Claim dependencies in economic capital modeling: The Australian experience

B. Avanzi[✪,★], G. Taylor[★], B. Wong[★]

49th Actuarial Research Conference
Session B1 on Enterprise Risk Management, 14 July 2014

★ School of Risk and Actuarial Studies, University of New South Wales
✪ Département de Mathématiques et de Statistique, Université de Montréal

UNSW AUSTRALIA

Université de Montréal

Outline

1. Why are we interested in this?
2. The Australian framework and practice
3. Sources of dependencies
4. Main areas in need of development
5. Discussion

Motivation

- Dependence structures can have a major impact in several areas of Enterprise Risk Management, including quantifying economic capital
- Less-than-full dependence creates diversification benefits, whose accurate estimation is crucial for:
  - Capital efficiency (not overestimate the capital that is needed)
  - Solvency (not underestimate the capital that is needed)
- Current modelling practices are lacking in that they could be more accurate and more coherent

The Australian regulatory framework (1)

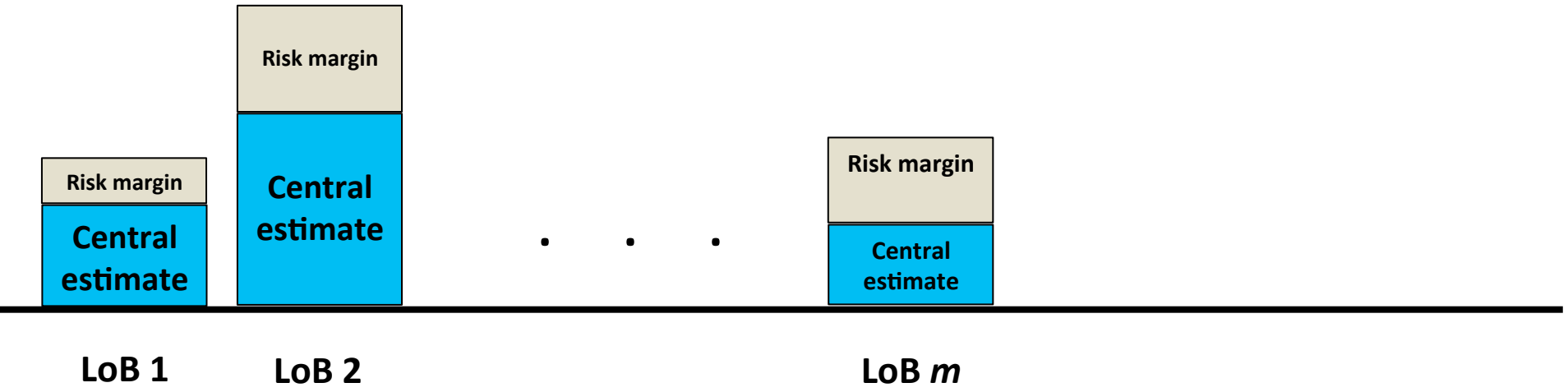
- General insurance (aka Non-life, or Property & Casualty) regulated by the Insurance Act 1973
- Regulator is the Australian Prudential Regulation Authority (APRA)
  - Also regulates life insurance, banking and employee benefit funds
- APRA promulgates **Prudential Standards** and **Practice Guides** to prescribe the detailed operation of its supervision

The Australian regulatory framework (2)

- Prudential Standards and Practice Guides of particular interest
  - **GPS 320** requires a loss reserve for each LoB to include a risk margin such that the reserve **over all LoBs** is equal to the 75% VaR associated with the liability
  - **GPG 113** requires an insurer to hold capital (net assets) such that the total amount of available assets is equal to the 99.5% VaR associated with the total liabilities, taking account of **all risks** (e.g. operational risk)
  - **GPS 110** deems an insurer to satisfy this last VaR if its net assets are at least equal to either:
    - an amount calculated by reference to a prescribed statutory set of parameters (one size fits all); or
    - The VaR generated by the internal model of the insurer, accepted by APRA for the purpose

Effect of diversification benefits on risk margins

Multiple lines of business

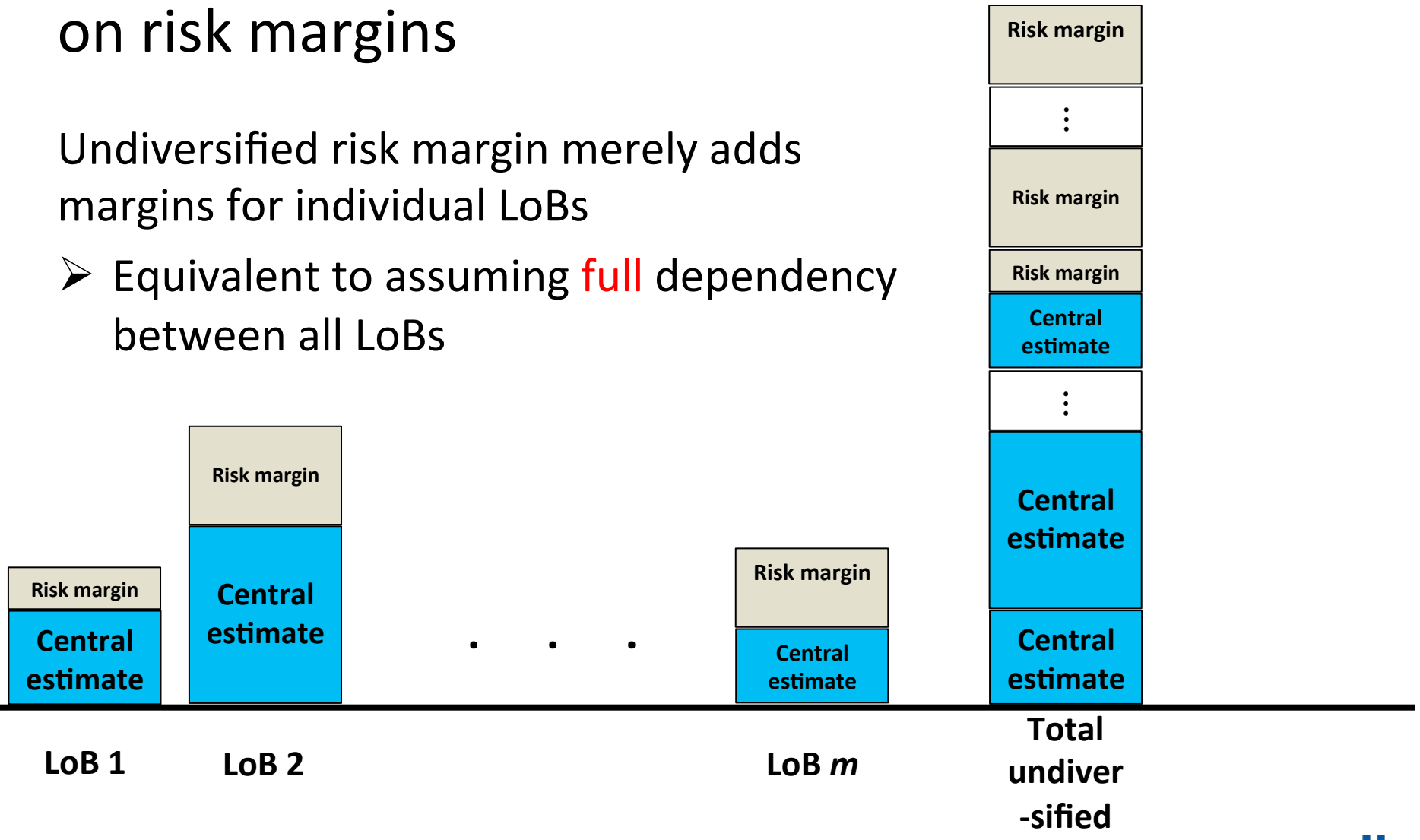


Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

Effect of diversification benefits on risk margins

Undiversified risk margin merely adds margins for individual LoBs

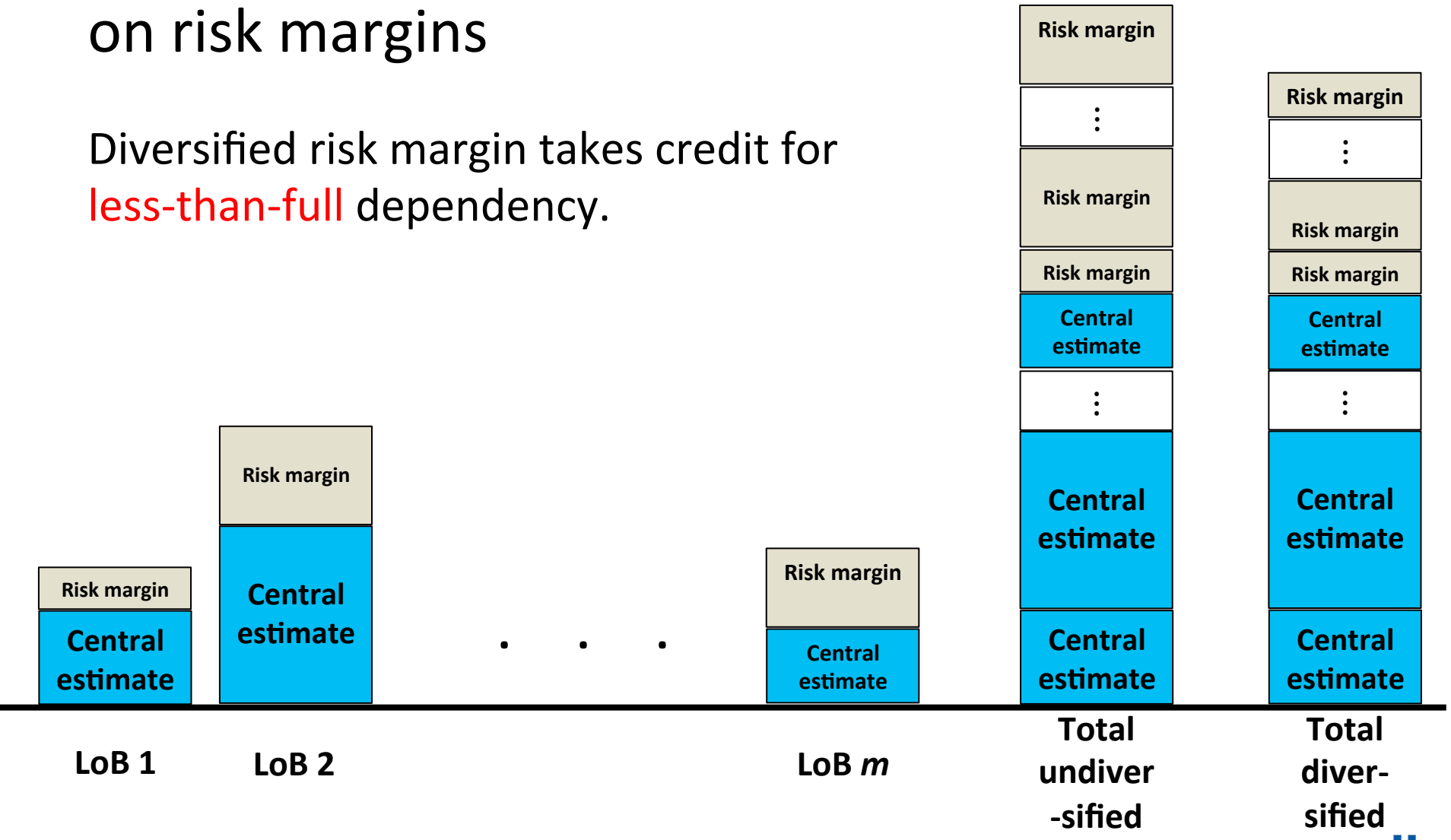
- Equivalent to assuming full dependency between all LoBs



Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

Effect of diversification benefits on risk margins

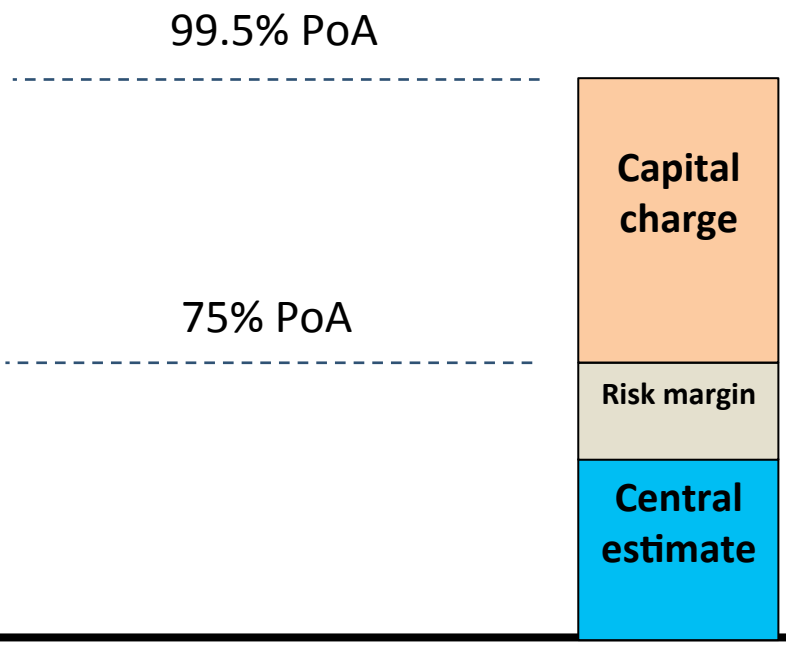
Diversified risk margin takes credit for less-than-full dependency.



Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

Effect of diversification benefits on capital charges

Capital charges are just enlargements of risk margins



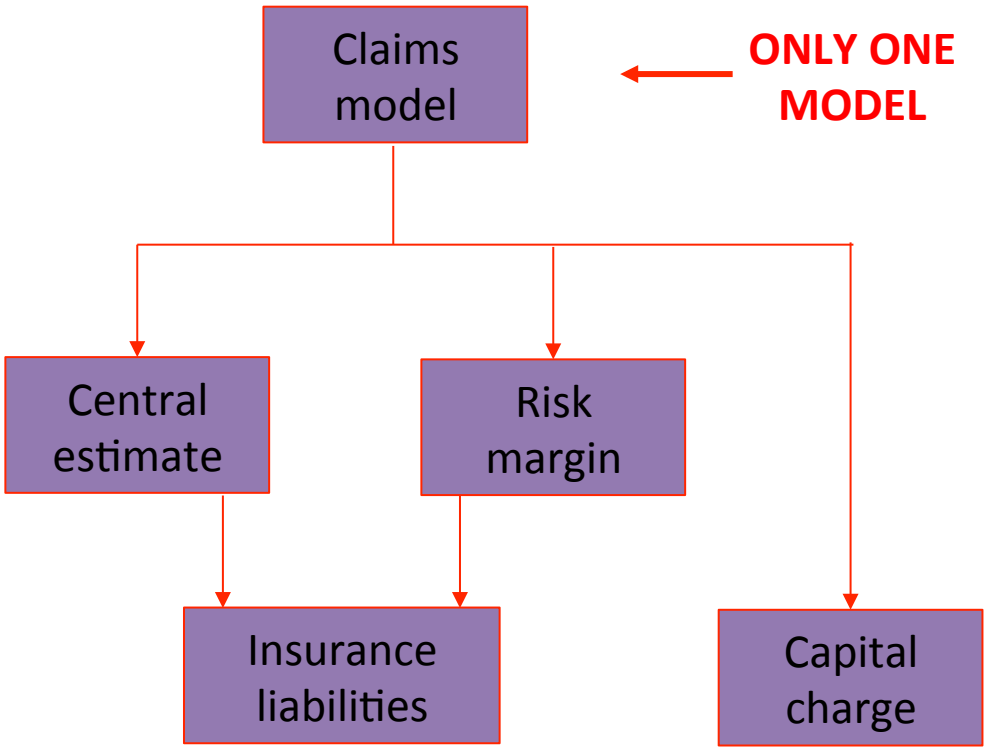
Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

Reserving, margins and modelling

The following are read-outs from the same distribution of liabilities:

- Central estimate
- Central estimate + risk margin
- Central estimate + risk margin + capital margin

There must be (at least "should be") consistency (**"coherency"**) between the claim models from which these quantities are derived.

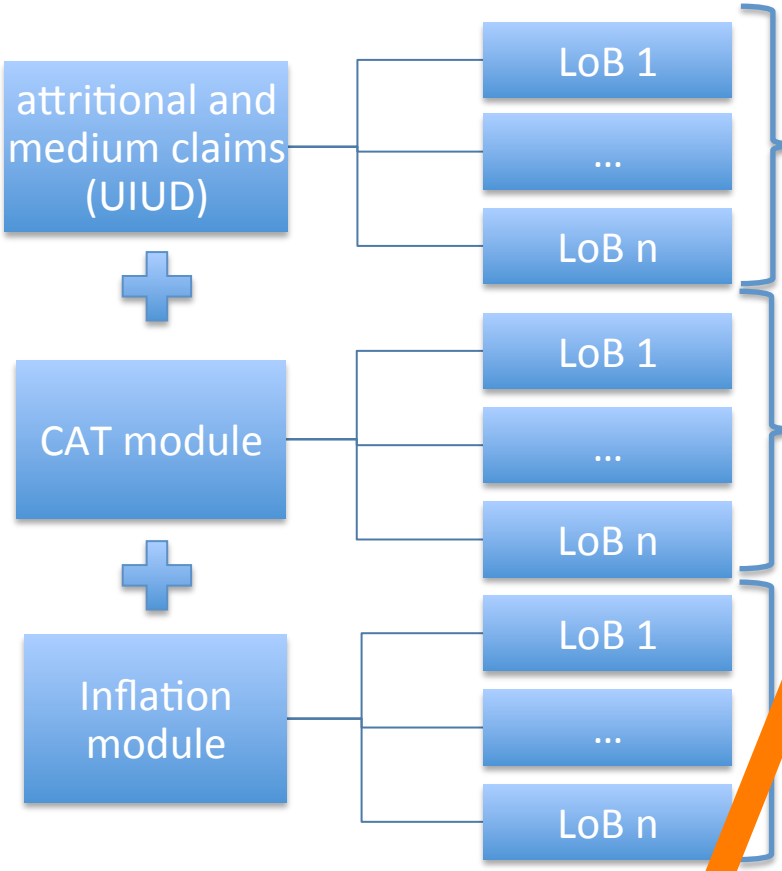


Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

UNSW AUSTRALIA
Université de Montréal

Australian practice

Piecemeal dependence construction
(e.g. t-copulas with about 15 deg. freedom)
Some idea of the origin of dependencies, but with no (or little) idea how to estimate those



UW and reserve risk considered separately
Attritional & medium : ≤ $250 million
UIUD = uninflated, undiscounted
DUBIOUS (IF ANY) ACCOUNT FOR DEPENDENCE

Advanced CAT modelling in use (software from, e.g., Risk Frontiers, RMS, AIR, EQECAT)
SPECIFIC, ACCOUNT FOR DEPENDENCE (PRESUMED ACCURATE)

Two modules: A - standard inflation (economic – CPI, AWE or hybrid) and B - superimposed inflation (what goes above and beyond 1)
SOME ACCOUNT FOR DEPENDENCE, BUT LACKING (ESPECIALLY FOR B)

Usually common scenarios models (CAT: on development year, inflation: on accident

Avanzi, Taylor & Wong (2014)
Claim dependencies in economic capital modeling: The Australian experience

UNSW AUSTRALIA
Université de Montréal

Australian practice

Furthermore:

- Not the same methodology for reserves and capital:
  - Risk margins: e.g. correlations (to compute variances)
    - Sometimes not even same methodology for central estimate and risk margin
  - Capital charge: e.g. (t-)copulas
- Regulator pushes for more coherency in the modelling
- Correlations are calibrated using (very small sample) expert opinions, not with data
- Little or no use of dependency structures in pricing or behavioural models (for estimating risk loading, cost of capital etc…)

Sources of dependence heat map

	Motor[1]	CTP[1]	WC	Liability	Property
Idiosynchratic					
Catastrophic					
Inflation					
Social *					
Fraud					
Internal factors **					
Weather					

None
Minor
Major
Critical

[1] Motor=Auto Property Damage and CTP=Auto Bodily Injury.

* includes: economic, medical, societal, judicial, political, technology, …

** includes: same actuary, same manager, data systems

Anything to add / change?

Main areas in need of development

- Superimposed inflation
- Identification and modelling of causes of dependence for attritional claims
- Differential treatment of past vs future dependence structures (type and strength)
- Impact of weather on some lines
- Improvement of practices using correlations, e.g.
  - Accumulation and selection of matrices
  - Reconciliation with methods better suited to tails

Discussion

We would like ideas / feedback on:

- Importance of dependence in actuarial modelling
- Your understanding of what the most important current issues are
- Sources of dependence: which are the ones that matter and should be modelled?