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Stochastic v. deterministic projection models

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Solvency II

“The methods used to calculate the probability distribution forecast shall be based on adequate, applicable and relevant actuarial and statistical techniques and shall be consistent with the methods used to calculate technical provisions. The methods used to calculate the probability distribution forecast shall be based upon current and credible information and realistic assumptions.”

Article 119, Commission of the European Communities (2008)

More on longevity risk under Solvency II can be found on our [blog](#)

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

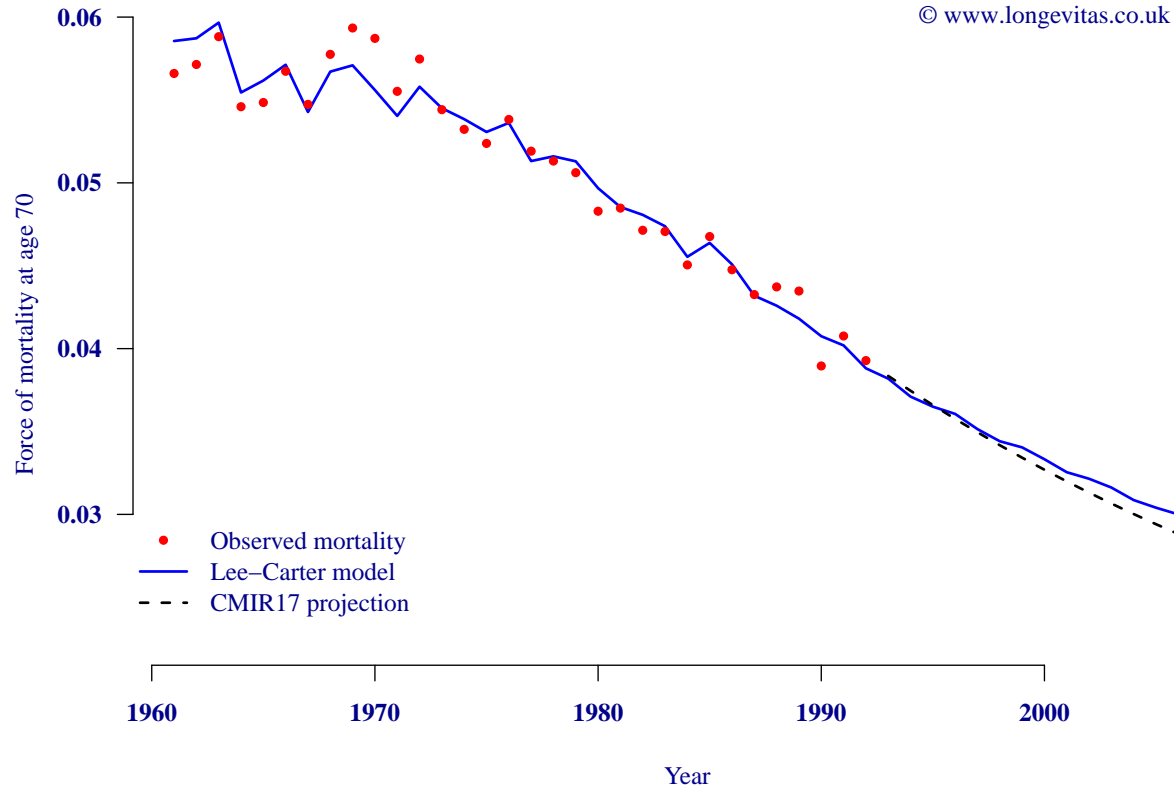
- Measuring uncertainty is a key part of ICA
- Solvency II has similar aims
- A stress test ideally has a probability attached to it
- Such tests and probabilities come from *stochastic projections*

An illustration — back-testing

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

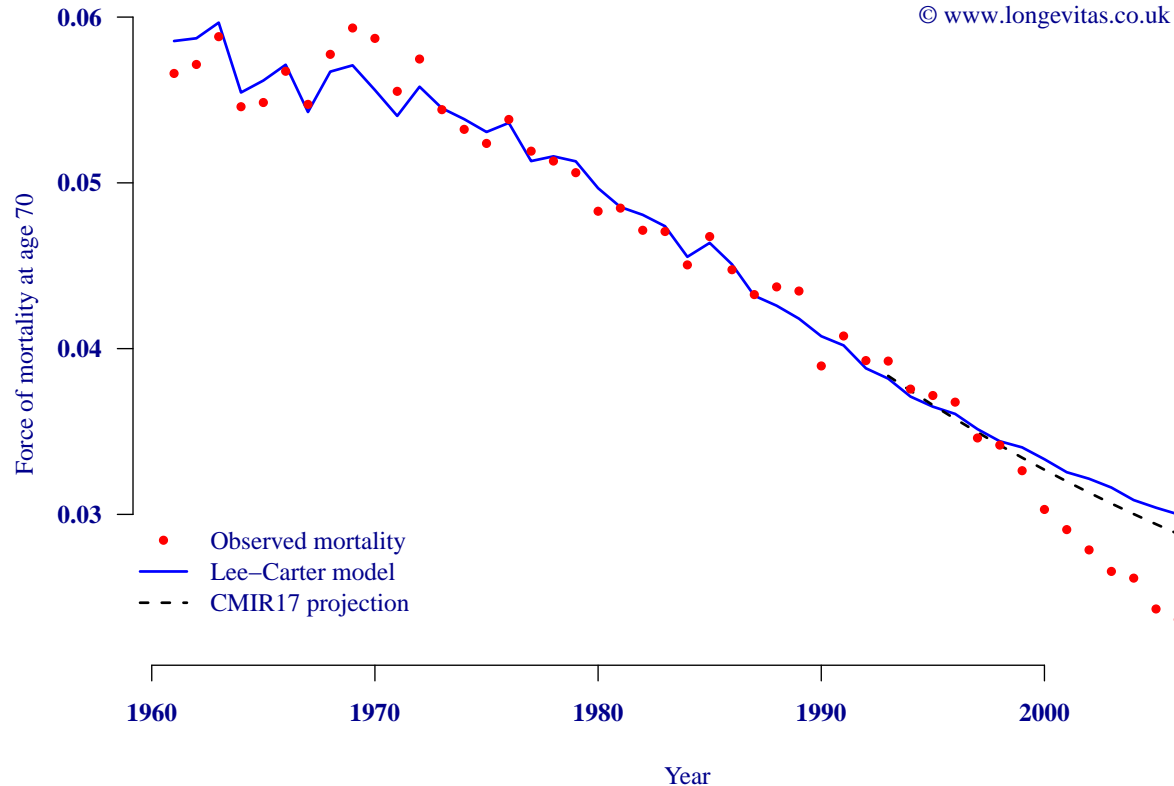
More on back-testing can be found on our [blog](#)

Back-testing: fit model to data to 1992



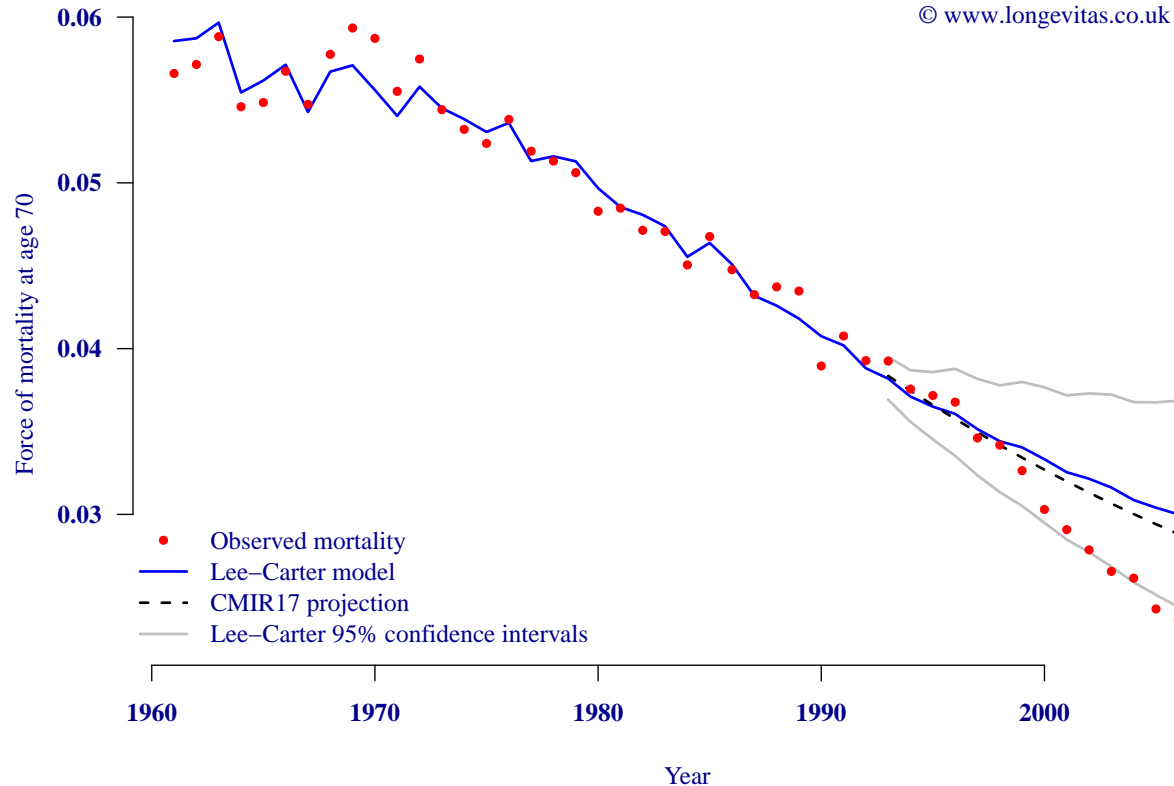
Source: Longevity Ltd. ONS data, CMIR17

Back-testing: compare projections to actual data



Source: Longevity Ltd. ONS data, CMIR17

Back-testing: compare data to confidence intervals



Source: Longevity Ltd. ONS data, CMIR17

Conclusions and questions

- Deterministic scenarios limited by lack of likelihood
- Stochastic projections needed to illustrate uncertainty



References

CMIB (CONTINUOUS MORTALITY INVESTIGATION BUREAU) **1999** *Report Number 17*, Institute and Faculty of Actuaries

LEE, R. D. AND CARTER, L. **1992** *Modelling and forecasting the time series of US mortality*, Journal of the American Statistical Association **87**, 659–671