Aviation Reinsurance

CAS Spring Meeting

2005

Aviation Reinsurance

- Introduction to Aviation Reinsurance.

- Historical results.

- Reinsurance questionnaire.

- Different approaches to estimating loss costs.

- Conclusions.

Aviation Reinsurance

- Some proportional reinsurance but mainly large non-proportional (combined risk and cat) treaties.

    - Limited and paid reinstatements.

    - Sub-limit for third party war liability $50m.

- Coverage for Airline and Aviation Products broadly mirrors insurance policy.

- Global Whole Account premium ~ $500m
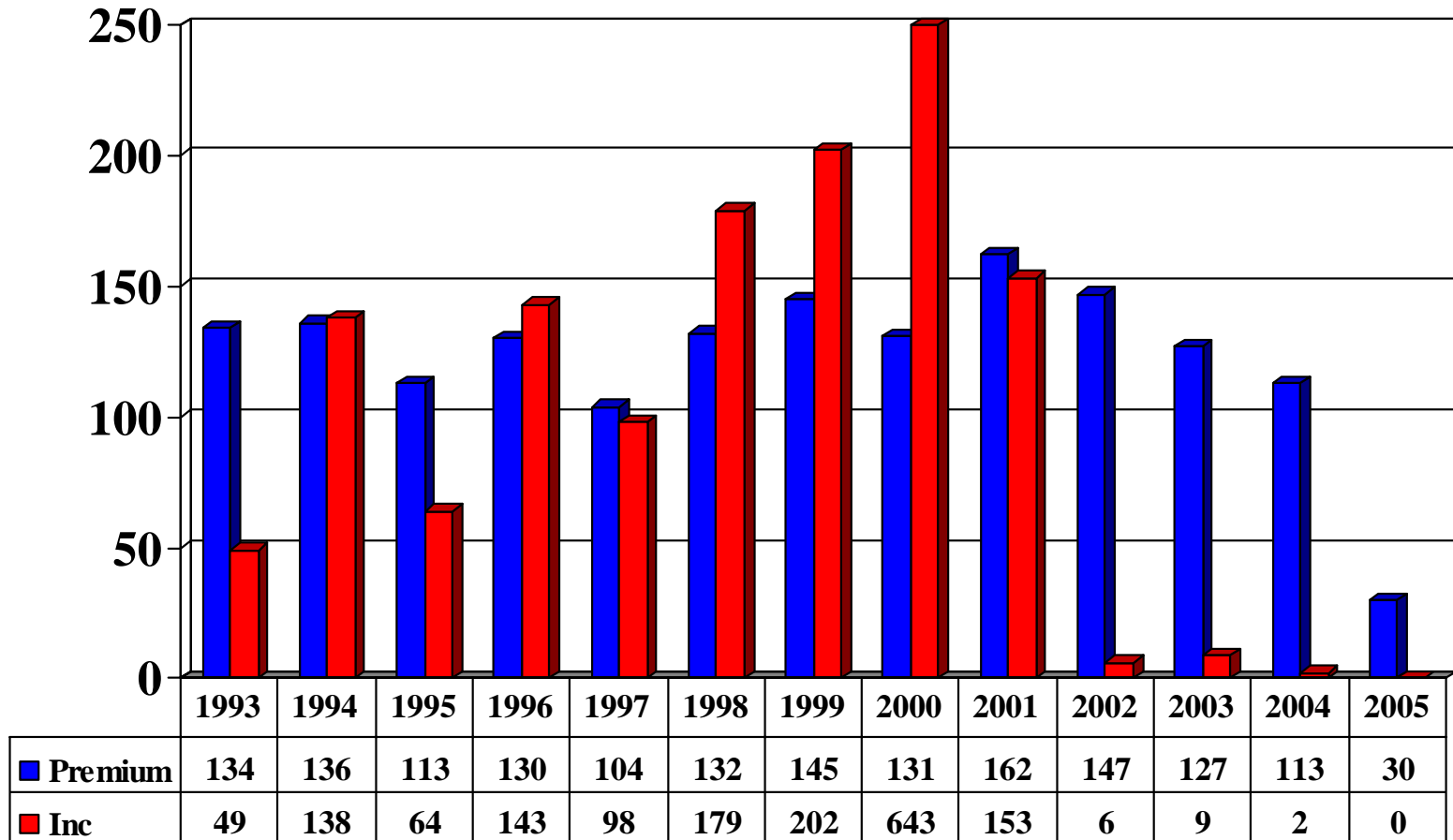
Aviation Reinsurance Programme Example

- Hypothetical reinsurance programme for insurer with a maximum acceptance of $250m any one risk:

  - 20% Quota Share   - net retention to XL $200m

  - $10m   x $10m   3 Reinstatements   - risk and catastrophe
  - $30m   x $20m   2 Reinstatements   - risk and catastrophe
  - $50m   x $50m   2 Reinstatements   - risk and catastrophe
  - $100m x $100m   1 Reinstatement   - risk and catastrophe
  - $200m x $200m   1 Reinstatement   - catastrophe

- Majority of programmes LORAD with rest on LOD.

Aviation Reinsurance Market Historical Results

- Graph shows accounted premium and incurred claims for Lloyd's Risk Code XY – Aviation Excess of Loss

- 1993 – 2004 Total Premium £1,600,907,468
- 1993 – 2004 Incurred Claims £1,686,647,994
  - Excluding INBR reserves
- 1993 – 2004 Incurred Loss Ratio 105.36%
  - Net of brokerage but gross of reinsurance

Lloyd's Risk Code XY – Premium and Incurred Claims (£m's)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Premium	134	136	113	130	104	132	145	131	162	147	127	113	30
Inc	49	138	64	143	98	179	202	643	153	6	9	2	0

Aviation Reinsurance Questionnaire

- Market standard questionnaire provided to reinsurer's detailing clients experience and exposures, including:

- Schedule A – Non US Airlines.

- Schedule B – US Airlines.

- Schedule C – Aviation Products.

- Combined schedules represent approximately 75% of global airline exposure.

Aviation Reinsurance Questionnaire Schedule A Example

SCHEDULE A

Non U.S.A. Airlines

Please advise NETT SIGNED LINE participation on all FACULTATIVE acceptances. (For Reinsured's who are Lloyd's Syndicates please advise whether these participations are subject to US Regulated Surplus Line and/or Reinsurance obligations).

Expiring limits shown. Please provide up to date renewal information where necessary.

Airline	Period 12 months @	Hull					Liability				
		Original Limit	Net line %				Original Limit	Net line %			
			2003	2004	2005			2003	2004	2005	
Aero Mexico / Mexicana (CINTRA)	01-Jun-04	US$ 100 m					US$ 1,500 m				
Aeroflot	03-Jul-04	US$ 176 m					US$ 751 m				
Air 2000	01-Nov-03	US$ 120 m					£ 1,000 m				
Air Algerie	01-Oct-03	US$ 80 m					US$ 1,000 m				

# Aviation Reinsurance Questionnaire Schedule G Example

SCHEDULE G

Major Loss Details

Please advise your NET LOSS based on the reserves recommended by the authorised party named in the Claims Handling Agreement.

Year	Loss	Date	Hull Unl	Liab Unl	Prop Tty	Risk Excess	XL	Total	Total As per Expiring Questionnaire
1993	State of S. Dakota/Hartzell	19-Apr-93							
	Avianca/SAM Colombia	19-May-93							
	Rocky Mountain Helicopters	27-May-93							
	C.A.A.C.	23-Jul-93							
	Asiana	26-Jul-93							
	Cambridge Aviation	05-Sep-93							
	Air France	13-Sep-93							
	Lufthansa	14-Sep-93							
	China	04-Nov-93							
	Express Airlines	01-Dec-93							
	Management Activities	15-Dec-93							

Approaches to Estimating Loss Cost

1. Subjective/Intuitive.

2. Top-down market analysis.

3. Historical claims analysis.

4. Bottom-up stochastic modelling.

Increasing Actuarial Input
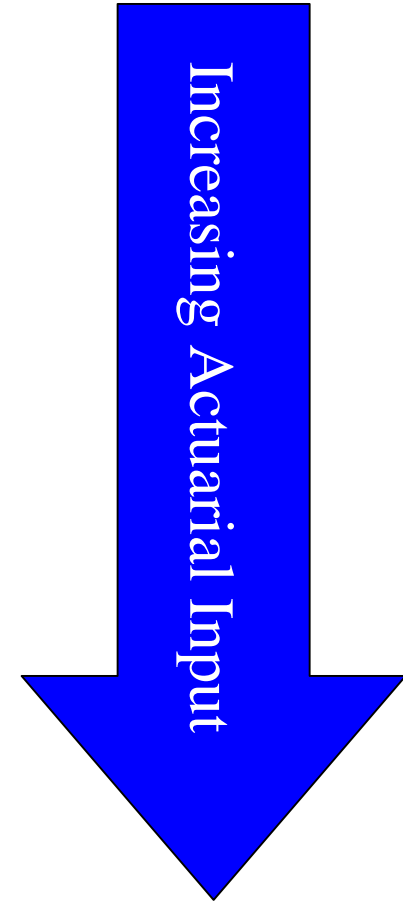
1 – Subjective/Intuitive

- Relies on the skill and experience of the underwriter.

- Historically the way the market developed.

- Takes into account **all** underwriting factors.

- Extremely flexible method.

2 - Top-Down Market Pricing

- Similar approach to direct pricing.

    1. Estimate losses for whole market.

    2. Allocate losses to excess points.

    3. Estimate reinsured's market share.

2 - Top-Down Market Pricing Example

- Expected global losses $850m split over the following layers:

    $150m   x $100m   - $250m

    $250m   x $250m   - $200m

    $500m   x $500m   - $225m

    $1,000m x $1,000m - $175m

2 - Top-Down Market Pricing Example

- Looking to estimate losses to following reinsurance layers:

  - $40m   x $10m
  - $50m   x $50m
  - $100m x $100m

- For reinsured that has a 10% line and an 80% market penetration.

2 - Top-Down Market Pricing Example

- Reinsurance layers equate to the following 100% limits and excess points:

  - $400m   x $100m
  - $500m   x $500m
  - $1,000m x $1,000m

- Apply reinsured line and market share to calculate loss costs.

2 - Top-Down Market Pricing Example

- Expected losses:

  - $40m x $10m   = $36m
  - $50m x $50m   = $18m
  - $100m x $100m   = $14m

- Equivalent 100% approach **very** common.

- Methodology particularly useful for **insurers** when analysing outwards reinsurance and net underwriting position.

3 - Historical Claims Analysis

- Various methods of increasing sophistication.

- Based on the premise that past losses are in some way representative of future losses – "As-If" problem.

- Very good data available for global aviation losses.

  - Following are fields available from Airclaims CASE database.

3 - Historical Claims Analysis Examples of Loss Data Available

- Date of Loss
- Aircraft Manufacturer and Type
- Operator
- Registration Number
- Passenger/Crew on Board
- Passenger/Crew Fatalities
- Location
- Aircraft Variant
- Service Type

- Serial Number
- Hull Value
- Hull Loss
- Liability Loss
- Generic Market Value
- Occurrence
- Phase of Flight
- Year of Build

3 - Historical Claims Analysis
Actual Experience

- Actual experience of allows for calculation of expected loss cost and volatility.

  - Either for whole market or for particular reinsurance layer.

- Problematic if reinsurance structure and portfolio have change over time.

- Can include explicit allowance for exposure changes over time if required.

3 - Historical Claims Analysis "As If" Experience

- Historical experience of current reinsurance based on current portfolio.

  - Map to current Questionnaire.

- Still based on actual losses but often apply claims inflation factor.

- Very popular analysis produced by brokers as underestimates "true" picture.

3 - Historical Claims Analysis Frequency/Severity

- Increasingly popular method using sophisticated techniques.

- Fit distributions to claim frequency, claim severity, and reinsured participation.

- Simulation allows calculation of various statistics for reinsurance programme.

- Explicit assumptions can be made regarding claim trends but still fundamentally based on value of historic losses.

3 - Historical Claims Analysis
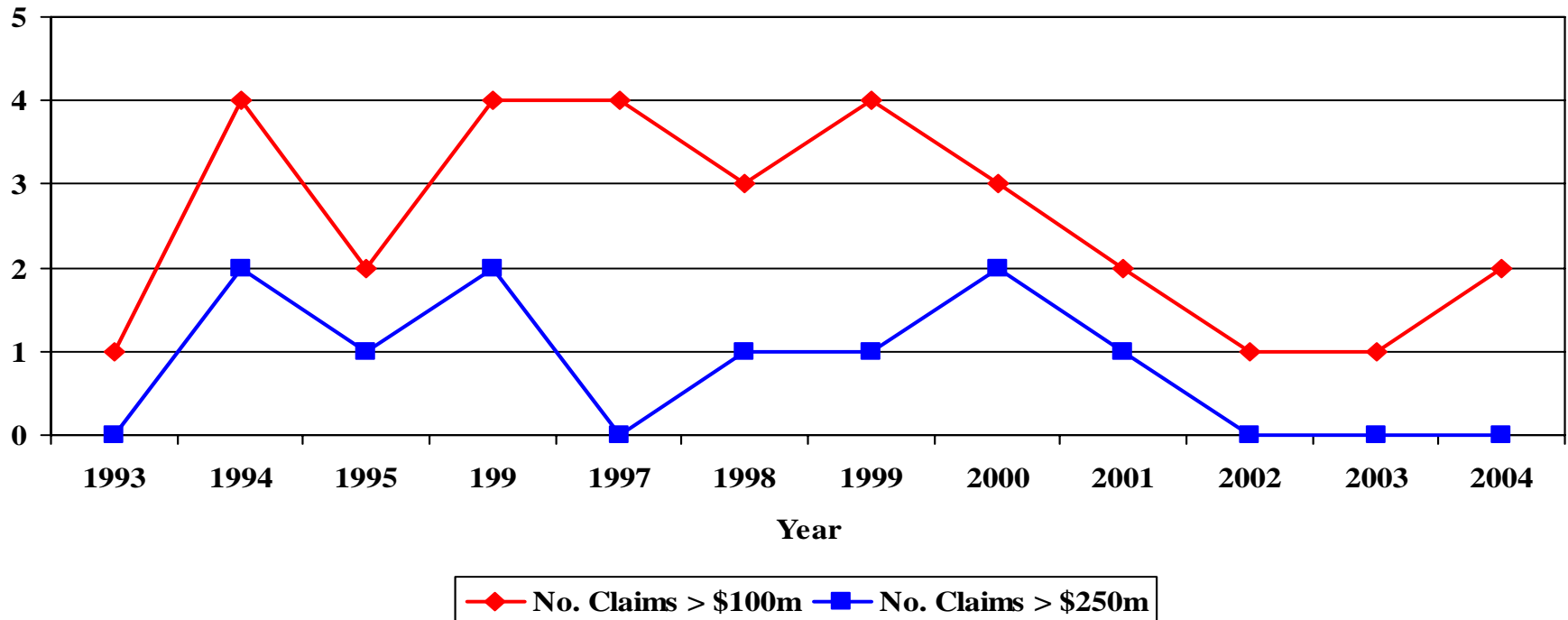# Frequency/Severity
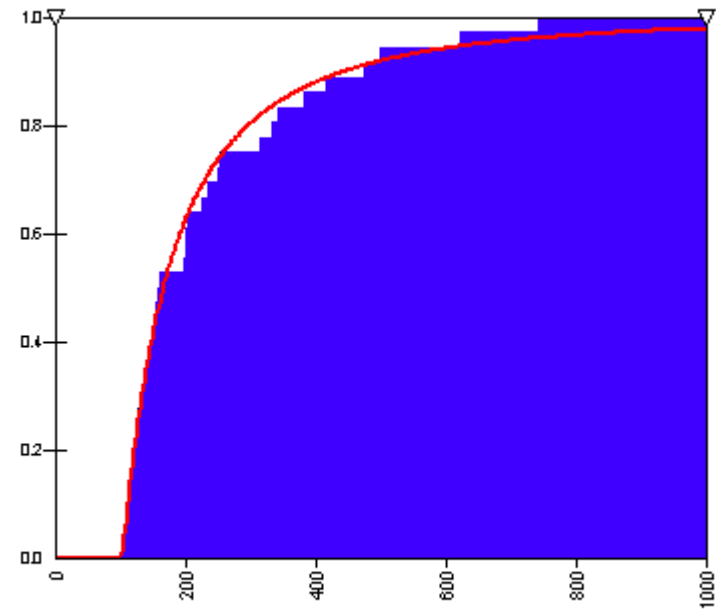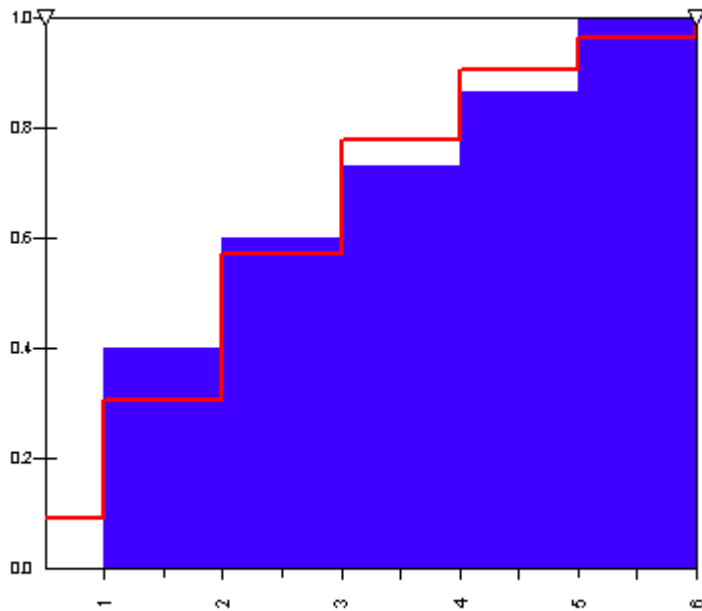
3 - Historical Claims Analysis Frequency/Severity

- Assumptions regarding claim frequency are main driver of expected losses.
    - Distribution
    - Parameters

- Severity problematic as loss curve probably not smooth.

- Very topical issue due to low frequency of losses over past 3 years.

# 3 - Historical Claims Analysis Frequency/Severity

Claim Frequency

Legend: ◆ No. Claims > $100m ■ No. Claims > $250m

X-axis (Year): 1993, 1994, 1995, 199, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004

3 - Historical Claims Analysis Frequency/Severity

Average Claim Counts	>$100m	>$250m
10 Yr	2.6	0.8
5 Yr	1.8	0.6
5 Yr – 10 Yr	+45%	+33%

3 - Historical Claims Analysis Frequency/Severity - Exposure

In Service Aircraft
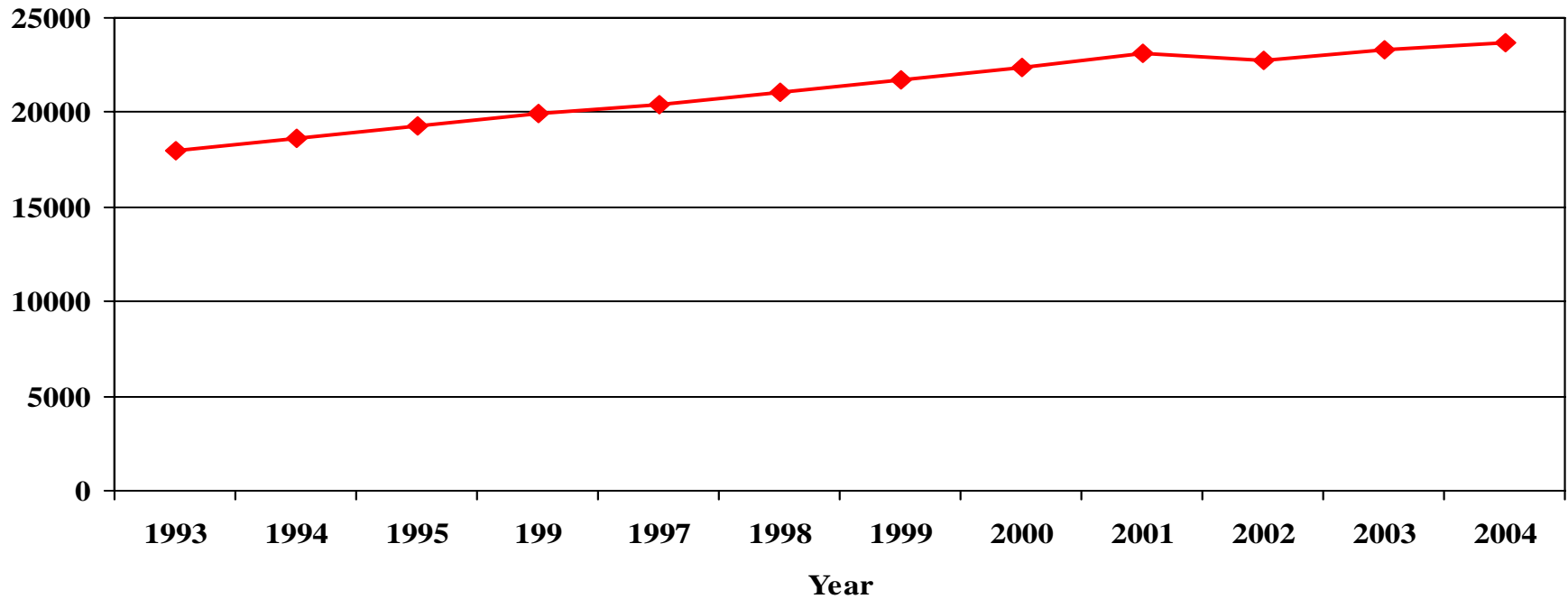
4 - Bottom-Up Pricing

- Break-down constituent parts of losses and model separately.

- Approach possible as very detailed data available for exposures and losses.

- Allows parameters based on expectations for future losses.

- Avoids problems associated with "inflating" historic losses.

4 - Bottom-Up Pricing
Examples of Exposure Data Available

- Status
- Manufacturer and Type
- Variant
- Registration Number
- Serial Number
- Line Number
- Year of Build
- Operator
- Manager

- Seats
- MTOW
- Hours/Cycles
- Usage
- Generic Market Value
- Financiers
- Noise Code
- Owner
- Engines

4 - Bottom-Up Pricing

- Simulation Model

    - Frequency of hull total loss by region
    - Allocate airline and aircraft to loss.
    - Simulate No. passengers from seating configuration and passenger load.
    - Simulate a fatality rate.
    - Allocate passenger fatalities to award regions.
    - Calculation of passenger liability.
    - Simulate third party damage.
    - Simulate any aviation products contribution.
    - Calculation of UNL from reinsured participation on airline and products.
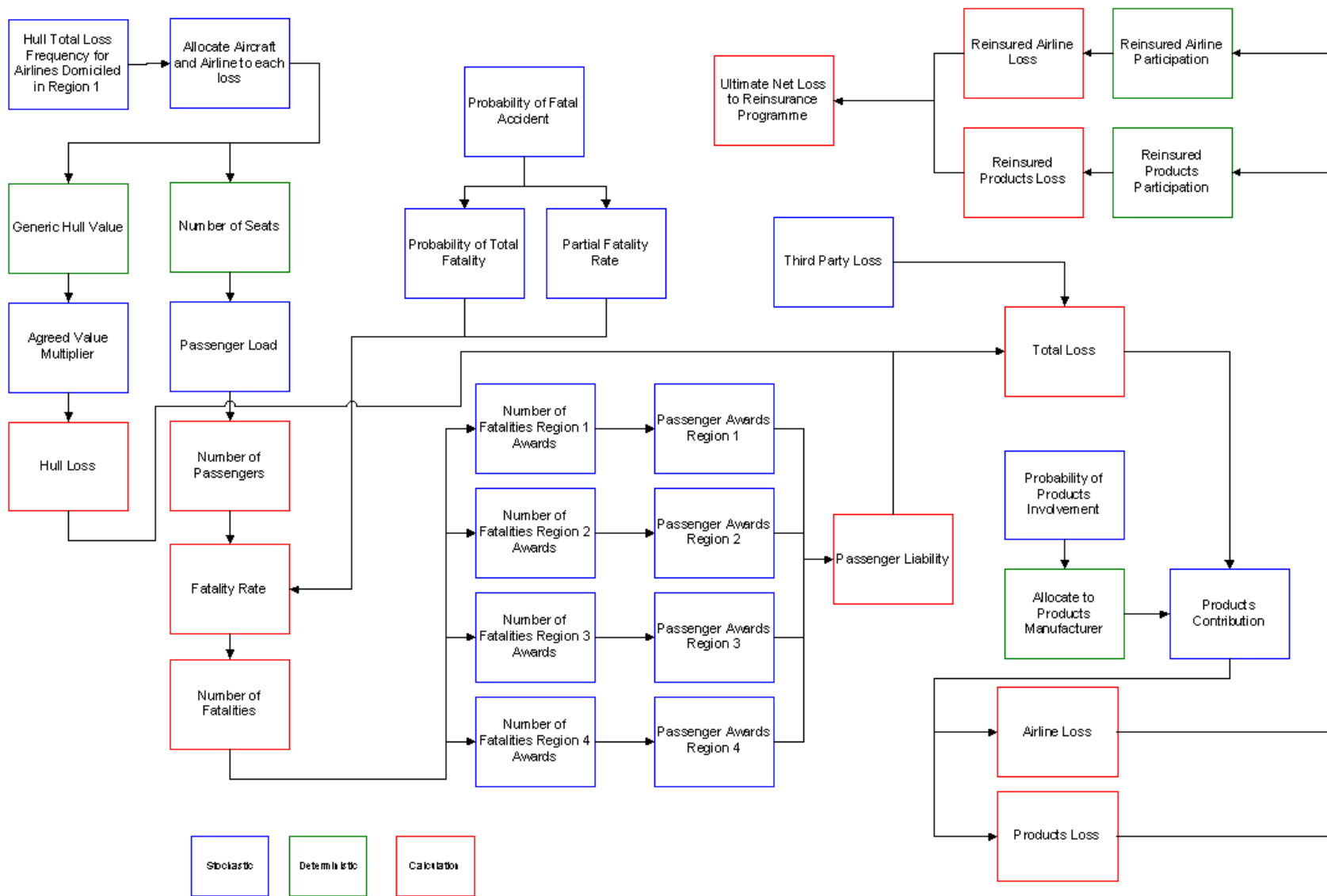
Conclusion

- Various approaches to estimating loss cost.

- Full analysis will include as many as possible and combinations of various methods.

- Increasingly sophisticated models analyse increasingly smaller sections of total exposure.

- Actuaries should be involved in **all** elements of pricing, especially the subjective side.

Approaches to Estimating Loss Cost

1. Subjective/Intuitive.

2. Top-down market analysis.

3. Historical claims analysis.

4. Bottom-up stochastic modelling.

Actuarial Input

Underwriter Input