

## DATA FORMAT

The projections toolkit works with simple CSV files of historic mortality data by age and year. There are no limits to the number of years data required. The Projections Toolkit is equally at ease handling data sets of initial exposure or central exposure.

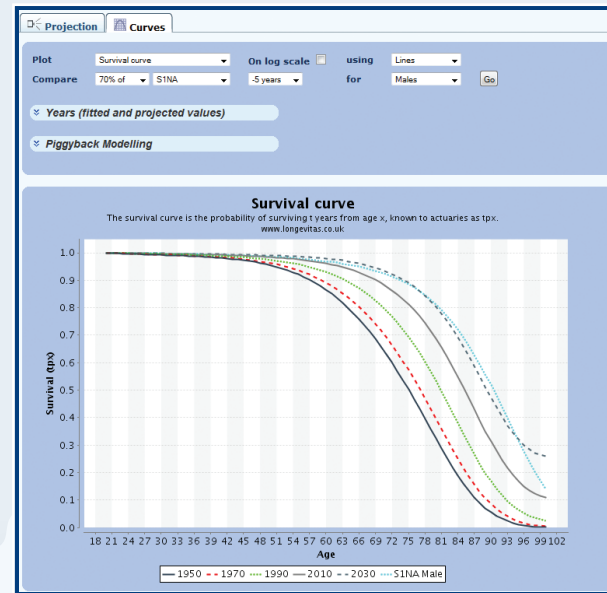
| Age/Year | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 |
|----------|------|------|------|------|------|------|------|
| 11       | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| 12       | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| 13       | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| 14       | 0    | 0    | 0    | 0    | 0    | 1    | 0    |
| 15       | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| 16       | 1    | 1    | 1    | 3    | 1    | 1    | 2    |
| 17       | 4    | 3    | 2    | 1    | 1    | 1    | 2    |
| 18       | 3    | 8    | 9    | 6    | 6    | 10   | 1    |
| 19       | 12   | 11   | 9    | 8    | 9    | 9    | 5    |
| 20       | 17   | 15   | 6    | 15   | 16   | 13   | 3    |
| 21       | 32   | 11   | 19   | 17   | 21   | 19   | 10   |
| 22       | 27   | 23   | 20   | 22   | 13   | 25   | 21   |
| 23       | 36   | 35   | 31   | 38   | 26   | 26   | 18   |
| 24       | 44   | 36   | 46   | 23   | 24   | 35   | 38   |
| 25       | 37   | 41   | 42   | 30   | 38   | 38   | 42   |
| 26       | 36   | 44   | 47   | 44   | 46   | 55   | 38   |
| 27       | 51   | 47   | 46   | 54   | 55   | 28   | 48   |

## CONFIGURATION

The Projections Toolkit is easily configurable, for example in controlling the stability of P-spline projections. The system will automatically select appropriate ARIMA parameters for a time series, or you can override this and specify your own parameters.

## AUDIT

It is a fact of modern business life that one must demonstrate a clear trail of evidence from data to decision. The Projections Toolkit records every single user operation, and all output is stored. Every user account contains a chronological activity log forming a permanent record of all actions carried out in the account. The activity log can be referred to and verified at any time.



## REFERENCES

Longevity Ltd, [www.longevity.co.uk](http://www.longevity.co.uk)

Richards, S. J. and Currie, I. D. 2009 Longevity risk and annuity pricing with the Lee-Carter model, British Actuarial Journal



Mortalityrating.com is a service for companies with defined-benefit pension plans in the United Kingdom. It recommends a mortality basis for pensions in payment using a proprietary model driven by age, gender, postcode, pension size and age at retirement. The models which underpin mortalityrating.com are created by the Longevity survival-modelling system.



The Longevity survival-modelling system is the state-of-the-art tool for analysing every aspect of demographic risk, from pensioner longevity to default rates on personal loans. Longevity is used by banks, insurers, reinsurers and pension consultants, with users throughout the EU.

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A SIMPLE, EASY-TO-USE TOOLKIT  
OF STOCHASTIC MODELS FOR  
MORTALITY PROJECTIONS.

The Toolkit is designed for actuaries working on long-term liabilities, such as annuities and pensions. All projections are produced in a common spreadsheet layout ready for direct use in actuarial calculations



## SERVICE, NOT SOFTWARE

Instead of requiring you to install, manage and maintain the underlying software, the Projections Toolkit is available as a fully supported service operated securely over the Internet. If you have a web browser, you are ready to use the Projections Toolkit.

## MODEL CHOICE

The Projections Toolkit has a wide choice of models drawn from peer-reviewed academic literature, from the Lee-Carter model to the P-spline projections.

**Generate Projection**

Description: New Projection

Projection Model: Lee-Carter: Currie/Richards 2009

Interest %: 00

Key Age 1: 35

Key Age 4: 100

Minimum age: 20

Maximum year: 2005

Submit Cancel

## ICAS AND SOLVENCY II

The Projections Toolkit provides the facility to download best-estimate projections of mortality rates, or to generate stress scenarios of a given probability.

Projection(26995): Mortality to 2040

Unstressed

0.5% Stress

1% Stress

5% Stress

10% Stress

25% Stress

75% Stress

90% Stress

95% Stress

99.5% Stress

## FIRST TO KNOW

We regularly publish research notes and papers relevant to mortality projections. Licence holders have exclusive access to research notes as well as privileged early access to papers and presentations up to four months before they become public.

Resources

Documentation Published Papers Presentations FAQ

Mortality projections

Assessing longevity risk and annuity pricing with the Lee-Carter model (2009) by Richards, S. J. and Currie, I. D., Preview: Faculty of Actuaries 2009

Research2009.pdf - Adobe Reader

Log mortality: age 70

Log mortality: age 80

Crude mortality

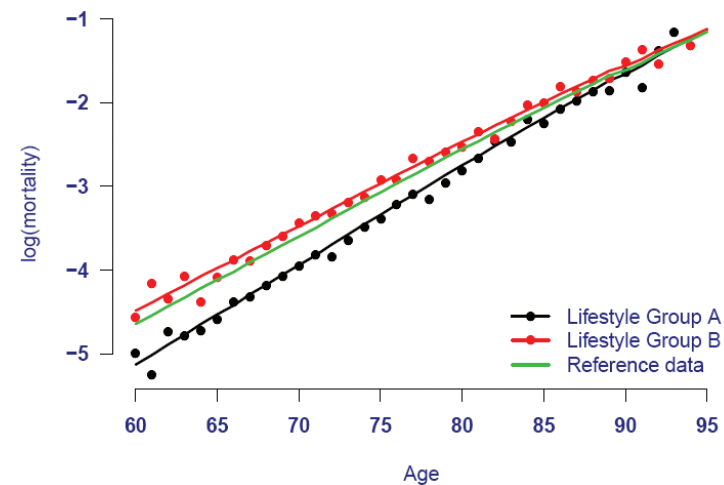
Fitted Lee-Carter rates

Fitted DDE rates

Fitted CR rates

## OVERCOMING BASIS RISK

When it comes to mortality projections, often the only data sets with a long-enough time series are unrelated to the contracts being valued. Applying projections from one data set to another gives rise to basis risk, i.e. the risk that the portfolio of interest has different mortality patterns from the reference data set. So-called piggy-back modelling enables you to “borrow” the power of a reference data set, while explicitly controlling for differences compared to your portfolio data.



## EXPERT SYSTEM

The Projections Toolkit has an expert system which follows the models you fit. It offers both suggestions and warnings based on our experience of the projection models.

Projection(27269): Mortality to 2100

Unstressed

Summary of model

| Setting         | Value                      |
|-----------------|----------------------------|
| Model class     | Lee-Carter                 |
| Model sub-class | smooth beta and kappa      |
| Reference       | Richards and Currie (2009) |

Analysis

- A penalty of order 1 is not recommended for projections.
- Spline knot spacing of 3 years in the time direction may give volatile projections. A larger knot spacing will increase stability if required.

The Projections Toolkit also has a built-in help system. Help text will explain what an item is, what role it performs, and may include links to more in-depth background material.