“DFA – The Value of Risk”

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Boston – June 7, 2001

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Session

- Introduction to the approach
  - Systematic and non-systematic risk
- Analysis of DFAIC
  - The CEO Questions and DFA Results
- Discussion

DFA – The Value of Risk

Part 1: Introduction to the approach

The three ‘What’ questions

- What has been done?
  - Conventional DFA approach *plus*
  - Operational Risks *plus*
  - Market consistent pricing
- What does it produce?
  - Realistic risk capital assessments
  - Systematic and non-systematic risk (or capital) costs and allocations for product and strategic evaluations
- What does it need, beyond conventional DFA?
  - Arbitrage free economic model with deflators
  - Frictional cost function with appropriate features

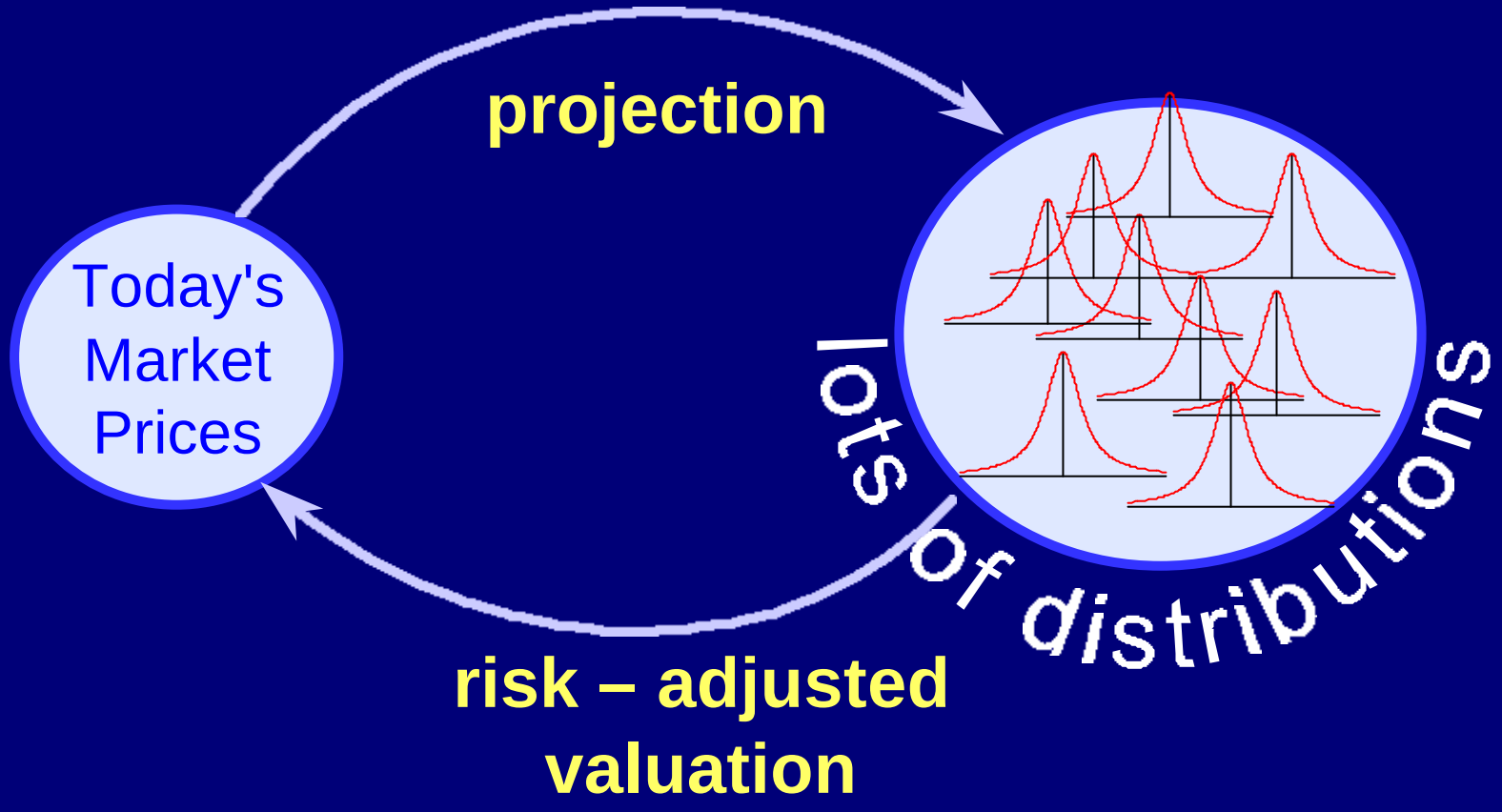
Systematic and non-systematic risk

- ➔ Key insight is understanding two kinds of risk
  - systematic risk is risk correlated with capital markets – implies (usually) higher shareholder required returns
  - non – systematic risk (diversifiable) is company specific risk, uncorrelated with financial markets and generates unbudgeted internal costs or frictional costs
- ➔ See survey by the CAS Risk Premium Project
- ➔ *Challenge is to find ways to quantify risk costs from DFA outputs*

Dealing with the two components

- ➔ Systematic risk will depend on the market
  - arises primarily from volatility in investment returns
- ➔ Insurance classes also carry some systematic risk
  - premiums set on expected inflation and investment returns
  - claims subject to inflation at time of payment
  - pricing cycles may be influenced by economic conditions
- ➔ Frictional costs will depend on the company
  - a function of its overall results volatility –from both assets and liabilities
  - systematic risk also generates frictional costs for companies

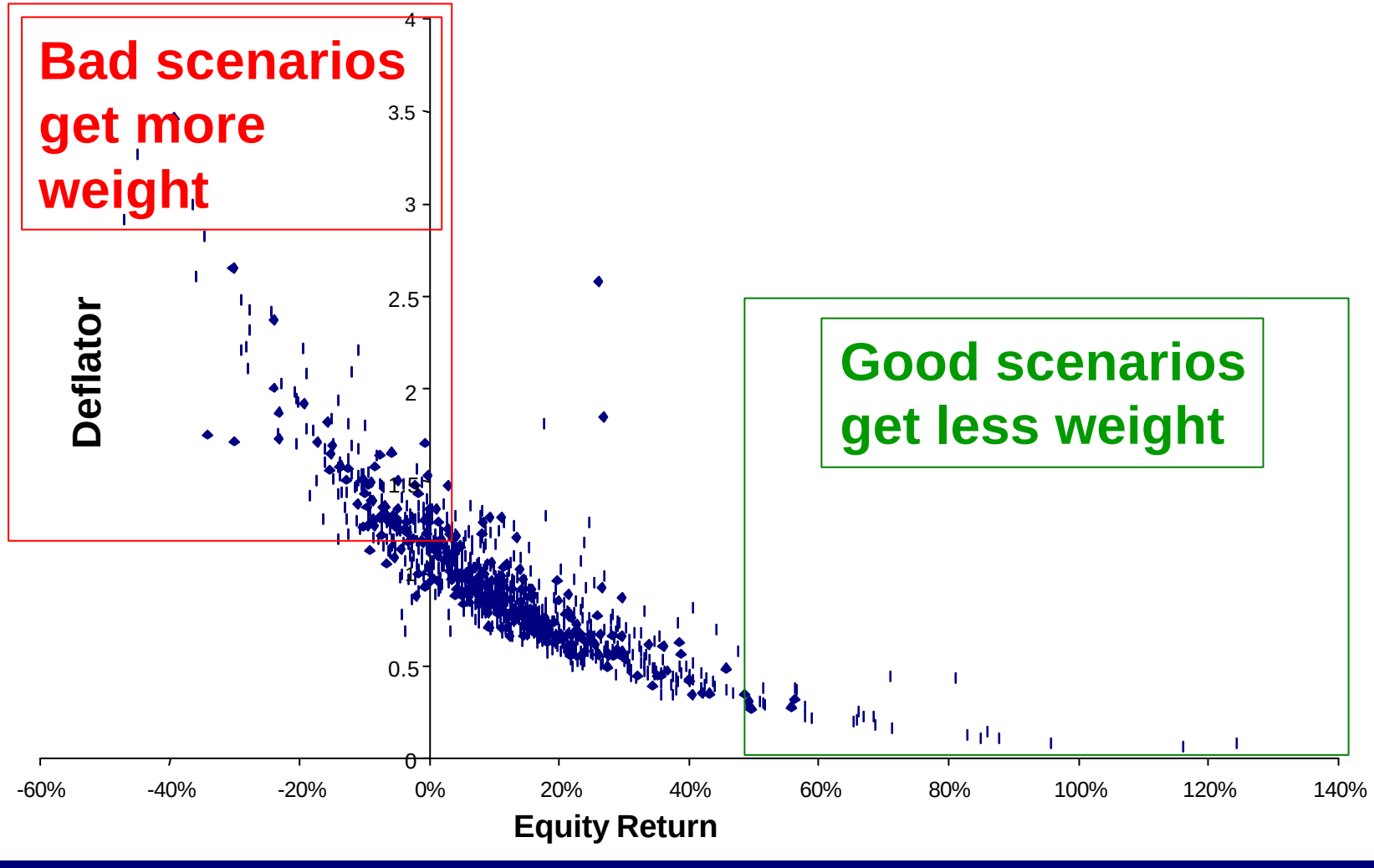
Systematic risk and market pricing



Deflators: the answer to discounting

- Deflators convert cash flow model to a market price
- Acts like a stochastic discount factor
  - price = mean{ cash flow * deflator }
  - deflator depends on the simulation
  - but not on the cash flow we are trying to value
- Deflators have helped us make sense of DFA outputs
  - absence from DFA models may limit power

Equity Return and Deflators



Deflator valuation example

sim #	X_a	Y_a	D_a	D_aX_a	D_aY_a
1	100	65	1.2	120	78
2	100	95	1.0	100	95
3	100	115	0.8	80	92
4	100	125	0.8	80	100

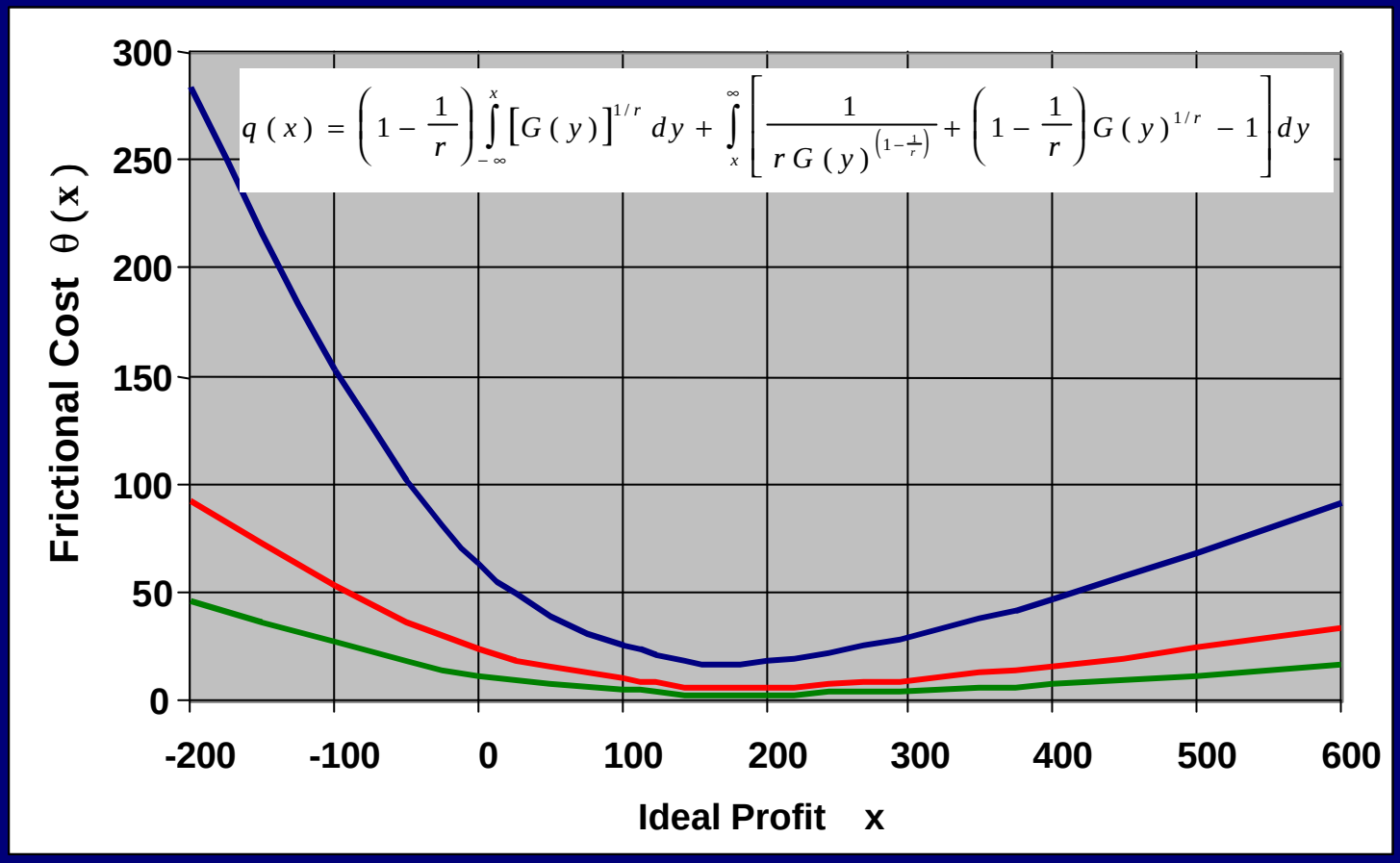
average	100	100	0.95	95	91.25
discount				5.26%	9.59%

Frictional Costs and DFA

➔ Examples of costs that may fall outside DFA models:

- Future business terms sensitive to credit risk
- Project disruption and wastage of unbudgeted flows
- Optimistic plans survive longer in an uncertain world
- Convex tax formulas (sub-utilisation of tax losses)
- Convex claims handling expense
- Capital raising, distribution and restructuring costs
- Double taxation of risk capital
- Operational risk of cash misuse
- Management time opportunity cost

Our choice of FC Function



➔ Based on real DFA outputs – varying values of the fci ρ

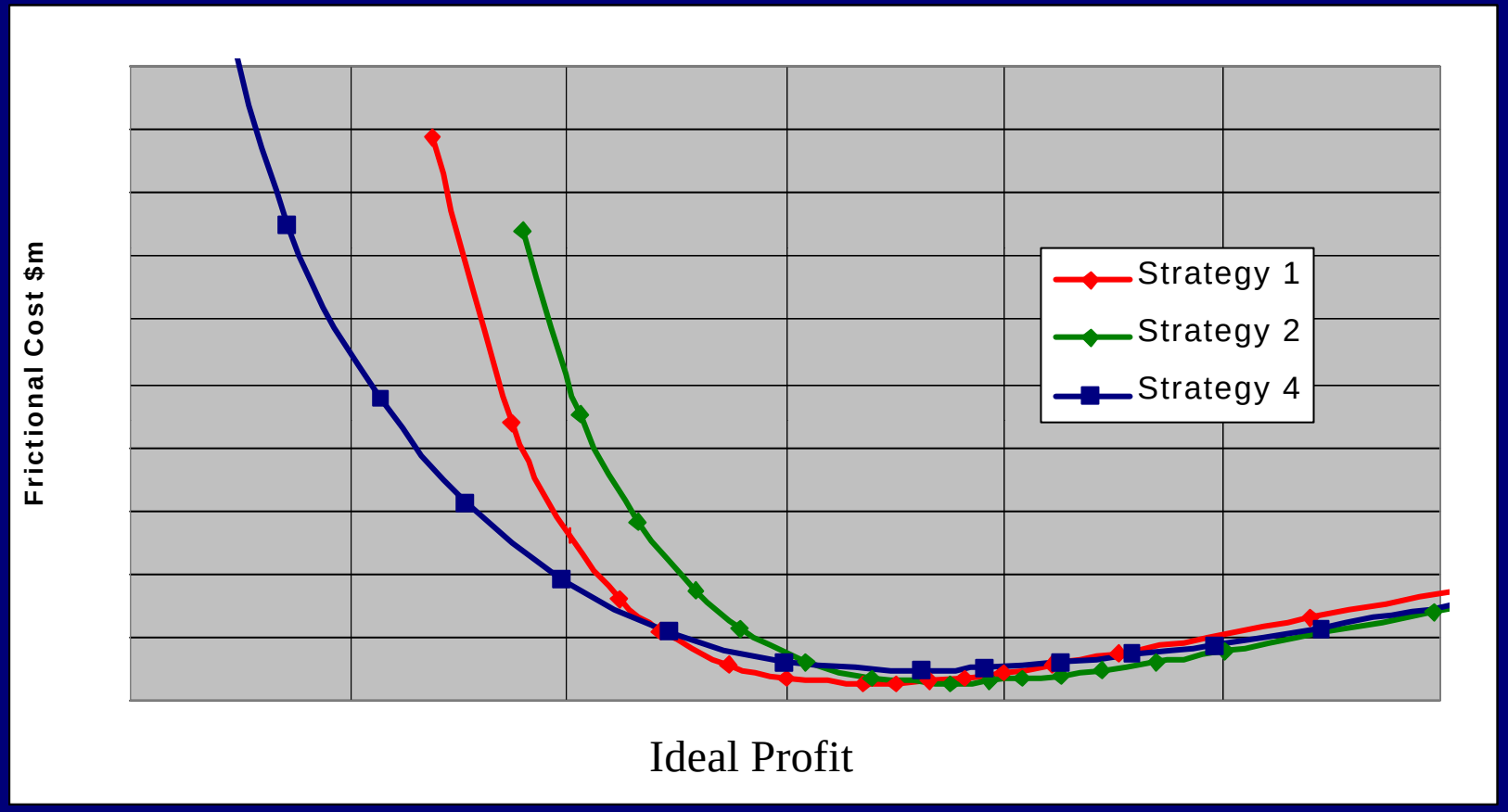
Why do we choose this FC Function

- No need to contrive extreme events to justify need for capital
- Avoids associated calibration nightmares
  - How do you allow for a Nick Leeson?
- Allowing for frictional costs enables us to:
  - get closer to observed rates of failure
  - reconcile to observed levels of capital
  - reconcile to market value (capitalisation) of company
- Generalisation of the Proportional Hazards (P-H) transform

FC and the Role of Management

- ➔ Management can ‘choose’ cost function
  - From a range of alternatives, but cannot be zero
  - Objective is to minimise the cost of capital
  - Must choose in advance of knowing profit
  - Equivalent to choosing asset / liability / capital strategy
- ➔ Management aims to minimise frictional costs so as to create shareholder value
- ➔ Links DFA and Risk Management => Enterprise Risk Management

Frictional costs and strategies

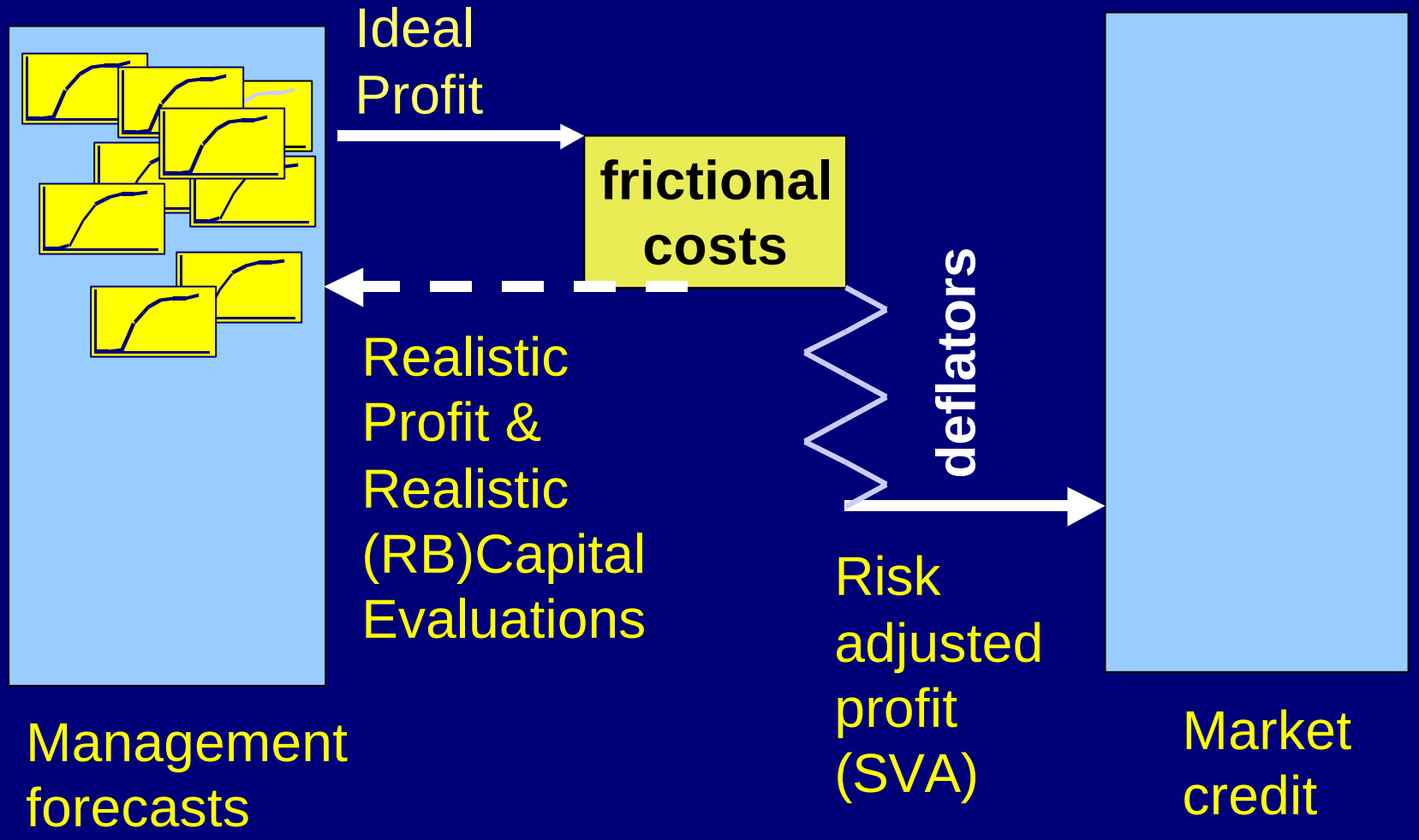


- Actual results from increasing equity investments – fixed FCI
- Management try to minimise FC so as to create SV

Frictional Costs and Market reality

- ➔ Frictional costs and Market Capitalisation
  - Frictional costs are important because they explain the gap between management plans and what the market gives the company credit for in its share price or capitalization
- ➔ Frictional costs and Risk Capital
  - We have modelled most operational failures as contingent losses, which are triggered when losses (excluding operational costs) are big enough, or to a lesser extent, when profits are very big
  - Operational costs major cause of insolvency, yet ignored by conventional DFA models

Risk costs and Market realities



DFA – The Value of Risk

Part 2: Analysis of DFAIC

Introduction to DFAIC

- P&C company licensed in all 50 states
  - mainstream personal and commercial business
  - 'A' rating from A.M. Best, limited APH and cat exposure
- Reinsurance protections
  - Retained class losses limited to $1million
  - Cat RI of 90% of $150m excess of $50m
- Asset strategy
  - 70% in fixed income securities, most in tax-exempt municipal bonds, 18% cash and 12% in equities.
- In 1999 net premium were $2.3billion and Surplus at the end of the year was $1.6billion, or 70% of its premium

The CEO questions on DFAIC

- 1: Is the Company adequately capitalized? Is there excess capital? How much capital should the Company hold as a stand-alone insurer?
- 2: How should the capital be allocated to lines of business?
- 3: What is the return distribution for each line of business and is it consistent with the risk for the line?
- 4: Should the Company buy more or less reinsurance? What type? How efficient is its current reinsurance program
- 5: How efficient is the asset allocation?

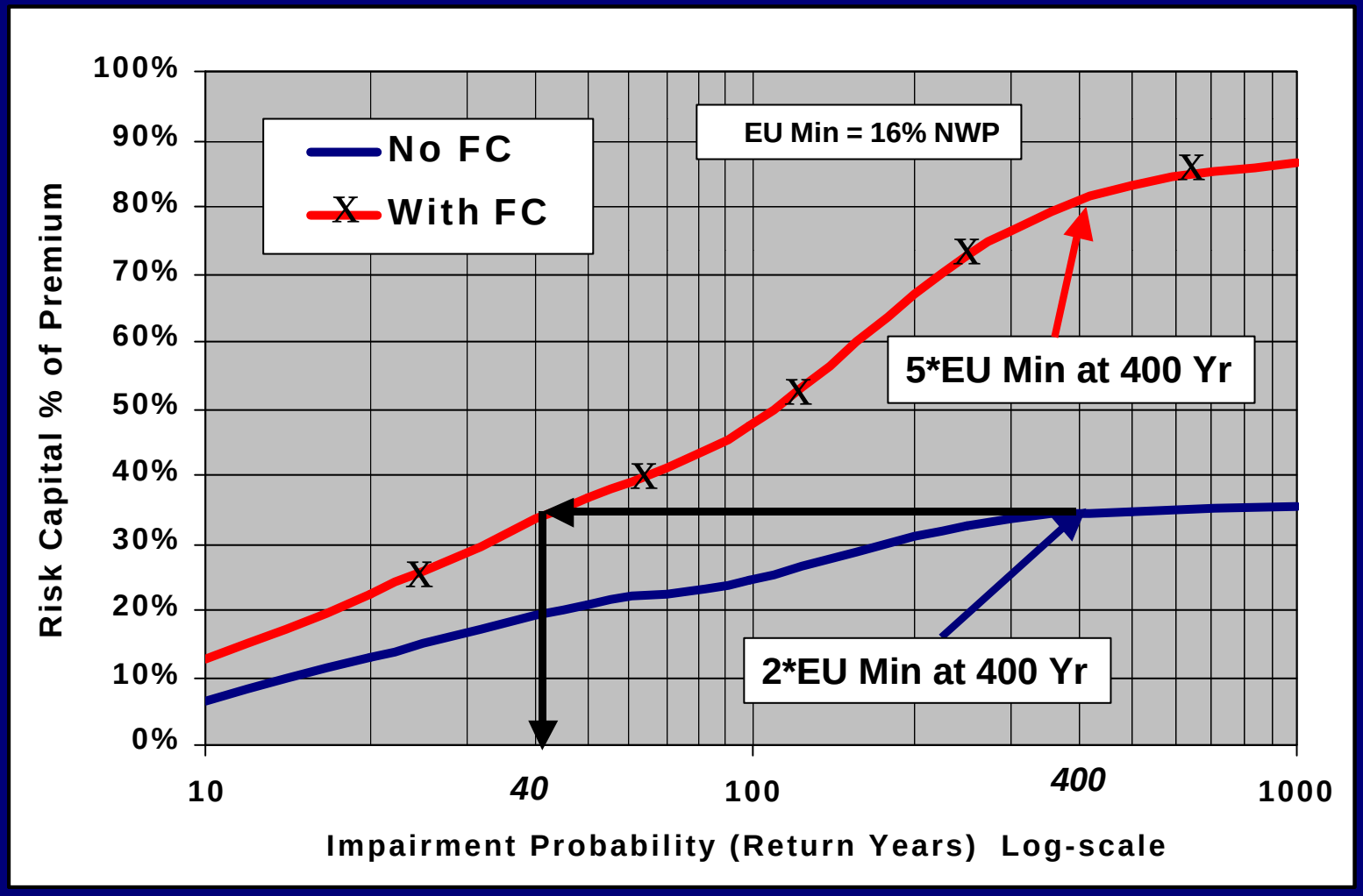
Scenarios for Analysis

1. Base = Plan with the reinsurance and asset strategies as in 1999
2. Base but with no Class Excess of Loss Reinsurance
3. Base but with no Class or Catastrophe Reinsurance
4. Base but with reinsurance at risk cost (cover at risk costs)
5. Base but with 100% of surplus in Equities rather than 35%
6. Base but with all investments in bonds matching terms of liabilities
7. Base, no reinsurance, surplus in equities (Scenario 3+Scenario 5)
8. Select: Base, lower capital, no class ri, investments in bonds

How much capital does DFAIC need?

- Capital or surplus has to be sufficient to:
  - Satisfy regulators
  - Reassure security analysts (rating agencies)
  - Meet the expectations of policyholders
  - Provide an adequate return to shareholders
- Amount chosen has to reflect market conditions, financial and operational exposures of company
- Capital assessment has to include all risk aspects
- Frictional costs of major significance in practice

Frictional Costs and Risk Capital



➔ Ignore operational risks at your peril……

Why we cannot ignore frictional costs?

- ➔ Significant impact on ‘risk capital’ once we include frictional costs
- ➔ Without frictional costs, ‘RBC’= 32% of Premium at 400 year return
  - Such remote probabilities become necessary in order to get ‘risk capital’ values that look believable in context of reality
- ➔ With frictional costs (ρ=.33) the ‘realistic’ return period for this amount of risk capital is around 40 years (10 times more likely)
  - Demonstrates danger of conclusions from incomplete models
  - Opens possibilities for developing new generation RBC basis

Capital evaluation with frictional costs

Impairment Probability	Minimum Solvency Ratio During Plan (5-yr) Period							
	Scen1	Scen2	Scen3	Scen4	Scen5	Scen6	Scen7	Scen8
0.25%	28%	28%	21%	31%	18%	30%	16%	23%
0.50%	38%	41%	31%	42%	21%	38%	21%	37%
1.00%	43%	46%	38%	48%	25%	48%	29%	43%
2.50%	53%	54%	51%	56%	34%	58%	38%	52%
5.00%	57%	58%	56%	60%	42%	61%	45%	55%
10.00%	60%	61%	60%	63%	48%	64%	51%	58%
25.00%	65%	66%	65%	67%	56%	67%	59%	60%

- Scenarios 1 to 7 start at 70%, Scenario 8 has lower initial capital with a solvency margin maintained at 65%
- Rating may be lost when surplus reduces by 20% of required
  - Min Solvency ratio 56% for Scenarios 1-7 and 52% for Scenario 8

Comparing and ranking Strategies

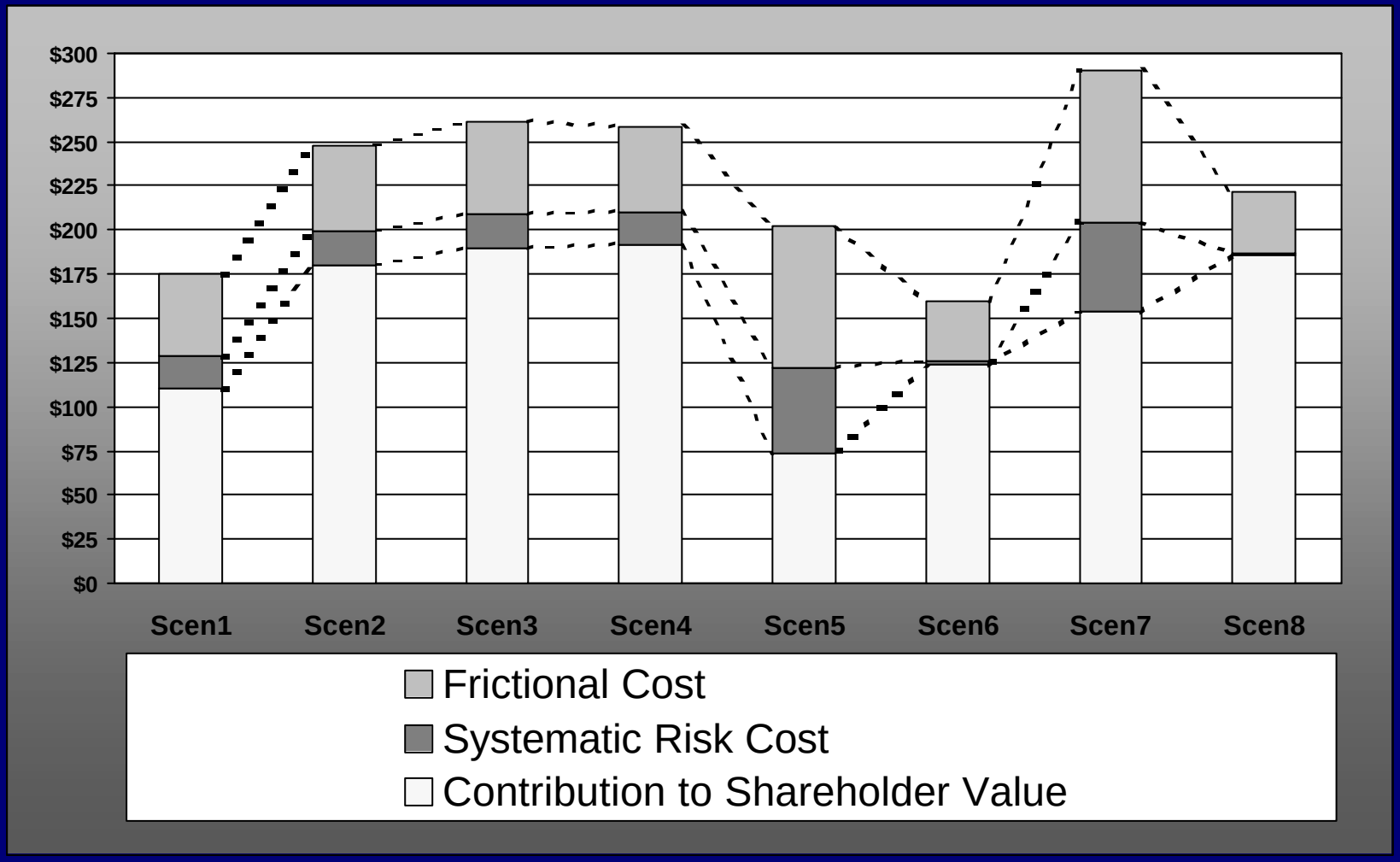
- Alternative strategies considered include:
  - Changes in equity investments
  - Reductions in reinsurance
- Equity risk premium or reinsurance loadings need to be compared to the costs for shareholders
- Contribution to Shareholder Value (CSV) adjusts results for both systematic and non-systematic risk
- Strategies with higher CSV preferred by Shareholders
  - CSV can be used to rank strategies and measure SVA
- Decision makers (managers) not so well diversified

Comparing Scenarios for SV

$ 000	Scen1	Scen2	Scen3	Scen4	Scen5	Scen6	Scen7	Scen8
Pre-Tax Profit @ rfr	175,123	248,122	261,594	257,945	202,009	159,400	290,307	221,456
Systematic Cost	18,593	19,218	19,257	18,687	48,725	1,574	50,617	1,381
Frictional Cost	46,567	48,969	53,027	47,490	79,948	33,532	85,632	34,543
Total Risk Costs	65,160	68,187	72,284	66,176	128,673	35,106	136,249	35,924
Contribution to SV	109,963	179,936	189,310	191,769	73,337	124,294	154,057	185,532

- ➔ Pre-tax profits are before FC and discounted at risk free rate
- ➔ Contribution to Shareholder Value is before tax
- ➔ Scen2 has no class RI, Scen3 has no RI, Scen4 assumes cheap RI

Comparing Value of Strategies



DFA and the value of Reinsurance

- This is an area that is often misunderstood
- DFA model uses loss parameters and ri cost assumptions
  - Results may simply reflect inconsistencies in inputs
  - ‘Optimisations’ usually identify biggest inconsistencies
- Cheap, credit risk free, reinsurance is always good for cedant
- For DFAIC, excess of loss for individual claims may be of little value to shareholders (but may be of value to managers)
- DFA model can be used to ‘identify’ the fair price for reinsurance, given calibrated loss assumptions
- Catastrophe reinsurance may be worth purchasing

Capital and risk cost allocations

- Framework enables us to quantify systematic and operational risk costs for each insurance class and for the capital (surplus) account
- Investment of the surplus contributes to overall variability and impacts risk capital requirements
- Any frictional costs associated with the surplus can only be compensated by the insurance operations so these costs have to be allocated to the insurance classes
- Capital allocations can be derived from the risk costs (or capital costs) allocations
- Capital, risk costs and allocations depend on chosen strategy

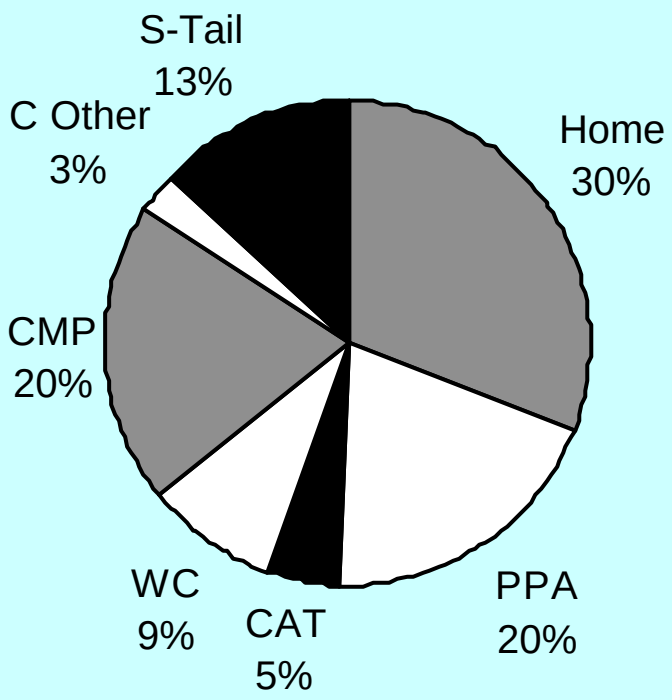
Total Class Risk Costs by Scenario

Value $000	Scen1	Scen2	Scen3	Scen4	Scen5	Scen6	Scen7	Scen8
Capital	38,504	40,341	38,796	39,829	111,311	5,300	115,430	4,636
Home	8,082	7,751	13,641	7,952	4,355	10,411	8,519	10,173
PPA	5,276	5,711	5,097	5,228	3,603	5,430	2,940	6,010
CAT	1,298	1,581	1,418	1,283	966	1,219	960	1,512
WC	2,349	2,652	2,400	2,331	1,834	1,899	1,423	2,192
CMP	5,445	5,577	6,769	5,405	3,732	5,634	4,239	5,791
OC	785	1,304	1,100	770	581	709	680	1,246
S-Tail	3,420	3,270	3,063	3,378	2,292	4,503	2,058	4,365
Total Risk $000	65,160	68,187	72,284	66,176	128,673	35,106	136,249	35,924

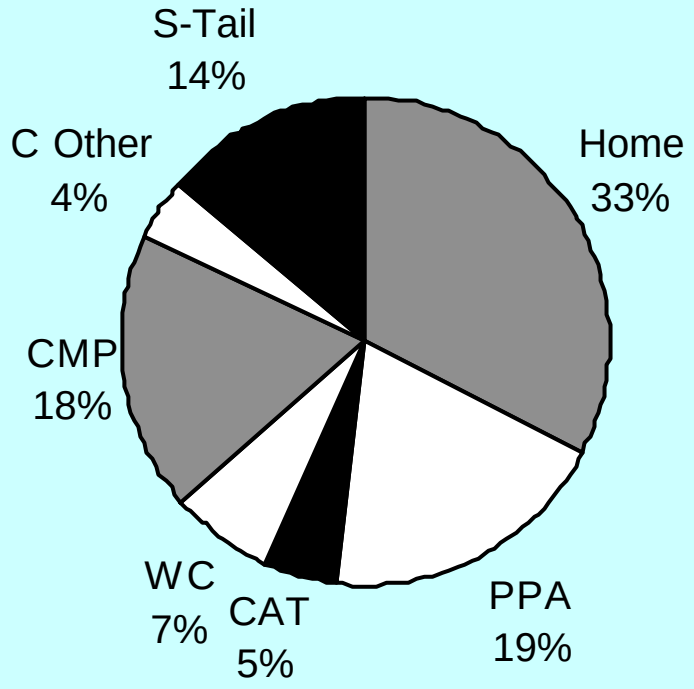
- ➔ Risk costs include both systematic and non-systematic risk
- ➔ Note impact of higher equity investments in Scen5 and Scen7

Risk Cost & Capital allocations

Capital Allocation: Scenario 1



Capital Allocation: Scenario 8

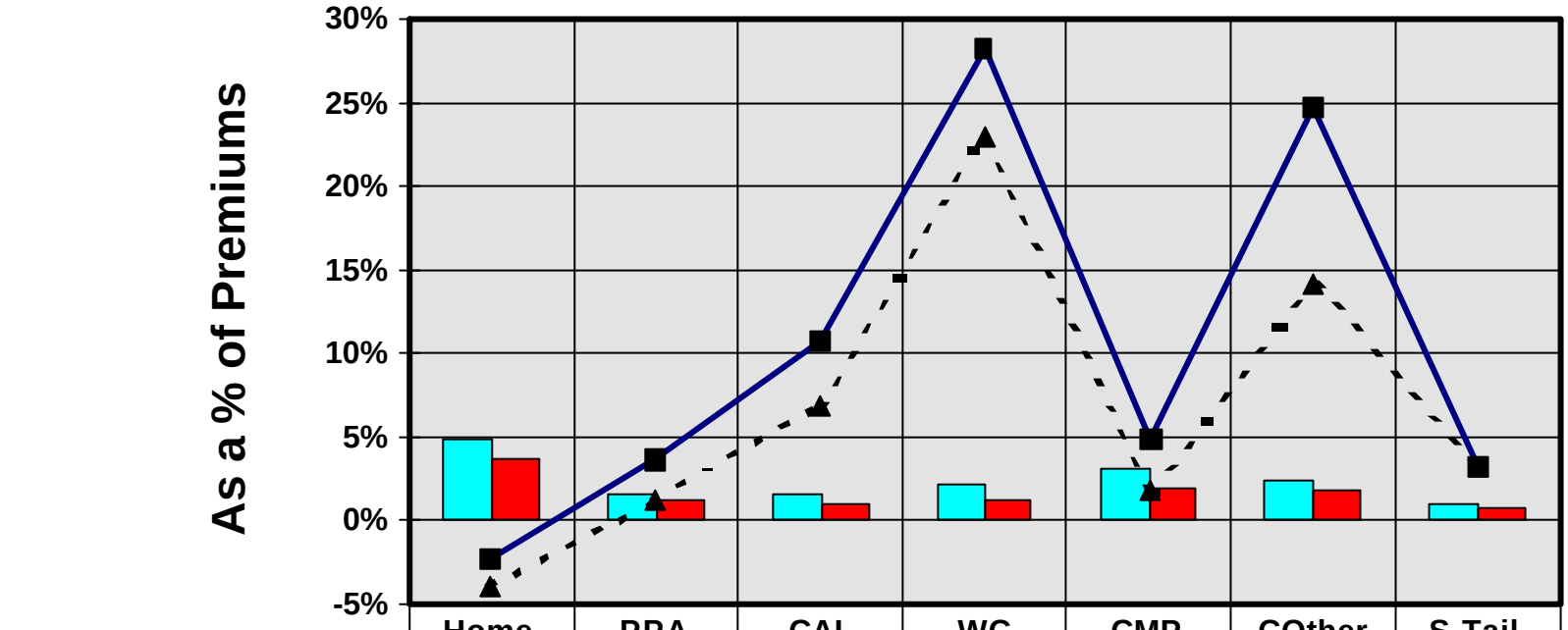


➔ Class risk costs plus allocated capital frictional costs to NWP

Returns by class and SVA

- Framework identifies capital costs by class of business for each of the alternative strategies
- Class returns, before frictional costs, should exceed cost of capital
- Classes with returns below cost of capital are under-performing and destroying Shareholder Value
- Classes with returns above cost of capital are creating SV
- We can measure Shareholder Value Added

Returns and Cost of Capital by lob



	Home	PPA	CAL	WC	CMP	COther	S-Tail
Risk Costs Scen1	4.8%	1.7%	1.5%	2.3%	3.2%	2.4%	1.0%
Risk Costs Scen8	3.7%	1.1%	1.0%	1.2%	2.0%	1.7%	0.8%
Ideal ProfitScen1	-3.9%	1.2%	6.9%	23.0%	1.8%	14.2%	3.2%
Ideal ProfitScen8	-2.4%	3.7%	10.7%	28.2%	4.9%	24.7%	3.2%

➔ Profit estimates subject to accuracy of expense allocations

Recap: Answering CEO questions

- 1: Scenario 8 has $100m less capital, similar level of security and generates more value for s/holders
- 2: Risk cost (capital) allocations for all scenarios derived
- 3: Cost of Capital by class compared to class returns has identified classes requiring attention
- 4: Analysis shows class (xol) reinsurance is of little value to shareholders unless at or below burning cost
- 4b: Catastrophe reinsurance, although expensive, is of some benefit
- 5: Equity investments increase capital requirements and destroy value for shareholders

The authors

- Stavros joined B&W in November 1998 where he leads the firm's P&C DFA development. Prior to joining B&W, he was Group Non-Life Technical Manager at Commercial Union (now CGNU plc). He has 25 years P&C experience.
- Stavros has published papers on Stochastic Reserving, Catastrophe Modelling, ALM and Pricing and was awarded a prize by the General Insurance Study Group (GISG) for his paper on 'Pricing for Risk in Financial Transactions' presented at the 1998 GISG/ASTIN Conference. His conjecture on skewness and risk loads has been the subject of two papers in the ASTIN Bulletin. Stavros has a 1st class degree in Mathematics, and also holds an M.Phil. in Pure Mathematics.
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- Andrew joined B&W in 1990 where he is responsible for developing the firm's ESG – The Smith Model (TSM) used in the firms financial modelling work and software.
- Andrew has published papers on the use of martingales in actuarial work, option pricing techniques, asset-liability modelling and financial reinsurance. He was awarded a prize by the Institute of Actuaries for his paper 'How Actuaries can use Financial Economics' published in the Journal of the Institute in 1996. He has a 1st class BA in mathematics from Cambridge University as well as a Certificate of Advanced Study in Mathematics specialising in probability and statistics.
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