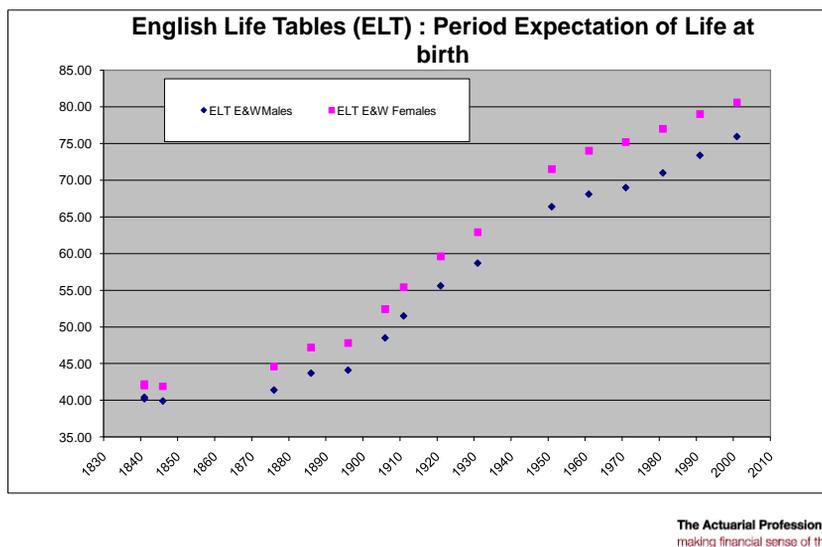


Forecasting of U.K. Population Mortality

with allowance for age, period and cohort effects

Forecasting U.K. Population Mortality



Forecasting U.K. Population Mortality

Poisson Distribution Model for Deaths

$$\text{Probability}\{D(x,t) = D\} = \frac{e^{-E(x,t)m(x,t)} \cdot \{E(x,t)m(x,t)\}^D}{D!}$$

Forecasting U.K. Population Mortality

Two-dimensional Lee-Carter Model No cohort graduation effect

$$m(x,t) = e^{a(x)+b(x).k(t)}$$

$$\sum b(x) = 1 \text{ and } \sum k(t) = 0$$

Forecasting U.K. Population Mortality

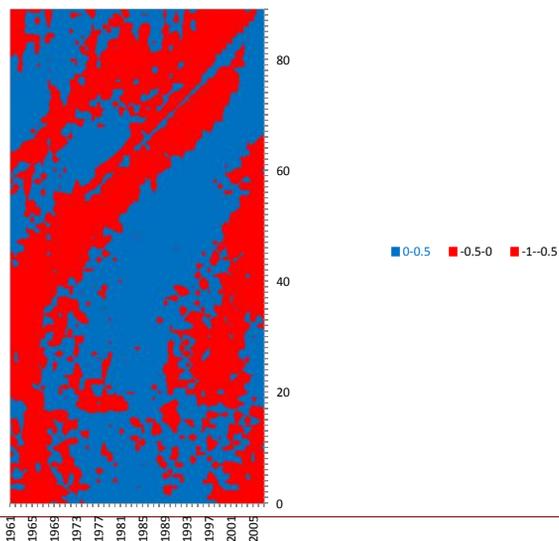
Data : 1961-2007

Test of whether there is a cohort effect

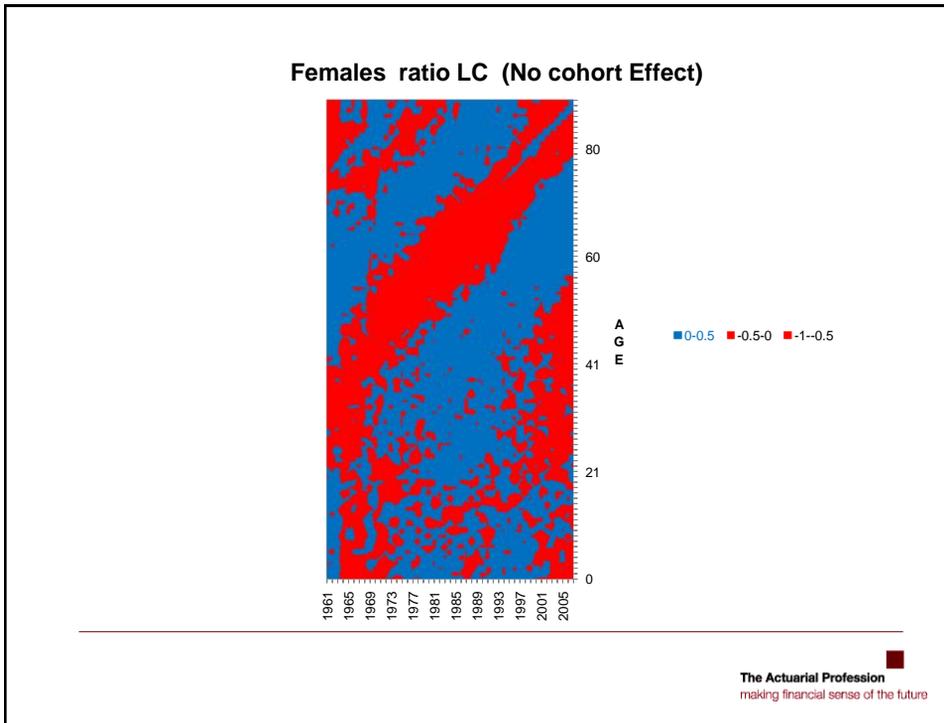
$$1 - \frac{\text{Actual Deaths}}{\text{Expected Deaths LC}}$$

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Males: ratio LC (no cohort effect)



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Forecasting U.K. Population Mortality

Two Dimensional Lee Carter Extended i.e. With Cohort Effect

$$m(x, t) = e^{a(x)+b(x).k(t)+\lambda\{89-(x-t)\}}$$

$$\sum b(x) = 1, \quad \sum k(t) = 0$$

$$\sum \lambda(\text{all } _ \text{cohorts}) = 0$$

Forecasting U.K. Population Mortality

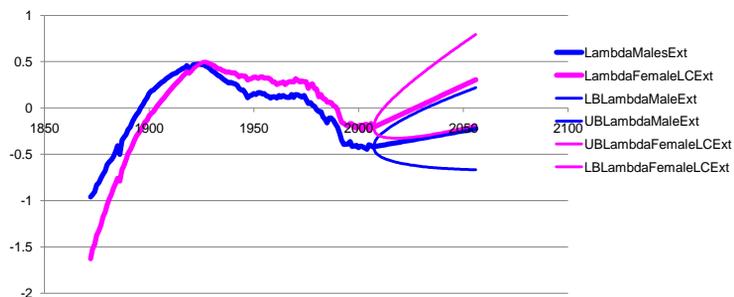
Test of whether the cohort effect goes away

$$1 - \frac{\text{Actual Deaths}}{\text{Expected Deaths } LCExt}$$

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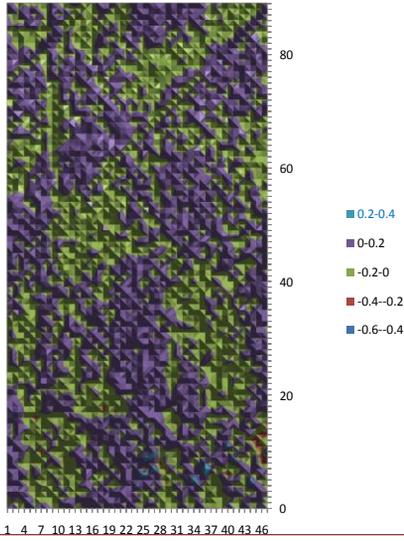
Forecasting U.K. Population Mortality

LCExtended : allowing for the cohort effect
i.e. projecting lambda using ARIMA(0,1,0)



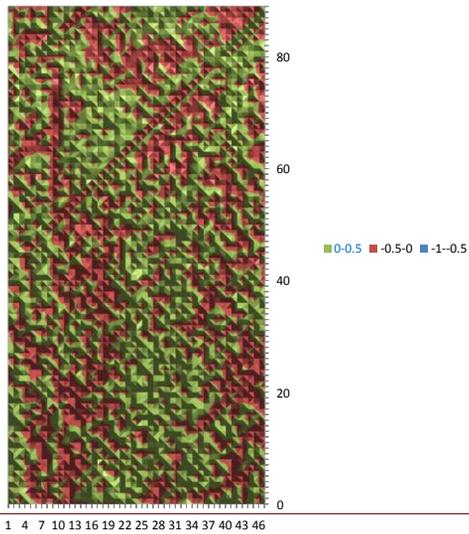
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Males LCExt i.e. with allowance for Cohorts



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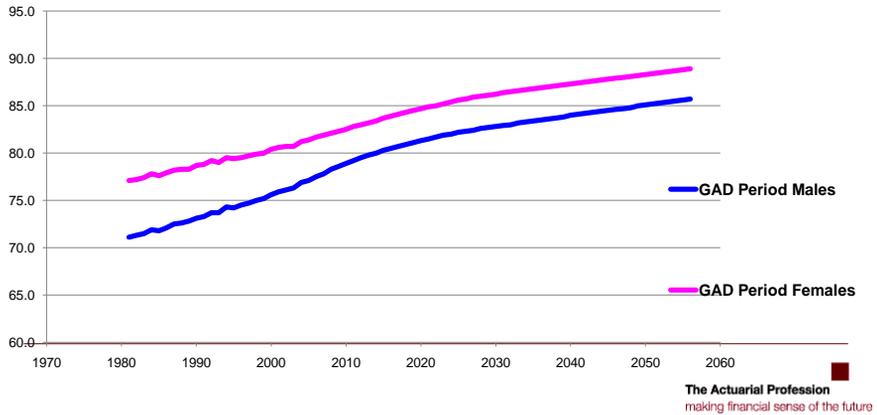
Females LCExt i.e. allowing for Cohort effect



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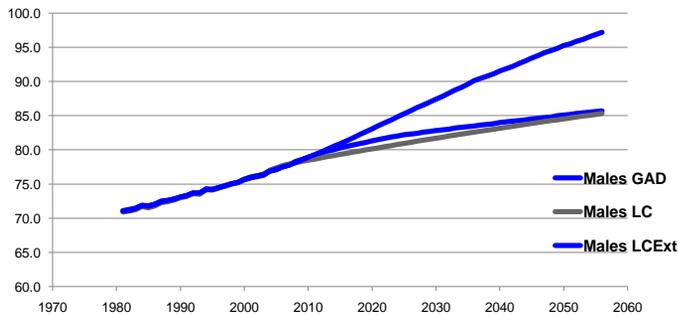
Forecasting U.K. Population Mortality

GAD : Period Expectations of Life at Birth
Males and Females



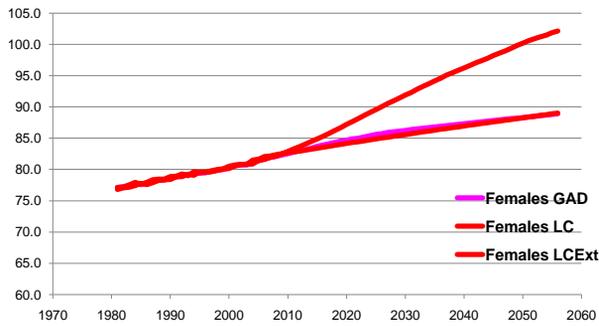
Forecasting U.K. Population Mortality

GAD : Period Expectations of Life at Birth : Males
and Females
versus LC model and LCExtended



Forecasting U.K. Population Mortality

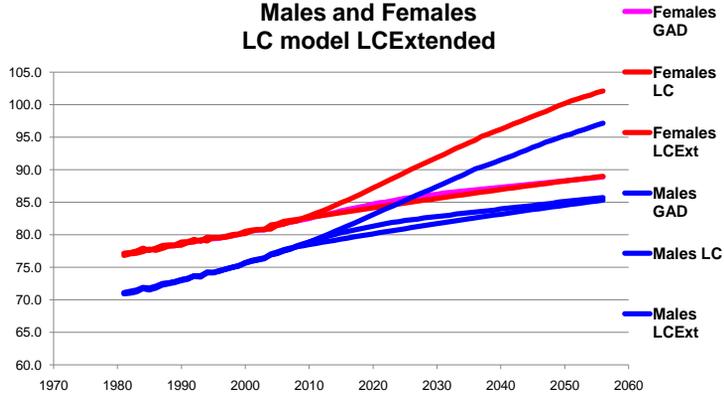
GAD : Period Expectations of Life at Birth
Females
LC and LCExtended



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Forecasting U.K. Population Mortality

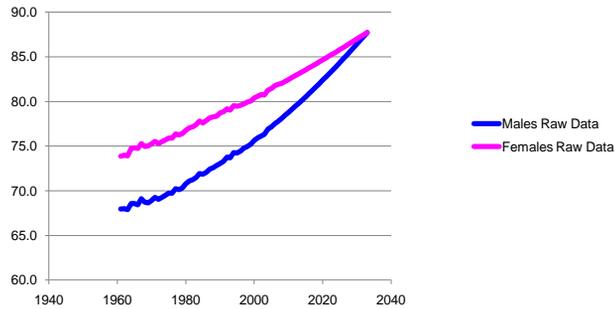
GAD : Period Expectations of Life at Birth :
Males and Females
LC model LCExtended



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Forecasting U.K. Population Mortality

Data 1961-2007 projected by 2nd degree curve -meet in 2033?



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Forecasting U.K. Population Mortality

	Expectation of Life : Cohort exceeds Period by			Cohort born in 2008		Cohort born in 2008
	LC	LCEExt	GAD	LC	100 in Year	LCEExt
Males	13%	36%	13%	88	2084	106
Females	12%	35%	12%	92	2058	111

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