Standard Life, Dundas House, Edinburgh

Longevity — risk and opportunity

Stephen Richards
20th February 2007

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- GLMs and survival models
- Summary and questions

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- Start-ups: Paternoster, Synesis, PIC
- More to come: Lucida, Goldman Sachs...

Stochastic risk

Scheme	Members
E	40
H	800
C	5,300

Source: Richards Consulting calculations using Prudential data.

*Concentration is the percentage of members accounting for half of all pensions in payment.

Stochastic risk

Scheme	Safety premium* 95%	99%
E	25.6%	37.2%
H	4.8%	6.7%
C	2.1%	3.0%

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 PM/FA00 without any future improvements. Benefits valued at 2.5% per annum interest to allow for indexation.

The buy-out deficit

Pension scheme	Funding level
1	94%
2	77%
3	88%
4	94%
5	93%

The buy-out deficit

Pension scheme	Funding level	Buy-out level
1	94%	93%
2	77%	74%
3	88%	63%
4	94%	55%
5	93%	49%

Buy-out basis usually excludes discretionary pension increases, i.e. true buy-out deficit is at least as large as shown above.

Source: Richards Consulting and Barrie and Hibbert calculations using information from selected scheme statements in October 2006.

Concentration of risk

Scheme	Members	Concentration*
E	40	11%
H	800	12%
C	5,300	6%

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

Source: Richards Consulting calculations using Prudential data.

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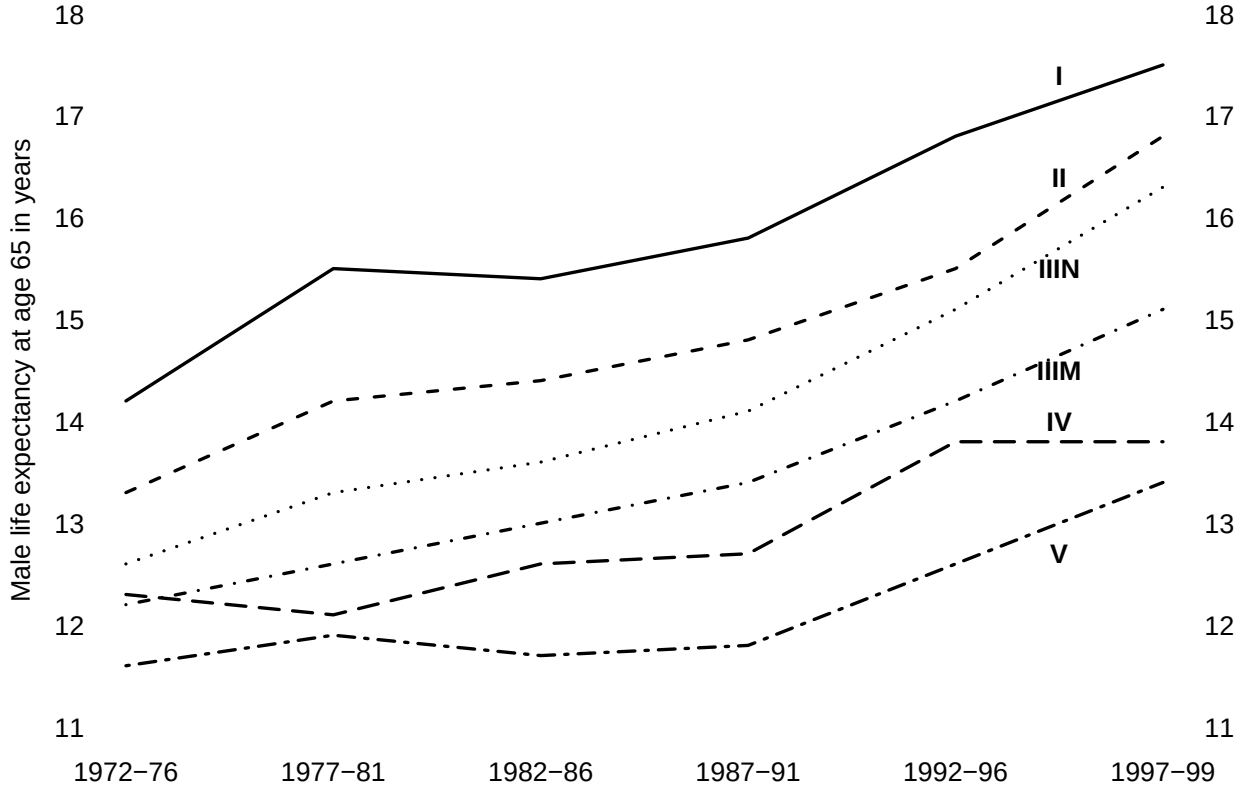
- . . . and therefore with the biggest liabilities
- Rating socio-economic group *very* important in bulks business

Impact of socio-economic group

Retirement life expectancy by socio-economic group



Source: ONS Longitudinal Survey.

Financial impact of lifestyle

Financial impact of mortality rating factors

Factor	Step change	Reserve	Change
Base case	-	13.39	-
Gender	Female-male	12.14	-9.3%
Lifestyle	Top-bottom	10.94	-9.9%
Duration	Short-long	9.88	-9.7%
Pension size	Large-small	9.36	-5.2%
Region	South-North	8.90	-4.9%
Overall	-	-	-33.6%

Source: Richards and Jones (2004), page 39.

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- But AVC fund elsewhere of £42,808...
- ...giving total fund of £51,391...
- ...so not poor and likely light mortality!

Solution to socio-economic profiling

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- Postcode is (much) better than "amounts"
- Household (address) profiling is better still

New techniques and tools

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- Mortality group assigned to matched households
- Postcode-dominant mortality group where no household match

Life expectancy at age 65

Group*	Males	Females
1	20.4	22.9
2	19.8	22.4
3	19.1	21.7
4	18.7	21.5
5	17.9	20.8
6	17.4	20.6
7	16.1	19.3

Source: *Mortality Group, courtesy of Experian plc.

Mortality profiling

- Previous slide uses historical data

Mortality profiling

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- How would this look if applied to actual 2005 experience*?

Source: *Portfolio of around quarter of a million immediate annuitants and bulk buy-out pensioners

Complete life expectancy at age 65

Group*	Males	Females
1	20.8	22.6
2	20.2	22.1
3	19.6	21.6
4	19.1	21.1
5	18.4	20.5
6	18.4	20.6
7	17.3	19.6

Source: Longevitas Ltd. Survival model of mortality experience of quarter of a million pensioners.

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- Proportion-married assumption could be 60–90%
- Personal profiling can also model likely marital status
- Less guesswork in setting proportion-married assumption

Source: *Richards Consulting calculations for level annuity to male aged 65 using PMA00 and 2.5% discount rate.

P-splines

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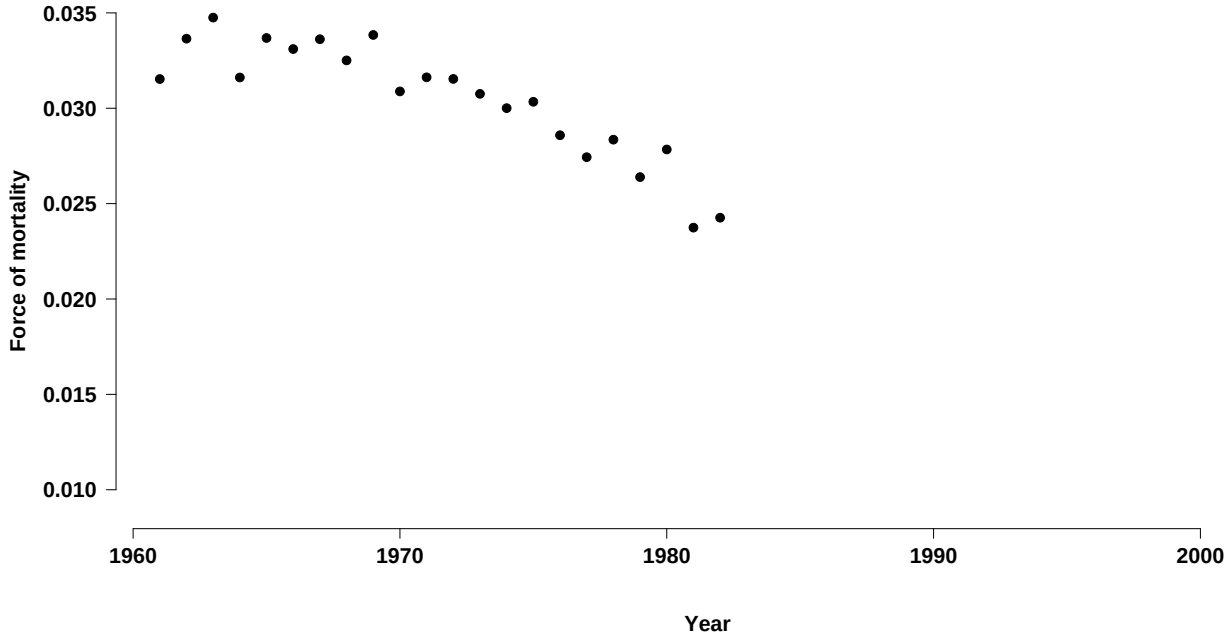
- Central projections and percentile projections

French male mortality rates at age 65



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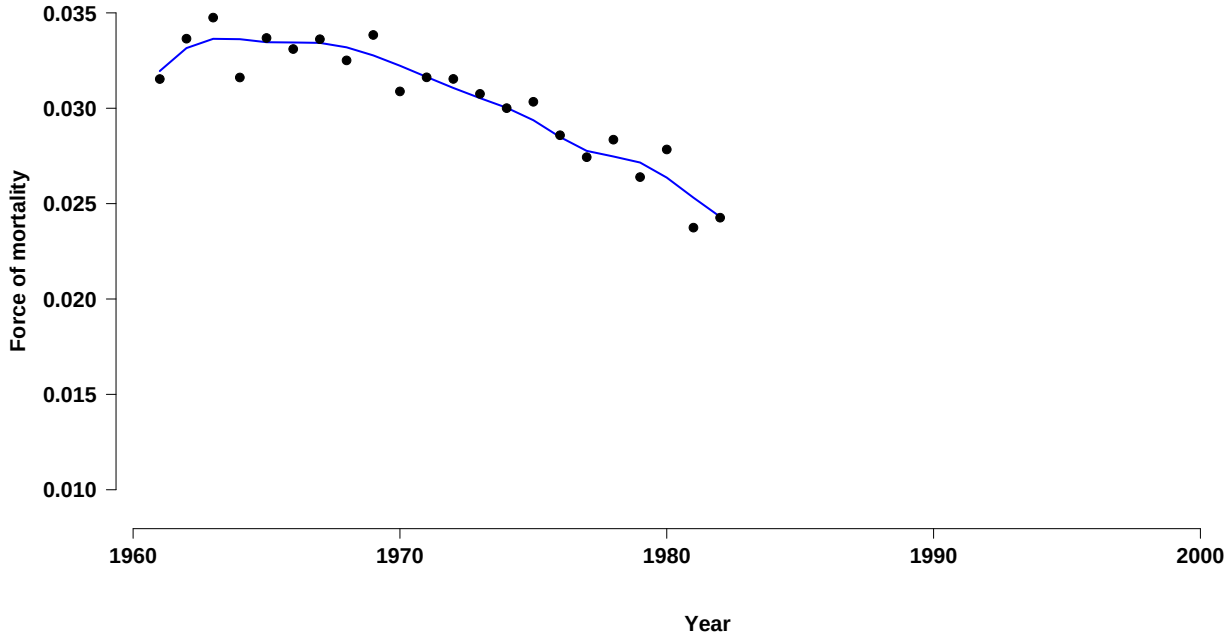

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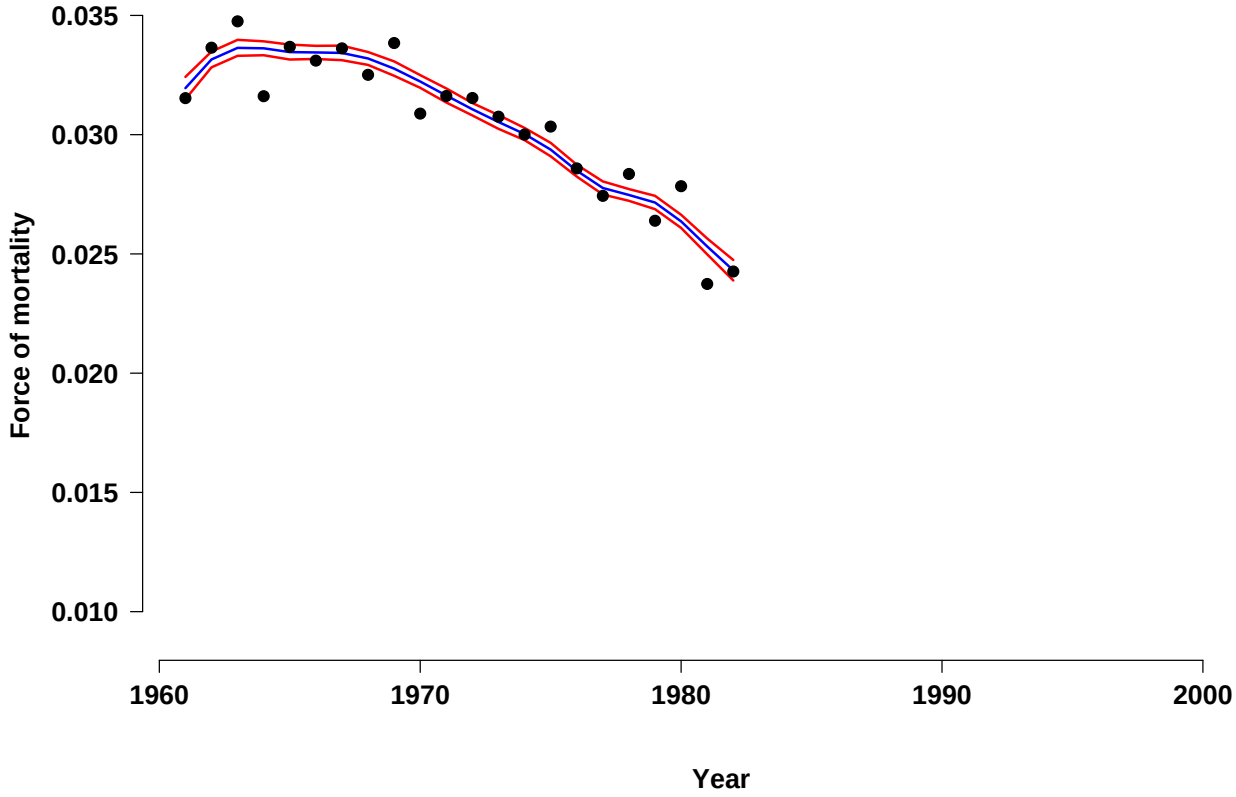

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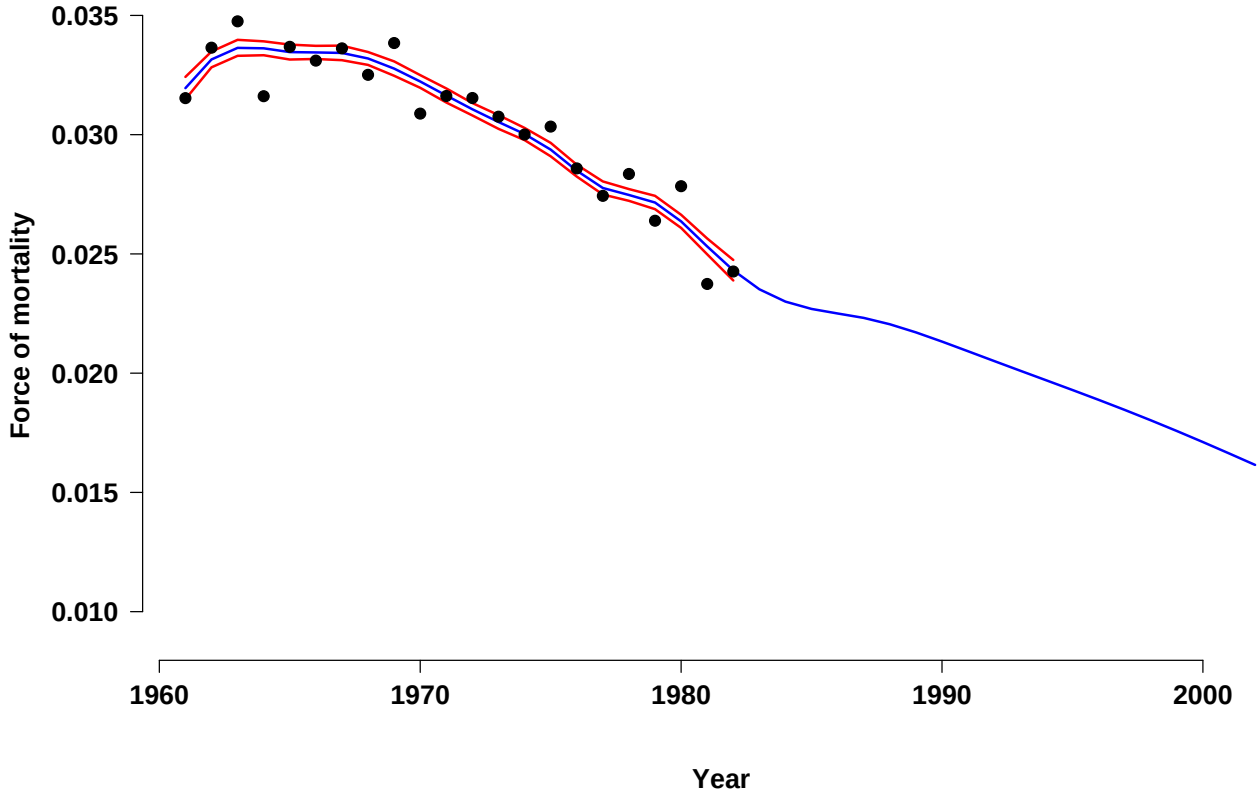

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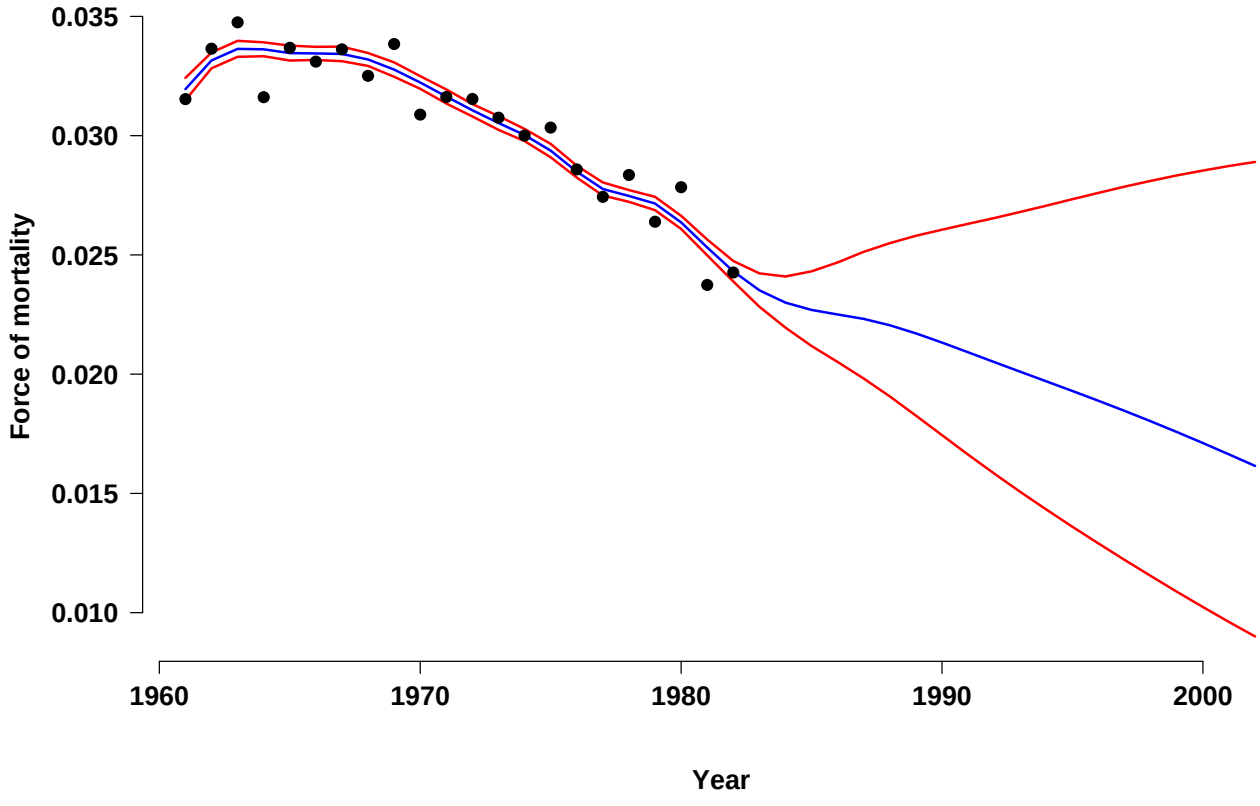

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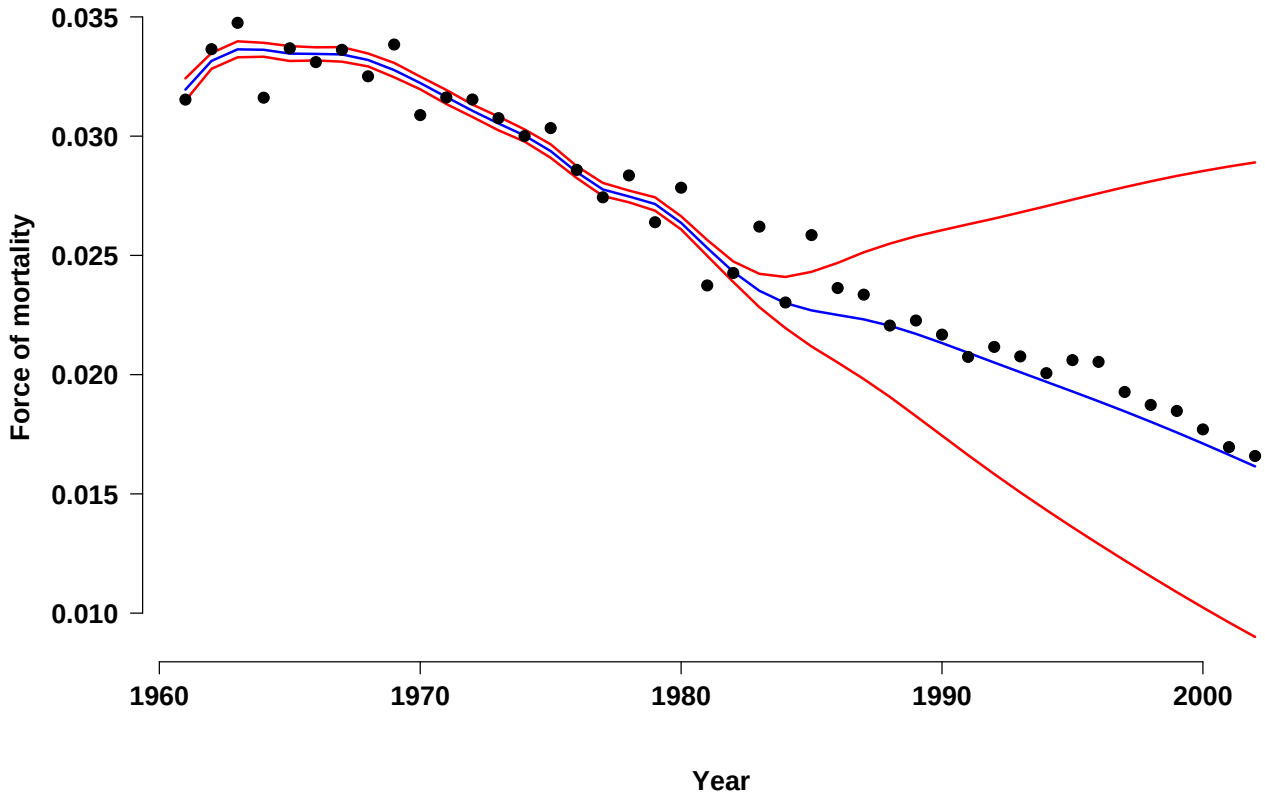

Source: J. Hubbard, AXA Group Risk Management

P-splines and trend risk

Basis	e_{65}	a_{65}
No improvements	16.53	12.85
Central projection	20.09	14.84
95^{th} percentile	20.92	15.28

- 15.5% extra reserves between "no improvements" and central projection.
- Further 3.1% reserves between central projection and 95^{th} percentile.
- Trend risk not diversifiable like stochastic risk.

Source: Richards Consulting calculations using population data for males aged 20–100 in England & Wales between 1961 and 2003. Projection is P-spline with age and cohort penalties. Annuities calculated in arrears using 2.5%.

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- Fitted with free software (R at www.r-project.org)

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- GLM estimates parameters for risk components

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- Only a single year's experience can be used (very wasteful!)
- Cannot easily use fractional years' exposure

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- Want to use exact data on time of death
- Want to use fractional years of exposure
- Want to have similar parameters and interpretation to GLMs

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- GLMs increasingly used for risk analysis
- *But* already being replaced by survival models

References

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