

APPLIED FINANCE

Lecture 8



DETAILS OF THE FRAMEWORK

- ▶ Scenario analysis
 - ▶ Default-free discounting
 - ▶ Scenario-level capital consumption
 - ▶ Evaluation of capital consumption using a “**quasi~utility**” approach
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DEFAULT-FREE DISCOUNTING

- ▶ Conditional on its occurrence, a given scenario's outcome is certain → discount at the default-free rate
- ▶ Risk-adjusted discounting is too clumsy
 - ▶ Overloaded operator
 - ▶ Try splitting out default probability from price of risk in risky debt spreads
- ▶ Reflect uncertainty between scenarios, not within
- ▶ What is uncertainty within a scenario anyway?
Do you believe the scenario is possible or not?

- ▶ Experience fund

- ▶ From Finite Reinsurance

- ▶ Fund into which goes all revenue, from which comes all payments

- ▶ Bakes in investment income

- ▶ When it drops below zero, and further payments need to be made, gotta “call the parents” for some capital

SCENARIO CAPITAL
CONSUMPTION

- ▶ That capital is spent → **CONSUMED**

Example 1
Experience Fund for Long-tailed Contract
120% Loss Ratio Scenario

Investment Rate **8.0%** Probability **10.0%**
 Loss Ratio **116.2%** Ultimate Loss **120,000**

1	2	3	4	5	6	7	8	9
Time	Beginning Fund Balance	Premiums	Expenses	Payment Pattern	Paid Losses	Investment Income	Ending Fund Balance	Capital Call
0	\$ -	\$ 103,305	\$ 15,000	0.0%	\$ -	\$ -	\$ 88,305	\$ -
1	\$ 88,305	\$ -	\$ -	50.0%	\$ 60,000	\$ 2,264	\$ 30,570	\$ -
2	\$ 30,570	\$ -	\$ -	25.0%	\$ 30,000	\$ 46	\$ 615	\$ -
3	\$ 615	\$ -	\$ -	12.0%	\$ 14,400	\$ -	\$ (13,785)	\$ 13,785
4	\$ -	\$ -	\$ -	6.0%	\$ 7,200	\$ -	\$ (7,200)	\$ 7,200
5	\$ -	\$ -	\$ -	4.0%	\$ 4,800	\$ -	\$ (4,800)	\$ 4,800
6	\$ -	\$ -	\$ -	2.0%	\$ 2,400	\$ -	\$ (2,400)	\$ 2,400
7	\$ -	\$ -	\$ -	1.0%	\$ 1,200	\$ -	\$ (1,200)	\$ 1,200
8	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
9	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
10	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
TOTAL		\$ 103,305	\$ 15,000	100.0%	\$ 120,000		\$ -	\$ 29,385
NPV		\$ 103,305	\$ 15,000	86.2%	\$ 103,479			\$ 21,714

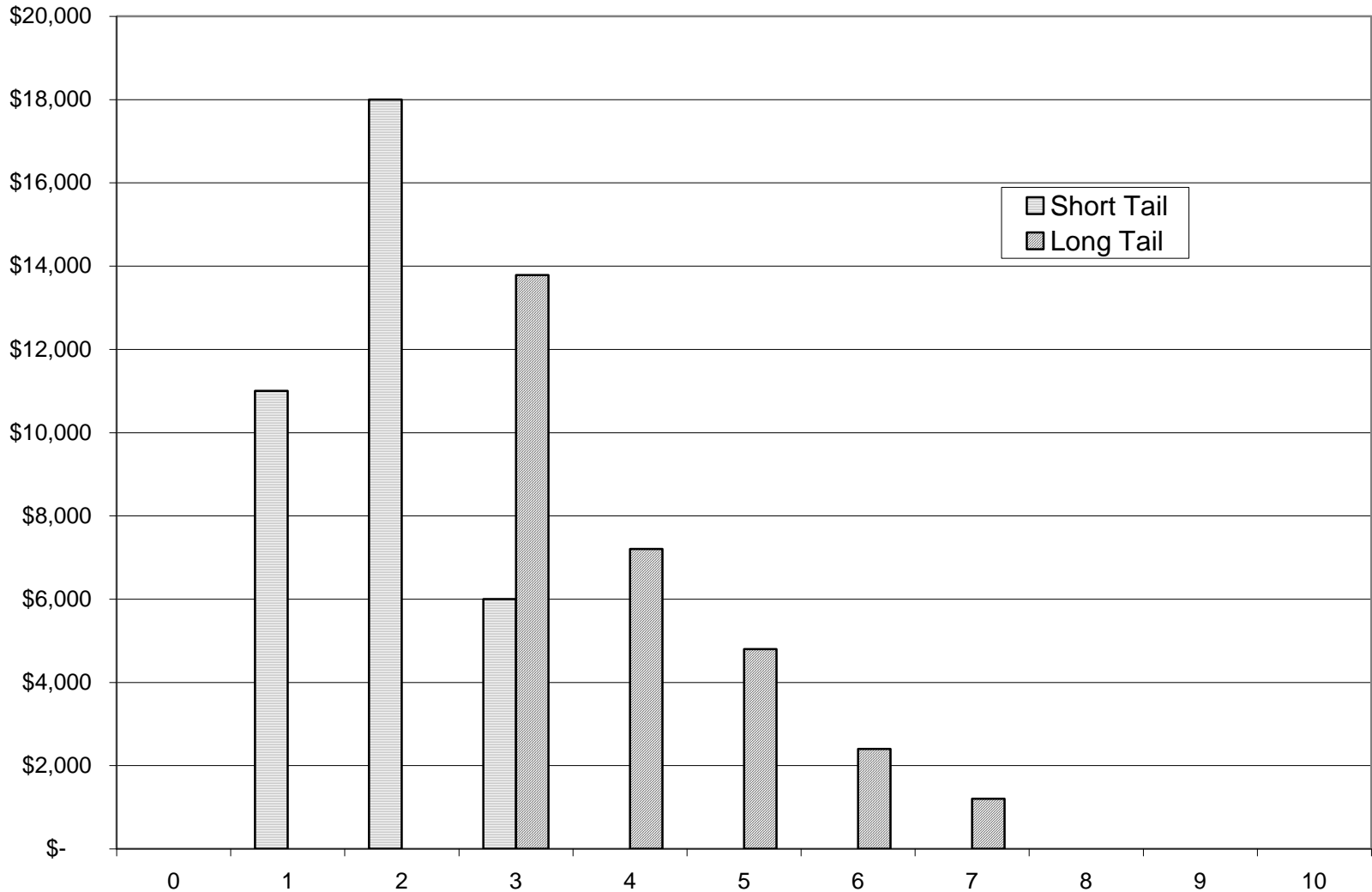
Example 1A
Experience Fund for Short-tailed Contract
120% Loss Ratio Scenario

Investment Rate **8.0%** Loss Ratio **120.0%** Ultimate Loss **120,000**

1	2	3	4	5	6	7	8	9
Time	Beginning Fund Balance	Premiums	Expenses	Payment Pattern	Paid Losses	Investment Income	Ending Fund Balance	Capital Call
0	\$ -	\$ 100,000	\$ 15,000	0.0%	\$ -	\$ -	\$ 85,000	\$ -
1	\$ 85,000	\$ -	\$ -	80.0%	\$ 96,000	\$ -	\$ (11,000)	\$ 11,000
2	\$ -	\$ -	\$ -	15.0%	\$ 18,000	\$ -	\$ (18,000)	\$ 18,000
3	\$ -	\$ -	\$ -	5.0%	\$ 6,000	\$ -	\$ (6,000)	\$ 6,000
4	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
5	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
6	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
7	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
8	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
9	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
10	\$ -	\$ -	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
TOTAL		\$ 100,000	\$ 15,000	100.0%	\$ 120,000			\$ 35,000
NPV		\$ 100,000	\$ 15,000	90.9%	\$ 109,084			\$ 30,380

Chart 1: Capital Consumption Profile Over Time

Short versus Long Tail with 120% Loss Ratio



- ▶ The entire surplus is available to every policy to pay losses in excess of the aggregate loss component.
- ▶ We can envision an insurance company instituting a **charge for the access to the surplus.**

CAPITAL CALLS (PHILBRICK/Painter)

This charge should depend, not just on the likelihood that surplus might be needed, but on the amount of such a surplus call.

- ▶ We can think of a capital allocation method as determining a charge to each line of business that is dependant on the need to access the surplus account.
- ▶ Conceptually, we might want to allocate a specific cost to each line for the right to access the surplus account.

CAPITAL CALLS
(PHILBRICK/PANTER)

▶ In practice though, we tend to express it by allocating a portion of surplus to the line, and then requiring that the line earn (on average) an adequate return on surplus.

CAPITAL CALL COST FUNCTION

- ▶ Risk-based overhead expense loading
- ▶ Pricing decision variable
- ▶ Application of utility theory

- ▶ Borch (1961):

To introduce a utility function which the company seeks to maximize, means only that such consistency requirements (in the various subjective judgements made by an insurance company) are put into mathematical form.

CAPITAL CALL COST FUNCTION

- ▶ Make the implicit explicit
 - ▶ Express your preferences explicitly, in mathematical form, and apply them via a utility function
 - ▶ The mythical ***Risk Appetite***
 - ▶ Enforce consistency in the many judgments being made
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- A decorative graphic consisting of several parallel white lines of varying lengths, slanted diagonally from the bottom right towards the top right, set against the blue background.

IMPLICIT PREFERENCES

- ▶ Preferences buried in Kreps' "Marginal Standard Deviation" risk load approach:
 - ▶ *The marginal impact on the portfolio standard deviation is our chosen functional form for transforming a given distribution of outcomes to a single risk measure.*
 - ▶ *Risk is completely reflected, properly measured and valued by this transform.*
 - ▶ *Upward deviations are treated the same as downward deviations.*

PROPERTY CAT EXAMPLE

Example 4 Property Catastrophe Contract

Premium	\$	1,000,000
Limit	\$	10,000,000

No Loss Scenario


Loss Scenario

	<i>No Loss Scenario</i>		<i>Loss Scenario</i>	
Probability		98.0%		2.0%
Premiums	\$	1,000,000	\$	1,000,000
Expenses	\$	-	\$	-
Losses	\$	-	\$	10,000,000
Capital Call Amount	\$	-	\$	9,000,000
Capital Call Factor		0.0%		400.0%
Capital Call Charge	\$	-	\$	36,000,000
Expected NPV	\$	800,000		
Expected Capital Call Cost	\$	720,000		
Expected Risk-adjusted NPV	\$	80,000		

PROPERTY CAT EXAMPLE

- ▶ How would you do this with capital allocation?
- ▶ Allocate a percentage of the limit – say 5% -- based on marginal portfolio capital requirements?
- ▶ What does that mean? What happens if the event occurs? Where does the money to pay the claim come from?
- ▶ Does the sum of the marginals add up to the company's total capital? If not, what does it mean?

BUILDING BRIDGES

- Pricing via probability measure change – from voluminous capital markets literature
 - ▶ Utility theory in pricing – from Halliwell, Heyer and Schnapp
 - ▶ The Wang Transform – from Wang
 - ▶ The market cost of risk – from Van Slyke
 - ▶ Additive Co-Measures – from Kreps
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FINAL THOUGHT:

- This actually IS capital allocation for insurance, done right
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