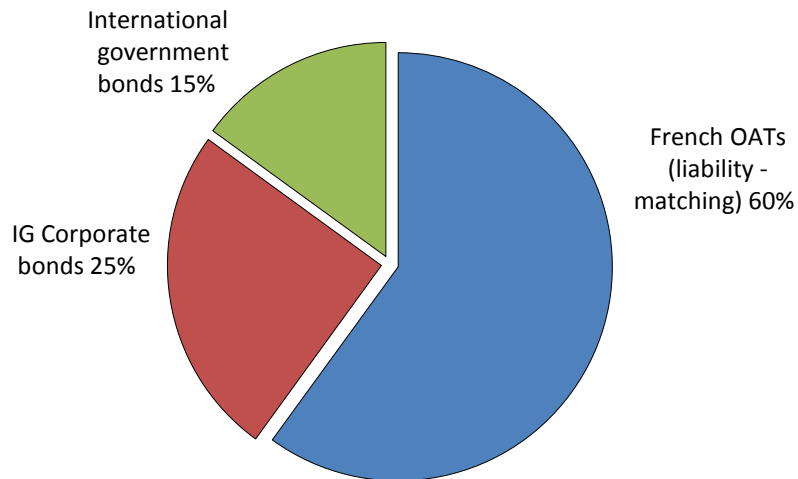
Return-seeking portfolio: 38%



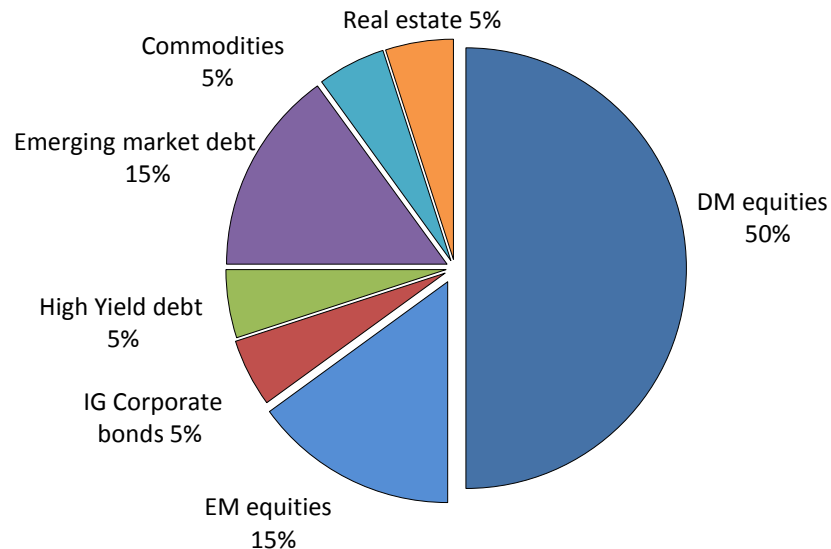
- Stress test scenario determines the global risk budget and the size of the return-seeking portfolio
- Portfolio optimization : Mean-variance (MV) and Most Diversified Portfolio (MDP)
- Expected return of the return-seeking assets over the long term: 6% p.a.

2012 strategic asset allocation

Liability-hedging portfolio: 58%



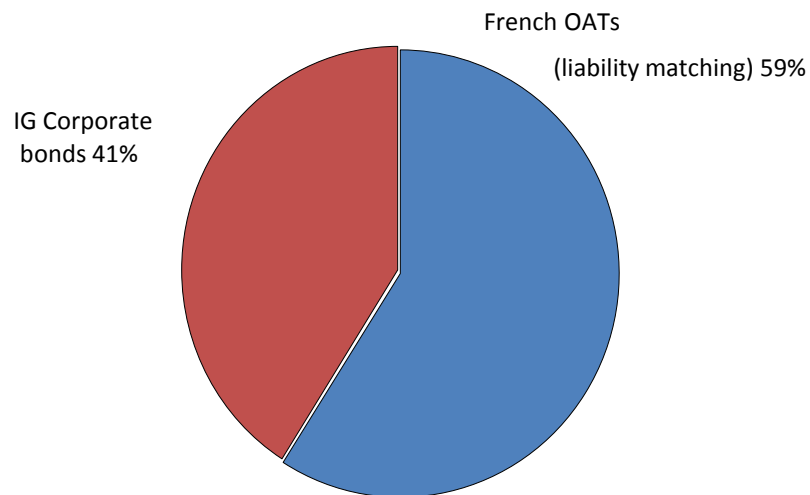
Return-seeking portfolio: 42%



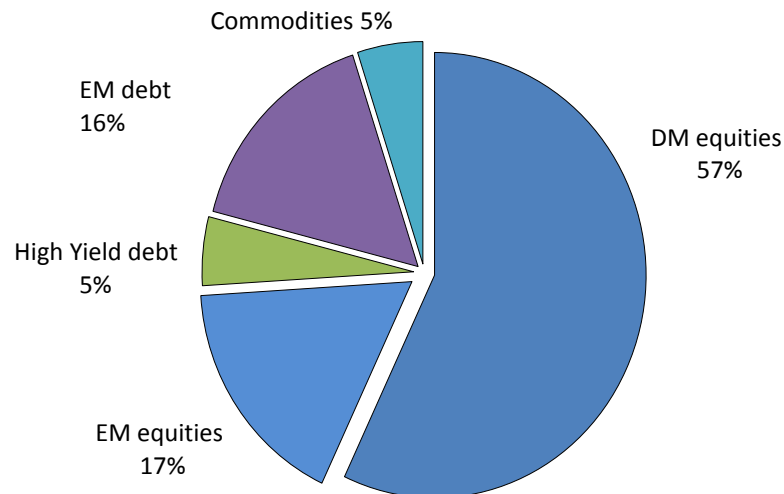
- Strategic allocations to international government bonds and commodities reduced
 - Portfolio optimization (MV and MDP) performed on the Fund's surplus (ALM framework)
 - Introduction of Monte Carlo simulations methodology (static multi-period approach – static portfolios rebalanced every year), as a tool to check the chosen asset allocation

2013 strategic asset allocation

Liability-hedging portfolio: 58%



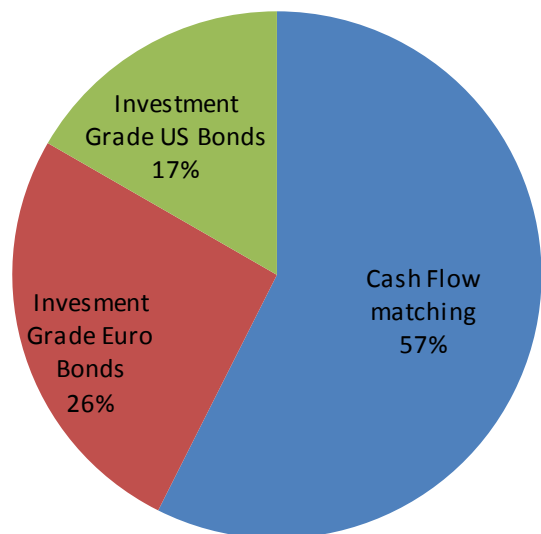
Return-seeking portfolio: 42%



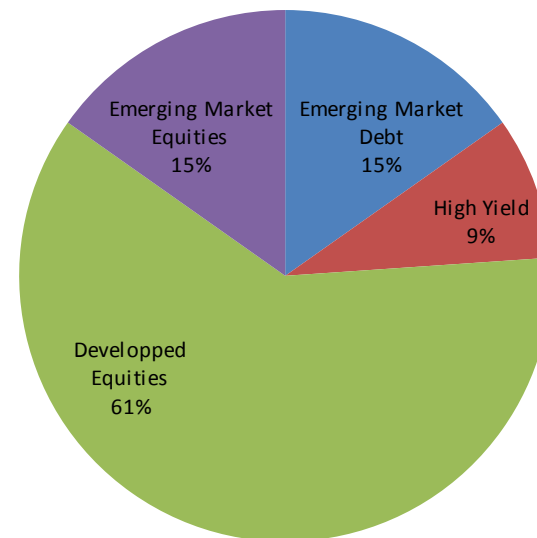
➤ International government bonds (too expensive) and listed real estate (less diversification benefits) removed from the strategic portfolio

- Extension of our Monte Carlo simulations model, used as a tool to select the optimal asset allocation
- Stochastic modelling of assets and liabilities: dynamic Nelson-Siegel approach for sovereign yield curves (€ and \$) and Vasicek model for IG credit spreads, stochastic volatility for equities, HY debt and EMD.
- New risk metric: average surplus in 2024 in the 1% worst cases (equivalent of a CVaR 99%).
- New asset class: European senior secured loans (included in the high yield compartment)

2014 strategic asset allocation



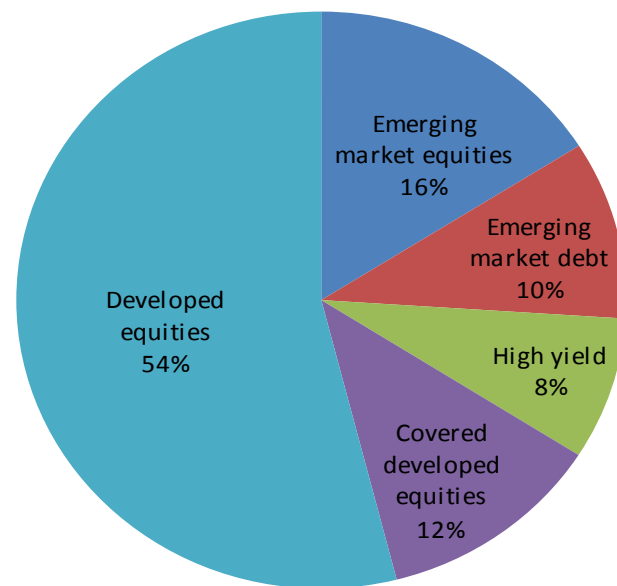
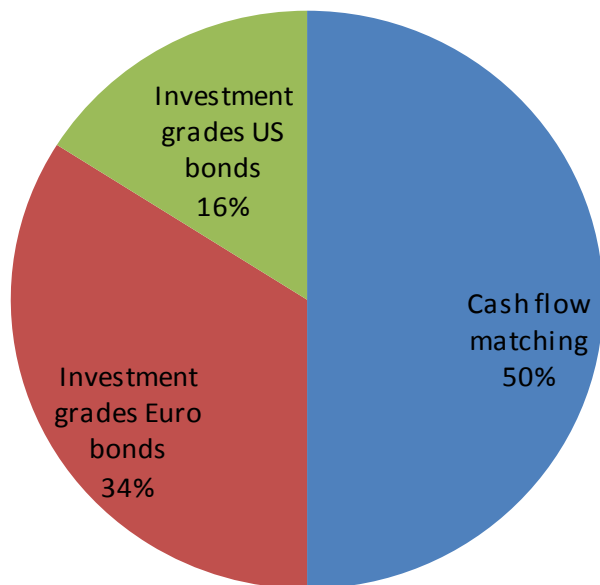
Liability-hedging portfolio: 54%



Return-seeking portfolio: 46%

- Estimation of the Fund's risk aversion and construction of a utility function
- Monte-Carlo simulations done also within a dynamic rebalancing framework (i.e. the various asset classes are not systematically rebalanced every year to the initial weights)
- Extension of the Vasicek model to HY debt and EMD.
- Regime switching log-normal (RSLN) complementary approach on the portfolio's asset classes
- Strategic composite of four equal weighted Smart Beta indices
- Elimination of commodities

2015 strategic asset allocation

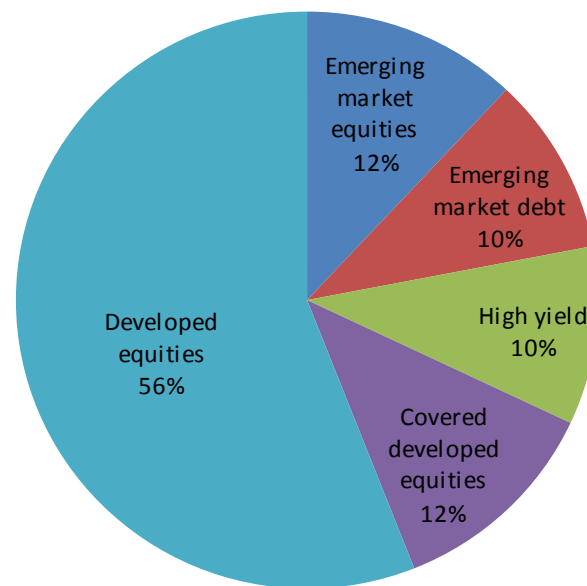
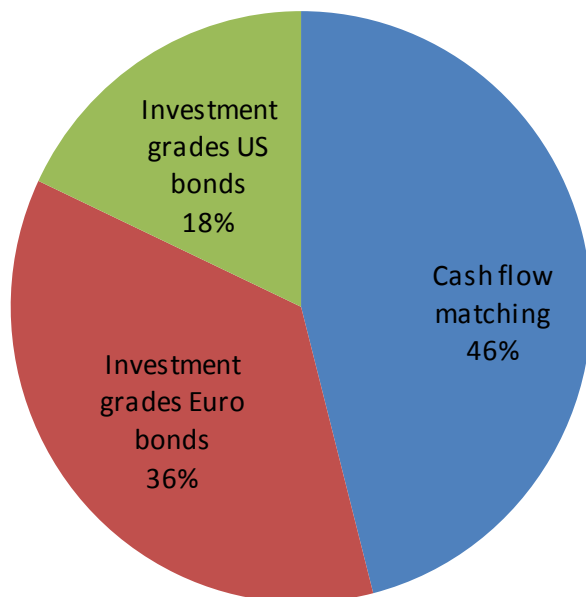


- Introduction of a new sub-asset class : covered developed equities (equities protected by zero premium put spread collars)

Liability-hedging portfolio: 50%

Return-seeking portfolio : 50%

2016 strategic asset allocation

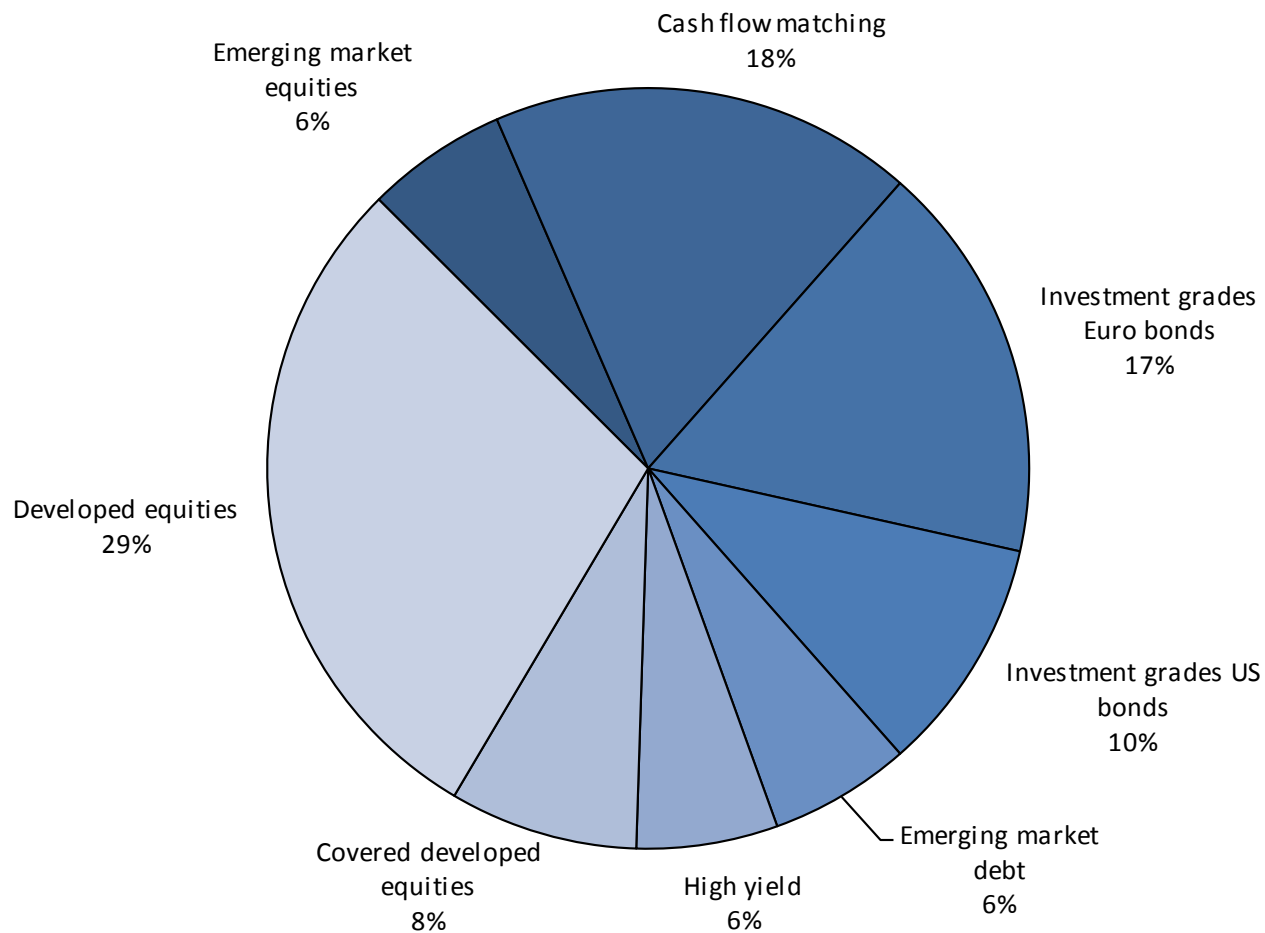


- Static and dynamic Monte Carlo simulations performed using Student laws instead of the Gauss distribution
- More accurate modelling of HY debt and EMD: defaults modelled with a Poisson law for their occurrence and a log-normal law for their intensity

Liability-hedging portfolio: 50%

Return-seeking portfolio: 50%

2017 strategic asset allocation



Risk-based investing : smart beta equities

FRR's beliefs (1)

I/ What is smart beta ?

- 1/ a great name
- 2/ smart marketing
- 3/ efficient systematic non cap-weighted schemes

II/ Smart beta and factor investing : the best of two worlds ?

- the flaws of cap weighted indexes :
 - inherently inefficient and trend following
 - top heavy in super large caps priced for perfection
- deconstructing active management (Fama-French, Carhart)

III/ The precursors

- The low volatility anomaly (1972)
- Robert Fernholz*, 1982 : volatility harvesting (a maximum diversification based trading strategy)

* Fernholz, R. and Shay, B. (1982) Stochastic Portfolio Theory and Stock Market Equilibrium, *The Journal of Finance*, 37: 615-624

IV/ Optimised vs non optimised indexes

Naive diversification : equal weights

Non optimised low vol : low vol tilted cap-weighted indexes (i.e. market cap applied to the x% least volatile stocks), low vol equal weights, volatility weighted (each stock has a weight inversely proportional to its volatility)

The case of fundamental indexation : RAFI

Optimised indexes : stocks weightings take into consideration individual volatilities but also correlations with other stocks. Not all stocks are necessarily present in the resulting optimised index.

Risk-based investing : smart beta equities

FRR's beliefs (3)

V/ Optimised risk-based indexes : 3 families (Min Vol, Max Diversification, Risk Parity)

MSCI Min Vol, FTSE Min Var, Russel, S&P, etc

TOBAM** Maximum diversification

Edhec Risk Efficient

Equal Risk Contributions or risk parity (aims at maximising the effective number of stocks i.e. another form of the holy grail quest for portfolio diversification)

Issues with optimised smart beta indexes :

1/ Model risk

2/ Problem of the covariance matrix [MSCI Min Vol : Barra multifactorial ; Min Var : principal components analysis]

3/ Sector concentrations/bond like behaviours

4/ Constraints (maximum and minimum weights by region, sector, stock) : the devil is in the details

** Choueifaty, Y. and Coignart, Y. (2008) Toward Maximum Diversification, *The Journal of Portfolio Management*, 34(4):40-51

VI/ Smart beta indexes vs factor investing

1/ pure factors and factor tilts

2/ rewarded factors : value, size, momentum, low vol/low beta, quality, etc

3/ Issues with factor indexes :

- intensity of the factor exposure
- AND purity of the factor exposure

« Evaluating the efficiency of smart beta indexes », Michael Hunstad, Jordan Dekhayser (October 14, 2014), Northern Trust Asset Management.

Bottom line : plenty of unintended exposures in most smart beta factor tilted cap-weighted indexes. None of those indexes gives a pure exposure to the intended risk factors.

4/ Smart beta indexes too are exposed to factors

Risk-based investing : smart beta equities

FRR's beliefs (5)

VII/ How to explain the relative performance of smart beta indices?

- 1/ Rewarded risks from factor exposures (value, small caps)
- 2/ Anomalies explained by institutional constraints and behavioural factors (low beta, momentum)
- 3/ The elusive rebalancing premium

Portfolio management is full of active decisions. And beliefs.

Smart beta involves beliefs almost of a religious nature : indexes vs factors, rebalancing premium.

Diversification benefit +/- changes in market concentration

20 to 30 basis points per annum ?

The very existence and magnitude of the rebalancing premium boils down to the crucial issue of mean reversion.

Mean reversion : between asset classes ?

between sectors ? (→ sector rotations)

between factors ? (→ factor timing)

at the individual stock level ?

- 4/ Residue : often large residual alpha in regressions of smart beta returns against factors