The Scotsman Hotel, Edinburgh

Longevity risk: a pension-scheme perspective

Stephen Richards
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1. About the speaker

- Consultant on longevity risk since 2005.
- Founded longevity-related analytics businesses in 2006:

- Joint venture with Heriot-Watt in 2009:

2. Enhanced annuities

2. Enhanced annuities

- Should a scheme buy enhanced annuities for members in ill health?

2. Enhanced annuities

- Enhanced annuities give better rates for lives with shorter life expectancy.
- This market works well for individuals.
- Some companies market this as a way of reducing scheme liabilities.
- Unfortunately, this is often an illusion...

2. Enhanced annuities

- Consider a scheme of ten male lives aged 65.
- Mortality follows 100% of S1PA in aggregate.
- Scheme reserve is £671,000†, i.e. £67,100 for each life on average.

† £5,000 pension p.a., paid continuously and discounted at 3% p.a. No mortality improvements.

2. Enhanced annuities

- Assume that nine lives are healthy and follow 90% of S1PA.
- The tenth life is unhealthy and follows 262% of S1PA†.
- An enhanced annuity is purchased for the unhealthy life for £47,200.

† Life expectancy at 90% of S1PA is 18.9 years, while at 262% of S1PA it is 11.6 years.

2. Enhanced annuities

- Superficially, the scheme appears to have saved nearly twenty thousand pounds on this one member (£19,900 = £67,100 - £47,200).
- This appears to save around 3% of scheme liabilities (3.0% = £19,900 / £671,000).

2. Enhanced annuities

- The "saving" is an illusion.
- The remaining nine members are healthier than the old basis.
- Aggregate mortality is now 90% of S1PA, not 100%.
- The reserve for each of the remaining nine members therefore climbs from £67,100 to £69,300.
- The scheme reserve is now around £623,700 (=9×£69,300).
- The difference between this and the starting reserve is £47,300, i.e. essentially the premium paid to the life insurer.

2. Enhanced annuities

- If both the insurer and the pension scheme are properly reserving, there is negligible benefit from selectively buying out ill-health lives.
- The scheme is under-reserved if it doesn't strengthen its basis after such an exercise.
- Also, the mere fact that a scheme has conducted such an exercise can result in buy-out providers refusing to quote.

3. Individual risk

3. Individual risk

- What proportion of scheme liabilities are in a small number of hands?
- How does this drive risk?
- Should a scheme buy annuities for members with large benefits?

3. Concentration of risk

Scheme	Number of Members	Members with half of total pension
E	38	4
H	790	98
C	5,272	328

Largest scheme (C) pays 50% of all pensions to just 6% of members.

Source: Richards Consulting calculations using Prudential data.

3. Individual risk

- What impact does concentration have on scheme risk?
- What risk is posed from who dies when?
- What margin should be held to be confident of paying all benefits?

3. Individual risk

	Safety premium*	
Scheme	**75%**	**90%**
E	15.1%	36.7%
H	4.0%	8.3%
C	2.1%	4.1%

Law of large numbers favours schemes with more members.

Source: Richards Consulting calculations using Prudential data.

*Safety premium is the extra funds above average in 10,000 simulations to ensure given probability of meeting all benefits in run-off according to S1PA without any future improvements. Benefit cashflows discounted at 3% per annum.

3. Individual risk

- Small pension schemes should buy out.
- Bigger schemes can reduce risk by buying out members with large benefits.
- For example, Scheme H's 90% safety premium would fall from 8.3% to 4.4% if benefits were all equal.

4. Trend risk

4. Trend risk

- How much should a scheme reserve for trend risk?

4. Trend risk

- At the risk of stating the obvious, the future is unknown.
- This applies as much to mortality rates as to the level of the FTSE-100.

4. Mortality projections in the 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.
- The CMI model is expectation-driven.

4. Mortality projections in the 21st Century

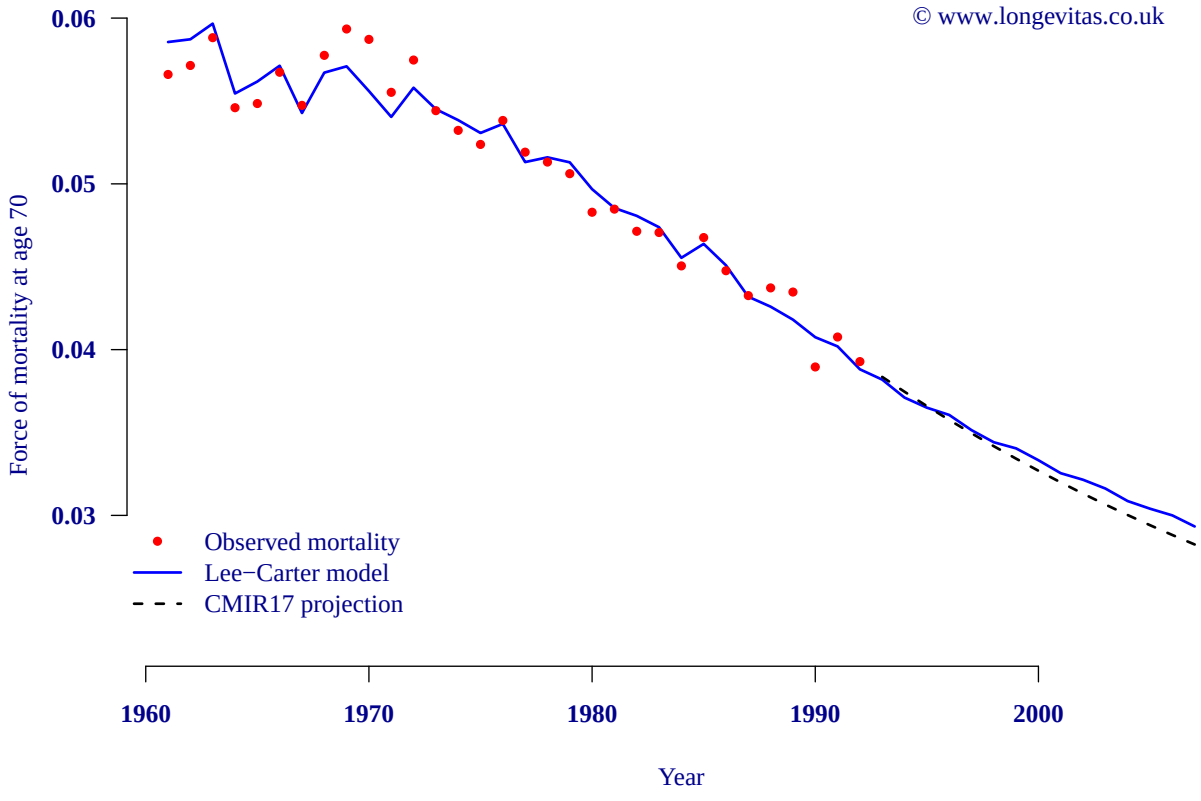
- Measuring uncertainty is now a key part of insurer regulations.
- A stress test ideally has a probability attached to it.
- Such tests and probabilities come from *stochastic projections*.

4. An illustration — back-testing

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

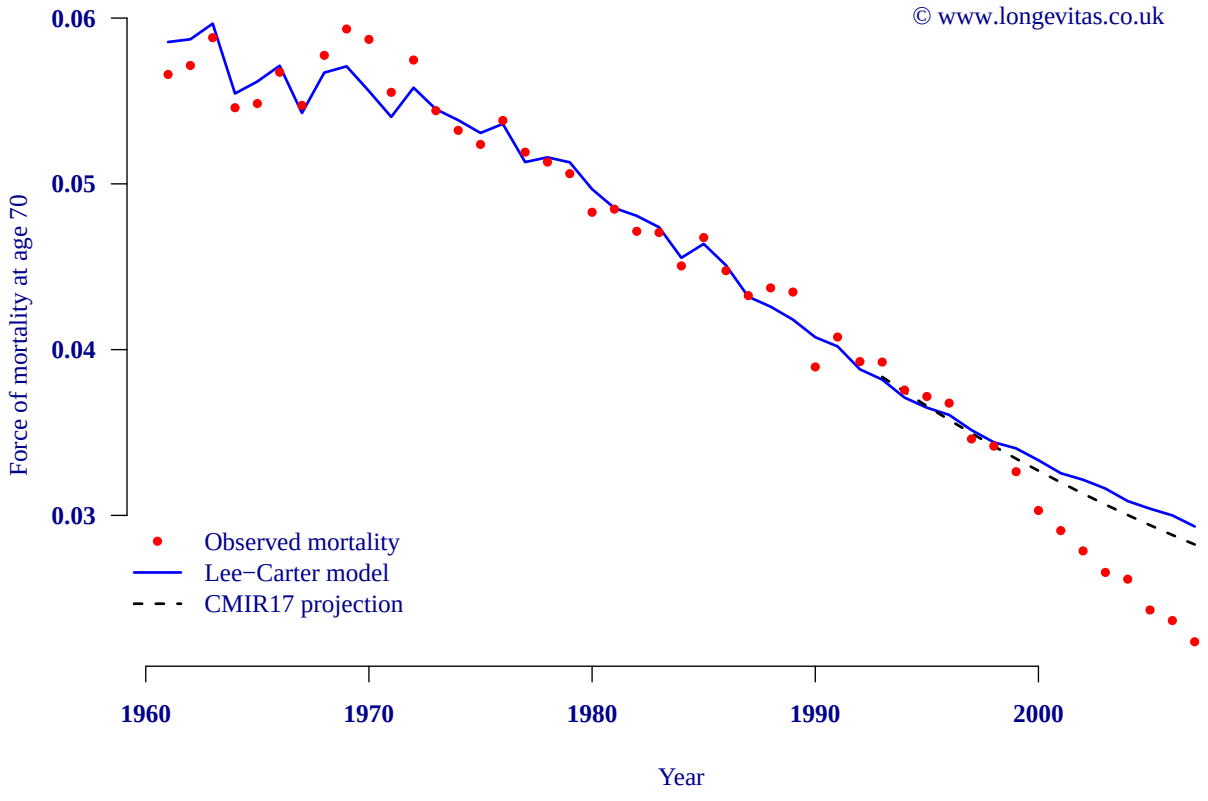
More on back-testing can be found on our blog

4. Back-testing: fit model to data to 1992



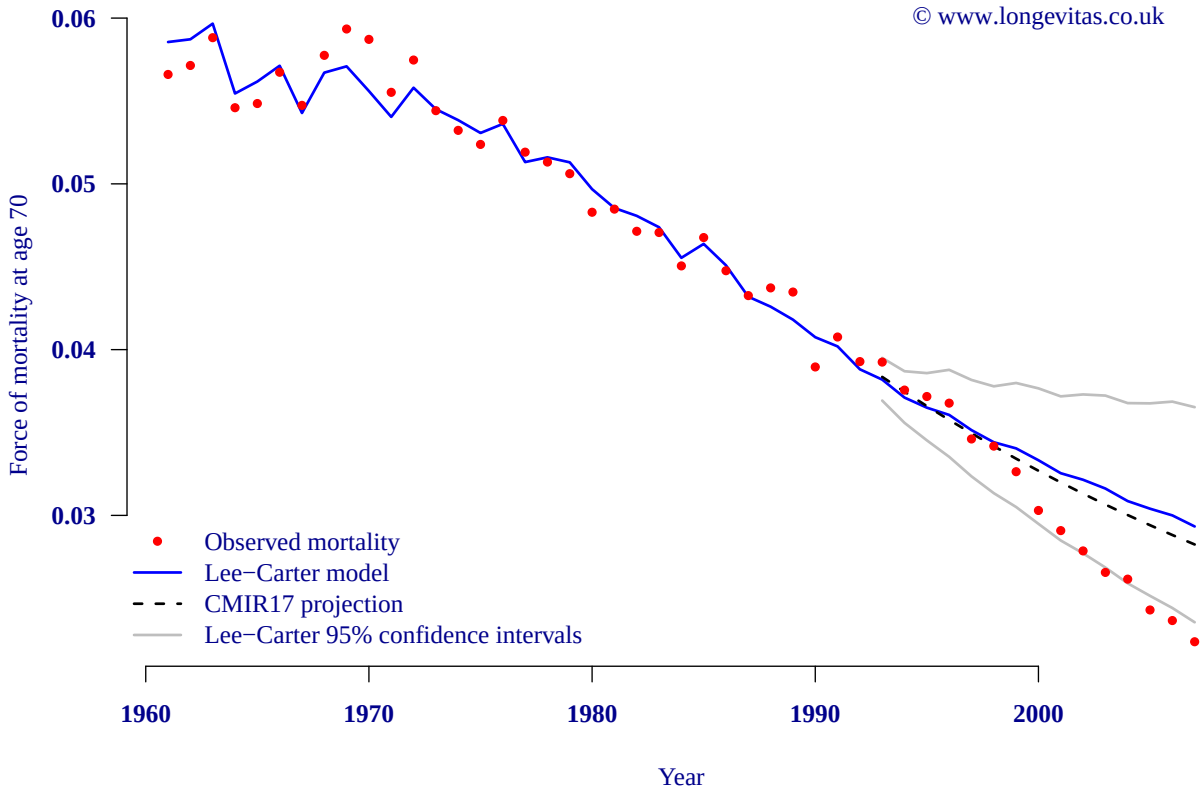
Source: Longevitas Ltd. ONS data, CMIR17

4. Back-testing: compare projections to actual data



Source: Longevitas Ltd. ONS data, CMIR17

4. Back-testing: data v. confidence intervals



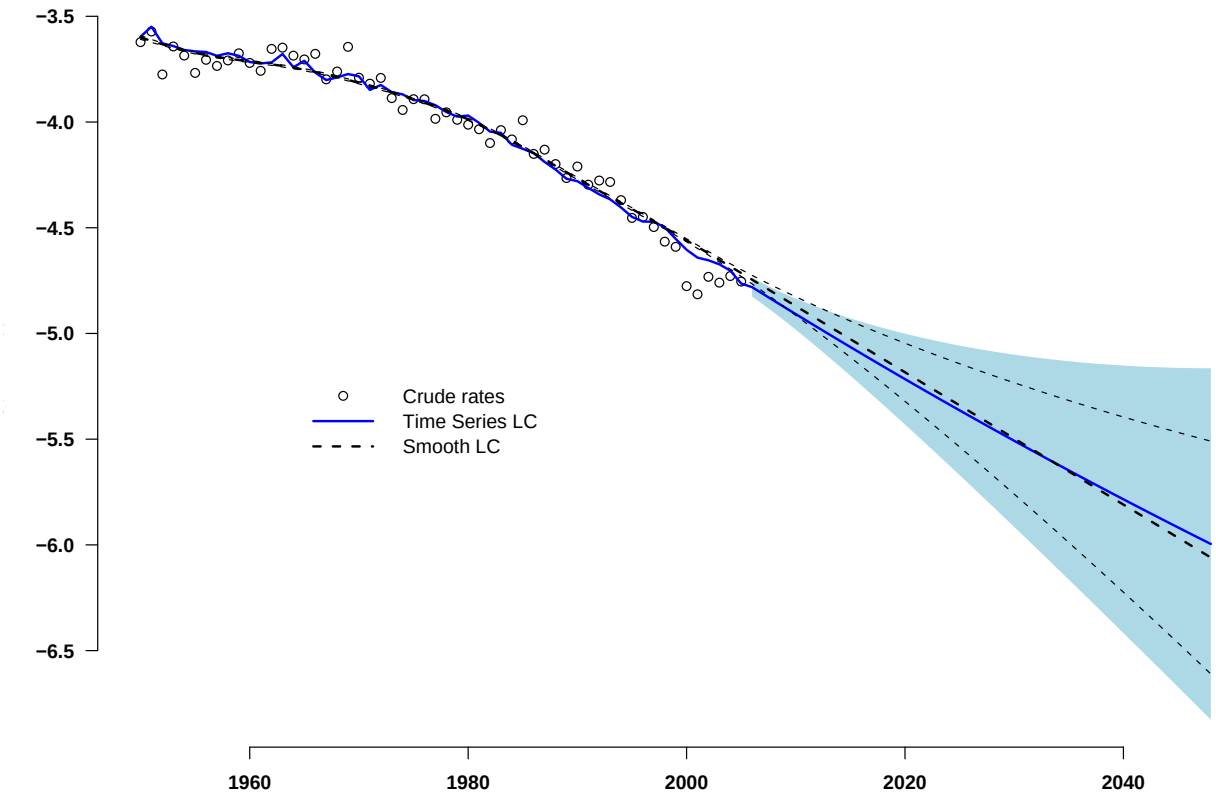
Source: Longevitas Ltd. ONS data, CMIR17

5. Model risk

5. Model risk

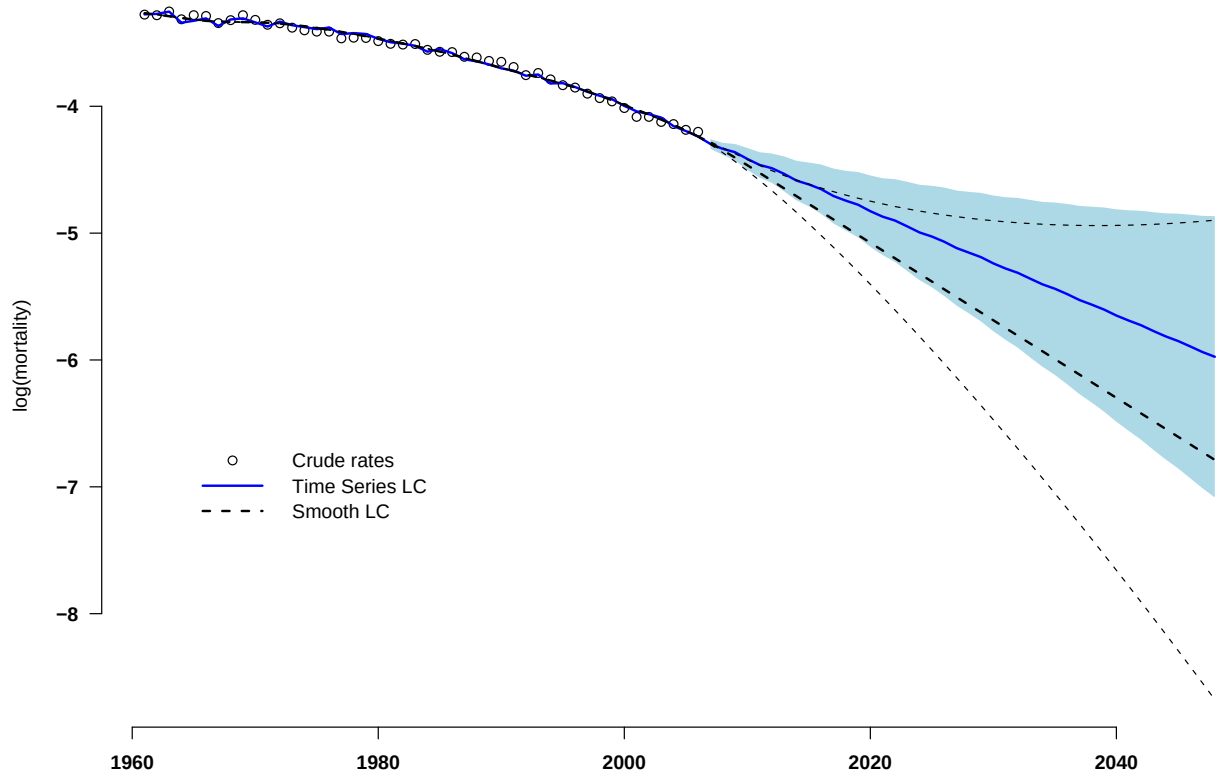
- Confidence intervals show uncertainty about central projection
- What about uncertainty over the model?
- What if the projection model is not the right one?

5. Similar projections, different uncertainty



Source: Richards and Currie (2009), Figure 6

5. Different projections and intervals



Source: Richards and Currie (2009), Figure 5

6. Conclusions

- Buying enhanced annuities often doesn't help scheme finances.
- However, buying out large benefits *can* reduce risk.
- Stochastic models tell you about the impact of uncertainty.
- Never rely on just one projection model!

References

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

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Richards, S. J. **2011** *Too good to be true?*, Longevitas Ltd