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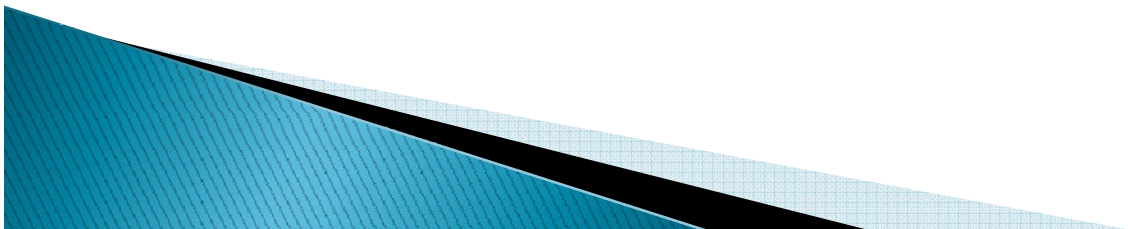
A structured approach to defining and identifying risk

17th Global Conference of Actuaries & 2015 AGFA

2nd & 3rd February, 2015 Mumbai - India

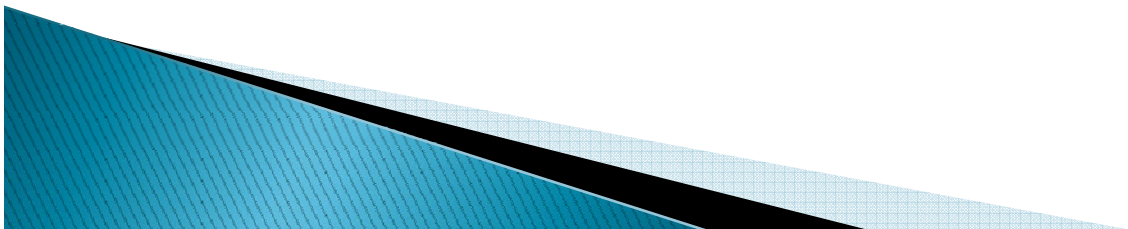
Risk

- ▶ What is risk?
- ▶ Using a risk framework to break down risk into components



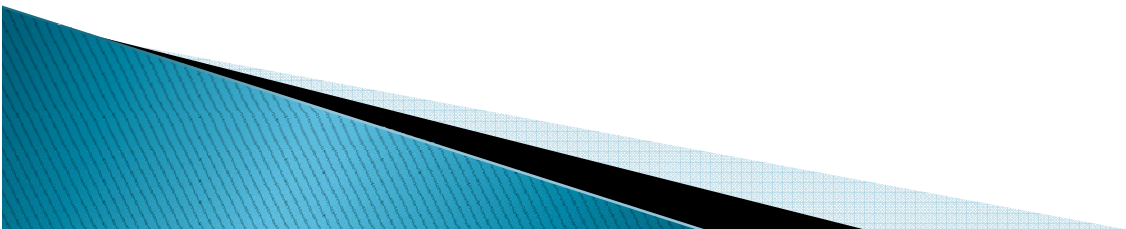
S2 Internal Model Approval

“You should ensure that your internal model (VaR) calculation captures and measures **all of the financial risks affecting the business**, including interactions between those risks”



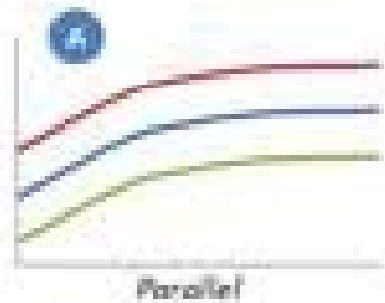
So we need a list of risks

- ▶ What would be on this list?
- ▶ What should not be on the list?

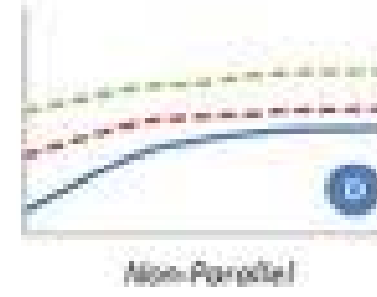
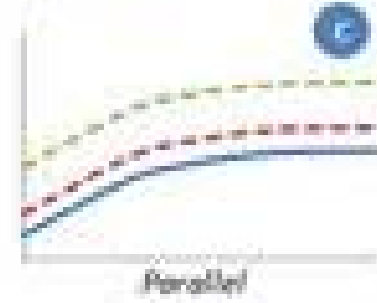


Interest Rate Risk Stress-Tests Basic Kinds

Instantaneous
(Shock)



Gradual
(Ramp)



CITY
EDITION

London Herald

LATE
PRICES

THURSDAY

FRIDAY 19th OCTOBER 1929

10

WALL STREET CRASH!

Black Thursday in America

Trade Plunged and
Banks
Closed Early

NEW YORK, Oct. 24.—The stock market today was a scene of confusion and panic. The Dow Jones Industrial Average fell 11.23 points to 286.35.

Trading was heavy and nervous. Many investors were selling their holdings in a hurry to get out of the market.

By 11 A.M. the market had lost more than 100 points. The panic continued throughout the day.

At 3 P.M. the market closed at its lowest point since the crash. The Dow Jones Industrial Average stood at 286.35.

The crash on Wall Street today has caused a severe reaction in the London market. The pound sterling fell to a new low.

Many investors in London are also selling their holdings in a hurry to get out of the market.

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THE NEW YORK STOCK EXCHANGE TODAY

'What Went Wrong?'

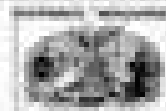
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ALM Framework - I



Building the ALM Model



THE EPIDEMIC SCORECARD

Tuberculosis

Malaria

Hepatitis B Virus

Diarrheal Diseases

AIDS

Measles

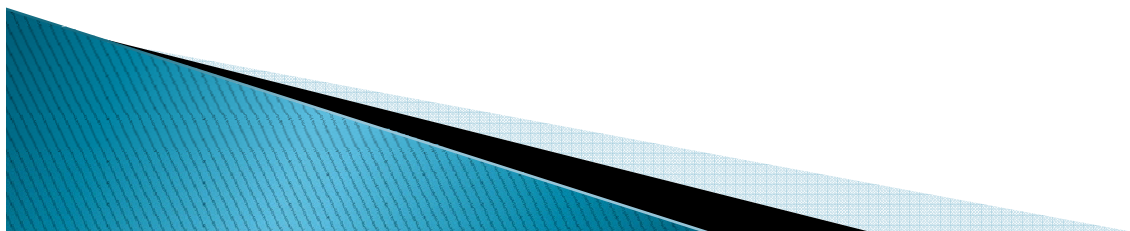
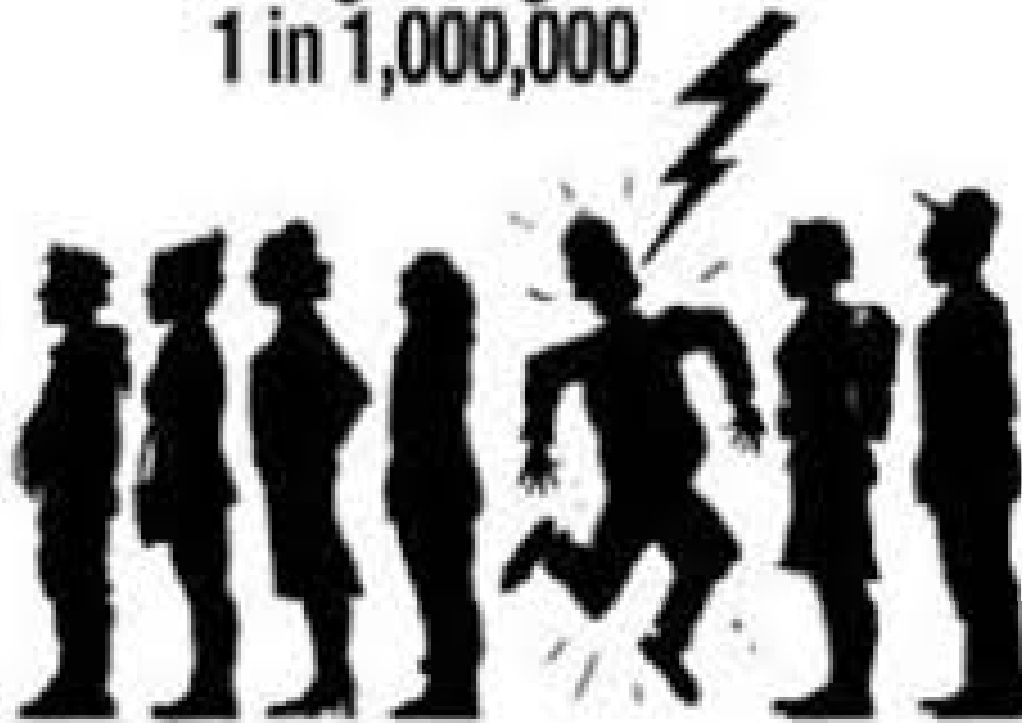
Dengue Fever

Influenza

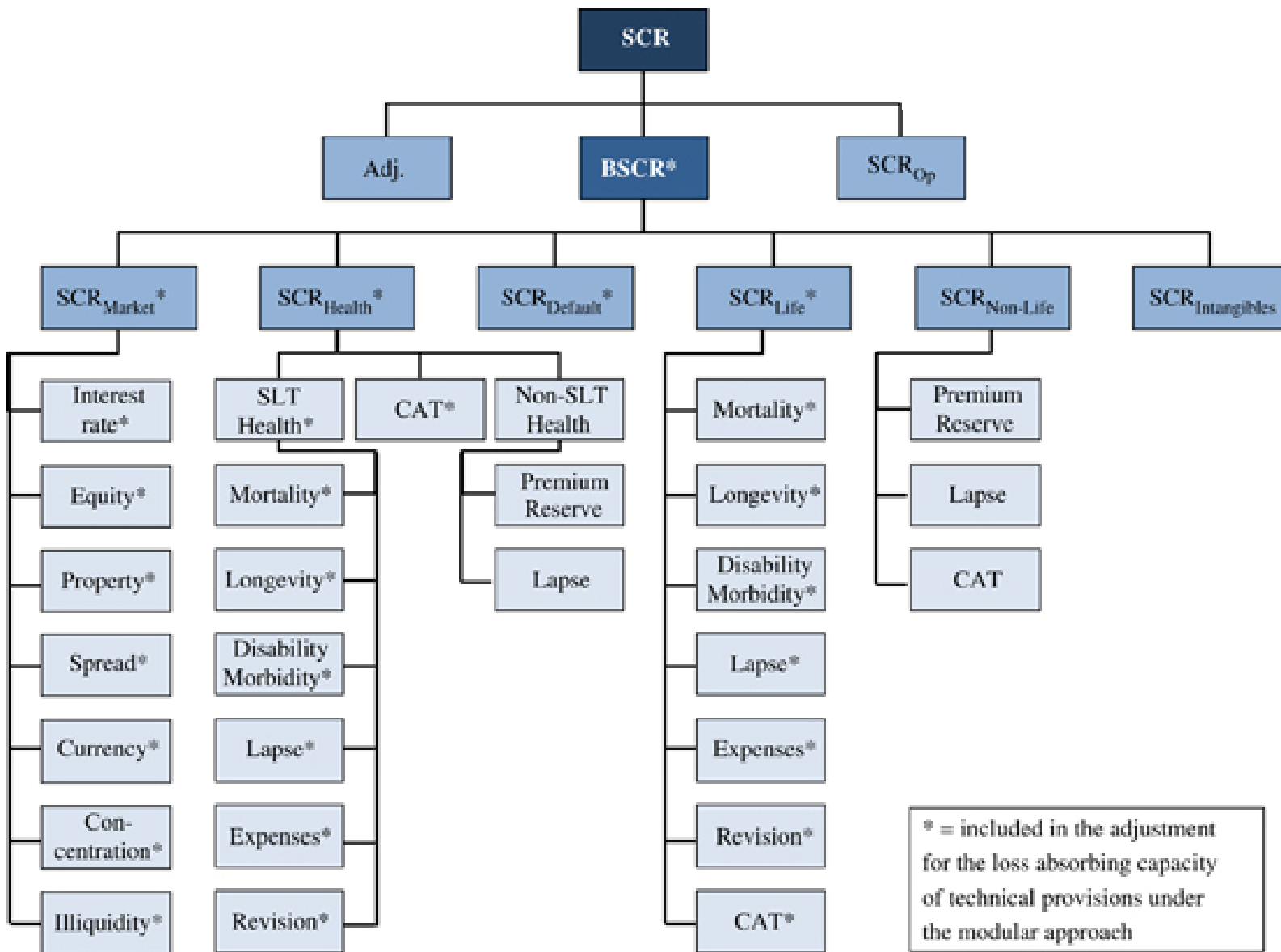
Yellow Fever SARS

Reprinted by permission from Jonathan Marshall and Elizabeth Glick, New York Times (Apr 12, April 28, 2003)

Getting hit by
lightning
1 in 1,000,000







SOLVENCY II

Pillar 1

Quantitative Requirements

Two Capital Requirements:

- Solvency Capital Requirement (SCR)
- Minimum Capital Requirement (MCR)

Pillar 2

Qualitative Risk Management & Supervisory Review

Internal Controls and Risk Management

Supervisory activities:

- Supervisory Review of firm specific capital requirements
- Supervisors, can adjust capital requirements of specific firms

Pillar 3

Disclosure Requirements

There will be two separate forms; Disclosure to the public and disclosure to the supervisor

These disclosures will encompass to various degrees

- Business overview and performance
- Governance
- Valuation basis used for solvency purposes
- Risk and capital management

Insurance and Reserve Risk

Catastrophe Risk

Interest Rate Risk

Equity Risk

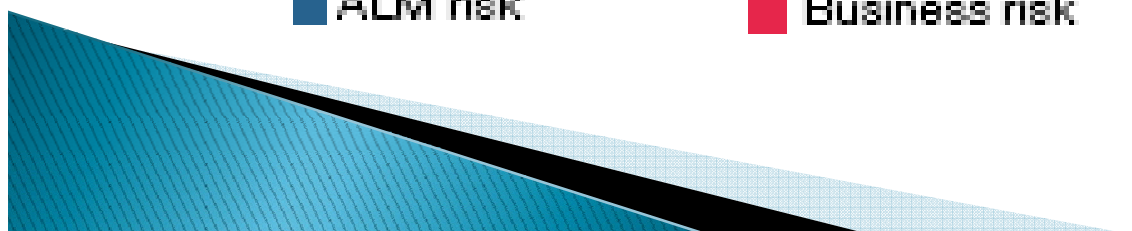
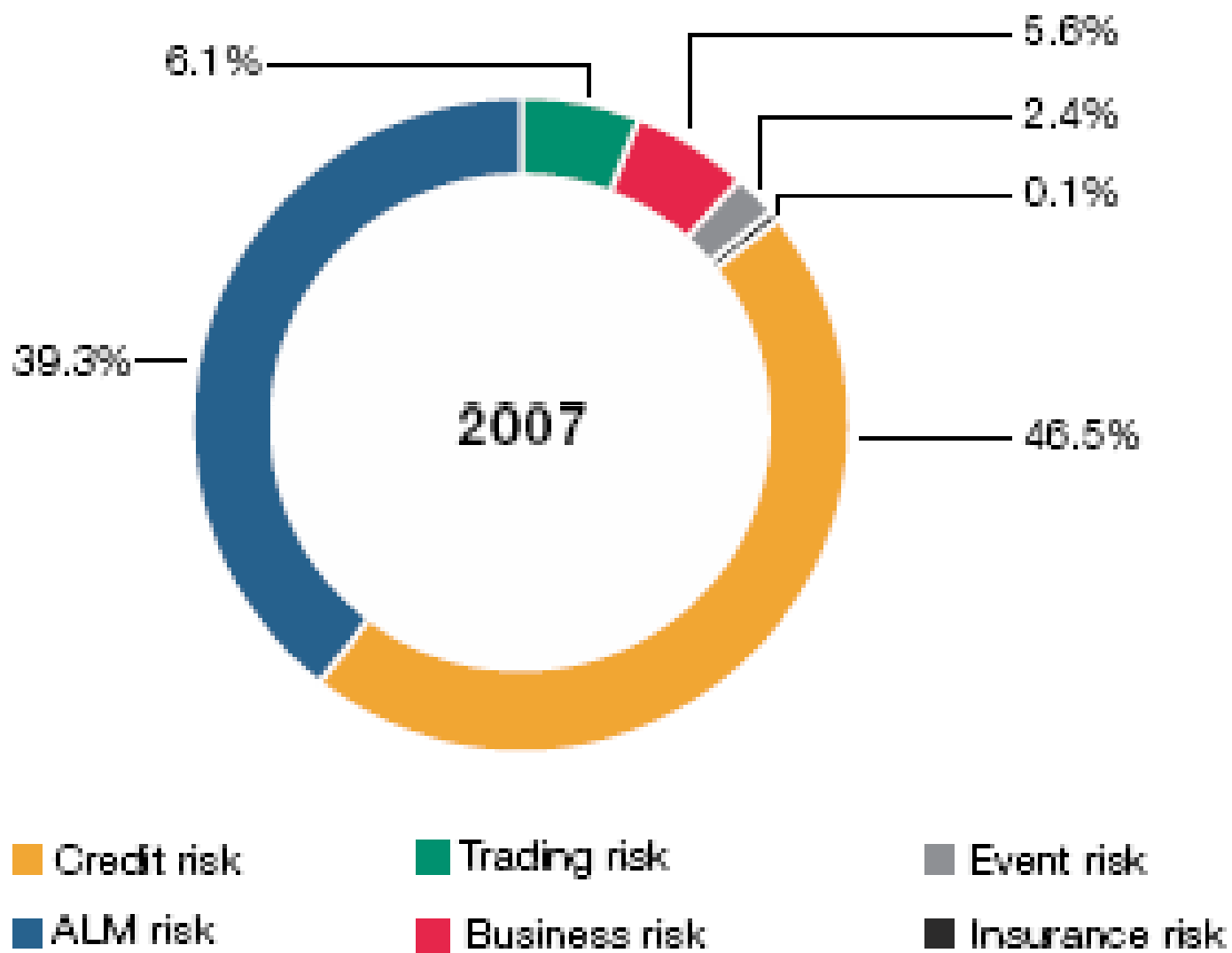
Currency Risk

Operational Risk

Concentration Risk

Spread Risk

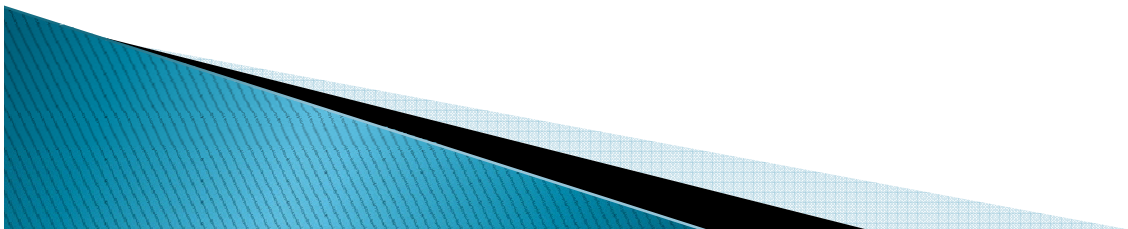
Default Risk





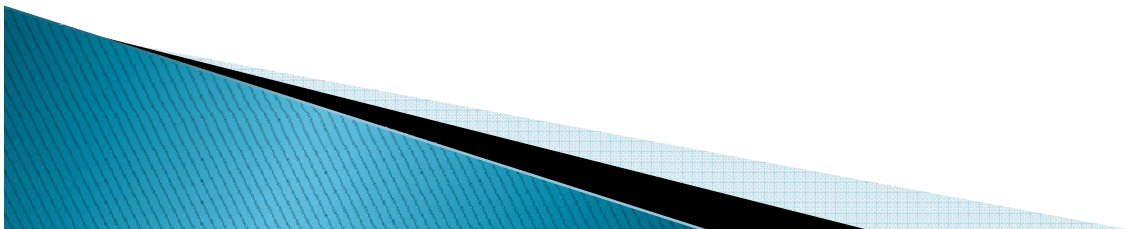
Take-Away 1

- ▶ People use the word “Risk” to mean all sorts of things
- ▶ It helps if we are a bit more specific



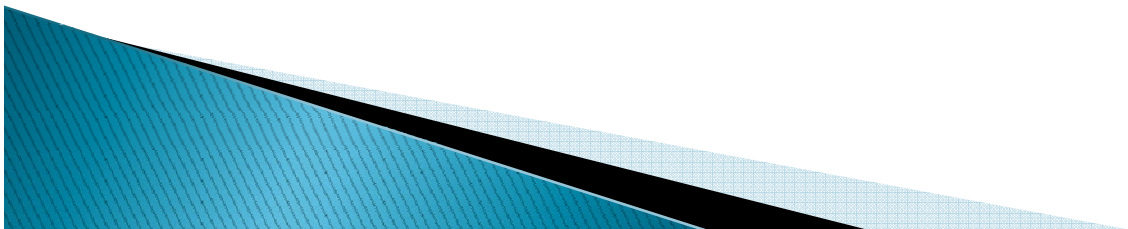
Let's assume that:

- ▶ For an insurance company, all “Risk” is ultimately financial risk
- ▶ ie the possibility of losing money, or not making as much money as you thought
- ▶ ie of having some value but maybe losing it



So:

- ▶ Risk =
- ▶ Having some **value**...
- ▶ ...but maybe **losing** it

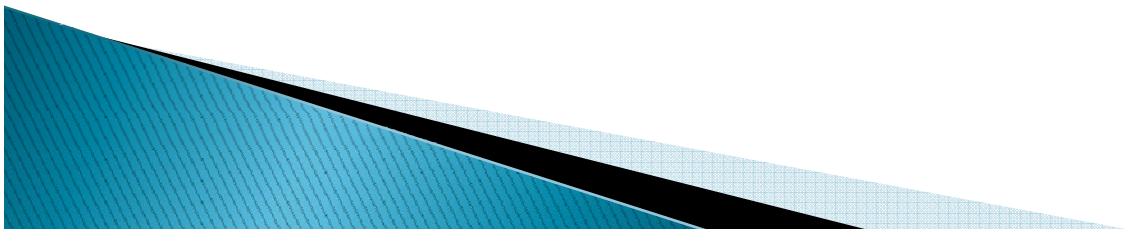


More mathematically

► Risk

= (some kind of) value at risk

= Exposure x Uncertainty



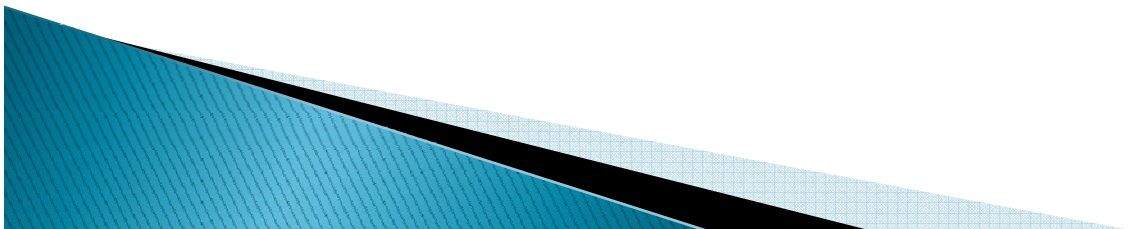
Check:

- ▶ Stock market crash

$$\begin{aligned} &= \text{Exposure} \quad \times \quad \text{Uncertainty} \\ &= \text{Value of stocks} \times \% \text{ drop in index} \end{aligned}$$

- ▶ Reputation risk

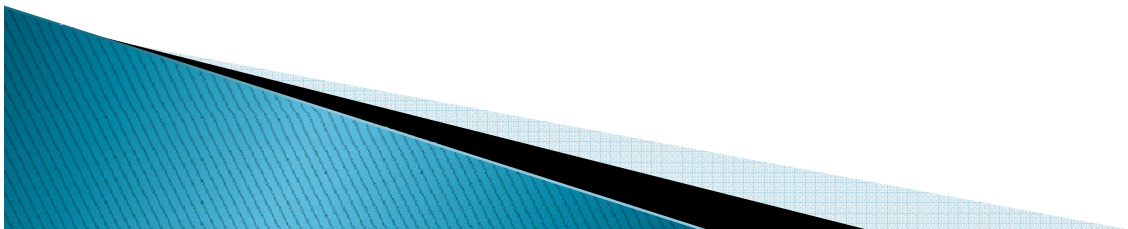
$$\begin{aligned} &= \text{Exposure} \quad \times \quad \text{Uncertainty} \\ &= \text{Value of sales} \times \% \text{ of sales lost} \end{aligned}$$



Take-Away 2

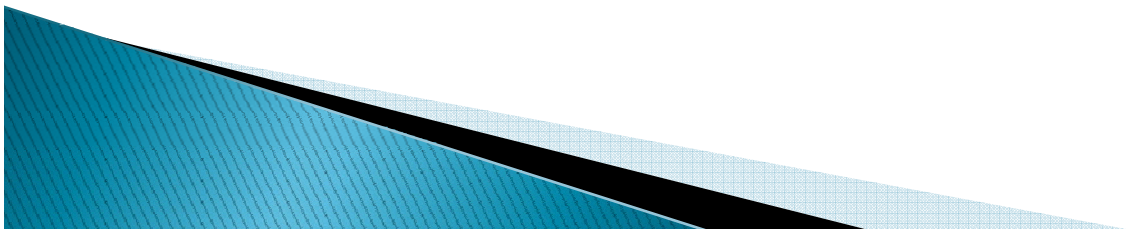
- ▶ All risk is ultimately about

Exposure x Uncertainty



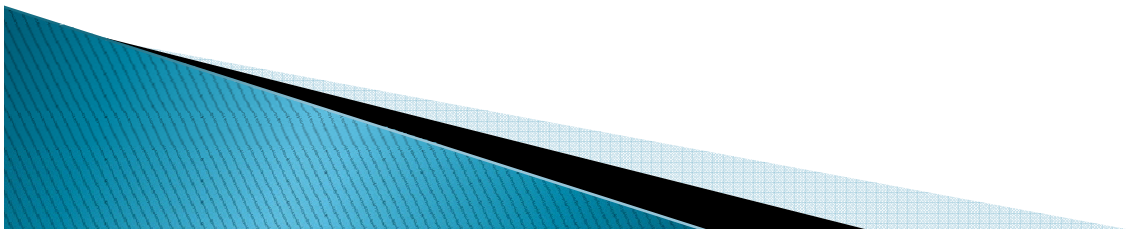
Concept 1: Exposure

- ▶ Exposure is the value that you have assigned to something
- ▶ Example: stocks
 - Current market value
 - Original purchase price
- ▶ Example: BEL
 - Calculated using best estimate discount rates
 - Calculated using swap rates



Concept 2: Uncertainty

- ▶ Uncertainty is the possibility that the exposure value changes
- ▶ Example: stocks
 - Potential drop in market value
 - Potential drop in dividend income received
- ▶ Example: BEL
 - Potential change in discount rates
 - Potential change in future cash flows



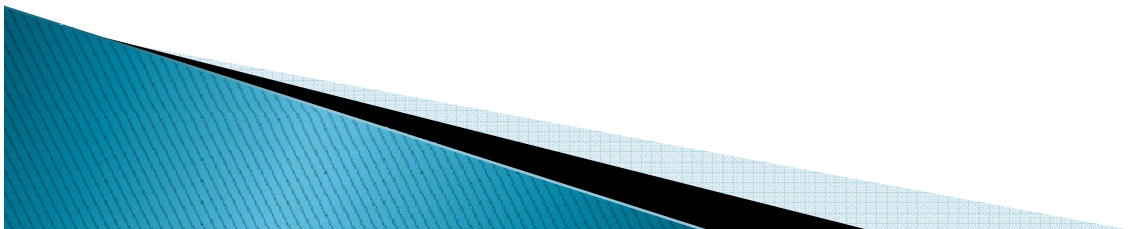
Linking the Two

- ▶ Example: stocks

- Risk = Exposure x Uncertainty

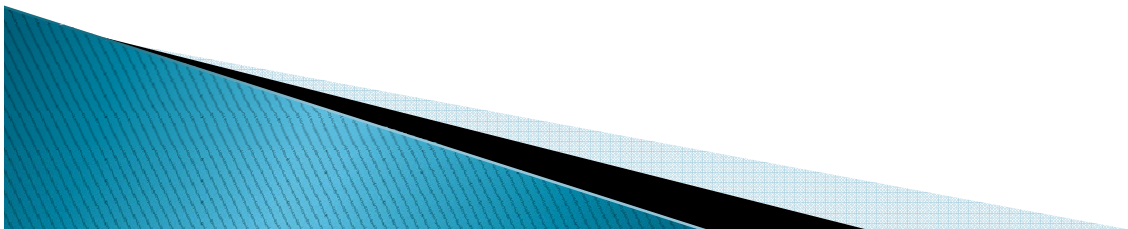
- = Current market value
x Potential drop in market value
= non-zero value

- or = Original purchase price
x Potential change in purchase price
= zero



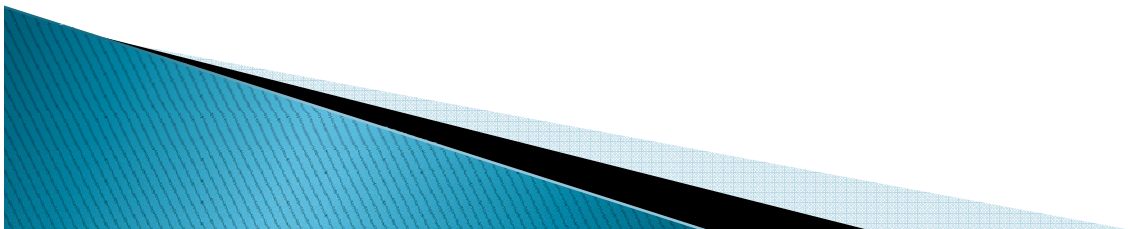
Take-Away 3

- ▶ Risk depends on the Exposure measure
- ▶ ie on the definitions you use for “value”



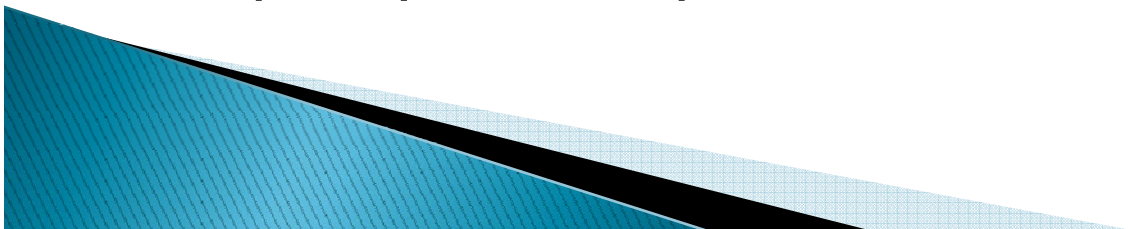
Identifying Uncertainties

- ▶ In short, uncertainties are all of the things that you need to make assumptions about...
- ▶ ...when you calculate the current value of something
- ▶ ...or estimate how its value could change in the future

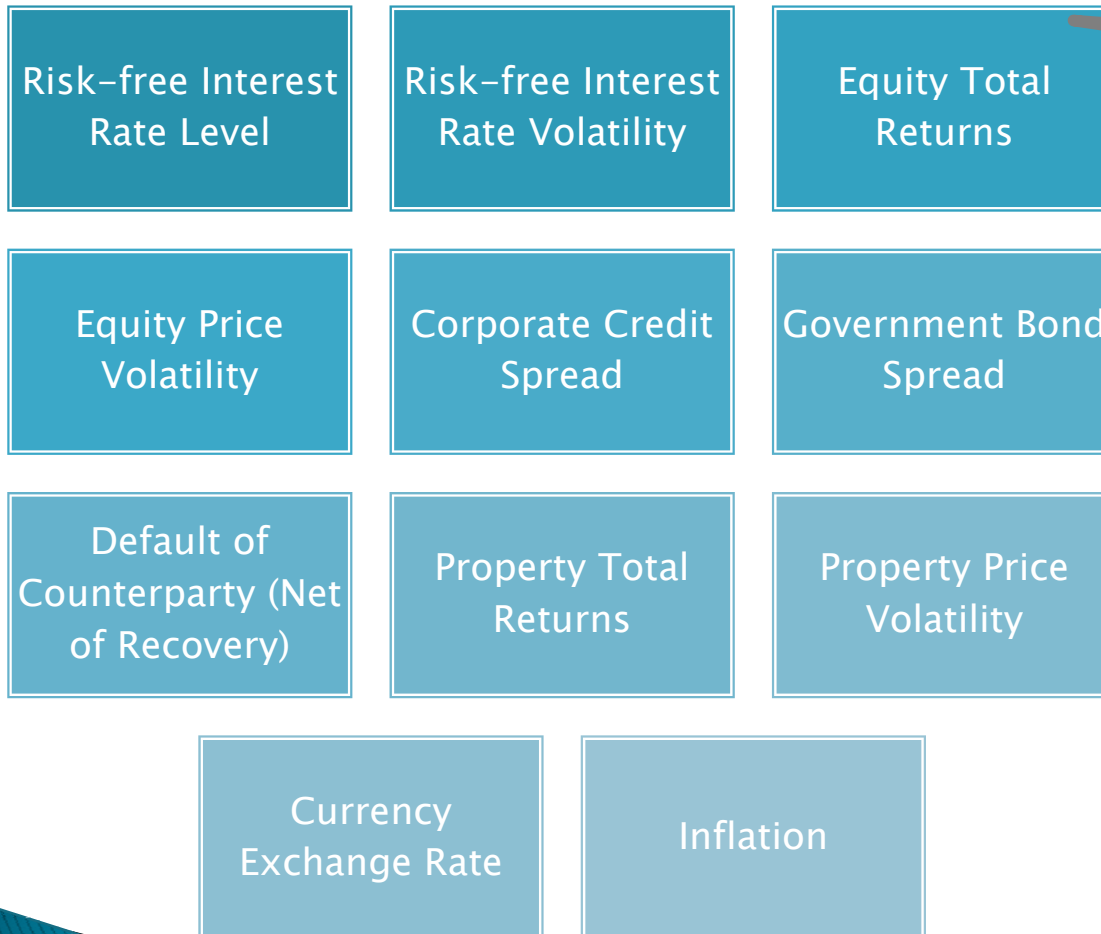


Think Mathematically

- ▶ If you are thinking about uncertainties that affect the value of insurance liabilities:
 - On a statutory basis, this means all of the assumptions that go into the GPV calculation
 - On an economic basis, it would be all of the assumptions that would go into “the perfect BEL” (ie a GPV with everything in it, eg stochastic, every single policy feature, management action, policyholder option,...)



Market Uncertainties



Uncertainty	Equity Price
Asset Cash Flows & MV affected?	Only MV
Liability Cash Flows or MV affected?	Most par & linked products
Dimensions of Uncertainty: not Closely Correlated	Sectors / Industries, Geography, Currency
Major Underlying Influences	* Uncertainty in financial results * Changes in market sentiment
Correlated uncertainties	Risk-free Interest Rate Level Equity Price Volatility
"Worst Case" Events	* Stock market crash
Asymmetry	High asymmetry on upside
Statistical	High
Overall Variability	High
Reliability of Assessment	Medium

Policyholder Behaviour Uncertainties

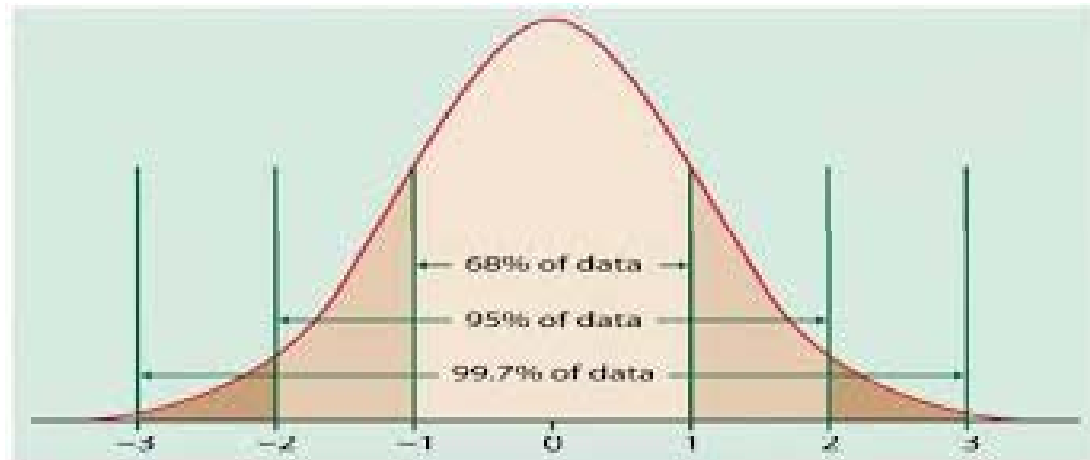
The uncertainty is rated as follows:

Lapse	Premium holiday	Partial withdrawals
Option to transfer	Mass lapse	Renew / extend policy term or increase cover
Conversion to paid up	Unit-linked fund switching	Annuity Commutation

Uncertainty	Premium Holiday
Asset Cash Flows & MV affected?	No
Liability Cash Flows or MV affected?	<ul style="list-style-type: none"> * Account Balance products * MV, via assumption changes
Dimensions of Uncertainty: not Closely Correlated	Incidence, duration, size of account balance
Major Underlying Influences	<ul style="list-style-type: none"> * Product design * Changes in market and economic drivers affecting liquidity needs of policyholders
Correlated uncertainties	<ul style="list-style-type: none"> * Lapse / Policyholder Termination * Partial Withdrawal - Incidence / Amount * Premium Top-Ups * Equity Price
"Worst Case" Events	<ul style="list-style-type: none"> * Economic downturn leading to low premium payments
Asymmetry	Some asymmetry towards higher PH levels
Statistical	Medium
Overall Variability	Medium
Reliability of Assessment	Bad

Take-Away 4

- ▶ Uncertainties are like assumptions needed in a BEL calculation
- ▶ If they need a best estimate, they are also subject to variation, ie uncertainty



Concept 3: Influences

► Risk =

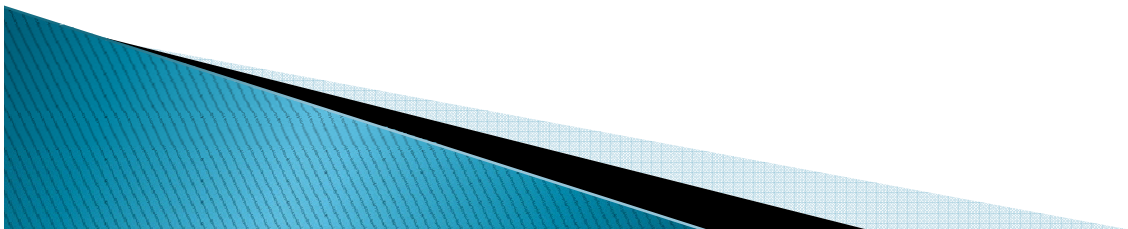
Exposure x Uncertainty



Influences

Influences for mortality:

Major Underlying Influences	<ul style="list-style-type: none">* Death by Accident: Safety regulations e.g. speed limits, Dangerous activities. Infrastructure* Death by Illness: Medical advances, Epidemics, Underwriting practices
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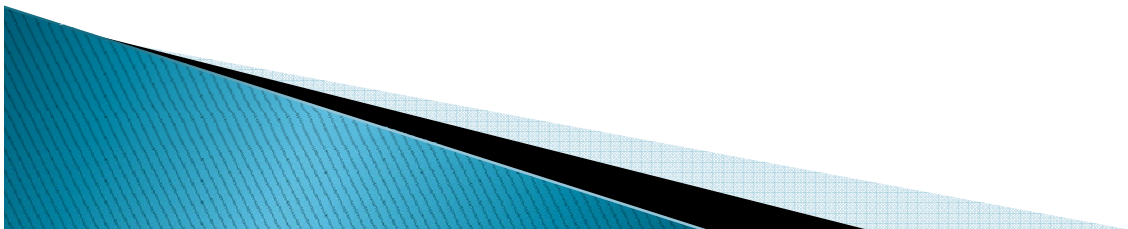
Examples of Influences

▶ Economic

- Government policy
- Market sentiment
- Quantitative Easing
- ...

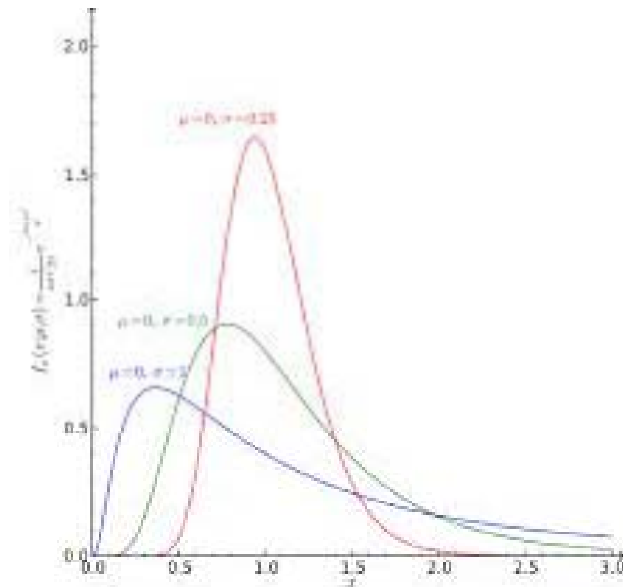
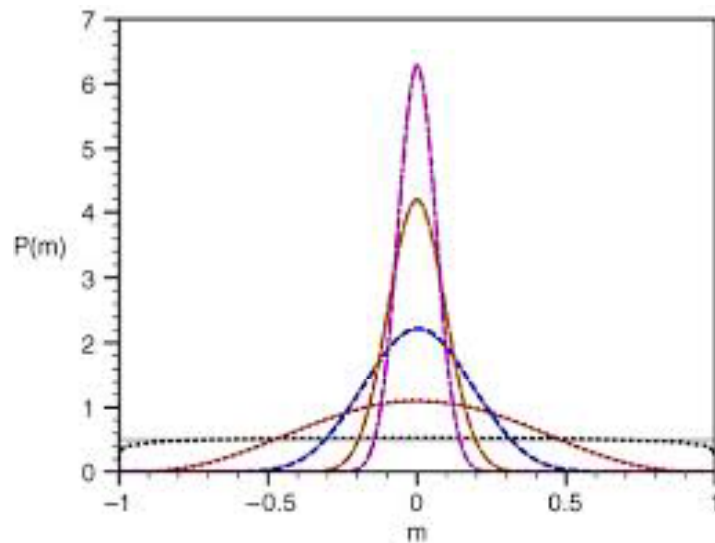
▶ Lapse Rates

- Agent activities
- Availability & price of alternative investments
- Economy & policyholder's need for cash
- Policyholder awareness



Take-Away 4

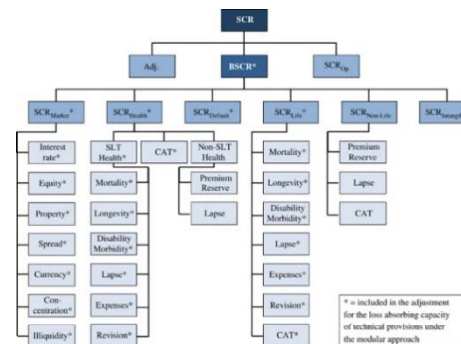
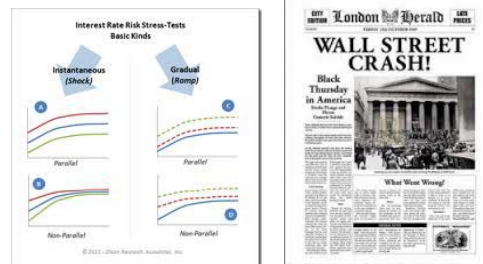
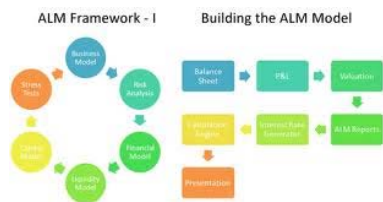
- ▶ Influences are things that affect the shape of the distribution of outcomes of an uncertainty



Bringing Everything Together

► Risk =

Exposure x Uncertainty ← Influences



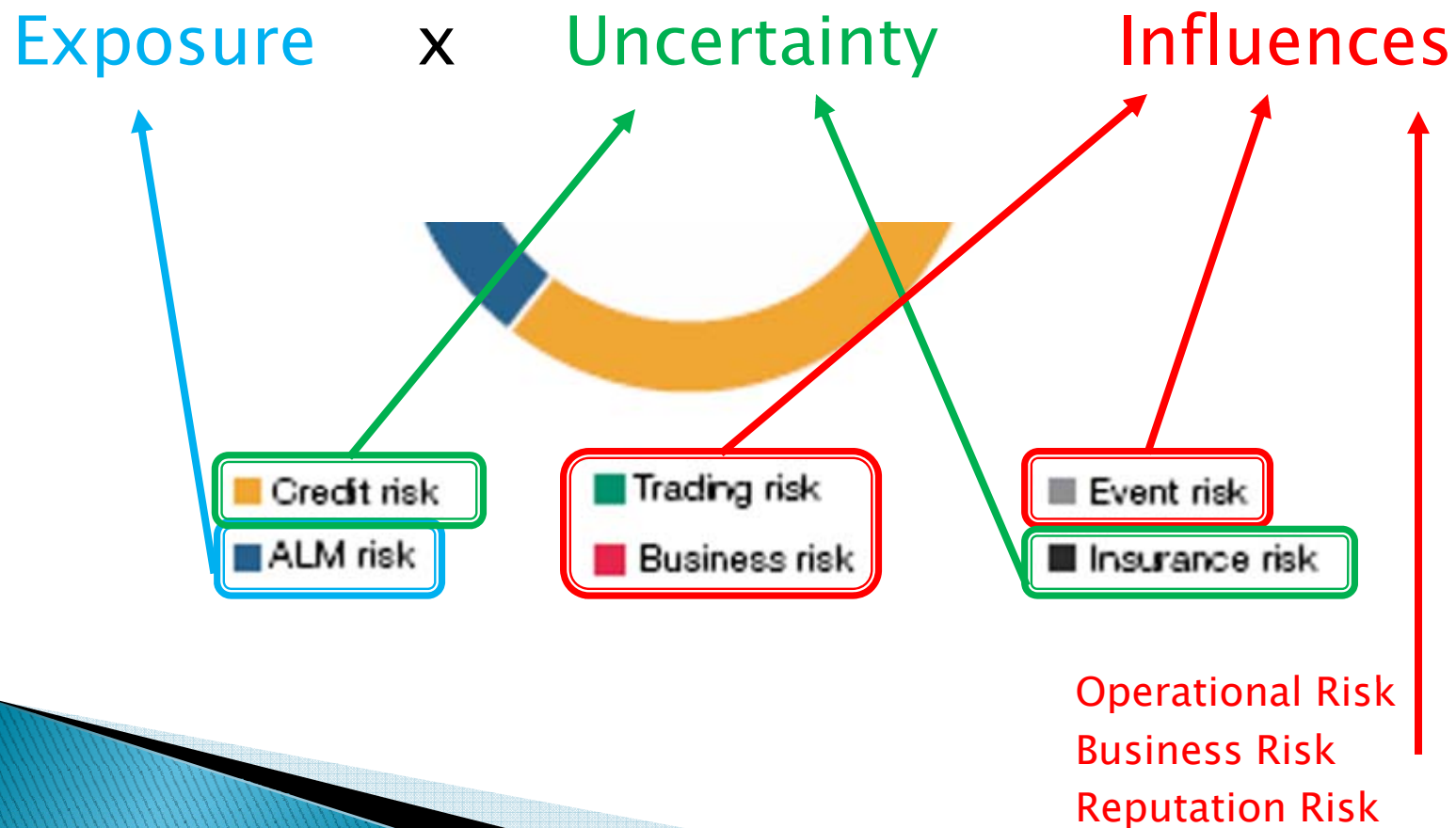
THE EPIDEMIC SCORECARD

Tuberculosis		
Malaria	Hepatitis B Virus	
Diarrheal Diseases	AIDS	Measles
Dengue Fever	Influenza	Yellow Fever
		SARS



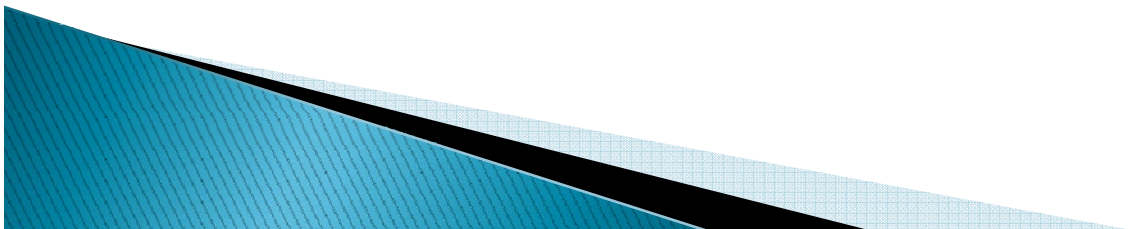
Bringing Everything Together

► Risk =



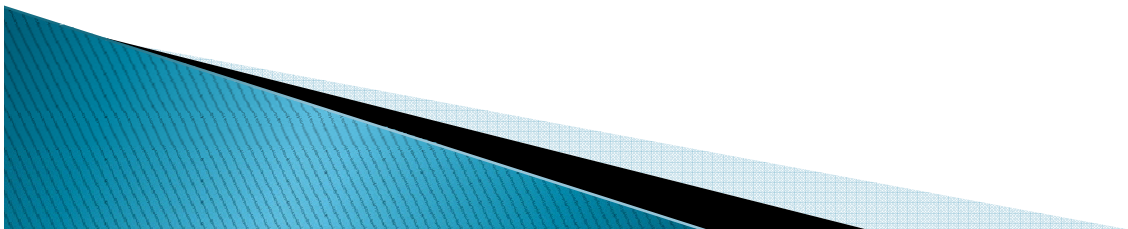
Take-Away 5

- ▶ When people say “Risk”, it could mean any of the following:
 - An uncertainty interacting with more than one exposures (or even with other uncertainties)
 - Eg ALM risk
 - A single uncertainty / exposure combination
 - Eg mortality risk
 - An influence, ie something driving an uncertainty
 - Eg ebola
 - A family of influences driving lots of uncertainties
 - Eg operational risk



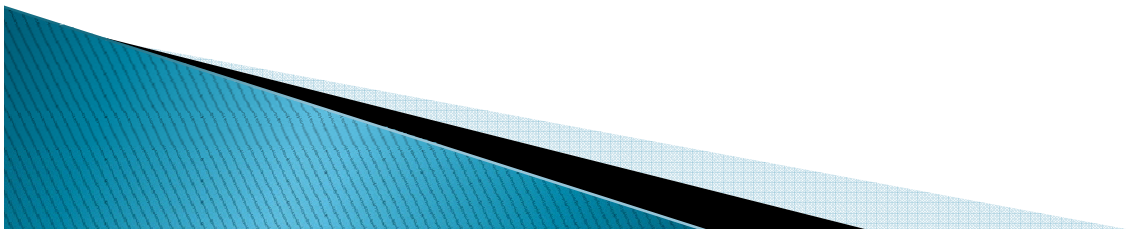
Summary of Take-Aways

- ▶ People use the word “Risk” to mean all sorts of things
- ▶ All risk is ultimately about
Exposure x Uncertainty
- ▶ Risk depends on the Exposure measure, ie on the definitions you use for “value”



Exam Question 1

- ▶ India interest rate risk:
- ▶ “The duration of our assets and liabilities is the same, and the MCEV does not move if interest rates move. So we have no interest rate risk.”
- ▶ Why is this correct, but not the whole story?



Exam Question 2

- ▶ India lapse risk:
- ▶ How could it be true that the exposure to lapse risk (ie losses from lapses) in the next 12 months is:
 - To fewer lapses on a statutory basis
 - To more lapses on an economic basis

