Merchants Hall (Edinburgh) and Regus Citypoint (London)

Why we need stochastic projection models

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Plan of talk

1. Why we need a stochastic projection model
2. Why we need several models
3. Which models to use
4. Conclusions and questions

1. Why we need a stochastic projection model

Mortality projections in 20th Century

- Historically actuaries relied on deterministic scenarios
- Often rates or improvements blending to a long-term value
- Such models are called *expectations*
- Cannot say how likely or unlikely such scenarios are

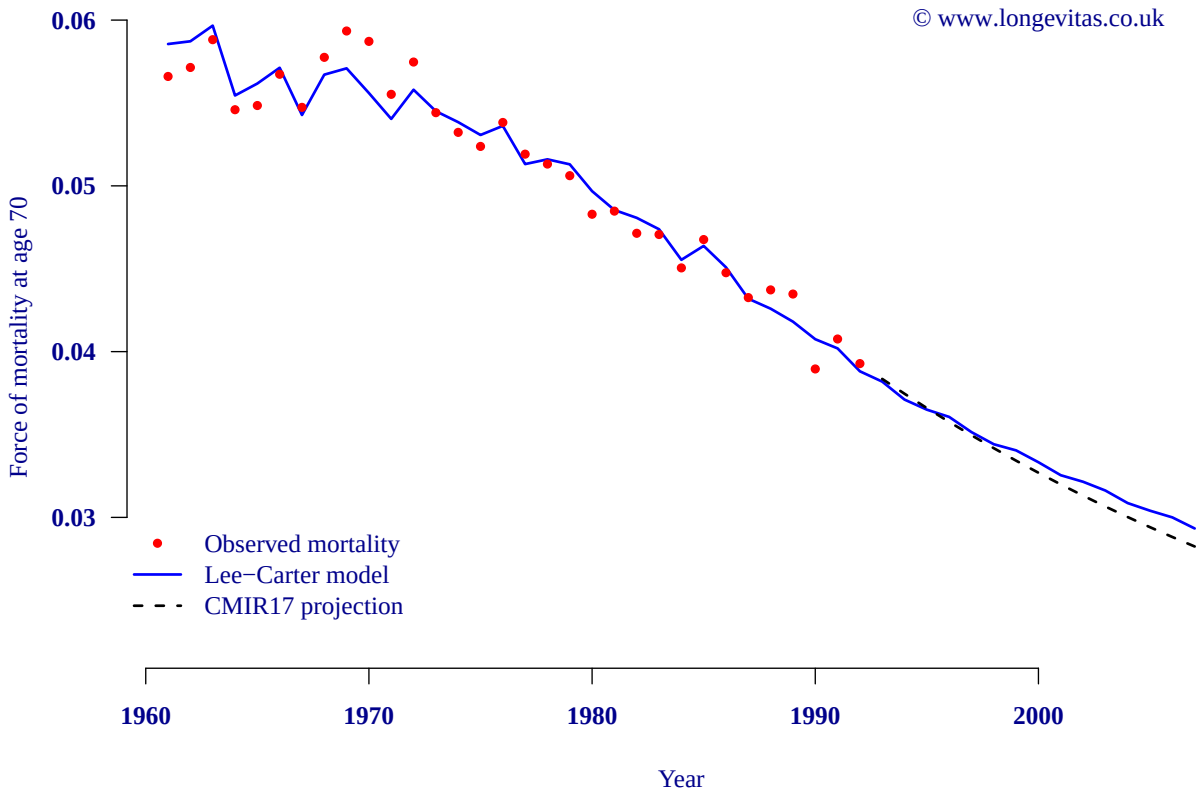
Mortality projections in 21st Century

- Measuring uncertainty is a key part of ICA
- Solvency II has similar aims
- A stress test ideally has a probability attached to it
- Such tests and probabilities come from *stochastic projections*

An illustration — back-testing

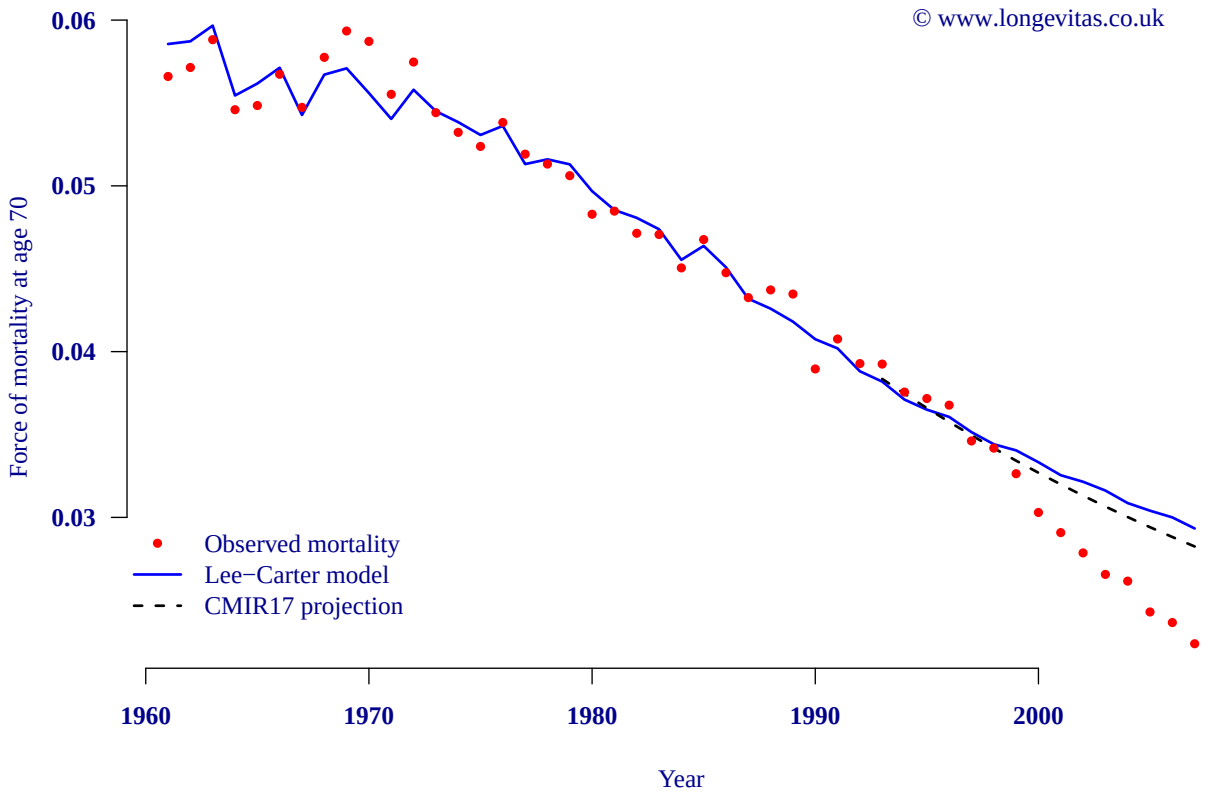
- Take a long data series
- Discard latter years and fit projection model
- Compare projected rates with what actually happened

Back-testing: fit model to data to 1992



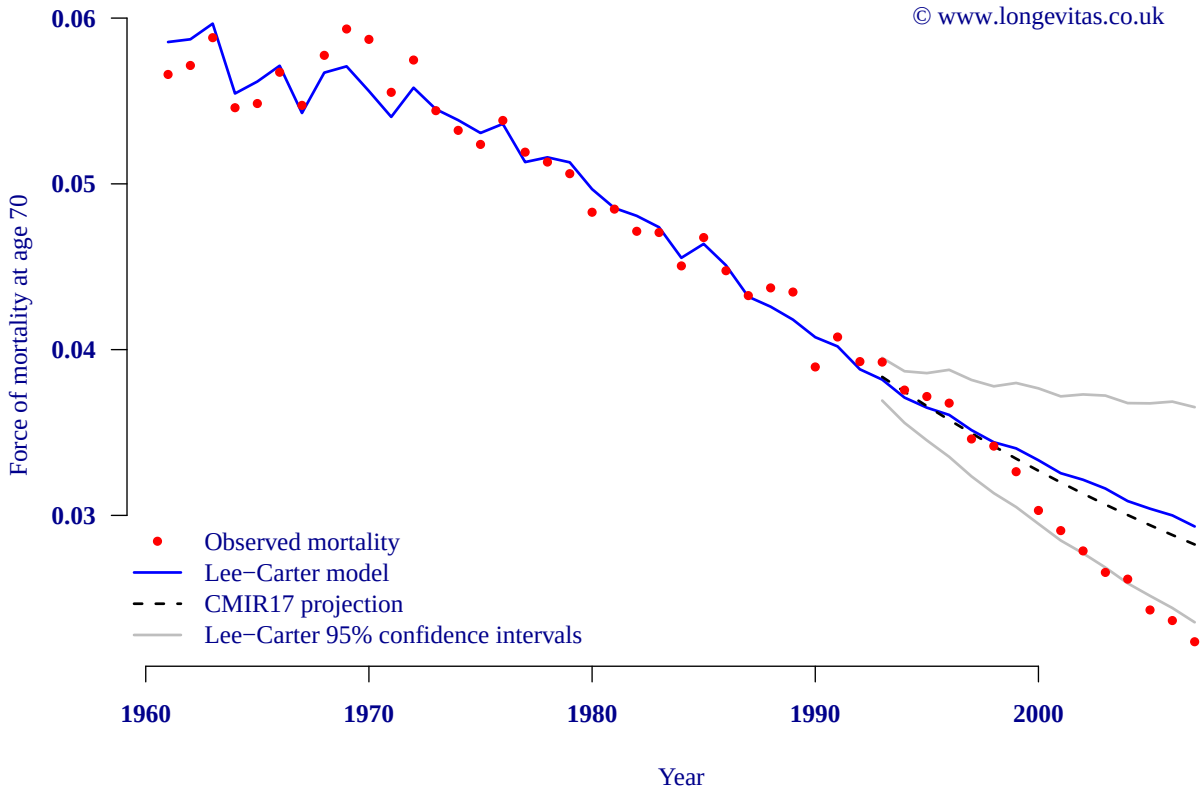
Source: Longevitas Ltd. ONS data, CMIR17

Back-testing: compare projections to actual data



Source: Longevitas Ltd. ONS data, CMIR17

Back-testing: compare data to confidence intervals



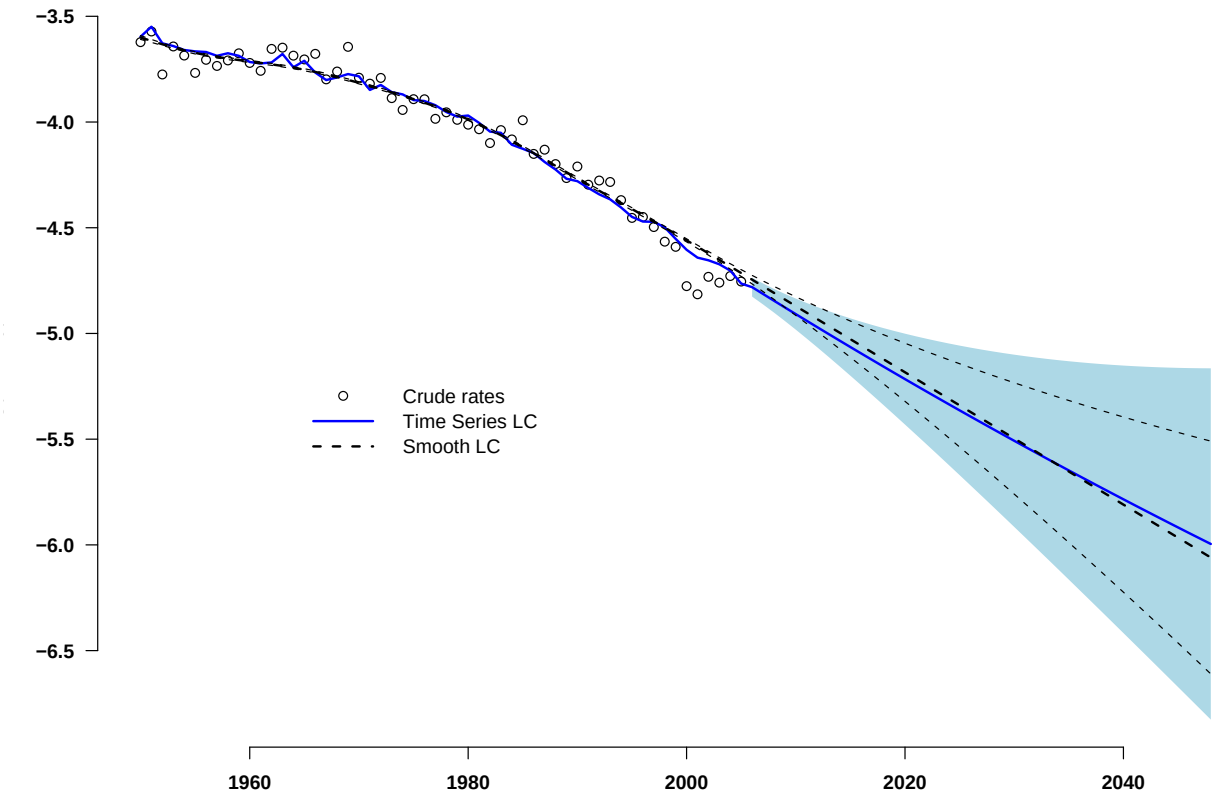
Source: Longevitas Ltd. ONS data, CMIR17

2. Why we need several models

Model risk

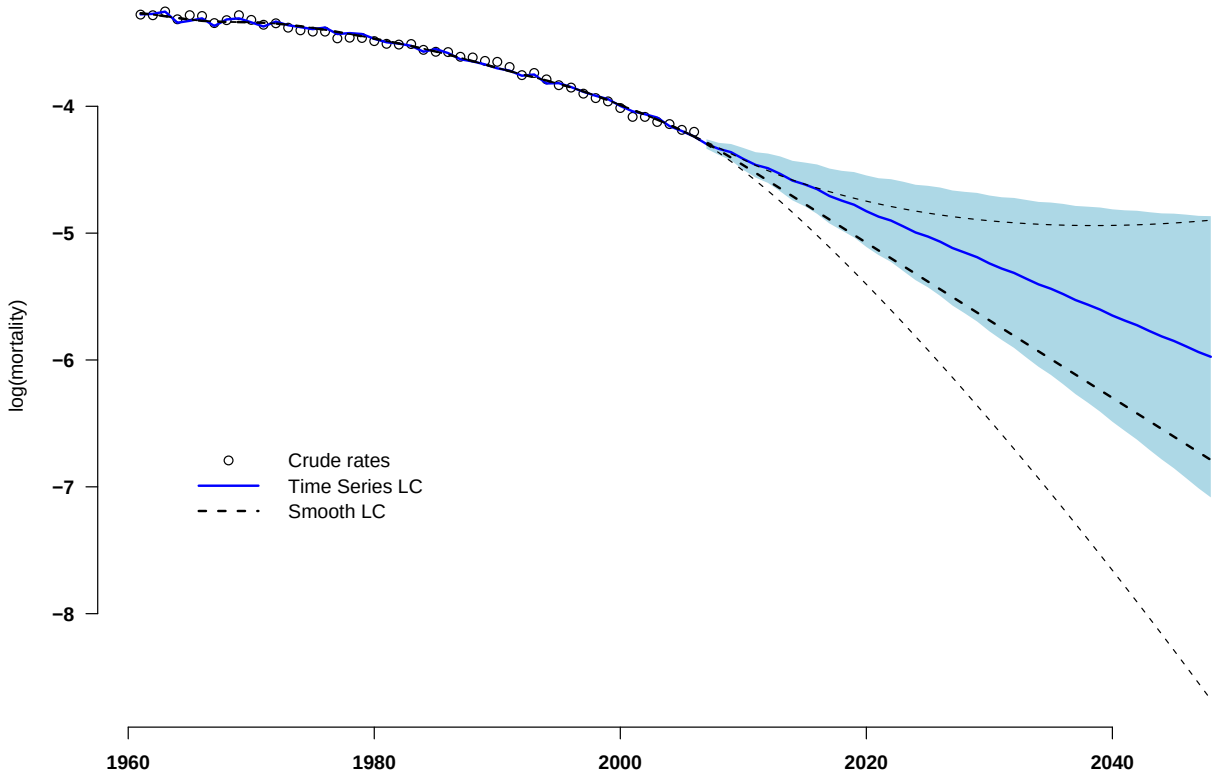
- Confidence intervals show uncertainty about central projection
- What about uncertainty over the model?

Similar projections, different uncertainty



Source: Richards and Currie (2009), Figure 6

Different projections and intervals



Source: Richards and Currie (2009), Figure 5

Model risk

- Confidence intervals depend on model and data
- Need multiple models to explore model risk

3. Which models to use

Which models to use

- Academic literature contains many projection models...
- ...and criticisms of their weak points
- Models in refereed journals are open and transparent
- Use of such models boosts confidence

4. Conclusions and questions

- Deterministic scenarios limited by lack of likelihood
- Stochastic projections needed for ICAs and Solvency II
- Multiple models needed to explore model risk
- Many models in peer-reviewed journals

References

CMIB (Continuous Mortality Investigation Bureau) **1999** *Report Number 17*, Institute and Faculty of Actuaries

Richards, S. J. and Currie, I. D. **2009** *Assessing longevity risk and annuity pricing with the Lee-Carter model*, Faculty of Actuaries Sessional Meeting Paper, February 2009