

MODELLING AND MANAGEMENT OF LONGEVITY RISK

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Plan

- Longevity risk
- Modelling
- Robustness
- Hedging longevity risk

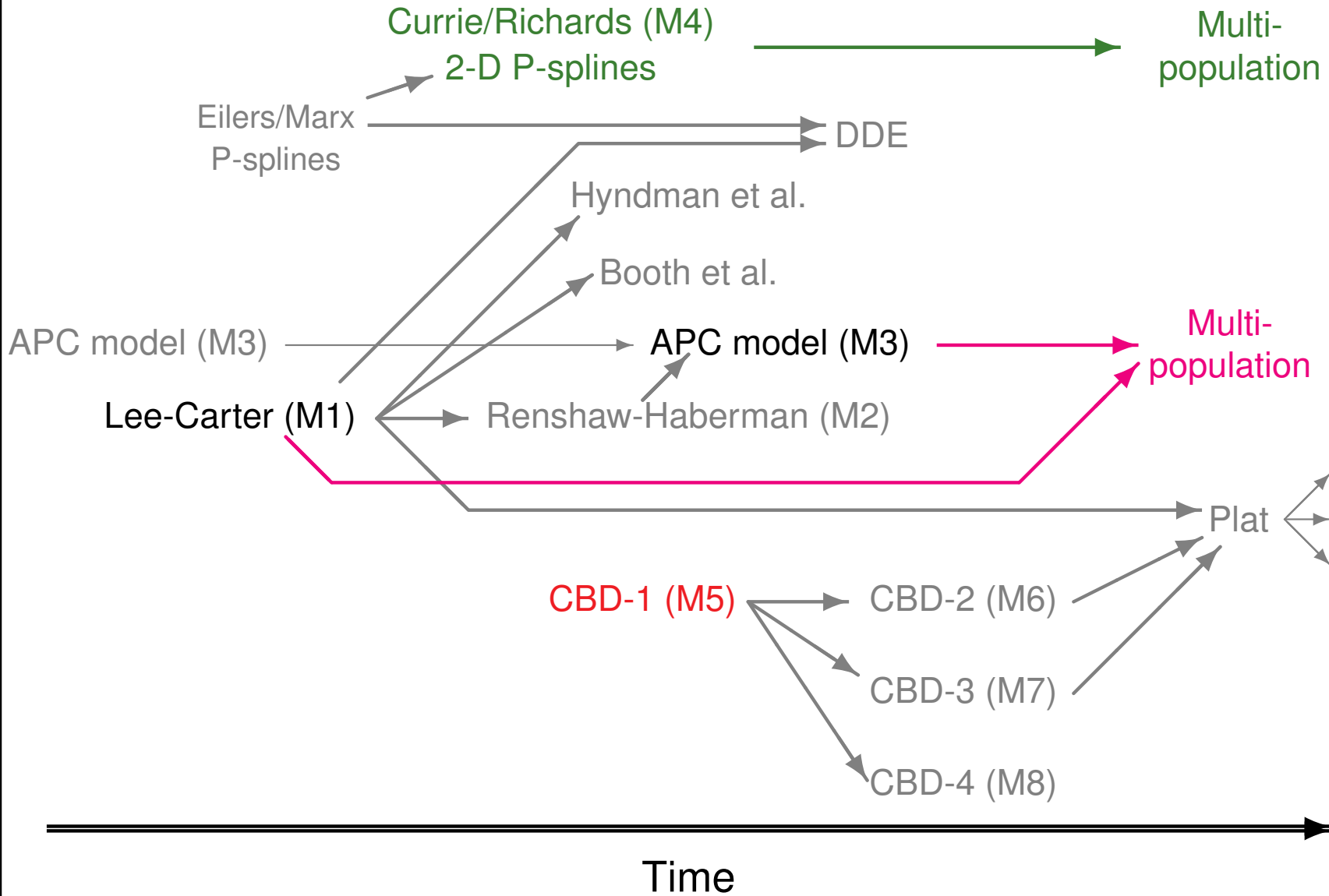
What is longevity risk?

*The risk that a group of pensioners **survive**, in aggregate, for longer **than anticipated**.*

Objectives of work:

- Stochastic modelling of future mortality
 - Multiple populations
- Longevity risk measurement
- Reserving for longevity risk
- Longevity risk management

Modelling Genealogy



Modelling challenges

- Robust modelling of multiple populations
- Greater understanding of modelling assumptions and limitations
- Data
 - Volume: years + age range
 - Reliability: deaths and exposures

Much done, but work more needed on all fronts

Robustness

- Model fit to historical data
- Forecasts of future mortality rates
- Business decisions: e.g.
 - reserving
 - volumes of new business
 - hedging decisions

Customised vs Index-Based Hedges

Customised \Rightarrow hedge linked to pension plan's own mortality experience

Index-based \Rightarrow hedge linked to e.g. national mortality index

\Rightarrow population basis risk

e.g. q -forwards, S -forwards (www.llma.org)

Risk Management Decisions

Are pension plans getting the right advice?

Why have there been so few index-linked longevity transactions?

Barriers to growth of index-based hedges

- ?? Pension plan risk appetite \Rightarrow customised
- Consultants avoid consideration of index-based hedges:
 - assessment of basis risk *perceived* as difficult
 - assessment of sponsor's risk appetite is difficult
 - communication of hedging solution *perceived* as difficult
 - reputational risk

A highly stylised example of good practice

Good ERM \Rightarrow consideration of ALL options

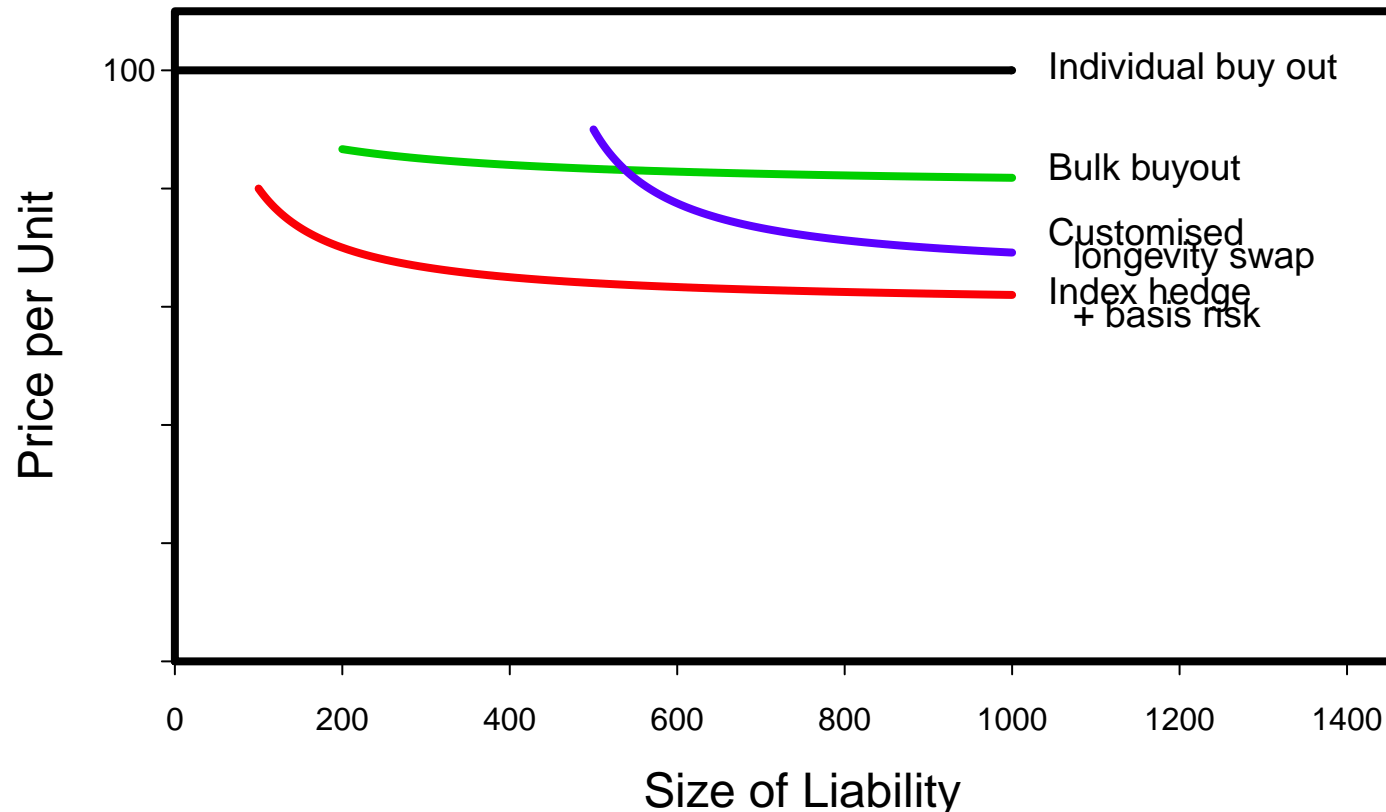
Expected Utility \leftrightarrow Risk Appetite

Options for risk management e.g.:

- no action
- individual buyouts (customised)
- bulk buyout (customised)
- longevity swap (customised)
- index-based swap e.g. q -forward

Longevity risk management options

Price Per Unit of Liability (Stylised!)

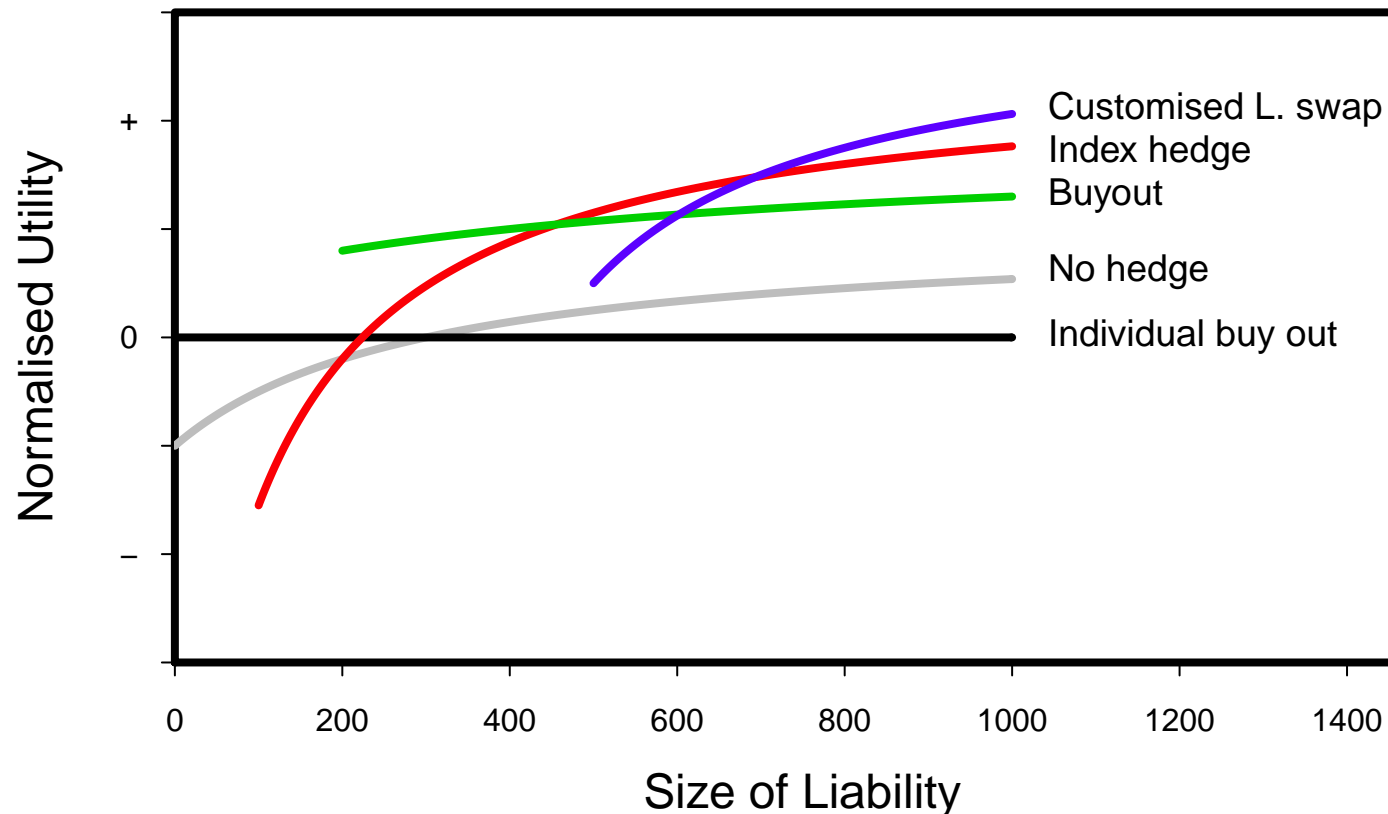


Issues: size thresholds; fixed costs; basis risk; sampling risk

WARNING: this figure is about concepts – it has no scientific basis!!!!

Choosing between the options

Normalised Utility (Stylised!)



Issues: Varying unit price; Poisson risk; basis risk; risk aversion

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Discussion

- Index-linked hedges have great potential
- Index-linked hedges have greater potential for robustness problems
- But these can be overcome:
 - More robust multi-population models
 - Careful choice of hedging instrument and maturity
 - Robust hedging strategies

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