

## Presenting DFA Results to Decision Makers

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Executive Level Decision Making Using  
DFA Working Party

Mark Shapland, FCAS, MAAA

## Agenda

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- Introduction
- Highlights of Working Party Report
- Selected Slides from Power Point Template
- Reinsurance Presentation Example
- Investment Presentation Example
- Questions from Audience

## Introduction

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- Working Party Concept
- Goal of the Executive Level Decision Making Using DFA Working Party
- Panelists from Working Party
  - Scott Sobel, FCAS, MAAA
  - Alex Popelyukhin, Ph.D.
  - Raju Bohra, FCAS, Are
  - Mike Larsen, FCAS, MAAA

## Presenting DFA Results to Decision Makers

2003 CAS Research Working Party:  
*Executive Level Decision Making using DFA*

Scott Sobel, FCAS, MAAA

## Agenda

- What are the challenges in presenting DFA results?
- What are some common elements in a DFA presentation?
- What elements vary in DFA presentations?
- What are the end products of the working party's efforts?

## Challenges in Presenting DFA Results

- DFA studies driven by probability distributions
- Volume of data can be overwhelming
- Complexity of the modeling process
  - Easy to get lost in the details

## Common Elements in DFA Presentations

- State the options to be evaluated
- State the financial metrics for the evaluation
- Summarize the model assumptions
- Display ranges of results for the financial statistics of interest
- Compare key financial statistics
- Conclude with evaluation of the options

## Varying Elements in DFA Presentations

- Options to be evaluated are specific to the DFA study
- Financial metrics are the choice of the management team – varies by company
- Display of results need to reflect these choices
  - The particular graphs selected
  - Comments placed on the graphs
- Conclusion – dependent on option types

## End Products of the Working Party Efforts

- Summary report
- PowerPoint template for graphs
- Paper describing concepts behind template
- Three sample presentations applying template graphs
- Guidelines for Presenting DFA.doc

## Presentation of DFA presentation template

by Alex Popelyukhin, Ph.D.

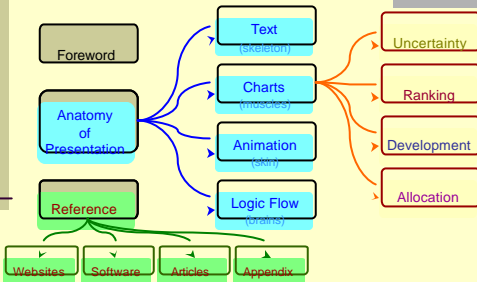
## Purpose

- CAS Working Party created these sample slides for presentations involving elements of Dynamic Financial Analysis (DFA)
- CAS Working Party believes that quality of the presentation of DFA findings to the management can be significantly improved
- CAS Working Party carefully selected topics for slides and for every topic chose the best suitable chart design

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## DFA Presentation.doc

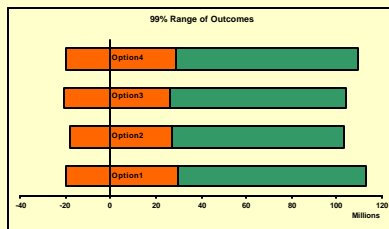


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## Uncertainty

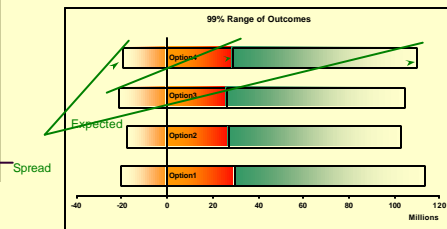
## Reinsurance options



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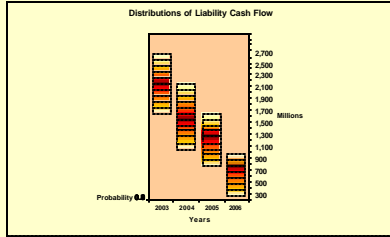
## Reinsurance options



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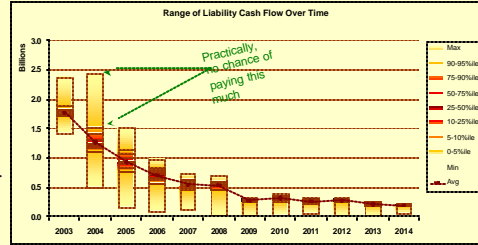
## Liability cash flow



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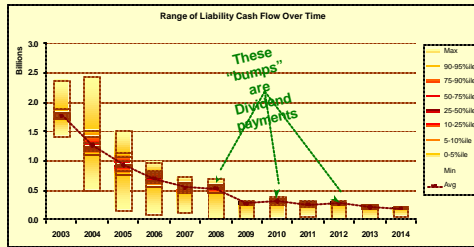
## Liability cash flow



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## Liability cash flow

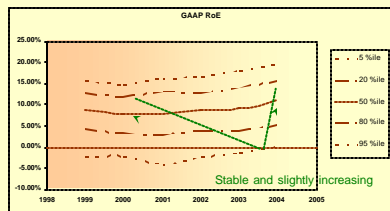


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## Development & Trends

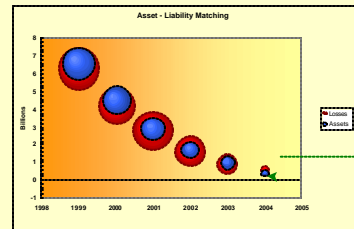
## RoE development



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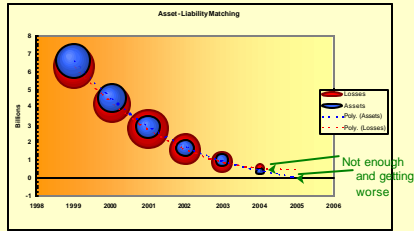
## Asset – Liability Matching



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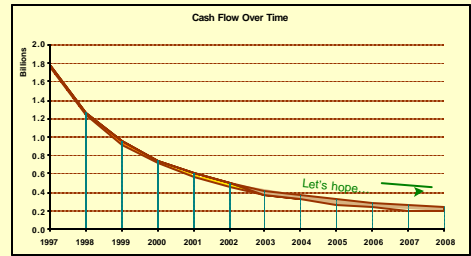
### Asset – Liability Matching



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### Cash Flow Forecast

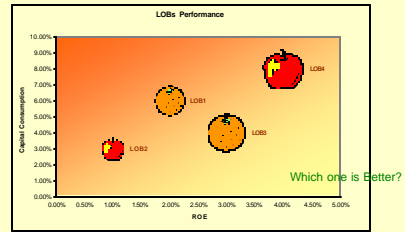


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### Ranking

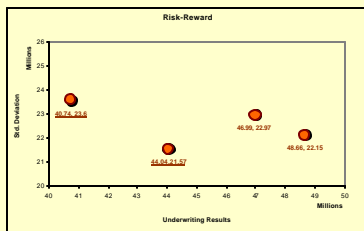
### Dare to compare



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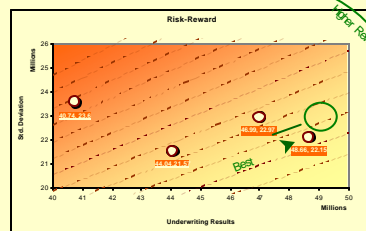
### Reinsurance options



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### Reinsurance options

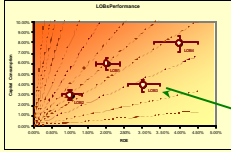


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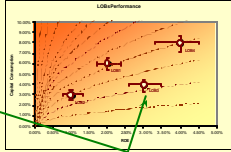
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## Different criteria

Max ROE per Capital



Max ROE per (Capital)<sup>2</sup>

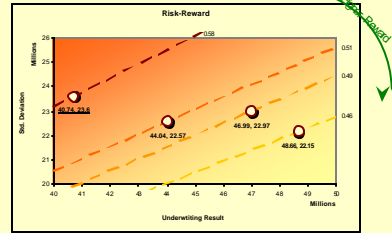


Still the best

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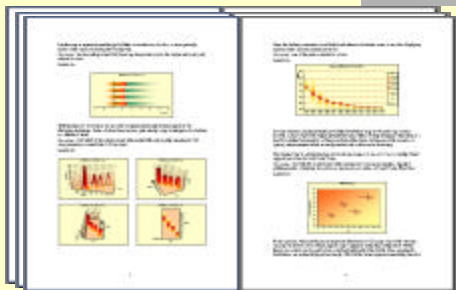
## Reinsurance options



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## DFA Presentation.doc



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■ If you are still reading this legalese nonsense, you need to get a life. Sorry.

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## References

- <http://www.dfa.com/flash.html>
- <http://www.casact.com/coneduc/dfa/2000/handouts/leibowitz.ppt>
- <http://www.casact.com/coneduc/rcm/2003/RCMHandouts/hobra1.ppt>
- <http://www.casact.com/coneduc/rcm/2003/RCMHandouts/isaac2.ppt>
- <http://www.casact.com/coneduc/dfa/2001/handouts/stricker1.ppt>
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- <http://www.casact.com/coneduc/dfa/99dfa/handouts/newman.ppt>
- <http://www.casact.com/coneduc/dfa/99dfa/handouts/conger.ppt>
- <http://www.casact.com/coneduc/reinsure/2001/handouts/venter1.ppt>

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## Charting Software

- Power Plugs for Power Point: Chart
  - (<http://www.crystalgraphics.com/presentations/charts/main.asp>)
- Tecplot
  - (<http://www.tecplot.com>)
- NetCharts
  - (<http://www.visualmining.com/examples/graphs.html>)
- Mathematica
  - (<http://www.wolfram.com/solutions/statistics/packages.htm>)

## Analysis of Reinsurance Options using DFA

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*Executive Level Decision Making using DFA*

Raju Bohra FCAS, ARe

## Background

- Dynamic Financial Analysis (DFA) systems model the entire operations (liabilities and assets) of an insurance company
- Statistical simulation techniques are used to model not only point estimates but also the distribution of outcomes
- This provides answers conventional analysis cannot
  - What is the chance of a given financial result?
  - How often is a given alternative better?
  - To what degree?
  - Under what circumstances?

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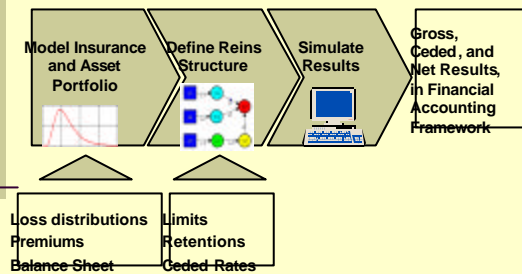
## Outline of Process

- Identify company's needs and objectives
  - Return – *What is your measure of success?*  
Usually stated in accounting terms
  - Risk – *Why do you buy reinsurance?*  
Measure of volatility of return, usually downside
- Model underlying gross liabilities by line of business
- Select reinsurance options to compare
  - How does changing retentions impact net results?
  - What combination of excess and pro-rata work best?
  - What is impact of changing covers or inuring structure?
  - How do loss sensitive and commission terms impact results?
  - What is effect of combining programs across operating units?
- Run model several times with varying structures
- Create statistics and charts to evaluate options

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## Outline of Process



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## Benefits of Process

- Help you better evaluate your reinsurance program
  - Understand the impact of reinsurance
  - Align reinsurance with your strategy
- Analyze your reinsurance program as a whole
- Measure "value" of reinsurance transaction
  - Go beyond only seeing "cost = ceded premium"
  - See risk reduction impact of reinsurance
  - Quantify risk-return tradeoff ("apples to apples" measurement)
- Analysis is tailored to company's risk appetite
  - Tolerance for risk
  - Current financial condition

*"What is the best reinsurance program"*

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## Scope and Limitations

- Comprehensively, insurance companies face many sources of risk from their operations:
  - Asset risk – *value of investments*
  - Credit risk – *premium and reinsurance receivables*
  - Liability risk – *frequency and severity of losses*
    - Pricing risk
    - Catastrophes
    - Reserving risk
    - Large Losses
- To do a reinsurance Reinsurance Analysis we focus our modeling efforts
  - Gross prospective losses for lines of business
  - Ceded reinsurance terms for several reinsurance programs
- Yields a solution with regard to reinsurance strategy
  - Relatively quick model set up
  - No data "noise" from generally unrelated issues, e.g. asset mix

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## Model Setup and Options

- Liability modeling – gross business
  - Core losses were modeled aggregate distributions
  - Large losses were modeled using severity and frequency distributions
  - Catastrophes were modeled using output from a catastrophe model
- Reinsurance options – net business
  - XOL attaching at \$1.0m and up
  - Pro Rata 25% QS with flat 20% ceding comm.
  - Stop loss attaching at 85% loss and LAE, 10 pts of limit
- Modeled detail needed to support decision making
  - Accounting, asset values, reserve balances, and cash flow parameters were entered using most recent public financial statements
  - Kept less relevant sources of variation static
    - Economic variables
    - Reserve development

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## Model Results

- Three types of charts were produced
  - Distribution graphs  
*Shows range of outcomes for various options*
  - Distribution statistics table  
*Shows outcome averages and risk measures*
  - Risk – Return graph  
*Shows risk – return trade-off*
- The following criteria were assumed
  - Return – Maximize SAP Net Income
  - Risk – Standard deviation of Net Income

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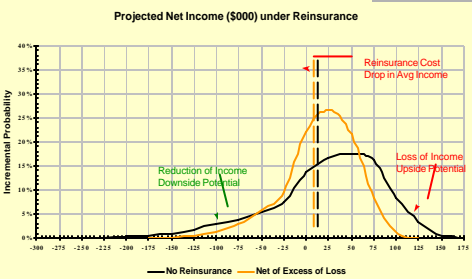
## Distribution Graphs

- Distribution graphs
  - Chart shows probability of return outcomes for each option
  - Benefit of reinsurance is less volatility (narrower curve) and less probability of extreme values (smaller tail)
  - Cost of reinsurance is shown as shifting of average value to the left, more average total cost
  - Formal statistics are developed later to quantify risk, for example:
    - Analytic: Variance/Std Dev., Ruin, EPD, VaR, Tail VaR
    - Business: Probability key accounting value falls below threshold
- Distribution graphs cumulative
  - Chart shows cumulative probability of total cost or less for each retention option
  - Can read off percentile values from chart
  - Lower curve is better at that level
  - Can quantify how often an option is better than another

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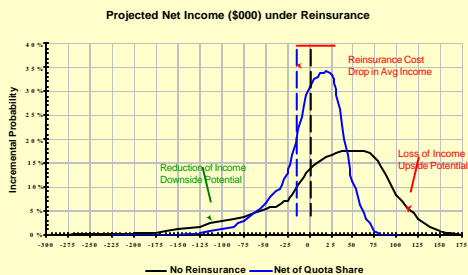
## Value of Reinsurance



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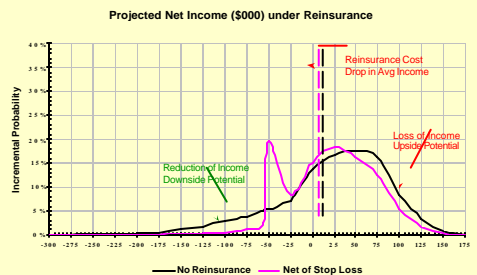
## Value of Reinsurance



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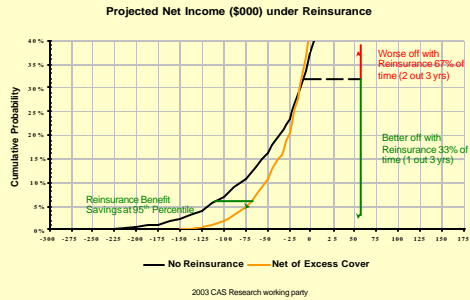
## Value of Reinsurance



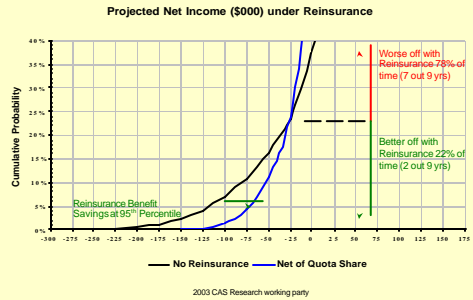
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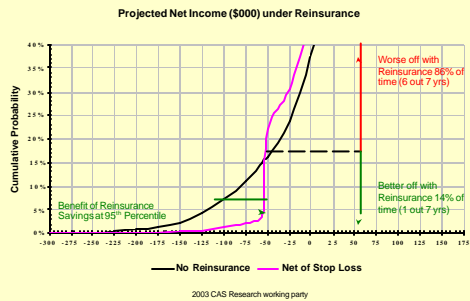
## Value of Reinsurance



## Value of Reinsurance



## Value of Reinsurance



## Distribution Statistics Table

- Summarizes risk and return calculations
- Return measures
  - Average Net Income under each option
  - Savings = increase in average Net Income between alternatives
- Risk measures
  - Percentiles at various levels
    - Similar to output of a catastrophe model
    - Select a percentile level selected that reflects risk appetite
    - A lower percentile level implies a higher risk tolerance
    - Lower result at that level reflects increased downside risk
  - Standard deviation
    - Statistical measure of volatility
    - Higher standard deviation implied greater risk

## Distribution Statistics Table

**Distribution Statistics  
Risk and Return Calculations**

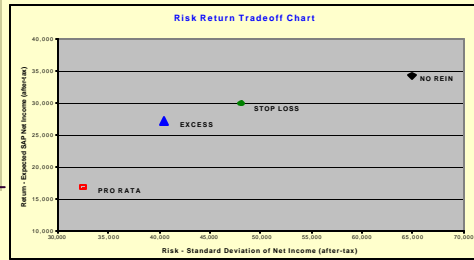
	No Rein	Excess	Pro Rata	Stop Loss
<b>Return Measure</b>				
Expected SAP Net Income	34,383	27,254	16,823	29,891
<b>Risk - Percentile</b>	<b>Return Period</b>			
0.1%	1 in 1000 years	(242,192)	(129,969)	(121,579)
0.5%	1 in 200 years	(185,566)	(104,641)	(93,766)
1.0%	1 in 100 years	(160,426)	(90,626)	(80,696)
5.0%	1 in 20 years	(92,804)	(49,509)	(46,885)
10.0%	1 in 10 years	(54,958)	(28,407)	(27,537)
25.0%	1 in 4 years	2,951	6,295	1,156
Median	1 in 2 years	43,762	31,847	21,562
75.0%		80,073	55,801	39,718
90.0%		105,540	73,932	52,451
95.0%		125,938	83,846	60,150
99.0%		146,225	101,075	72,794
99.5%		153,964	105,850	76,883
99.9%		171,059	118,382	85,211
<b>Risk - Volatility Statistics</b>				
Standard Deviation	64,886	40,494	32,498	48,202

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## Risk – Return Graph

- Graphs risk and return statistics for each option
- Generally, increased return requires additional risk
- Running multiple options will trace out efficient frontier
  - Identifies inefficient options that provide a lower level of return for the same or more risk as another option
  - Identifies unfavorable options that provide insufficient return for level of risk (convex points on curve)
  - Identifies options that have most attractive risk return trade-offs
- Chart is the intersection of three key views of risk
  - Underlying risk in portfolio
  - Reinsurer's risk appetite (reflected in ceded premiums)
  - Company's measure and tolerance for risk

## Risk – Return Graph



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## Observations

- All options are efficient based on a linear risk preference
  - No option provides less return for the same or greater risk than another option
  - If a lines was drawn through the points, no option is clearly on a convex point
- Ranking may change given an alternate risk preference function (use Alex's iso-line graphics)
- Ranking may also change using an alternate risk measure
  - The Stop Loss option will probably perform very well using a risk measure that reflects downside risk only

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## Investment Option Review Example

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Michael R. Larsen, FCAS, MAAA

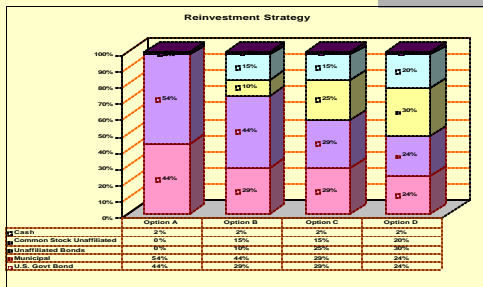
## Goals of Study

- Review Reinvestment Options
- Measure results using simulation model results
  - Risk as Average Loss in Surplus in Worst 1% of Cases over Five Years
  - Return as Average Increase in Policy Holder Surplus at End of Five Years

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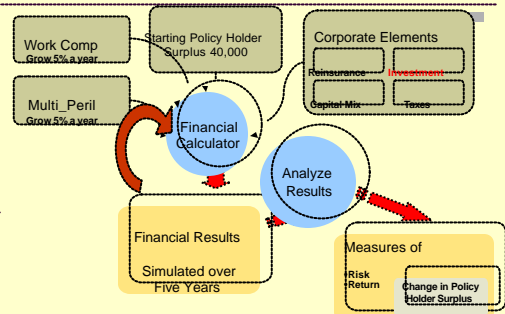
## Change in Reinvestment Allocation



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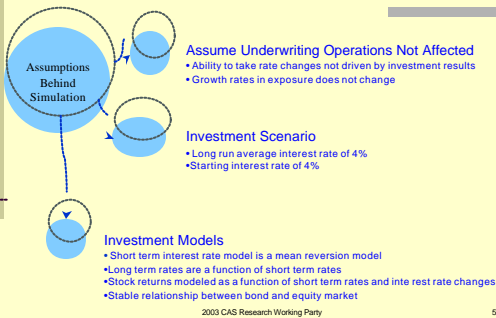
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## DFA flow



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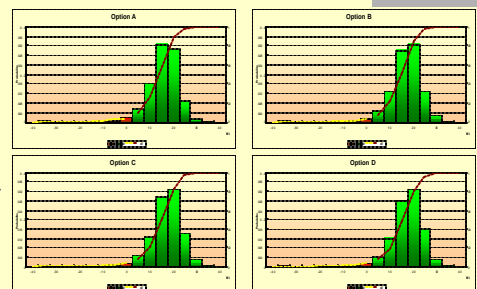
## Model / Assumptions



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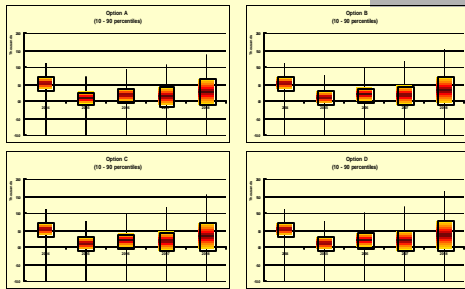
## Policyholder Surplus Change by Reinvestment Option



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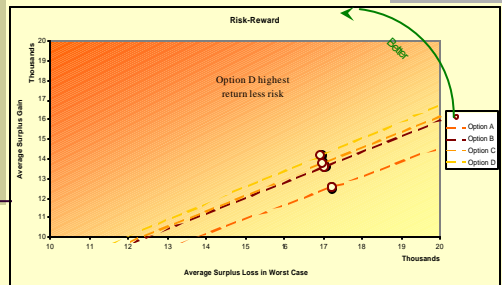
### Surplus Change Over Time by Investment Option



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### Investment Option Comparison



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### Investment Option Summary

Option	Return	Risk
A	12.6	17.2
B	13.6	17.0
C	13.8	17.0
D	14.2	16.9

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### Conclusion

- Reviewed four reinvestment options
- Option D gives best gain in Surplus with less additional risk

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