CYTA Pension Fund

Asset-Liability Modelling Results and Next Steps

13 December 2016

Ταμείο Συντάξεων και Χορηγημάτων Υπαλλήλων ΑΤΗΚ

Introduction

- As per Law 208 (I), 2012 and the Fund's approved Statement of Investment Principles (SIP), the Administration Committee (AC) must conduct a new ALM study every 3 years unless there is a significant event that effects the assets and liabilities of the Fund.

- This presentation sets out the ALM process for development of the strategic asset allocation of CYTA. The previous Strategic asset allocation was endorsed in 2014 (and was based on 2012 results). Due to a number of changes to the membership of the Fund, it was decided to update the results of the ALM sooner thus the applicable date of calculation was set as at 30/06/2016.

- Dynamic ALM study will assist CYTA in their decision-making relative to the Strategic Asset Allocation of the Pension Fund by:
  - Updating the risk/return objectives and constraints of the AC
  - Observing current and future risk of the implemented strategy as measured by the level of the Funding Level (FL) at the end of the time horizon.
  - **Setting a new optimised Strategic Asset Allocation for the Fund**

- The following presentation describes briefly the methodology adopted in the ALM, our assumptions, the initial inputs (objectives, constraints etc) and the results of our ALM.

Actuarial Results (Funding basis) – 30/06/2016

Financial assumptions:

- The ALM modelling is based on the basis used for the Funding Valuation

Important Assumptions:

- Discount Rate = 1,45% (based on AAA Corporate bond rates plus a margin)

Valuation results:

- The valuation results (which forms the base for the ALM projections) are given below:

Funding Basis Valuation Results at at 30/06/16	€
Past-service Liabilities on Funding basis	883.405.953
Market Value of Assets	563.451.990
Surplus / (Deficit)	(319.953.964)
Funding Level	63,8%

Initial strategic asset allocation – 30/06/2016

Asset Class	€	Actual Allocation 30/06/16 (%)	Target Allocation 2014 (%)	Difference (%)
Global Equity	31.334.346	6	10	-4
Infrastructure Equities	22.133.385	4	10	-6
Property	102.835.835	18	24	-6
Hedge Funds	45.124.482	8	10	-2
Total Growth Assets	**201.428.047**	**36**	**54**	**-18**
Local Bonds	67.467.845	12	18	-6
Global Corporate Bonds	-	-	8	-8
Cash[1]	294.556.097	52	20	32
Total Income Assets	**362.023.942**	**64**	**46**	**18**
Total	**563.451.990**	**100**	**100**	

[1] *Cash includes other receivables*

CYTA Pension Fund

ALM results 30/06/2016 – 10 year horizon

Ταμείο Συντάξεων και Χορηγημάτων Υπαλλήλων ΑΤΗΚ

ALM Metric, Investment Constraints (as set by the client) and Legal Constraints

Horizon	**10 years**
Primary Metric	The Funding Level of the Fund at the time horizon based on the Actuary's Funding Basis

Belief/Constraint	**Comments**
Asset Classes to be included	All asset classes to be included
Liquidity	The Fund can invest in illiquid and complex assets classes to benefit from illiquidity and complexity premium
Home Bias	No home bias
Active vs Passive	Active management would be considered
Minimum allocation to cash	Set at estimated net cashlows out of the Fund over the next 3 years (currently 13%)
Minimum allocation to local property	Set at the current level of 18%
Maximum allocation to hedge funds	Legal limit of 15%
Total exposure to assets in non-regulated assets	Legal limit of 40%
Total investment in shares and non-government bonds	Legal limit of 70%

Our model

Aon Hewitt uses an econometric model which is:

Complete and Consistent

- All the major markets and asset classes are modelled within a consistent framework allowing the interactions between them to be properly taken into account.

Full Yield Curve Model

- The yield curve relates the yield you can obtain on a bond to its term to maturity. For example, the yield on a five-year bond will not usually be the same as the yield on a ten-year bond.

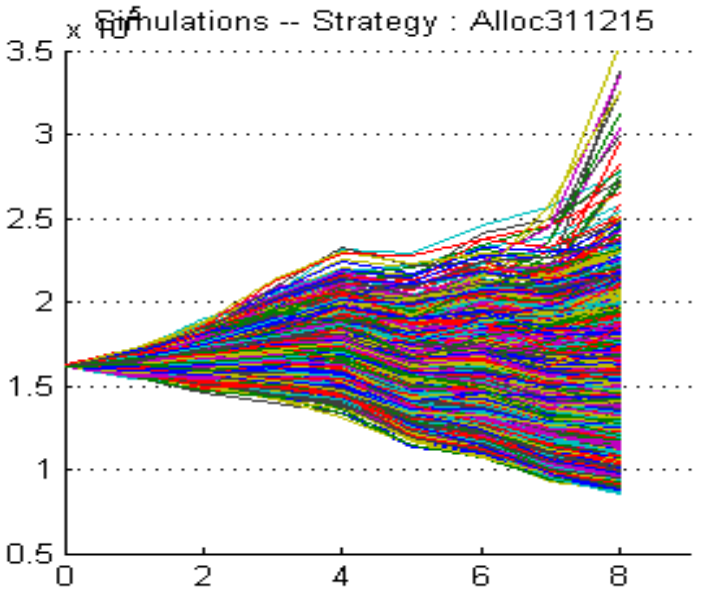
No 'Free Lunch'

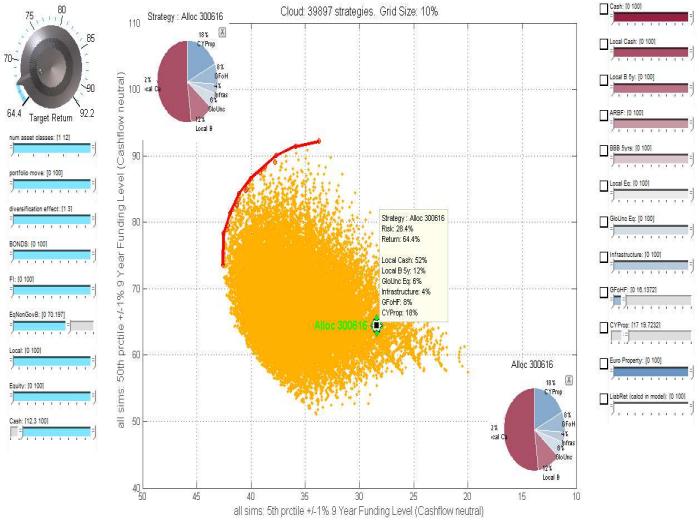
- 'Always win' strategies (arbitrage opportunities) are not generally available in the real world and therefore should not be present in the model. In other words, the discounted value of any set of future cash flows from an asset should equal the current market value of the asset. Our model is free of arbitrage.

Demographic Assumptions:

- We have adopted the demographic assumptions as implied by the actuarial valuation results of 30 June 2016. No attempt was made to apply different demographic assumptions to the actuary's cashflow projections.

Our model cont.





Aon Hewitt Asset Liability Projector (ALP)

- Our stochastic model uses Monte Carlo simulations to project assets and liabilities consistently using 5.000 economic scenarios. The screenshot demonstrates the resulting range of possible outcomes from a sample projection.
- This is a proprietary Monte Carlo projection system used for defined benefit pension schemes.

Aon Hewitt Interactive Modeller:

- This is a proprietary model for comparing portfolios' risk and return characteristics relative to liabilities or other metrics. The model explores the risk-return characteristics of tens of thousands of strategies, and results are presented within a large 'grid' (the "cloud"). The screenshot demonstrates a resulting cloud. Each yellow (and red) dot in the cloud represents 1 strategic asset allocation.

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Setting the assumptions

- Our model requires certain financial inputs. As far as possible, these are set with reference to market conditions at the time the calibration is carried out.

- Some inputs cannot be set with reference to market conditions. There is an element of subjectivity in setting these assumptions and we set these with reference to
  - Historical data;
  - Market conditions;
  - Our view of what is economically sensible.

- Volatility and correlations of returns between asset classes are features of both bull and bear markets. They will be affected less by the underlying economic conditions than by the actual level of returns. Therefore, estimates of volatility and correlations, which are based on historical data, will be less sensitive to the period that is chosen than to estimates of expected returns. For example, equities and bonds are usually (with a number of exceptions) positively correlated, whether markets are going up or down.

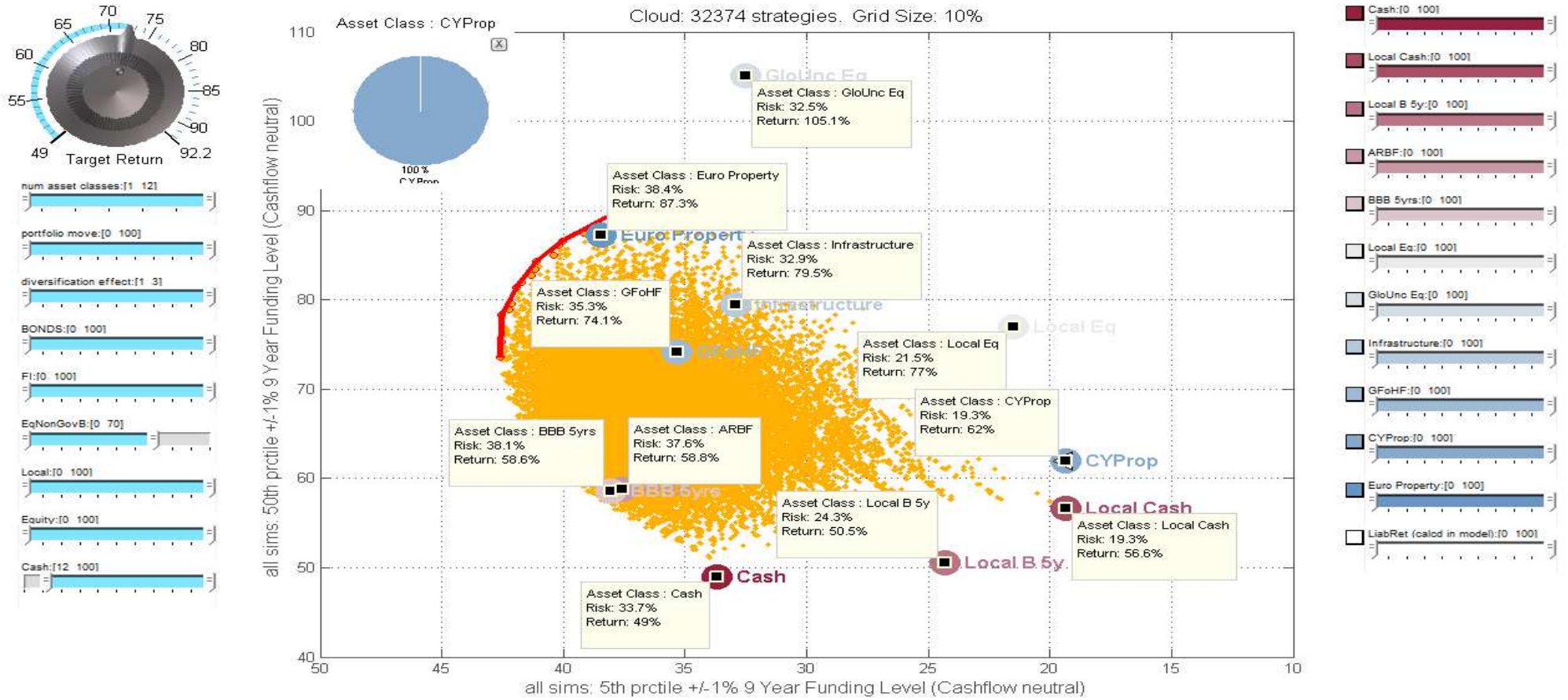
- When it comes to assumptions about volatility and the correlation between assets, we primarily consider the historical figures based on monthly returns data, in conjunction with implied volatilities from options prices (where this is possible).

Our important Asset Assumptions 30/06/2016 – 10 year

	Asset Class	Annualised median return	Annualised return (5% level)
1	Cash	-0,3%	-1,1%
2	Local Cash (proxy using adjusted European cash assumption)	0,9%	-9,7%
3	European BBB Bonds – 5 year	1,8%	-1,1%
4	Local Bonds – 5 year (proxy using adjusted Emerging Market bond assumption)	0%	-6,6%
5	Absolute Return Bond Fund	1,7%	-0,8%
6	Active Global (Unconstrained) Equity	8,2%	-3,8%
7	Local Equity	4,4%	-7,9%
8	Infrastructure	4,8%	-3,3%
9	Hedge Funds	4,1%	-3%
10	European Property	6,1%	-1,6%
11	Cyprus Property (proxy using adjusted European property assumption)	2%	-9,3%

The table above shows for each asset class, the annualised median return achieved by the 5,000 Monte Carlo scenarios generated by our stochastic model as well as the return at the 5% level i.e. the last column shows that only 5% of the 5000 Monte Carlo scenarios would achieve the return shown or lower. **The latter is our measure of risk and it is not a volatility measure.**

Modeling: All asset classes (10 year projections) without constraints



- The cloud above shows a graphical representation of Risk and Return profile of each asset class and each possible strategy.
- “Return” is defined as the expected FL over 10 years (y-axis) and “Risk” is defined as the FL over 10 years at the 5% level i.e. there are 5% of the 5000 Monte Carlo scenarios that achieve a return equal or lower than this level (x-axis). This is not a volatility measure.
- The asset classes are represented by the big blue and purple dots. The model combines the selected asset classes and each orange (and red dot) represents one of 184,756 different strategies that have been combined.
- Strategies that lie to the left of the graph have less risk and strategies that lie to the top of the graph have higher return.
- Strategies represented by the red dots lie on the efficient frontier.

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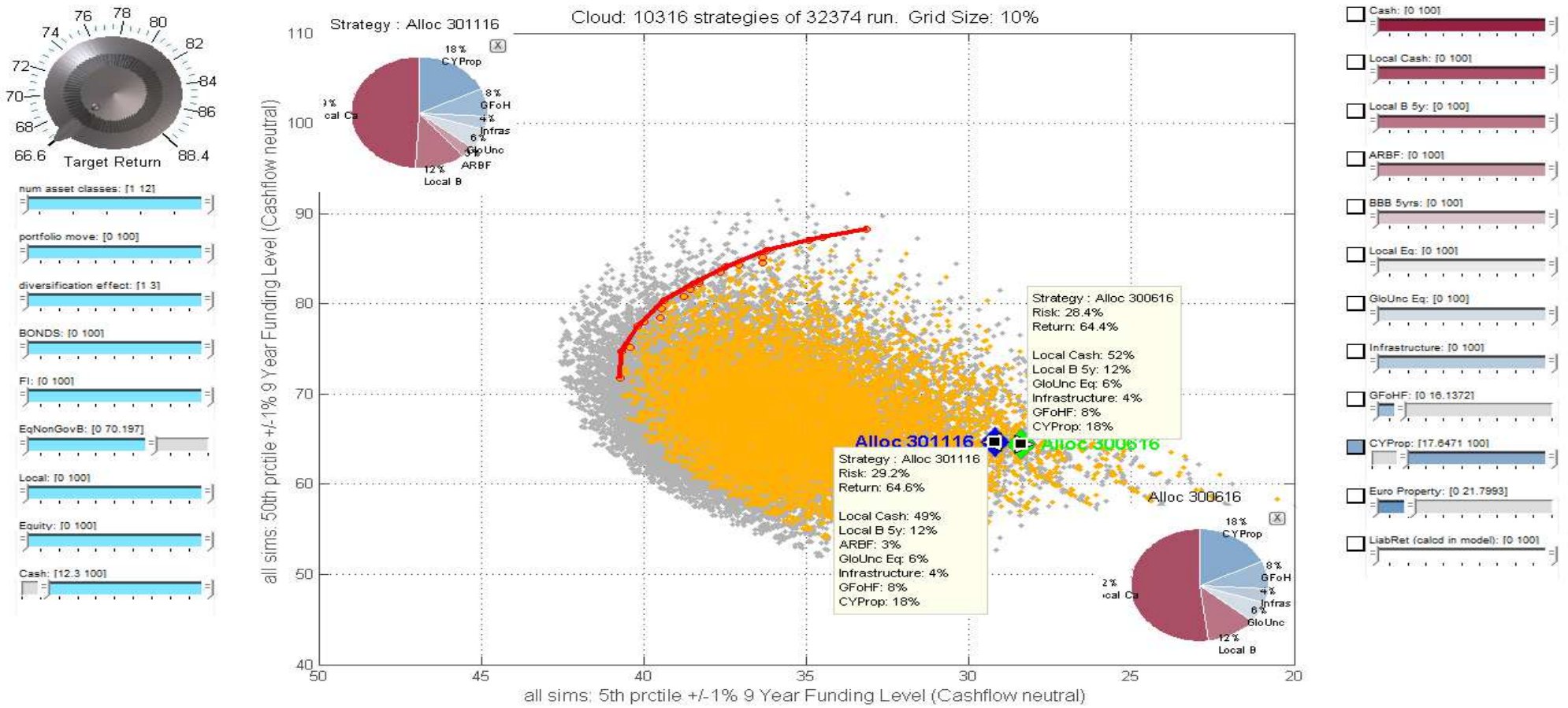
FL results over the time horizon
Asset allocation as at 30/06/2016 and 30/11/2016



- If the Fund follows the allocation as at 30/06/16 (as shown by the **green** dot) ,the FL at the end of the time horizon is expected to be **64,4%** and there are 250 out of the 5000 scenarios where the FL in 10 years time would be less than **28,4%.**
- If the Fund follows the allocation as at 30/11/16 (as shown by the **blue** dot) ,the FL at the end of the time horizon is expected to be **64,6%** and there are 250 out of the 5000 scenarios where the FL in 10 years time would be less than **29,2%.**
- Cashflow Neutral FL calculations assume that contributions made cover only new accrual for the year and no deficit contributions are made.

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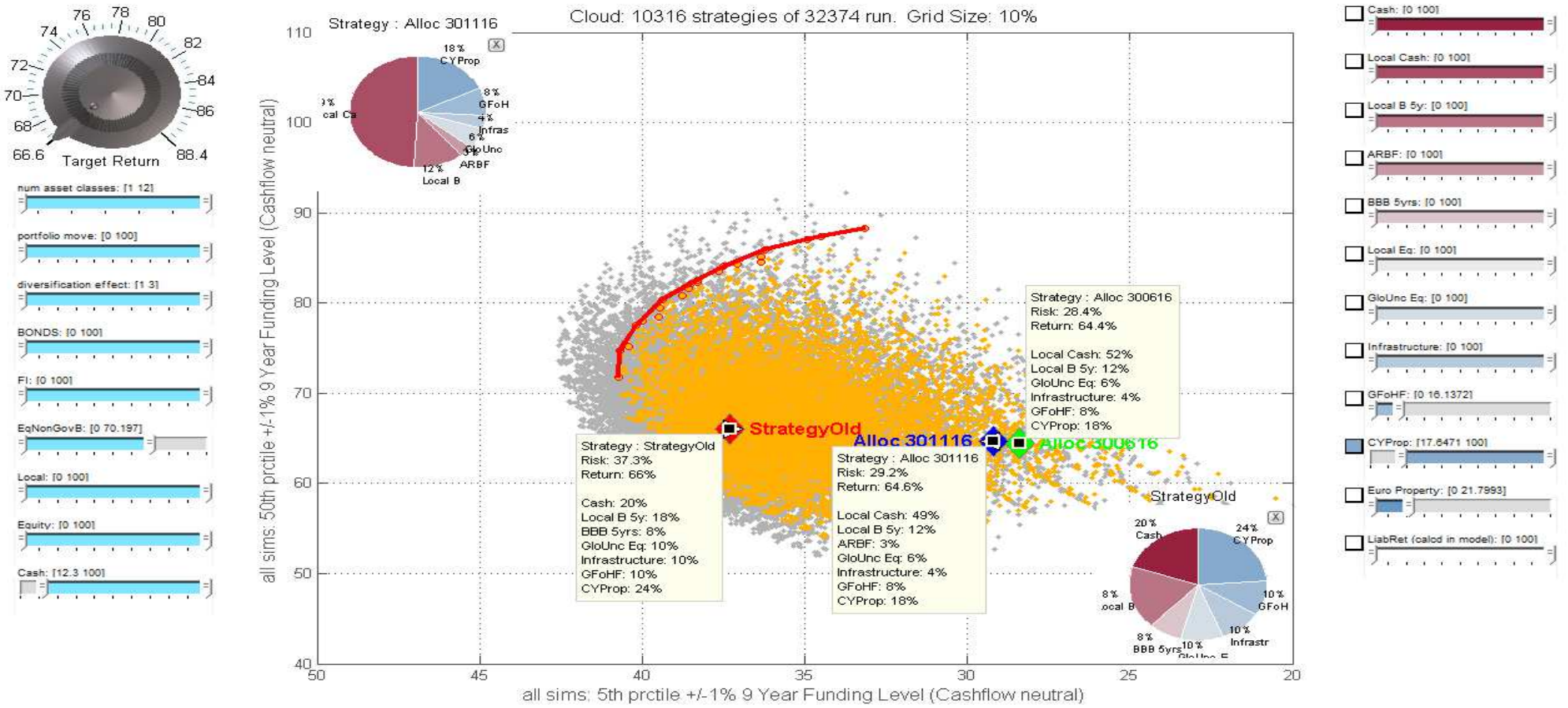
FL results over the time horizon
2014 SIP strategy



- As per the previous page, If the Fund follows the allocation as defined in the November 2014 SIP (the **red** dot), the FL at the end of the time horizon is expected to be **66%** and there are only 250 out of the 5000 scenarios where the FL in 10 years time would be less than **37,3%.**
- The above graph shows that there exist some strategies that are more efficient
  - They can result in a higher FL for the same level of risk (moving upwards towards the red dots).
  - They can result in the same FL for a lower level of risk (moving left towards the red dots).
- "Risk" and "Return" are defined on page 18.

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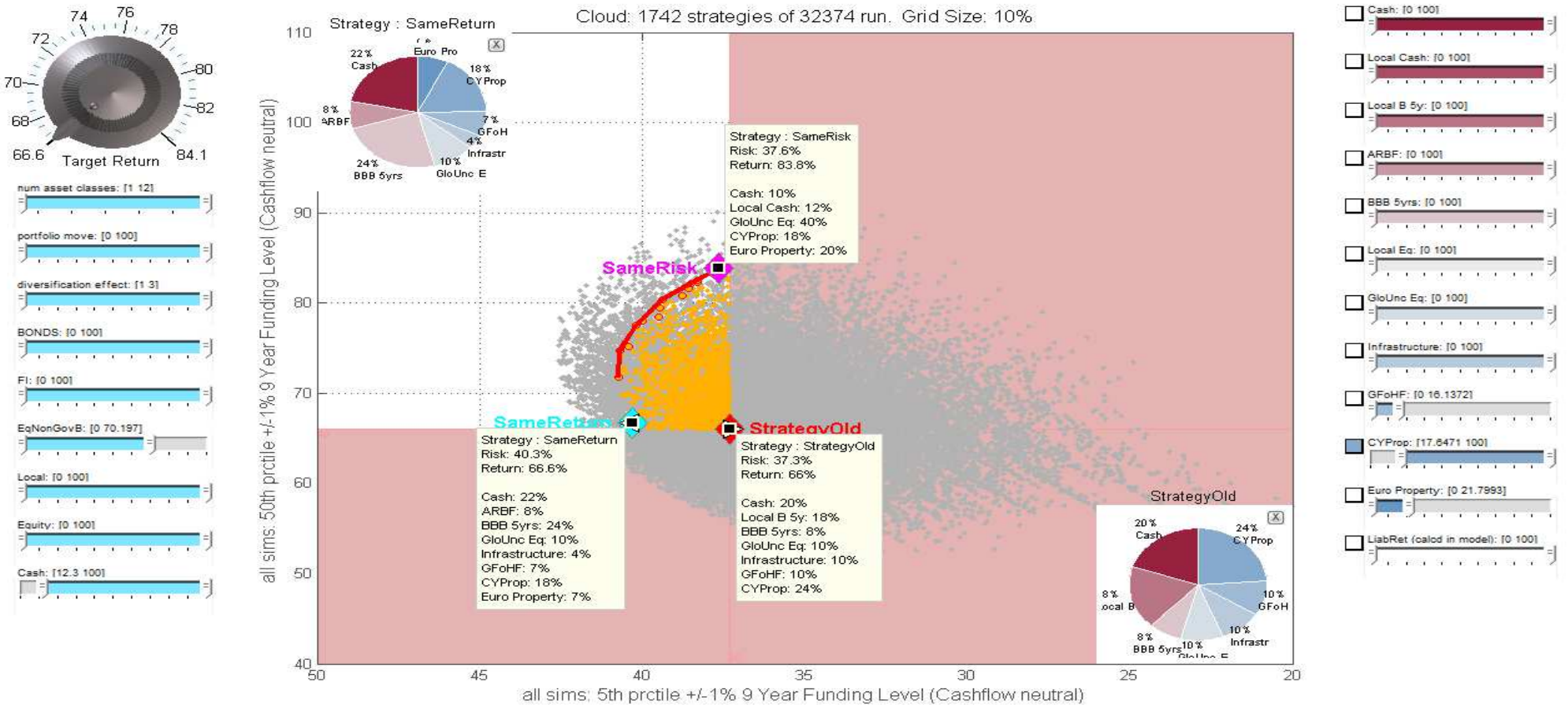
FL results over the time horizon
Optimal strategies



- The pink area represent strategies that are either of higher “Risk” or lower “Return” than the current allocation and are excluded .
- “SameReturn” strategy (**cyan** dot) is more efficient than the StrategyOld (**red** dot) as it is expected to have the same “Return” as the old Strategy but with lower “Risk”.
- “SameRisk” strategy (**pink** dot) is more efficient than the StrategyOld (**red** dot) as it is expected to have the “Risk” as the StrategyOld but with higher “Return”.

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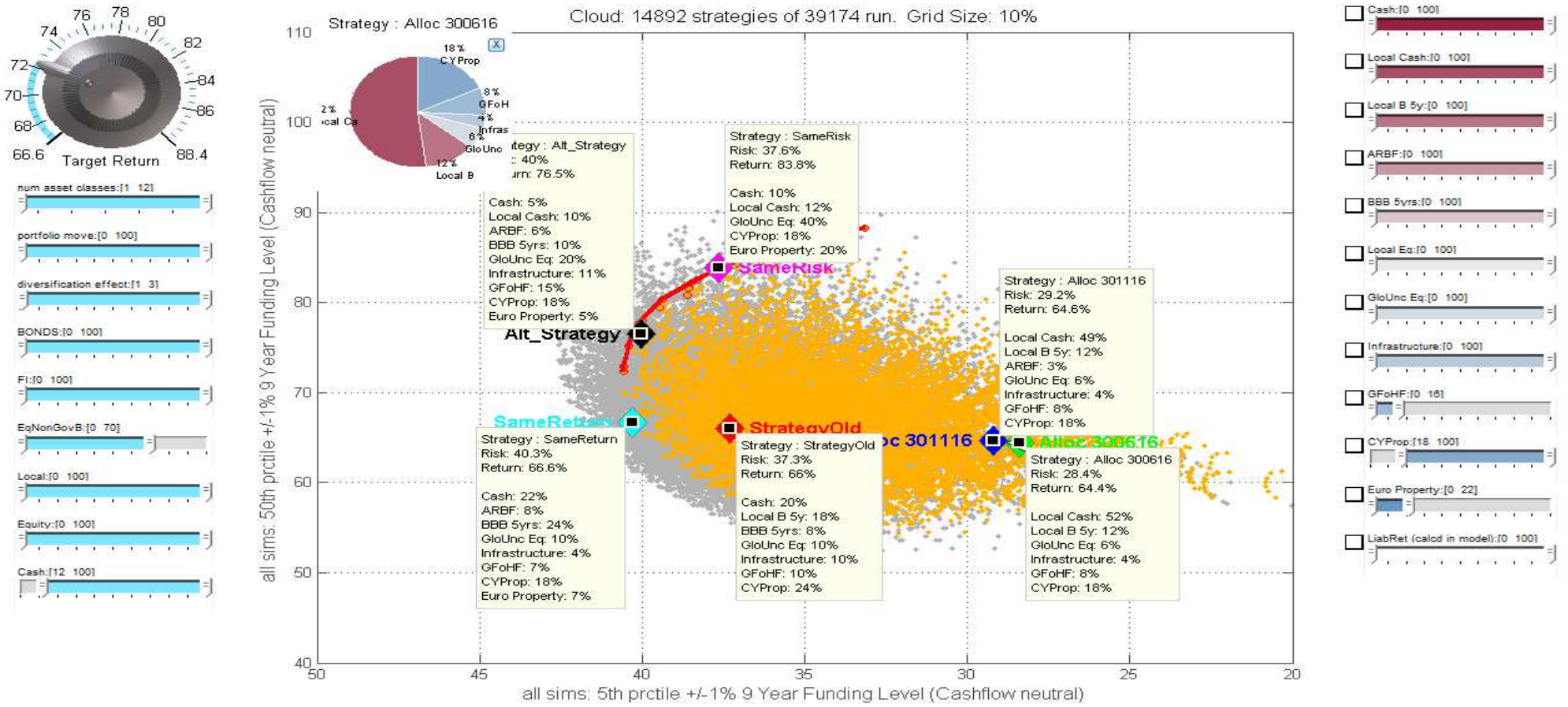
FL results over the time horizon
All strategies



- Another alternative strategy is introduced. “Alt_Stategy” strategy (**black** dot) is more efficient than the StrategyOld (**red** dot) as it is expected to have much more “Return” with lower “Risk” and it lies in the efficient frontier.
- “SameReturn” strategy (**cyan** dot) has more allocation to cash and bonds than the proposed Alt_Stategy with less Return and almost the same “Risk”.
- “SameRisk” strategy (**pink** dot) has more allocation to equities and European property than the proposed Alt_Stategy with more Return but higher “Risk”.

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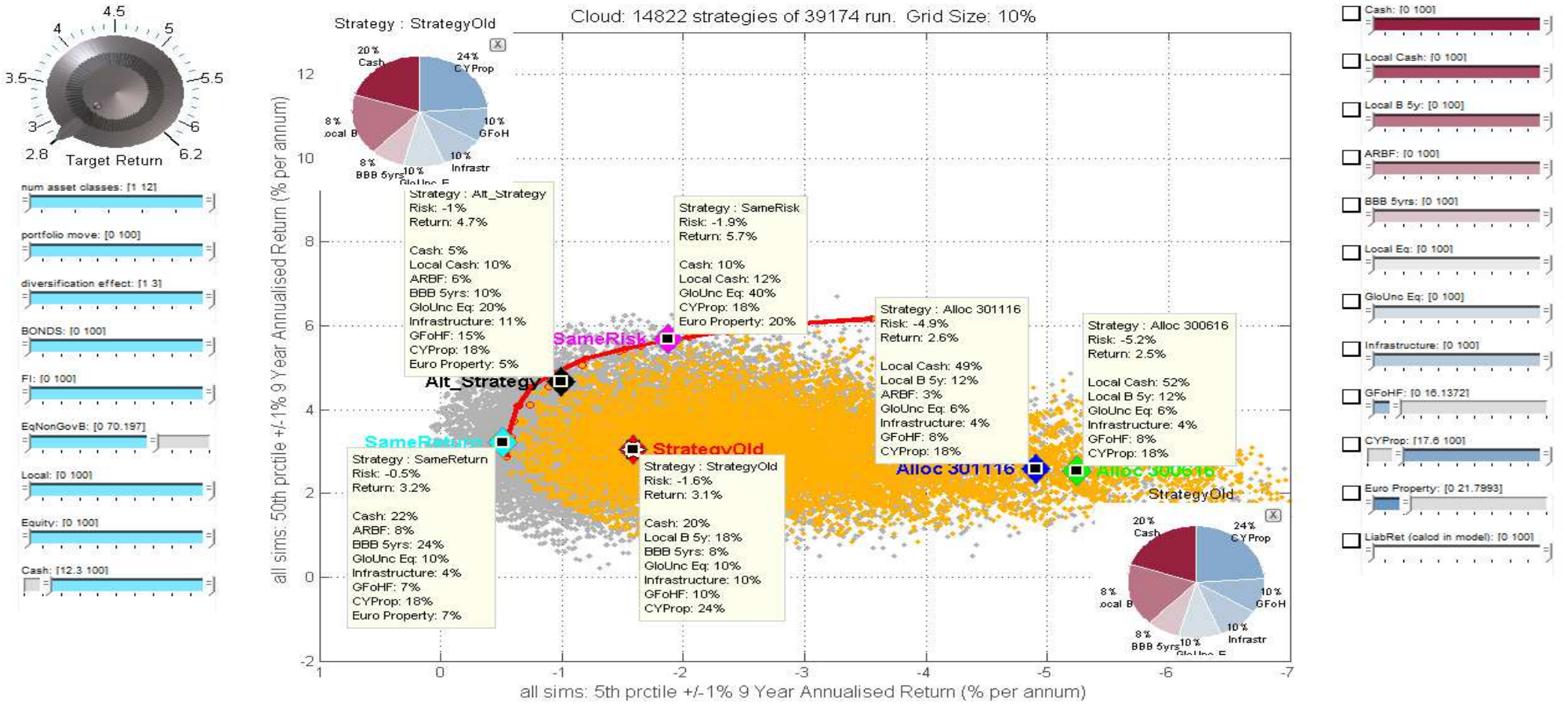
Annualised return results over the time horizon
All strategies



- In this graph, “Return” is defined as the average annualised expected return over 10 years (y-axis) and “Risk” is defined as the annualised return over 10 years at the 5% level ie there are 250 (ie 5%) of the 5000 Monte Carlo scenarios that achieve a return equal or lower than this level (x-axis). This is not a volatility measure.
- The six strategies shown in the previous slide are now shown using the above metric

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Summary of results (all metrics) – 10 year

	Asset Class	Allocation 30/06/16	Strategy 2014	Allocation 30/11/16	Same Return	Same Risk	Alt_Strategy
1	Cash	-	20%	-	22%	10%	5%
2	Local Cash	52%	-	49%	-	12%	10%
3	European BBB Bonds – 5 year	-	8%	-	24%	-	10%
4	Local Bonds – 5 year	12%	18%	12%	-	-	-
5	Absolute Return Bond Fund	-	-	3%	8%	-	6%
6	Active Global (Unconstrained) Equity	6%	10%	6%	10%	40%	20%
7	Local Equity	-	-	-	-	-	-
8	Infrastructure	4%	10%	4%	4%	-	11%
9	Hedge Funds	8%	10%	8%	7%	-	15%
10	European Property	-	-	-	7%	20%	5%
11	Cyprus Property	18%	24%	18%	18%	18%	18%
	FL median 10 yrs	64,4%	66%	64,6%	66,6%	83,8%	76,5%
	FL 5% 10 yrs	28,4%	37,3%	29,2%	40,3%	37,6%	40%
	Annualized Ret median 10 yrs	2,5%	3,1%	2,6%	3,2%	5,7%	4,7%
	Annualized Ret 5% 10 yrs	-5,2%	-1,6%	-4,9%	-0,5%	-1,9%	-1%

Results

- “SameReturn” strategy is more efficient than the old Strategy as it improves all metrics.

- “SameRisk” strategy is more efficient than the old Strategy as it improves all metrics (with the exception of annualized return at the 5% level over the time horizon which is only marginally affected).

- Whilst “SameRisk” and “SameReturn” strategies are considered appropriate for investment as they meet all objectives, we would recommend exploring a Stratgegic Asset Allocation in line with “Alt_Strategy” as this offer better diversification. It is more efficient than the old Strategy as it improves all metrics and gives higher Return with lower Risk.

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Next Steps

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Next Steps

- Decide Strategic Asset Allocation (Board)
- Prepare Statement of Investment Principles (Aon Hewitt)
- Finalize and Execute SIP and submit to Regulator (Board)
- Approve Implementation plan (Board)
- Prepare Asset Class Strategies (Aon Hewitt)
- Presentation to Board of Asset Class Strategies and finalization (Board)
- Consider implementation plan:
  - Selection of fund managers
  - Implementation of selected fund managers
  - Continuous monitoring of performance

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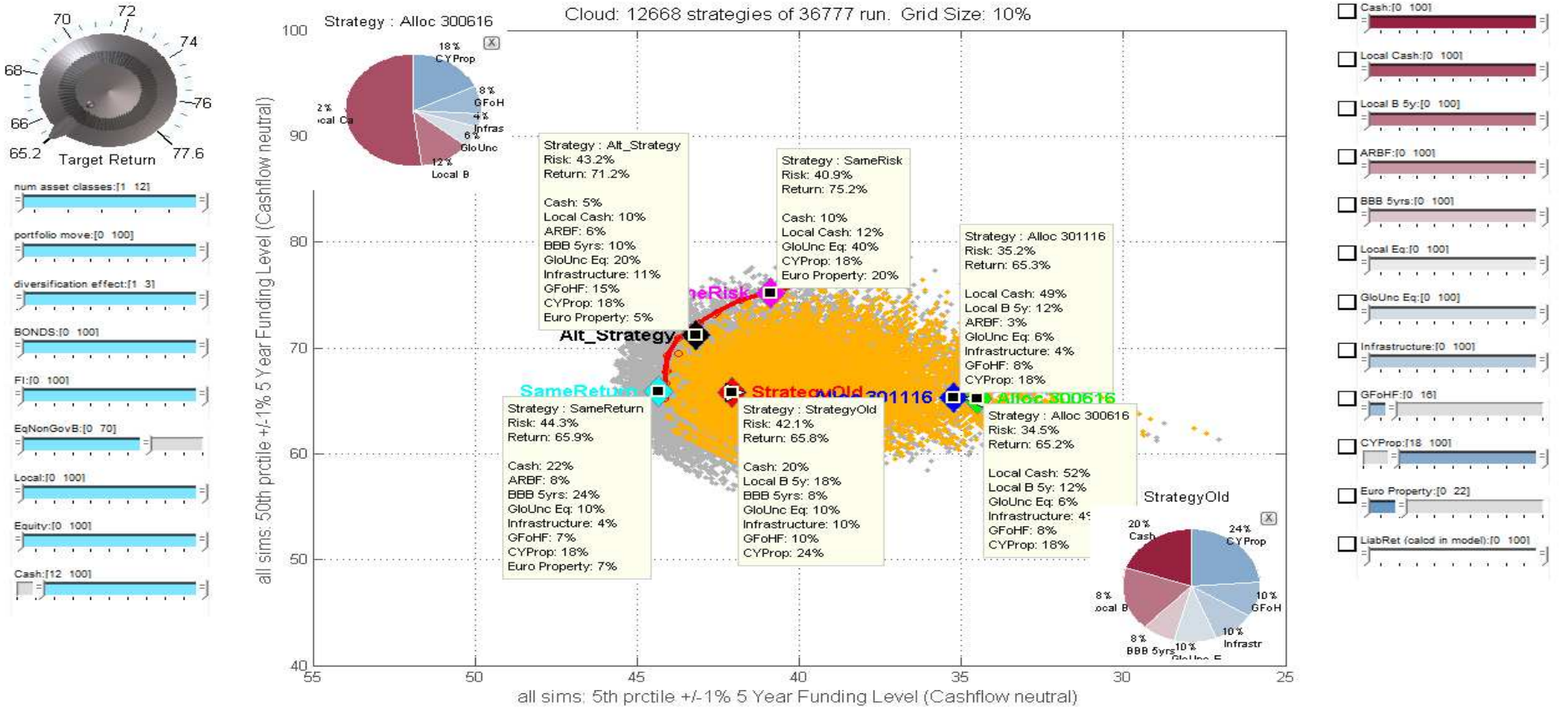
Appendix

Ταμείο Συντάξεων και Χορηγημάτων Υπαλλήλων ΑΤΗΚ

FL results over the 5 year horizon
All strategies



- "Alt_Stategy" strategy (**black** dot) is more efficient than the StrategyOld (**red** dot) as it is expected to have much more "Return" with lower "Risk" and it lies in the efficient frontier.
- "SameReturn" strategy (**cyan** dot) has more allocation to cash and bonds than the proposed Alt_Stategy with less Return and almost the same "Risk".
- "SameRisk" strategy (**pink** dot) has more allocation to equities and European property than the proposed Alt_Stategy with more Return but higher "Risk".

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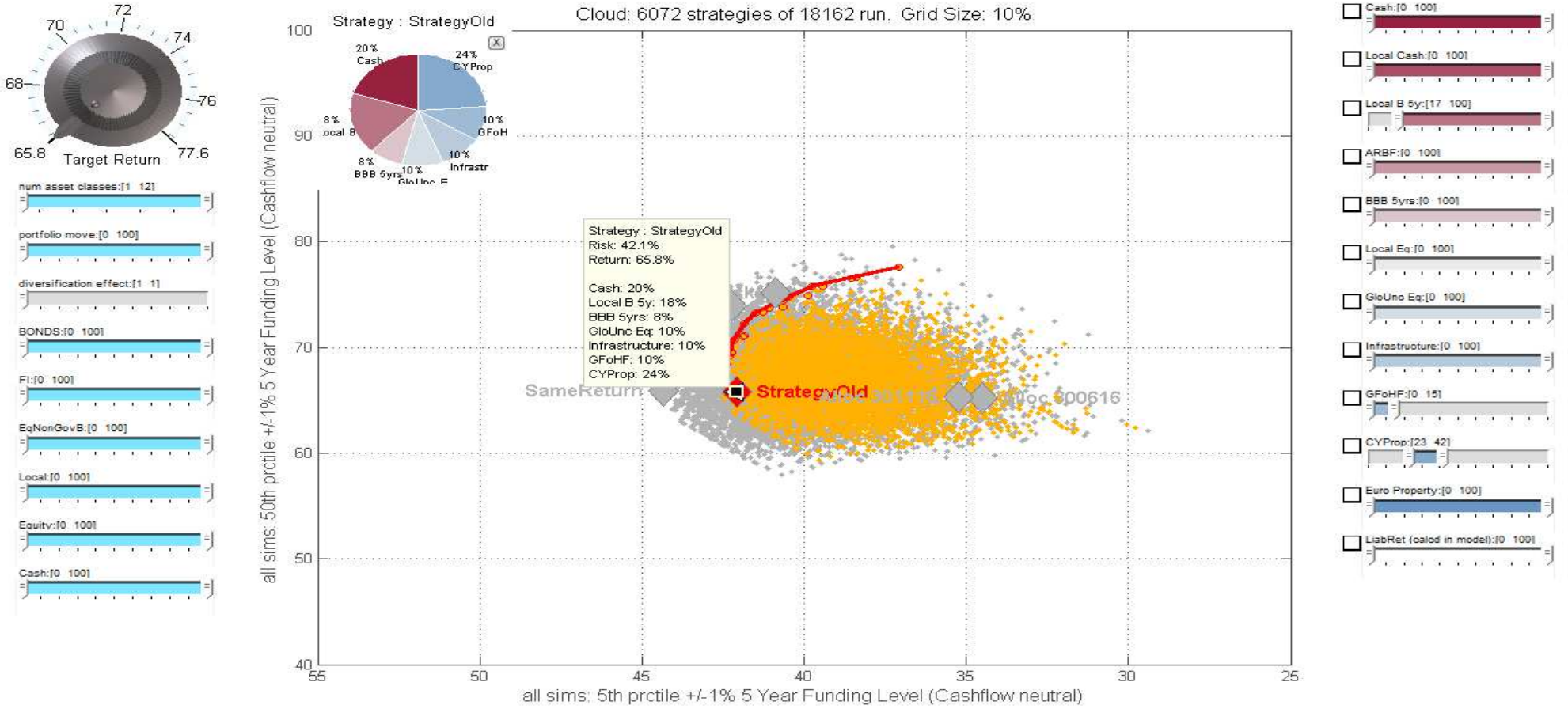
Summary of results (all metrics) – 5 year

	Asset Class	Allocation 30/06/16	Strategy 2014	Allocation 30/11/16	Same Return	Same Risk	Alt_Strategy
1	Cash	-	20%	-	22%	10%	5%
2	Local Cash	52%	-	49%	-	12%	10%
3	European BBB Bonds – 5 year	-	8%	-	24%	-	10%
4	Local Bonds – 5 year	12%	18%	12%	-	-	-
5	Absolute Return Bond Fund	-	-	3%	8%	-	6%
6	Active Global (Unconstrained) Equity	6%	10%	6%	10%	40%	20%
7	Local Equity	-	-	-	-	-	-
8	Infrastructure	4%	10%	4%	4%	-	11%
9	Hedge Funds	8%	10%	8%	7%	-	15%
10	European Property	-	-	-	7%	20%	5%
11	Cyprus Property	18%	24%	18%	18%	18%	18%
	FL median 5 yrs	65,2%	65,8%	65,3%	65,9%	75,2%	71,2%
	FL 5% 5 yrs	34,5%	42,1%	35,2%	44,3%	40,9%	43,2%
	Annualized Ret median 5 yrs	2,2%	2,9%	2,3%	3%	5,5%	4,4%
	Annualized Ret 5% 5 yrs	-7,7%	-3,1%	-7,2%	-1,8%	-4,3%	-2,9%

Summary of results (annualized return) – 1 year

	Asset Class	Allocation 30/06/16	Strategy 2014	Allocation 30/11/16	Same Return	Same Risk	Alt_Strategy
1	Cash	-	20%	-	22%	10%	5%
2	Local Cash	52%	-	49%	-	12%	10%
3	European BBB Bonds – 5 year	-	8%	-	24%	-	10%
4	Local Bonds – 5 year	12%	18%	12%	-	-	-
5	Absolute Return Bond Fund	-	-	3%	8%	-	6%
6	Active Global (Unconstrained) Equity	6%	10%	6%	10%	40%	20%
7	Local Equity	-	-	-	-	-	-
8	Infrastructure	4%	10%	4%	4%	-	11%
9	Hedge Funds	8%	10%	8%	7%	-	15%
10	European Property	-	-	-	7%	20%	5%
11	Cyprus Property	18%	24%	18%	18%	18%	18%
	Annualized Ret median 1 yrs	1,8%	2,8%	1,8%	2,9%	5,6%	4,2%
	Annualized Ret 5% 1 yrs	-19,2%	-11,1%	-18,4%	-8,3%	-16,4%	-12%

Efficient frontier with old constraints



- If we assume the old constraints the efficient frontier (red line) becomes less efficient. This is due the constraints in local bonds and local property. The old strategy lies on the above efficient frontier.

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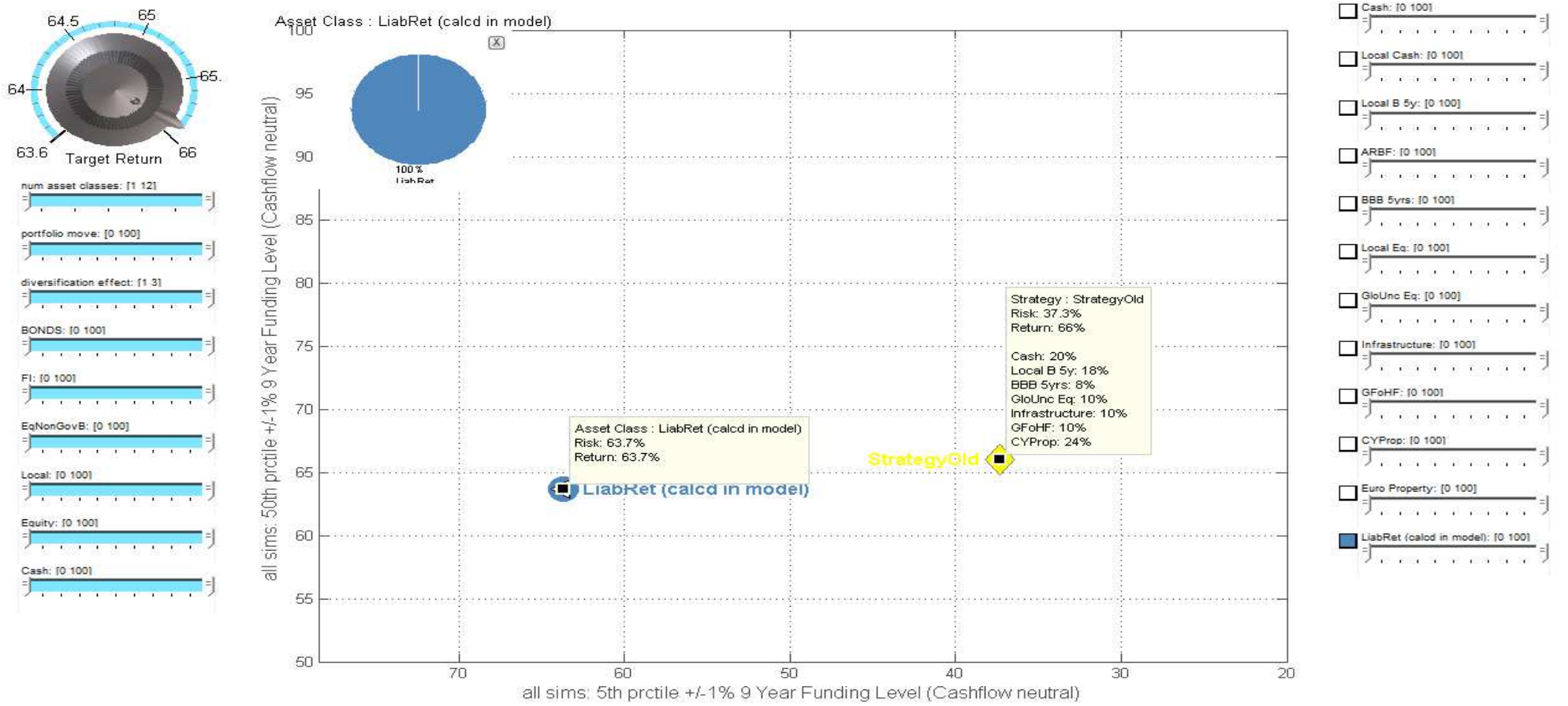
Investment in AAA government bonds



- If the Fund follows an allocation that invested 100% in AAA government bonds (which is the actuary's basis) then the risk is reduced to a minimum as the asset and liabilities move in tangent

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Summary of results (all metrics) – 10 year EXTRA SCENARIOS

	Asset Class	Same Return	Same Ret (more classes)	Same Risk	Same Risk (more classes)	Alt_Strategy	Alt1	Alt1 with GM
1	Cash	22%	15%	10%	7%	5%	7%	7%
2	Local Cash	-	7%	12%	5%	10%	5%	5%
3	European BBB Bonds – 5 year	24%	20%	-	5%	10%	8%	8%
4	Local Bonds – 5 year	-	4%	-	-	-	5%	5%
5	Absolute Return Bond Fund	8%	8%	-	5%	6%	5%	5%
6	Active Global (Unconstrained) Equity	10%	10%	40%	30%	20%	20%	20%
7	Local Equity	-	-	-	-	-		
8	Infrastructure	4%	4%	-	10%	11%	12%	12%
9	Hedge Funds	7%	7%	-	10%	15%	15%	15% (5% in GM)
10	European Property	7%	7%	20%	10%	5%	5%	5%
11	Cyprus Property	18%	18%	18%	18%	18%	18%	18%
	FL median 10 yrs	66,6%	67,6%	83,8%	81,0%	76,5%	75,7%	75,8%
	FL 5% 10 yrs	40,3%	39,4%	37,6%	40,1%	40%	40,3%	41,1%
	Annualized Ret median 10 yrs	3,2%	3,3%	5,7%	5,3%	4,7%	4,6%	4,6%
	Annualized Ret 5% 10 yrs	-0,5%	-0,9%	-1,9%	-1,0%	-1,0%	-0,9%	-0,7%

Summary of results (annualized return) – 1 year EXTRA SCENARIOS

	Asset Class	Same Return	Same Ret (more classes)	Same Risk	Same Risk (more classes)	Alt_Strategy	Alt1	Alt1 with GM
1	Cash	22%	15%	10%	7%	5%	7%	7%
2	Local Cash	-	7%	12%	5%	10%	5%	5%
3	European BBB Bonds – 5 year	24%	20%	-	5%	10%	8%	8%
4	Local Bonds – 5 year	-	4%	-	-	-	5%	5%
5	Absolute Return Bond Fund	8%	8%	-	5%	6%	5%	5%
6	Active Global (Unconstrained) Equity	10%	10%	40%	30%	20%	20%	20%
7	Local Equity	-	-	-	-	-		
8	Infrastructure	4%	4%	-	10%	11%	12%	12%
9	Hedge Funds	7%	7%	-	10%	15%	15%	15% (5% in GM)
10	European Property	7%	7%	20%	10%	5%	5%	5%
11	Cyprus Property	18%	18%	18%	18%	18%	18%	18%
	Annualized Ret median 1 yr	2,9%	2,9%	5,6%	5,1%	4,2%	4,3%	4,3%
	Annualized Ret 5% 1 yr	-8,3%	-9,5%	-16,4%	-13,5%	-12%	-11,9%	-11,1%
	Annualized Ret median 10 yrs	3,2%	3,3%	5,7%	5,3%	4,7%	4,6%	4,6%
	Annualized Ret 5% 10 yrs	-0,5%	-0,9%	-1,9%	-1,0%	-1,0%	-0,9%	-0,7%

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For more information on Aon Hewitt, please visit **www.aonhewitt.com**

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