

An important step closer to the Sicilian Actuary

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Introduction

- Sicilian actuaries
- Use more information
- Key risk factors (“KRFs”)
- Accumulating years = accumulating risk
- Our model: data, calibration, fit, residual risk
- Applications
- Specimen results – males over 60

Key risk factors

Demographic

Age, Sex

Medical conditions

Diabetes, Cholesterol, Blood Pressure

Lifestyle

Smoking, BM Index

Medical events

Heart diseases, Stroke, Cancers

...sub-categorised per data typically available in UK

The Model - outline

- Multi-state
- Stochastic: models change over time
- Transition intensities – simple, smooth functions
- Includes impact of interactions between KRFs
- Monthly time step
- Measure new events – heart attack, stroke, cancer, death

Data and model calibration

Data

- Longitudinal studies
- Medical and lifestyle data for E&W
- ONS population data and mortality tables for E&W
- Research results

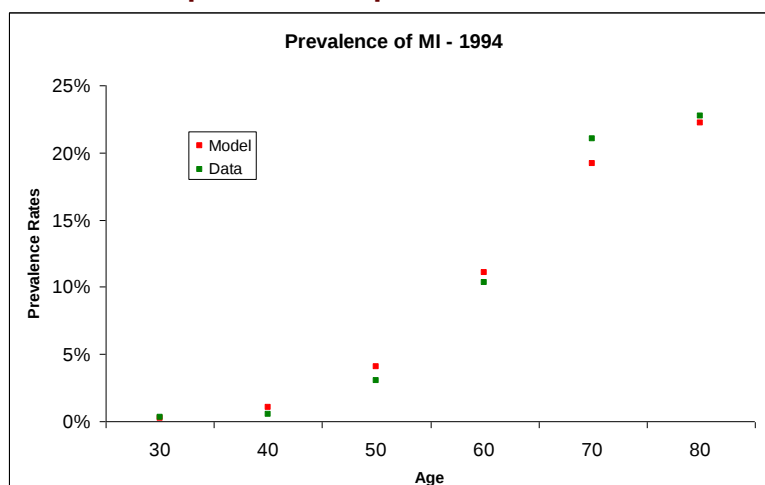
Calibration

- 1994 base
 - 1994 medical and lifestyle data (E&W)
 - Other settings to generate good fit to ONS1994 (E&W)
- KRF changes – simple functions progressively adjust KRFs from 1994 to 2004 levels

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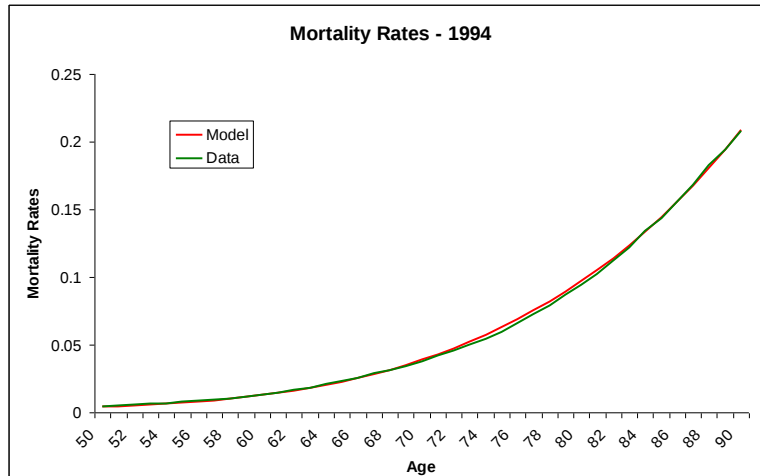
Fit – example = MI prevalence, Male

1994



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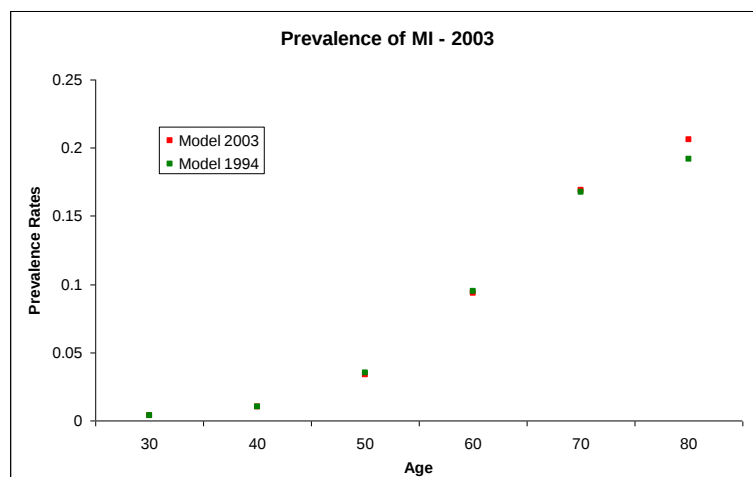
Fit – 1994 Mortality Rates



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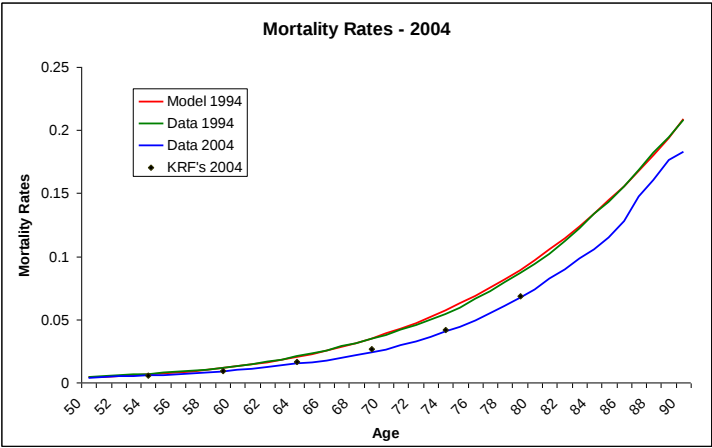
Fit – example = MI prevalence, Male

2003



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Fit – 2004 Male mortality Rates (KRF changes only)



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Mortality change 1994-2004: modelled KRFs vs ONS tables

Age	Males	Females
60	75%	72%
65	71%	70%
70	73%	69%
75	87%	93%

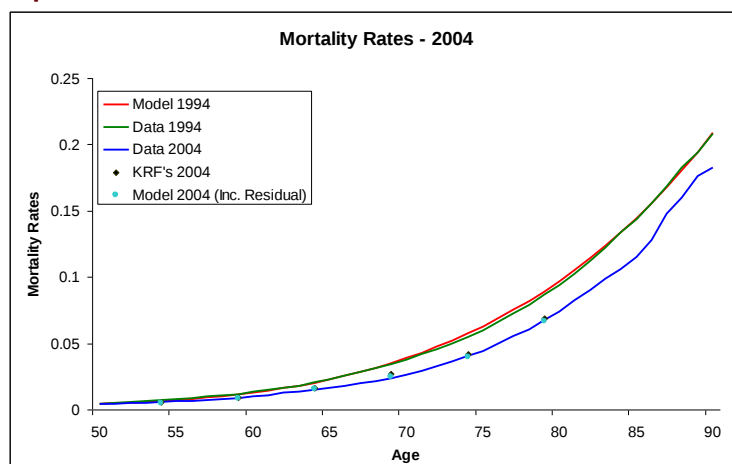
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Residual risk

- Other risk factors
- Don't throw away!
- Describe via simple, smooth functions

Inclusion permits some management of ORFs

2004 Male mortality rates – KRFs and simple function for residual risk



Applications

Change over time

- Analyse the sources of past change
- Estimate impact of future change

Finance

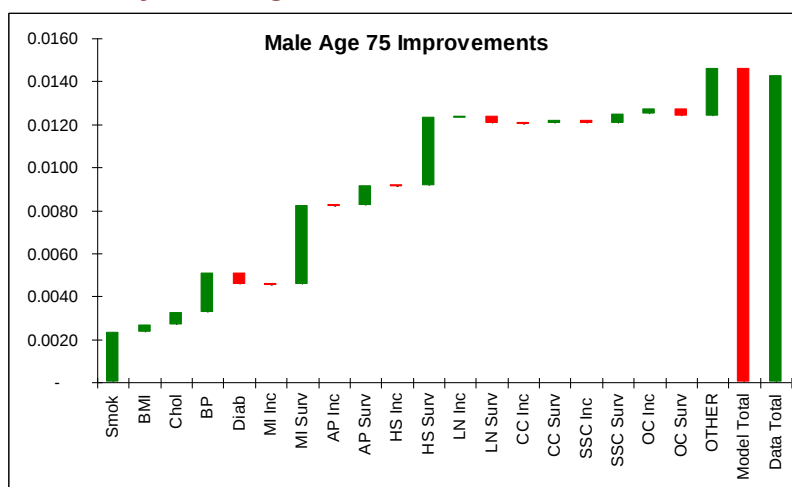
- Price products
- Determine liabilities
- Assess capital requirements

Medical research

- Estimate expected outcomes
- Prospective cost/benefit analysis
- Adjustment for differential KRF prevalence
- Enhance retrospective analysis

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Mortality changes from 1994-2004 – Male 75



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Individualised risk characteristics

Risk Factor	'Superlife'	'Impaired Life'
BP	Low	High
BMI	BMI = 23	BMI = 36
Smoker status	Never smoked	Ex-heavy smoker who quit smoking 5 years ago
Cholesterol	Low	High
Diabetes	No	Yes
Cancer	No	No
Heart attack	No	1MI
Stroke	No	No


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Specimen results – life expectancy* in 2004 for males

	Male 65	Male 75
Average, no further changes after 2004	16.7	10.2
Average, 1994-2004 change continues indefinitely	18.5	11.0
Average, 1994-2004 change continues in Medical Events but stops in Medical Conditions and Lifestyle Factors after 2004. Prostate cancer incidence stabilises in 2014. "Test scenario"	18.7	11.1
Heavy smoker (Test scenario)	13.4	7.4
'Superlife' (Test scenario)	20.8	13.0
'Impaired life' (Test scenario)	14.6	8.7

* Life expectancy to age 100


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Specimen results – life expectancy* for “average” males

Test scenario

	ENTIRE		HEALTHY **	
	Male 65	Male 75	Male 65	Male 75
2004	18.7	11.1	12.4	7.9
2014	19.7	12.2	12.2	7.7
2024	20.3	13.1	12.1	7.7
2034	20.3	13.6	11.8	7.7

* Life expectancy to age 100
**Alive without having MI, HS or any form of cancer

Model IT characteristics and run performance

- dll, written in C++
- can be accessed from Excel or MoSes
- projects a population for 40 years in 250 seconds
- Front end: amend population characteristics
 amend descriptive functions for KRFs
- SQL based, pre-built “extract and report” results facilities

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