Financing Catastrophic Risk: Mortality Bond Case Study

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Agenda

- Convergence of Insurance and Capital Markets
- An overview of major catastrophes
- Case Study: Tartan Capital

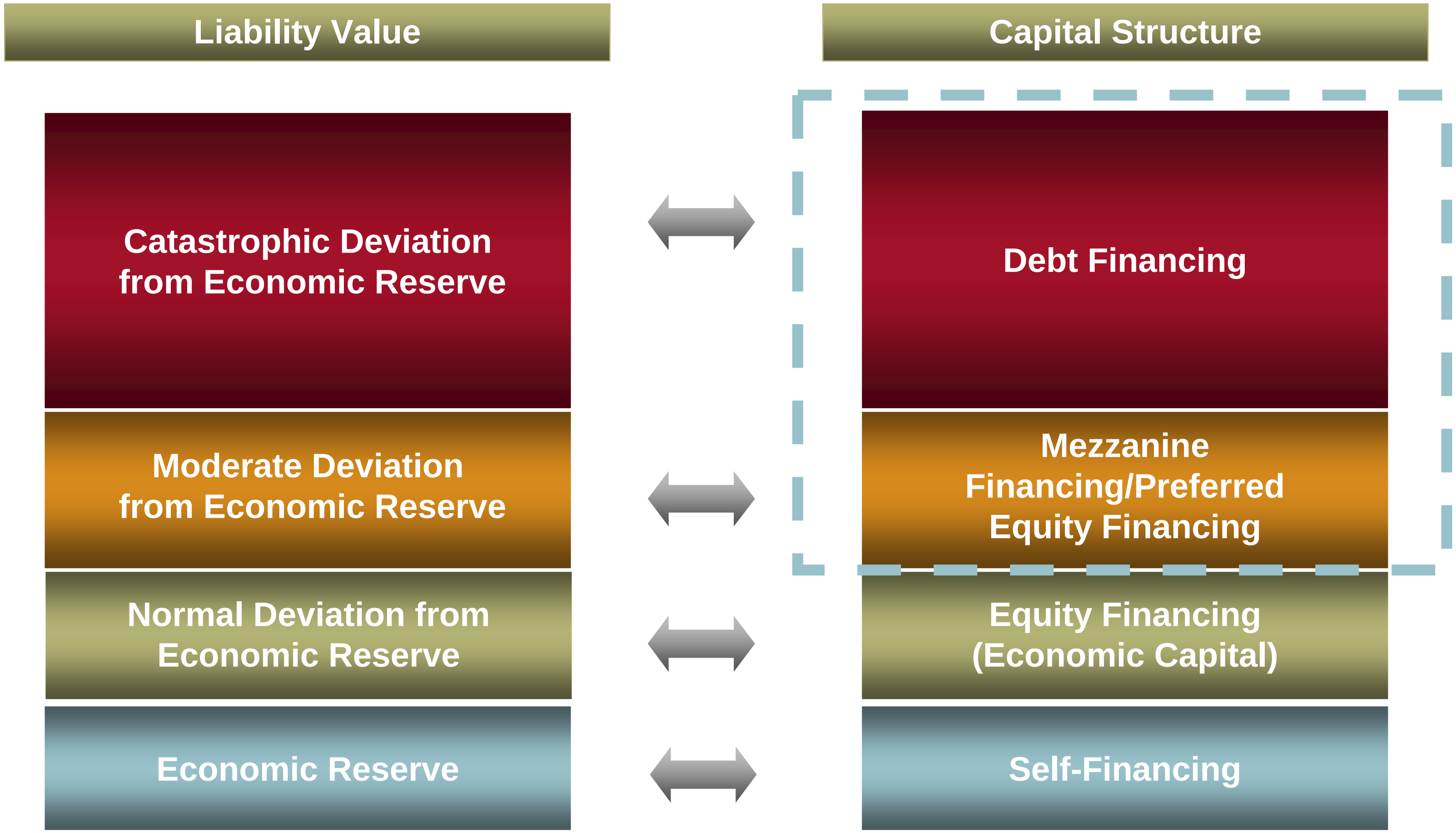
Convergence of Insurance and Capital Markets

- *What insurer ?*
  - **<u>Distributes</u> product, that is has** ← Sales
  - **<u>Manufactured</u>, using its people, that relies on a** ← Development/Servicing
  - **<u>Promise</u>, that is supported by its** ← Advertising/Branding
  - **<u>Capital.</u>** ← Finance/treasury

- How is this different to a bank ?
- Which areas get most of management's attention ?
- Who are the real experts in managing capital ???

Convergence of Insurance and Capital Markets

- *Should Capital be 'Outsourced' ?*



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Securitization Overview

- Securitization has developed in recent years into an important tool for capital management by financial institutions
  - **Originated by the banking industry in the 1970s and 1980s.**
  - **In a typical securitization a financial institution sells assets with reasonably predictable cash flows to a special purpose finance entity**
    - **Assets include residential mortgages, auto loans and credit card receivables**
    - **Assets must have relatively identifiable, though not necessarily low, default risk**
  - **The finance entity then sells debt securities backed by the cash flows to the capital markets**
    - **Single-class offering: All investors receive a** *pro rata* **interest in the incoming revenues from the asset pool**
    - **Multi-class offering: Two or more classes or** *tranches* **are granted different (and in some cases uncertain) claims, each with its own pay-out and risk characteristics**
  - **The proceeds of the issuance are transferred to the financial institution to be used for capital relief or other purposes**

Insurance Securitizations

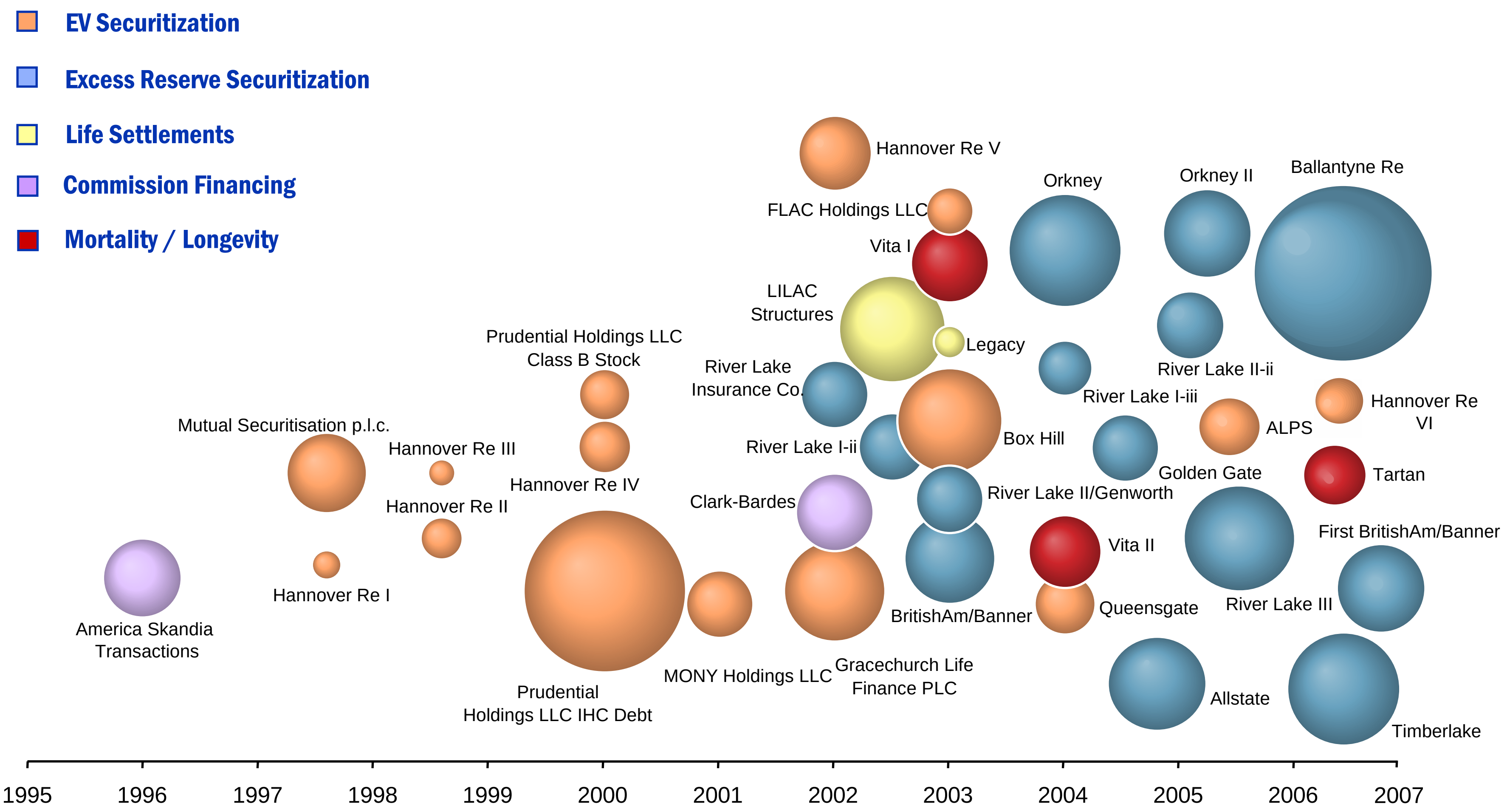
- Securitization offers insurers and reinsurers access to financing that will improve the insurer's capital or liquidity position at a cost that should be favorable in comparison with other sources
  - **Insurance securitizations are similar to securitizations by other financial institutions in many respects:**
    - **Assets with predictable cash flows and default risk are transferred to a special purpose financial entity**
    - **Insurance-linked securities ("ILS") are sold to the capital markets based on those cash flows**

- Insurance securitizations differ from securitizations by other financial institutions in one significant respect: securitizations can be used as another means of managing insurance risk.
  - **Capital markets take on risk of insurance losses in excess of expected losses--but limited to the investment in the ILS**

Economic Benefits of Securitization

- Provides lower cost financing
  - **Reduces capital needs**
  - **Lowers overall cost of capital**
- Increases velocity of the balance sheet
  - **An alternative to the traditional “buy and hold” strategy, using the insurer’s capital to back insurance risk**
  - **Securitizations permit insurers to redeploy capital in an efficient manner**
- Diversification of capital
- Transfer of risk
  - **Securitizations typically use “bankruptcy remote” vehicles**
  - **ILS are typically non-recourse to the sponsoring insurer**

All Life Insurance Securitization Transactions



Mortality Cat Bond Issuance

• 2003	Vita 1:	Swiss Re	$400M
• 2005	Vita 2:	Swiss Re	$362M
• 2006	Tartan:	Scottish Re	$155M
• 2006	Osiris:	Axa	$442M

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World Natural Disasters

Natural Disasters with highest death toll since 1750 (excluding drought)

1.	Flood	3.7 M	1931	Yangtze-Kiang River, China
2.	Flood	2 M	1959	N. China
3.	Flood	900K	1877	Huang He (Hwang Ho or Yellow) River N. China
4.	Flood	500K	1939	Hunan province China
5.	Cyclone, Flood	3-500K	1970	Ganges Delta isles, Bangladesh
6.	Earthquake	255-655K	1976	Tanashan (Tianjin) Earthquake- E. China (8.2)
7.	Earthquake	300K	1850	Sichuan, China
8.	E'quake, tsunami	225K+	2004	Indian Ocean Earthquake (9.0) + SE Asia tsumani
9.	Earthquake	200K	1927	Xining (Nanshan), China (8.3)
10.	E'quake, Landslide	200K	1920	Gansu (Kansu), China (8.6)

source: http://www.geocities.com/dtmcbride/hist/disasters-war.html

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World Pandemics

Death toll from Influenza Pandemics

Date	Strain	US	World
1918-19	H1N1 - Spanish Flu	500,000	21-50 M
1957-58	H2N2 - Asian Flu	60,000	1 M
1968-69	H3N2 - Hong Kong	40,000	750 K
1997-	H5N1, H9N2, H7N7, H7N2 H7N3 - Avian influenza (Bird Flu)	none	60

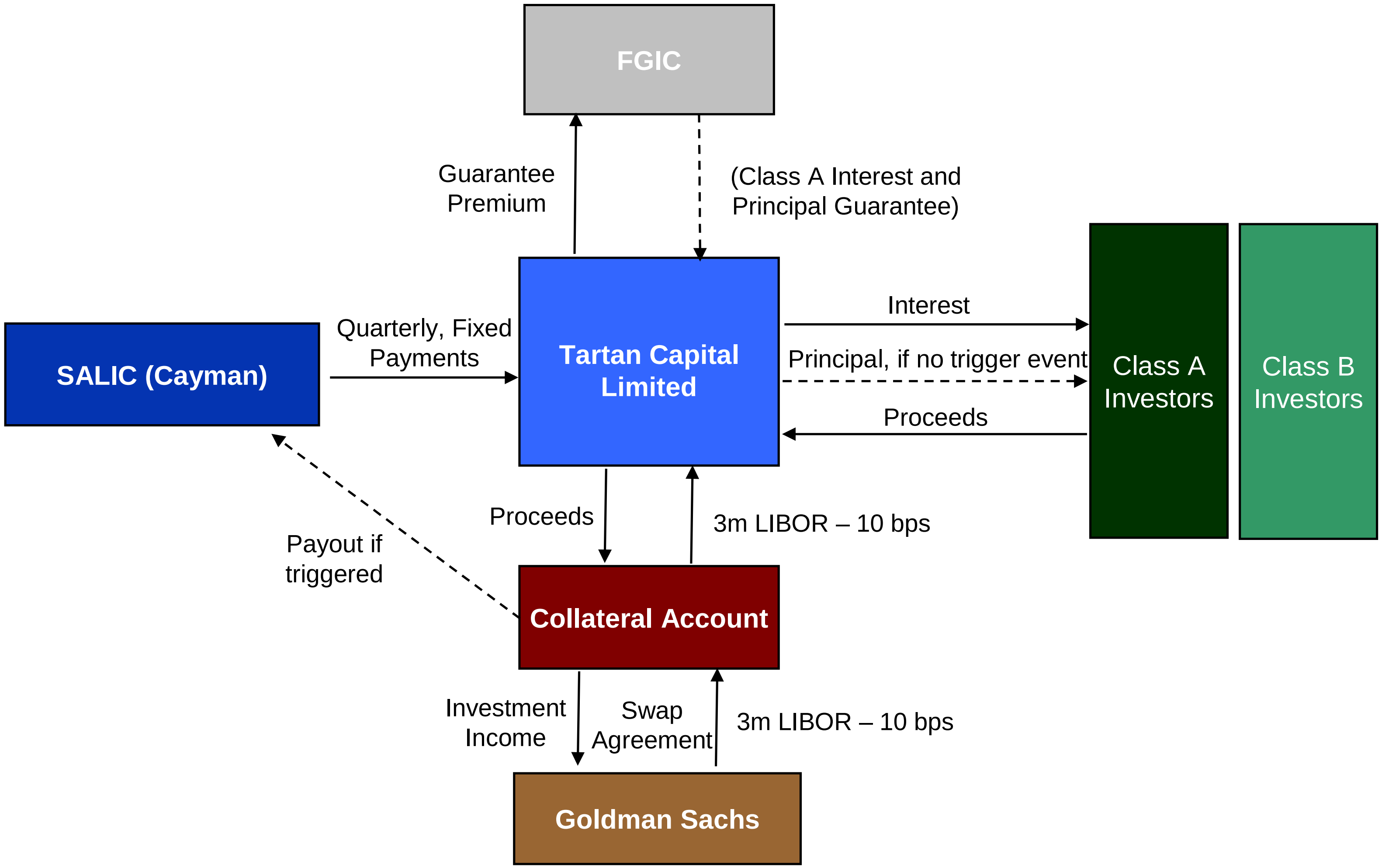
Note 1: Some sources report up to 4 Million worldwide flu deaths in 1957-58

source: http://www.geocities.com/dtmcbride/hist/disasters-war.html

Case Study: Tartan Capital Limited

- Scottish Re is a relatively young (8 year old) life reinsurance specialist. The largest portfolio is in the US.
- Scottish Re Group sponsored a catastrophic mortality risk securitization through Tartan Capital Limited
  - The transaction provides Scottish Re Group two tranches of 3-year, collateralized protection
  - The transaction provides Scottish Re with coverage against losses from extreme mortality in the U.S. on an indexed basis
  - The transaction will cover losses in excess of the trigger threshold up to the limit of each tranche
- A shelf is being established for potential additional issuance in the future
- The company's motivations for entering into the transaction include:
  - Mitigation of the impact of extreme mortality events
  - Execution of stated objective of increasing capital efficiency through the use of securitizations

Illustrative Issuance Structure



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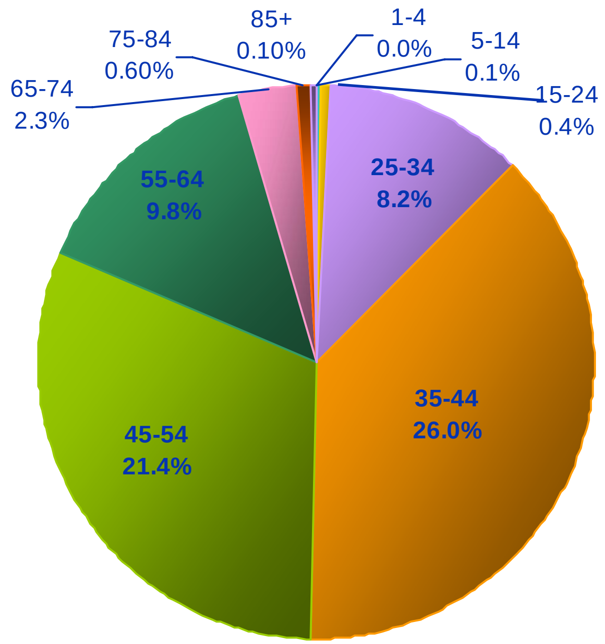
Program Summary

	Class A Notes	Class B Notes
Issuer:	Tartan Capital Limited	Tartan Capital Limited
Offered Amount:	$75 mm	$80 mm
Term:	3 Years	3 Years
Trigger Level:	115%	110%
Exhaustion Level:	120%	115%
Interest Spread:	L + 19 bps	L + 300 bps
Rating:	AAA/Aaa	BBB/Baa3

Index Construction: Age/Sex

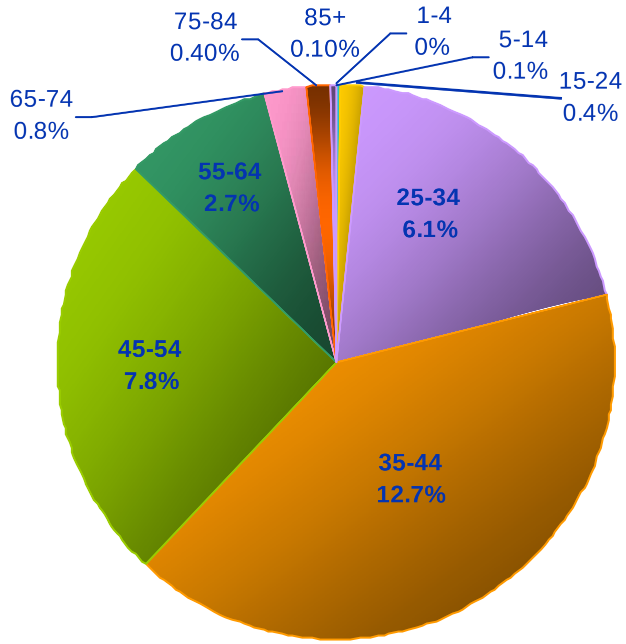
- The following weights are selected to create a profile of mortality risks by gender and age groupings

Age Weights: Male



Male = 68.8% of Total

Age Weights: Female



Female = 31.2% of Total

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Index Definition: Calculation Formula

The *Index Value* for Measurement Period ending on December 31 of year *t* can be expressed as:

$$\textit{Index Value}_t = \frac{\tfrac{1}{2} \times \left(q_t + q_{t-1}\right)}{\tfrac{1}{2} \times \left(q_{2005} + q_{2004}\right)} \times 100\%, \text{ where}$$

$$q_t = \sum_x \left(W_{x,m}\, q_{m,x,t} + W_{x,f}\, q_{f,x,t}\right)$$

$W_{x,m}$ is the weight applied at age group x to male Mortality Rates
$W_{x,f}$ is the weight applied at age group x to female Mortality Rates
$q_{m,x,t}$ is the Mortality Rate for males of age group x in calendar year *t*
$q_{f,x,t}$ is the Mortality Rate for females of age group x in calendar year t

Index Definition: Loss Payment

The *Index Value* is defined over a consecutive 2 year period

The *Index Value* is based on age and gender weighted death rates for the United States constructed from publicly available data sources, as defined at inception (CDC)

For any Class, a Trigger Event is deemed to have occurred when the Calculation Agent delivers a Calculation Report where the *Index Value* exceeds the respective *Trigger Level*

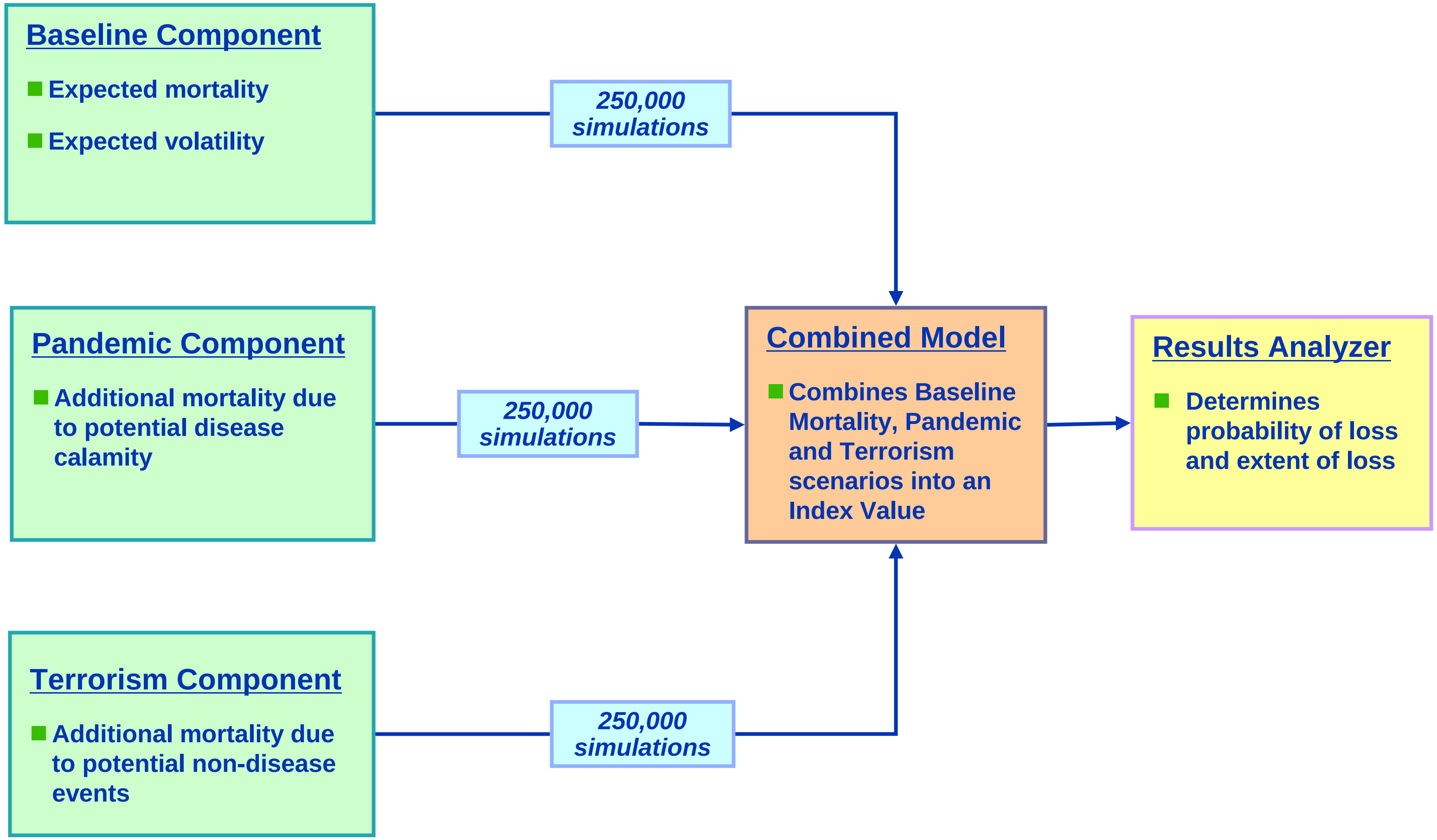
If a Trigger Event has occurred, the percentage of the original principal amount lost increases linearly between the *Trigger Level* and *Exhaustion Level*, calculated as:

$$\text{Loss Percentage} = \frac{\text{Index Value} - \text{Trigger Level}}{\text{Exhaustion Level} - \text{Trigger Level}} \times 100\%,$$

provided that the Loss Percentage shall not be less than 0% or greater than 100%

The *Reporting Agent* is the Centre for Disease Control (CDC)
The *Calculation Agent* is Milliman Limited.

Expert Modeling Approach: Overview

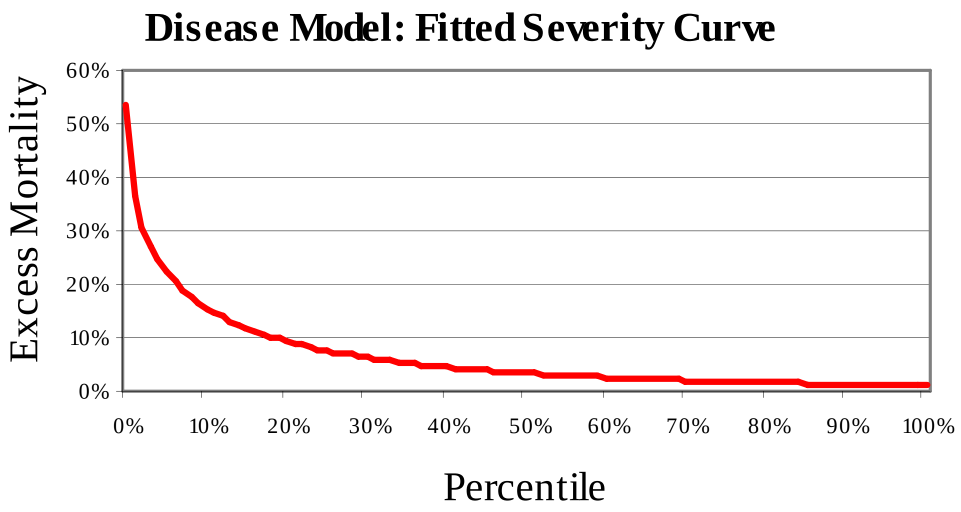


Expert Modeling Approach: Pandemic Component

- Pandemic Component – infectious disease epidemics:
  - **Frequency and severity modeled separately based on historical occurrences of infectious disease epidemics**
  - **Binomial modeled frequency of 7.4% per year, based on estimated 31 occurrences in the past 420 years, or 1 every 13.5 years on average**
  - **Modeled severity of epidemic event as the percentage of excess mortality fitted to 4 influenza and 1 SARS occurrences over the last century**
  - **Data points used: Adjusted 1918-20, 1918-20, 1957-58, 1968, 1977 and SARS 2003**
  - **The flu severity data are based on U.S. population experience**

Expert Modeling Approach: Pandemic Component

	Percentile	% Excess Mortality from Epidemic	Excess Mortality Rate ‰ from Fitted Curve
Adjusted 1918-20	0.0%	53.56%	2.9046
1918-20	3.2	26.55	1.4396
1957	27.4	6.92	0.3753
2003 SARS	51.6	3.23	0.1753
1968	75.8	1.78	0.0967
1977	100.0	1.08	0.0583



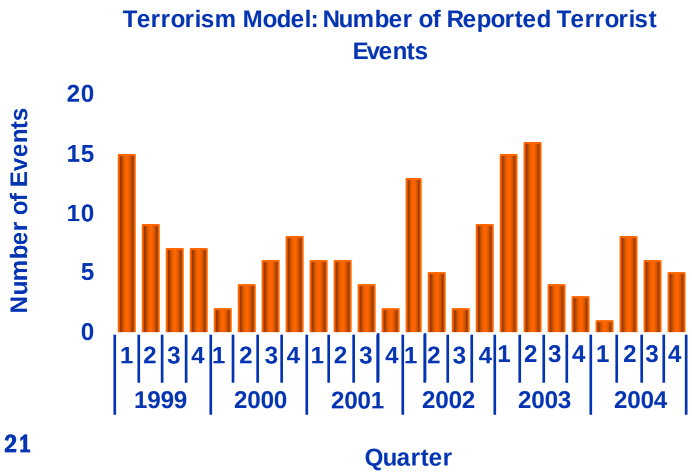
Expert Modeling Approach: Terrorism Component

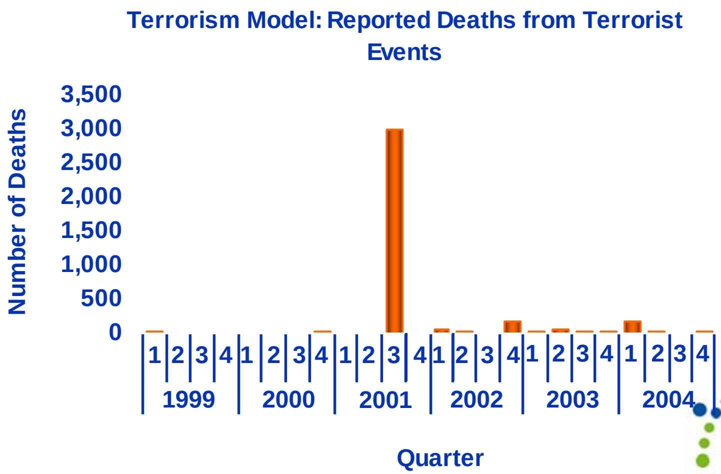
Frequency:

- **Frequency of terrorist events is chosen from a normal distribution, with an expected number of 6.8 events per quarter and standard deviation of 4.3**
- **This is based on a total of 163 recorded terrorist events world-wide between 1999 and 2004, where all events involved U.S. citizens or property (excluding Iraq and Afghanistan)**
- **1999-2003 data is from the U.S. State Department. 2004 data is from the National Counterterrorism Center, the U.S. government organization established in 2004 to serve as a "knowledge bank" on international terrorism**

Severity:

- **The probabilities of success, failure and escalation at all levels are determined by fitting an exponential distribution to the number of casualties from the data described above**





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Impact of Historical Events on the Index

- Several historical events have caused large numbers of deaths of U.S. citizens
- Most of these events produced fewer deaths than would be required to reach any Trigger Level for the Notes
- Estimated magnitudes of historical events required to reach the respective
- Trigger Levels for each Class, assuming that the Index is based on a reference year immediately prior to each event, are shown below

	Est. Magnitude[1] to reach Trigger Level	
Historical Occurrence	**Class B**	**Class A**
• Influenza Epidemic[2] (1918-20)	0.7x	1.0x
• World War II[3] (1942-45)	2.1x	3.2x
• Korean War[3] (1950-53)	17x	25x
• Vietnam War[4] (1968-69)	13x	20x
• AIDS (1995)	3.9x	5.8x
• September 11 (2001)	105x	158x

1) *Actual magnitude will vary depending on actual concentrations by age groupings.*
2) *Based on 29.6% increase in Index Value calculated using 1917 – 1920 CDC historical data.*
3) *Includes US military deaths only, averaged over 4 years.*
4) *Includes US military deaths only, based on worst years of 1968 and 1969.*

Mortality in Historical Natural Disasters

- There have been a number of devastating natural disasters in the U.S. over the past 100 years
- While these natural disasters have resulted in large amounts of property damage, such events would not have resulted in a large enough number of deaths to cause a loss to any Class of the Notes:

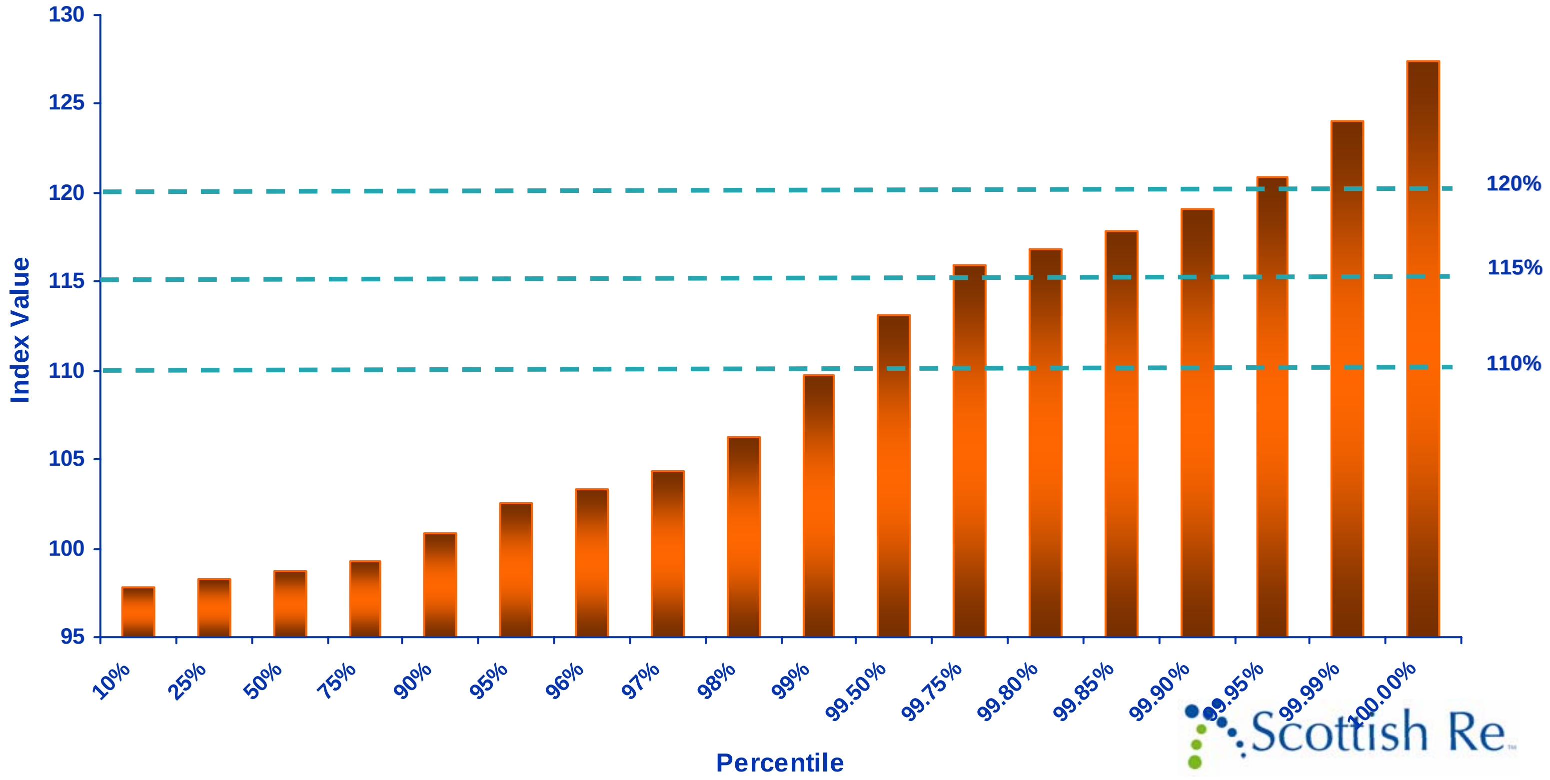
Natural Disasters in Recent United States History[1]

Event Type	Year	Fatalities
• Hurricanes Katrina/Rita/Wilma	2005	1,326
• Heat Wave	1995	670
• Tornado	1984	600
• Winter Storm	1983	500
• Tornado	1984	328

(1) Source: World Health Organization, Emergency Event Database

Distribution of Maximum Index Value

- The graph below shows the distribution of the maximum Index Value over the three-year projection period for the 250,000 model scenarios
- The results are summarized with an emphasis on the extreme right rail where the severe mortality scenarios are located



Tartan Capital Loss Profile

The following tables show the cumulative probability of loss of each Class of Notes over a three-year risk period, as well as the average loss (given that a loss has occurred) expressed as a percentage of the original principal amount

Summary of Modeling Results (bps)

	Total Risk Period		Annualized Results	
	Class A	Class B	Class A	Class B
• Estimated Probability of Attachment	29 bps	88 bps	10 bps	29 bps
• Estimated Probability of Exhaustion	7 bps	29 bps	2 bps	10 bps
• Estimated Expected Loss	16 bps	54 bps	5 bps	18 bps

Cumulative Probability of Loss (bps)

Year	Class A	Class B
• 1	0 bps	0 bps
• 2	21 bps	62 bps
• 3	29 bps	88 bps

Estimated Average Principal Loss Given a Loss Has Occurred

Class	% of Principal Loss
A	53%
B	61%

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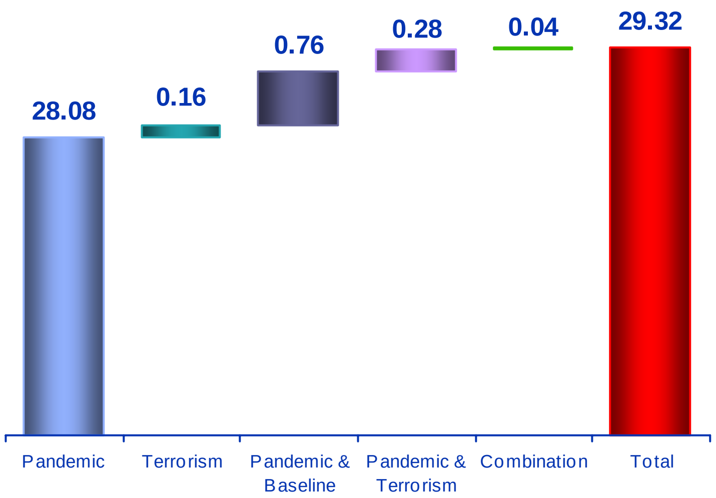
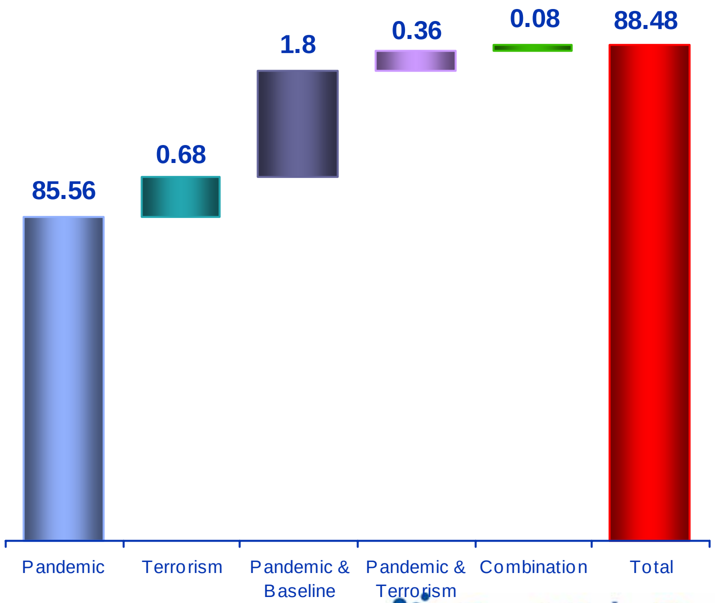
Attachment Probability Attribution Analysis

- The estimated probability of attachment over the Risk Period for Class A Notes is 29 bps and for Class B Notes is 88 bps. The graphs below depict the contribution by cause of each scenario in which the trigger level was reached
- In over 95% of these scenarios, the attachment may be attributed to the Pandemic Component alone

Class A (bps)



Class B (bps)



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Acknowledgement

This presentation draws on material prepared by, among others, Goldman, Sachs & Co., and Milliman Limited. While all care has been taken, any errors contained within are the responsibility of the author.

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