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new solutions for a new world
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ACTUARIAL SOCIETY OF SOUTH AFRICA

PORTFOLIO OPTIMISATION FOR WITH NON-STANDARD UTILITY FUNCTIONS

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Agenda

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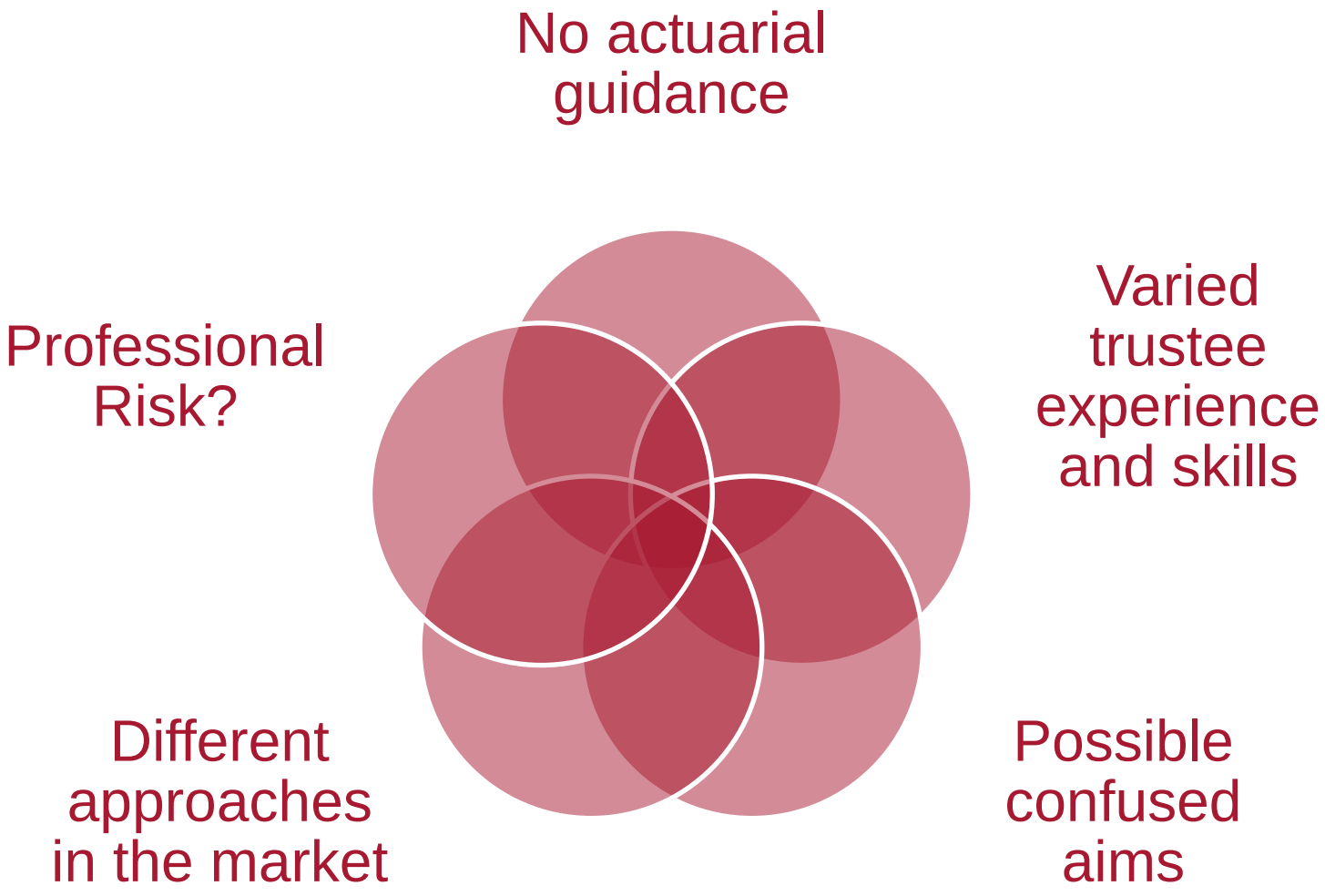
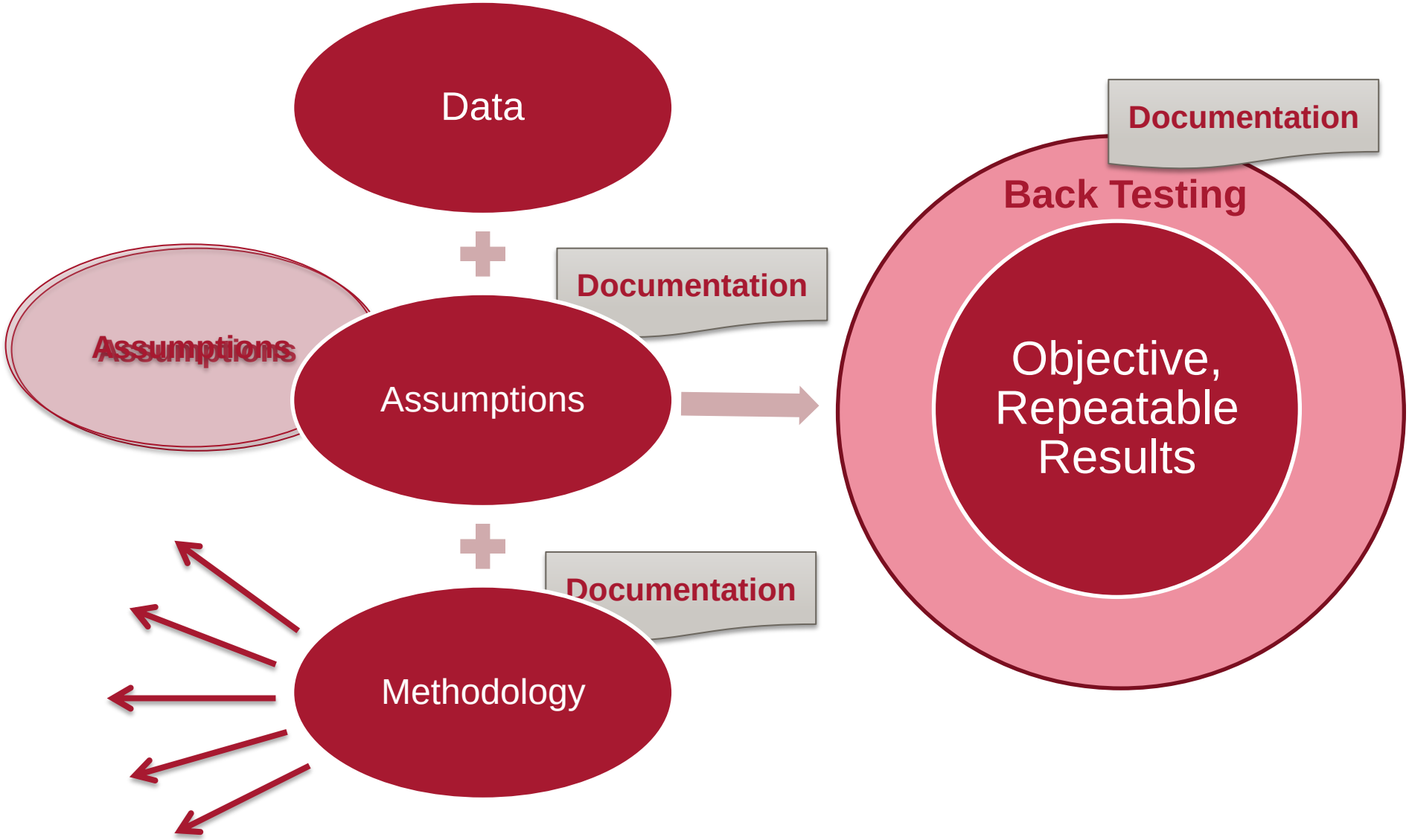
1. Actuaries, Trustees and ALM
2. Loss Aversion, Prospect Theory vs Mean Variance
3. Non-mean-variance efficient optimal portfolios
4. Some possible results

Actuaries, Trustees and ALM



Slightly naïve aim of objectivity



Rationality

- Traditional Utility Functions
- Complete, Transitive, Independent and Continuous
- A model of rationality...?

Loss Aversion, Prospect Theory vs Mean Variance

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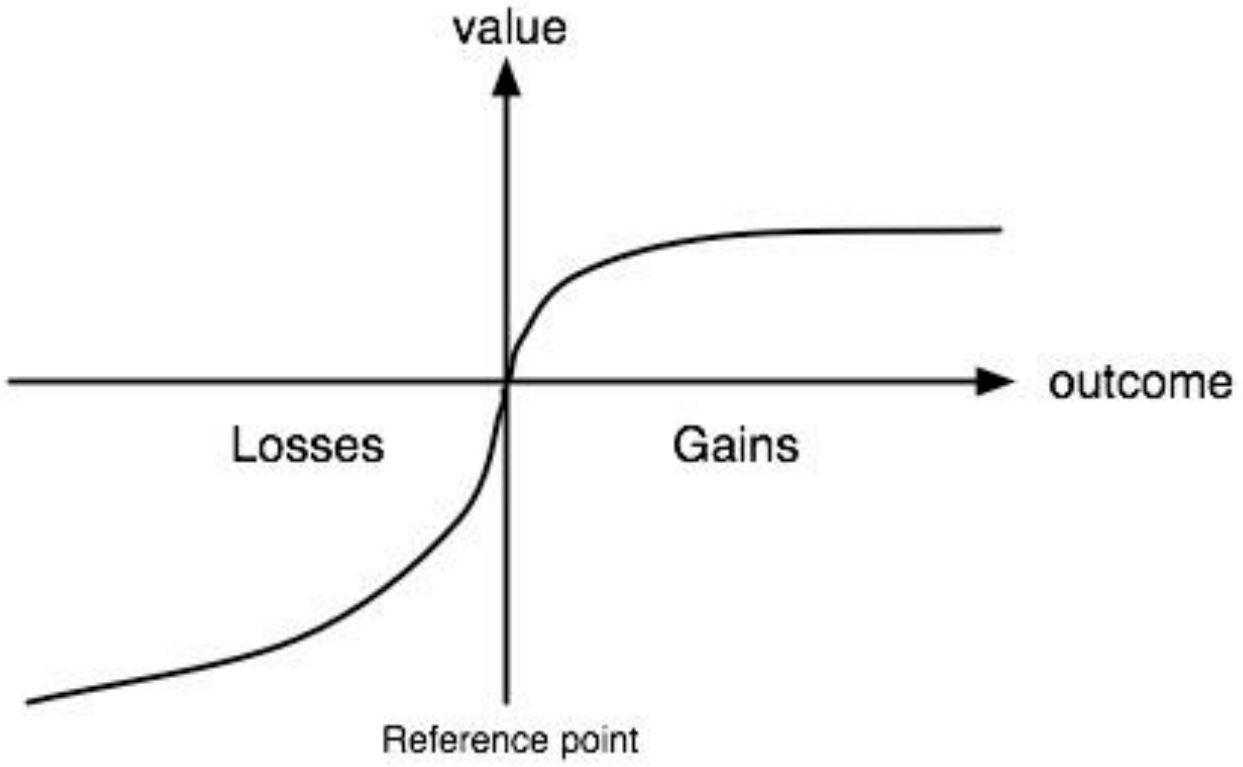
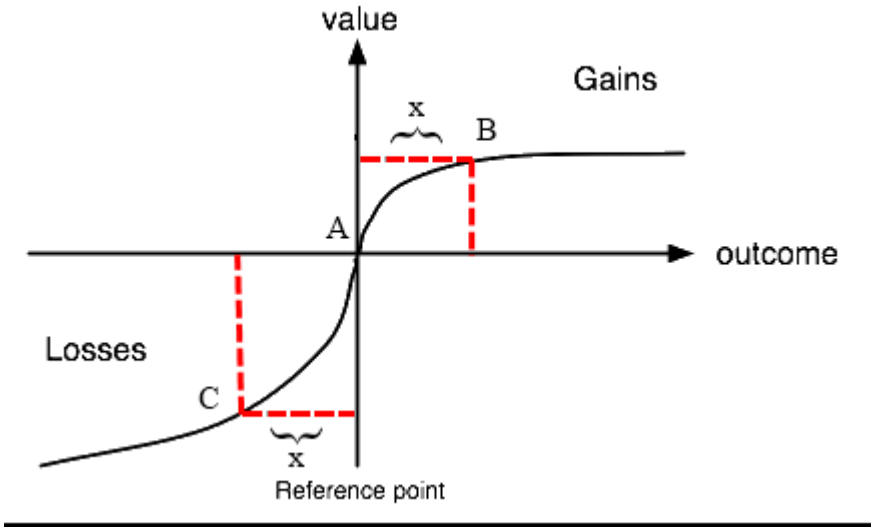
- Prospect Theory
  - Gains and Losses matter more than the final outcome



Loss Aversion, Prospect Theory vs Mean Variance

- Loss Aversion
  - "The central assumption of the theory is that losses and disadvantages have greater impact on preferences than gains and advantages." ~ Tversky and Kahneman

"It is not so much people hate uncertainty – but rather they hate losing" Tversky



Other measures of Risk Appetite

- Probability of shortfall
- Maximum shortfall
- Differing tolerances for different levels of shortfall

So is Mean Variance Useless?

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- When Mean-Variance still works
  - If returns are symmetric
  - Single Period
  - As a second order approximation to other utility functions
  - Provides a common, familiar language

Theory vs Practice

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"I should have computed the historical covariance of the asset classes and drawn an efficient frontier. Instead I visualized my grief if the stock market went way up and I wasn't in it-or if it went way down and I was completely in it. My intention was to minimize my future regret, so I split my contributions 50/50 between bonds and equities."

~ Harry Markowitz, 1998

Non-mean-variance efficient optimal portfolio

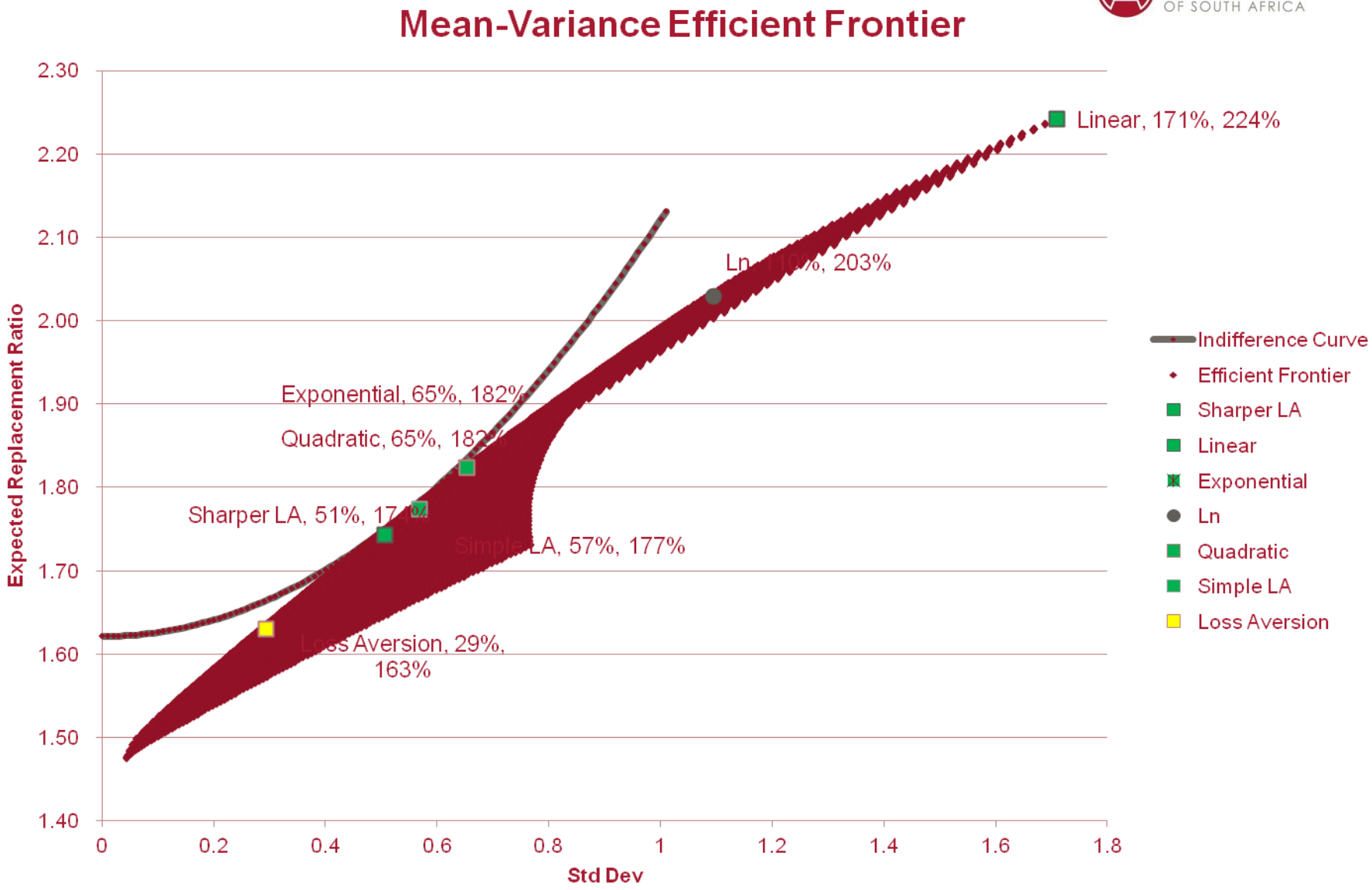
- If a portfolio is optimal according to the selected algorithm and ISN'T mean-variance efficient?
- Mean Variance of what measure?
  - Wealth?
  - Income?
  - Replacement Ratio?

  → How are liabilities modelled?
- Sensitivity to initial fund size / current balance
  - Without a specific targeted outcome or practical Risk Appetite, easy to get unhelpful results

Some possible results – model set up

- Trivial 3 asset model
  - Geometric Brownian Motion
  - Notionally Property, Equity and Index Linked Bonds
  - Mean, Variance and Correlations set pragmatically
- Liability
  - Defined Benefit
  - 100% annuitisation into real life annuity at retirement
  - Replacement Ratio at retirement key target

Some initial results



Some initial results

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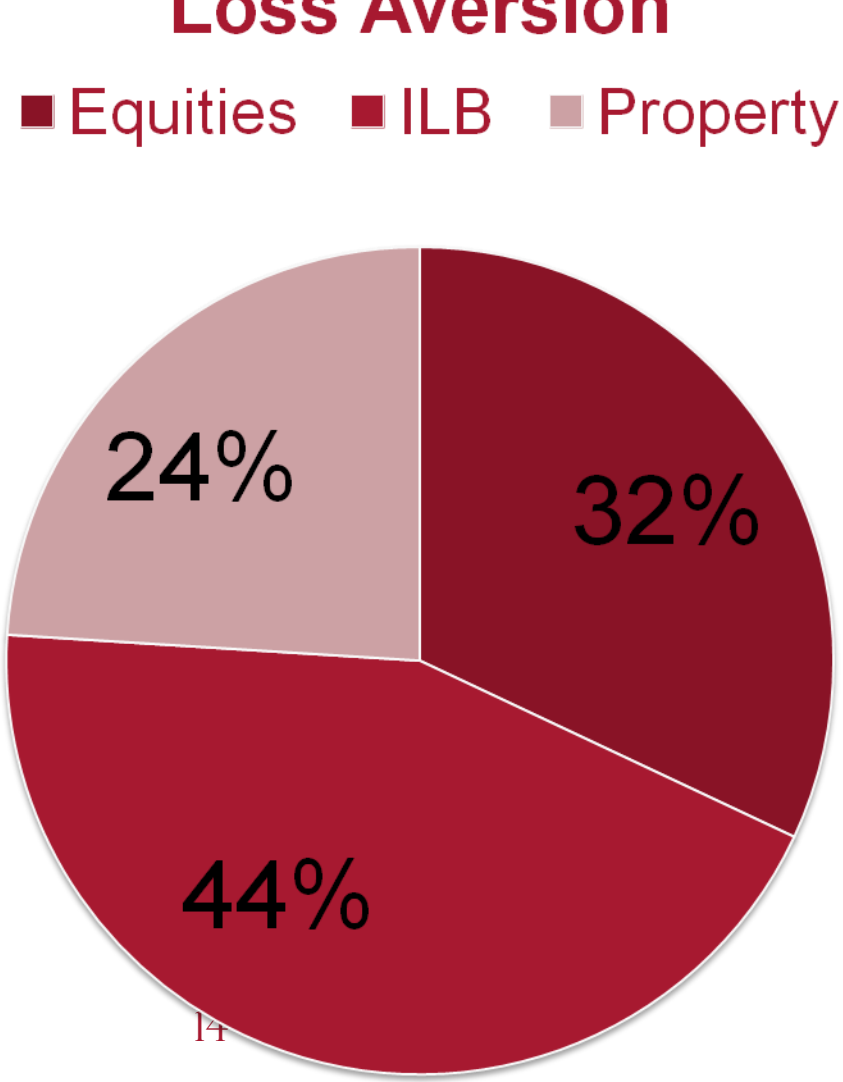
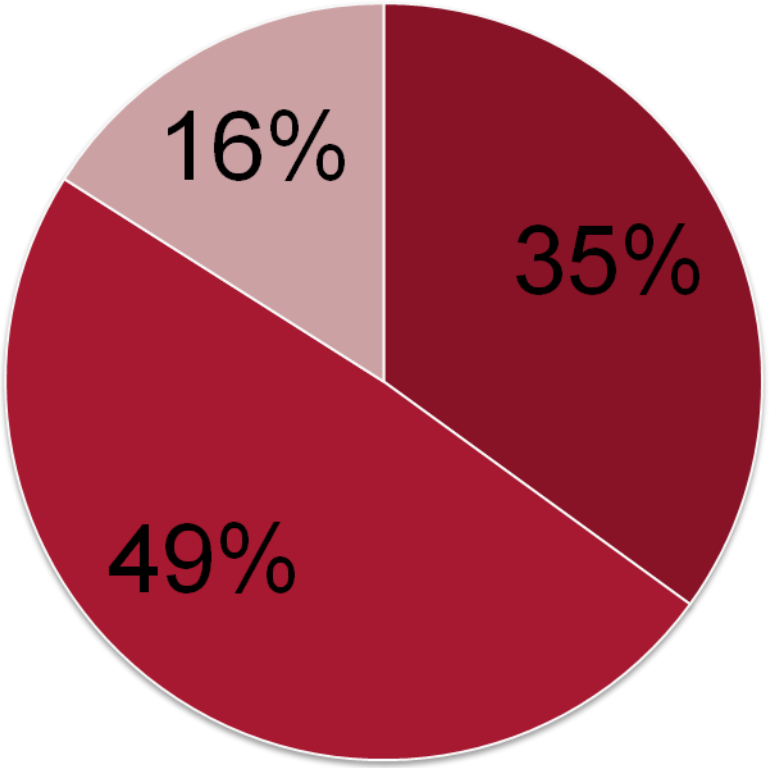
Loss Aversion



"More" MV efficient



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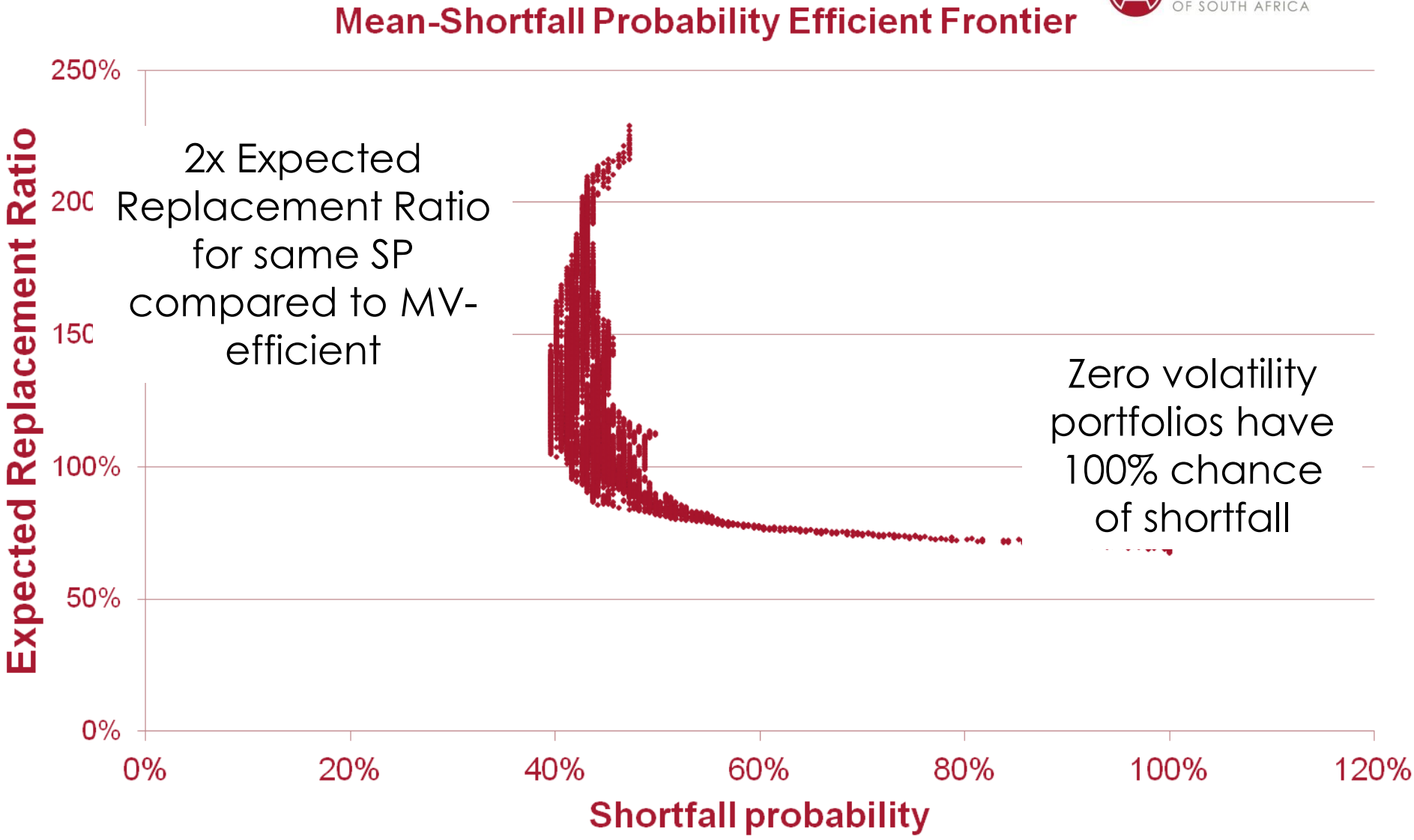
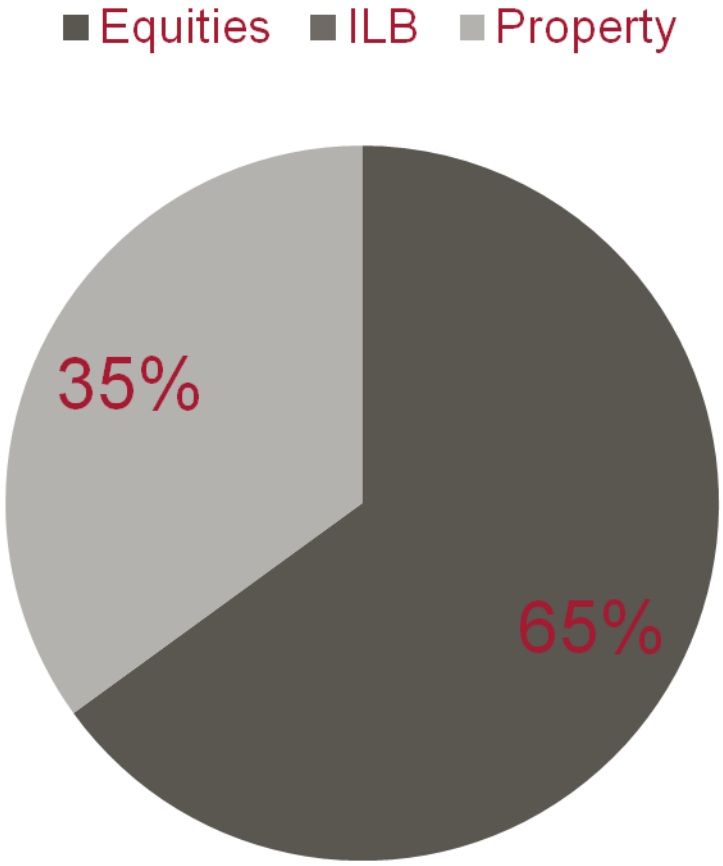


Some initial results

Loss Aversion



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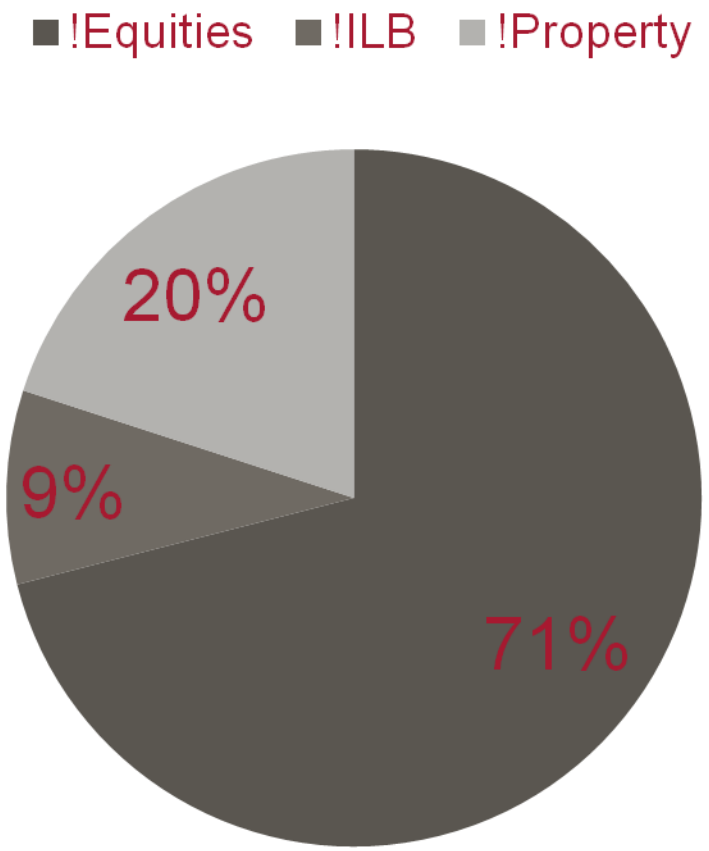

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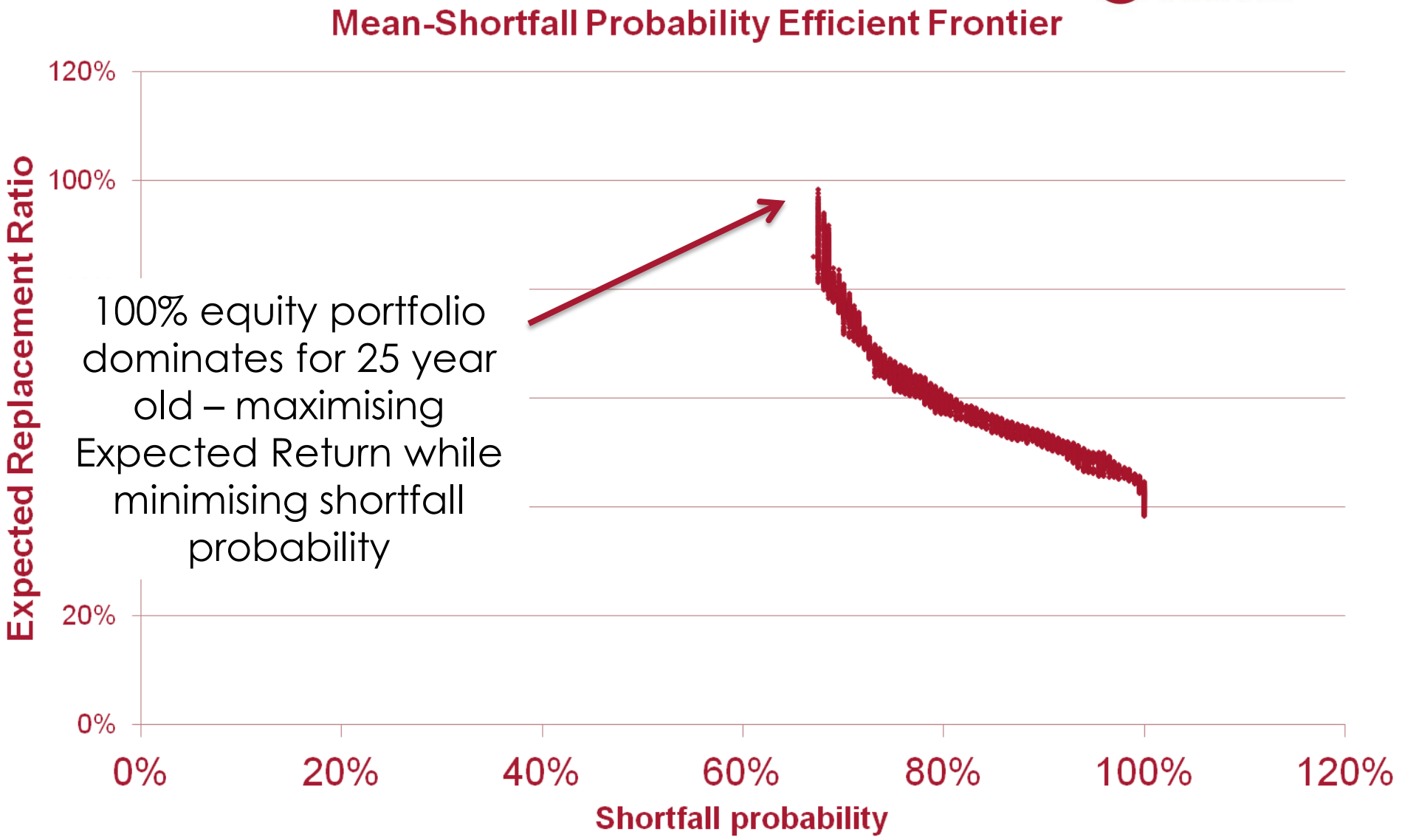

100% equity portfolio dominates for 25 year old – maximising Expected Return while minimising shortfall probability

Implications for derivative protection and structured products

- Different Utility Functions lead to (modestly) different optimal portfolios
- Impact of more defined Risk Appetite can be quite large on even standard portfolios

Much larger potential impact when considering specific investment guarantees, derivatives and structures

Conclusions