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Current Issues in Pensions
MORTALITY UPDATE

16 February 2005
Tony Leandro

Size of the liabilities

- U.K. life insurers have £70bn[1]
- Public-sector schemes have £580bn[2]
- Occupational schemes have £762bn[3]
- Total = £1.5 trillion
- 10% change = £2,500 for every person in UK

[1] "*Financial aspects of longevity risk*", Richards and Jones, SIAS, 2004.
[2] Watson Wyatt press release, August 2004.
[3] GAD (2000), Eleventh Survey of Occupational pension Schemes.

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Financial effects – annuities

- Age 65, 3%, Males

	u=2000	u=2010
PA(90)-2	100%	100%
PA(90)-4	107%	107%
PMA92	117%	121%
PMA92 pilot	113%	118%
PMA92*mc*	128%	131%
PMA92*mc* pilot	124%	128%

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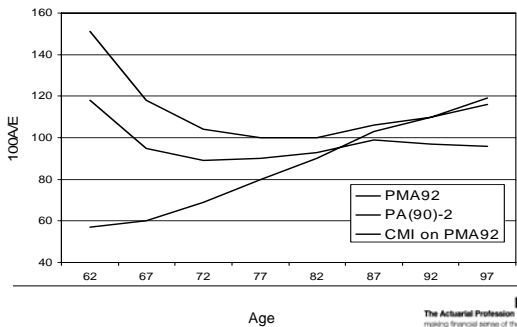making financial sense of the future

Mortality update - Agenda

- Update on self-administered pensioner investigation
- Update on other CMI investigations
    - Data collection and observations
    - The work on the "00" Series of tables
- Dealing with risk in models for q_x

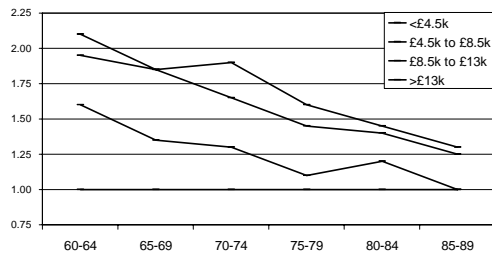The Actuarial Profession
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The SAPS mortality investigation

- WP4 and WP9
- 99 Schemes with 1.04m records
- 6 largest schemes cover 50% of the data
- 9 Consultancies have contributed data
- Data for 1996 to 2003
- 13 industry types, significant amounts of data for 7

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Mortality of self-administered pensioners 2000-02
All retirements : Males : Amounts

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Ratio of q_x for varying amounts of pension

Crude Mu and gates for males: pensions over £13,500
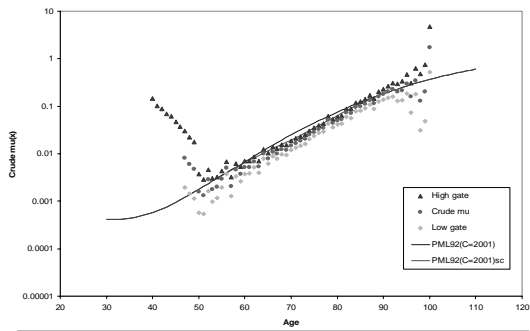
Crude Mu and gates for males: pensions £8,501 to £13,500

Crude Mu and gates for males: pensions £4,501 to £8,500

Crude Mu and gates for males: pensions £0 to £4,500
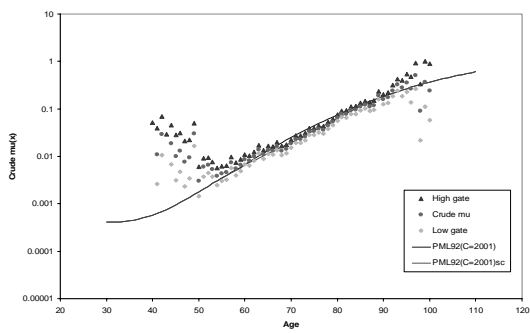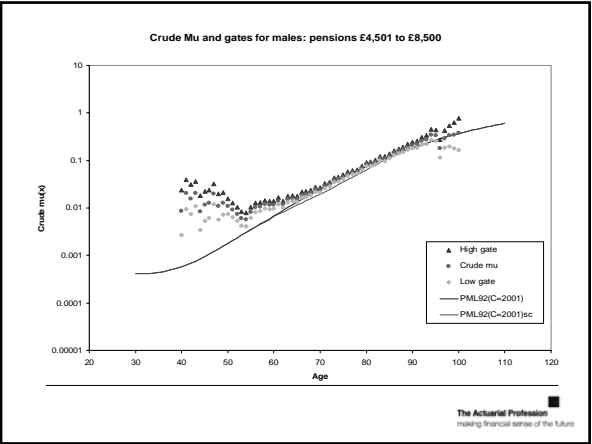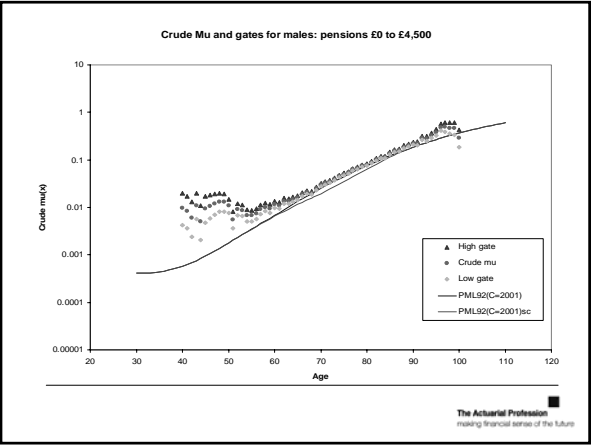
Comparison by industry (PML92)

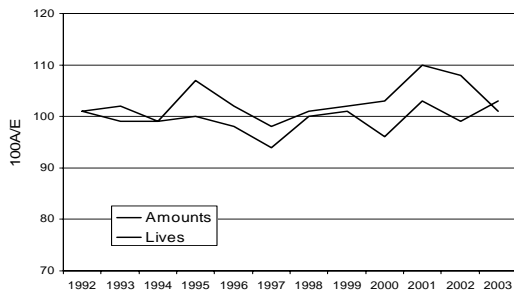| Grouping	Average pension	100A/E
Basic Industries	£4,390 pa	115
General Industries	£4,410 pa	95
Local Authorities	£4,420 pa	132
Cyclical Services	£6,670 pa	105
Information Technology	£8,220 pa	101
Financials	£13,330 pa	92
CMI Life Offices	£2,373 pa	90

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Update on other CMI investigations

**Life Office Pensioners 100A/E using the "92" Series projected mortality rates : Males**

Chart: 100A/E on y-axis (70 to 110), years 1992–2003 on x-axis. Two series: Amounts and Lives.

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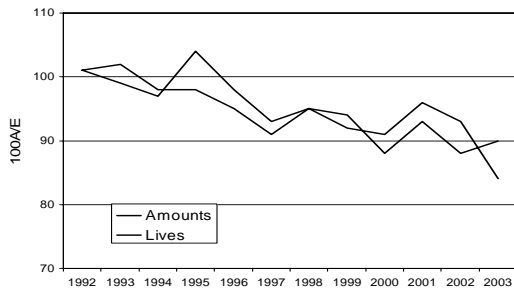
Life Office Pensioners 100A/E using the "92" Series - medium cohort, projected mortality rates : Males

Chart: 100A/E on y-axis (70 to 120), years 1992–2003 on x-axis. Two series: Amounts and Lives.

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CMIR 21 - Assured Lives, all age 100A/E, AM92 or AF92
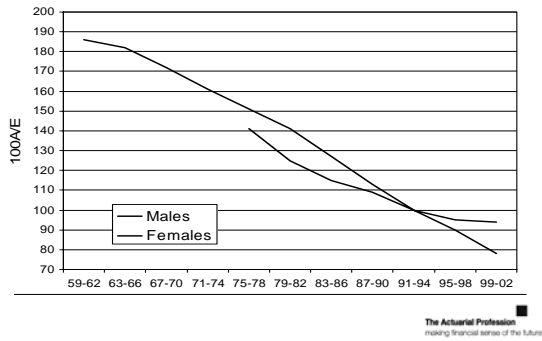
Males
Females

CMIR 21 - Assured Lives 100A/E using AM92 or AF92

Males
Females

CMIR 21 - Smoker v non-smoker, Males

Smoker
Non-smoker
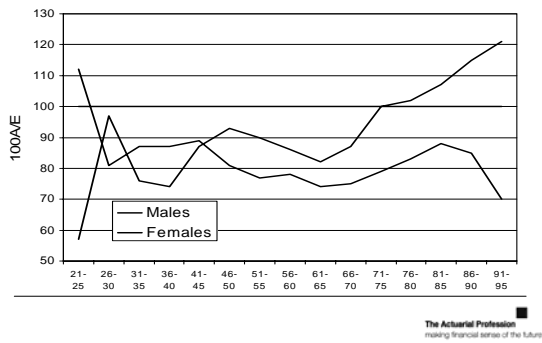
CMIR 21 - Smoker v non-smoker, Females
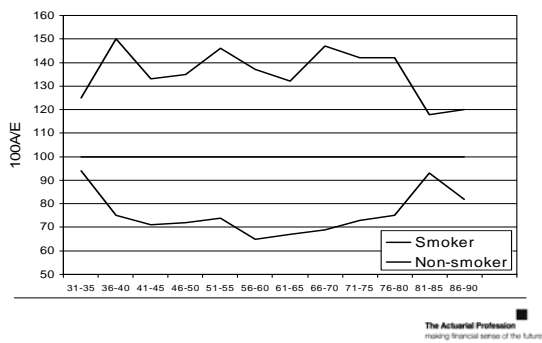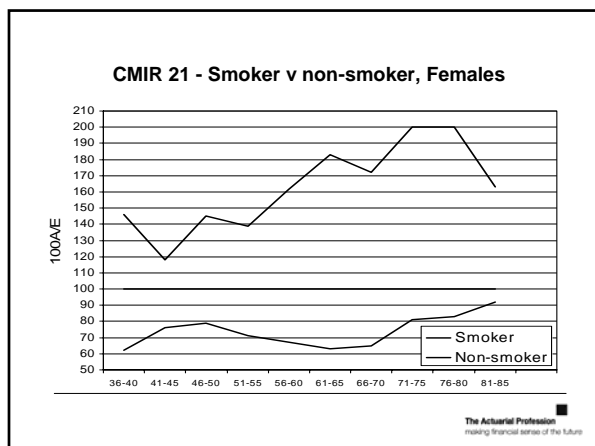
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Update on the "00" Series of tables

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Work on the "00" tables

■ Base tables - WP8 published in June 2004
  ■ Which tables (not too many!)
  ■ How should they relate to each other
  ■ Durations, lives and amounts
■ Projections
  ■ WP3 published May 2004
  ■ WP11 published Feb 2005

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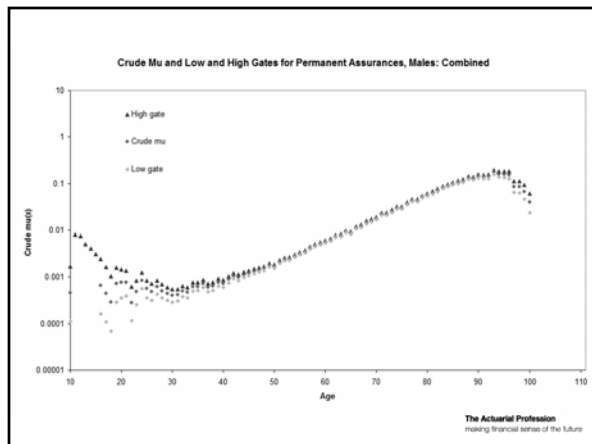
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"00" Series, Assured Lives

- About to publish Assured Lives tables
  - AM00 & AF00, 2 year select
  - TM00 & TF00, 5 year select
  - Combined, Smoker & non-smoker
  - Difficulties with select periods
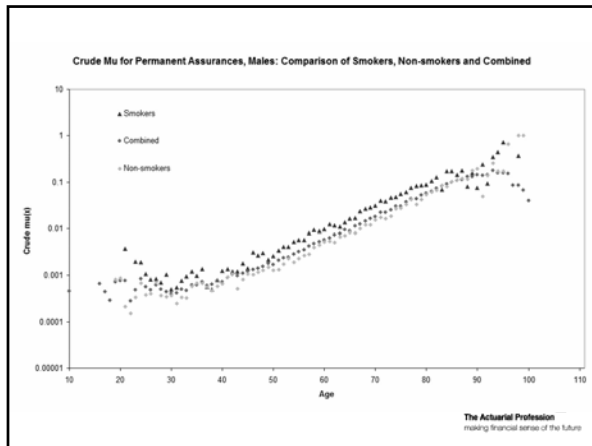 - A? = T? at ultimate durations
  - 12 tables

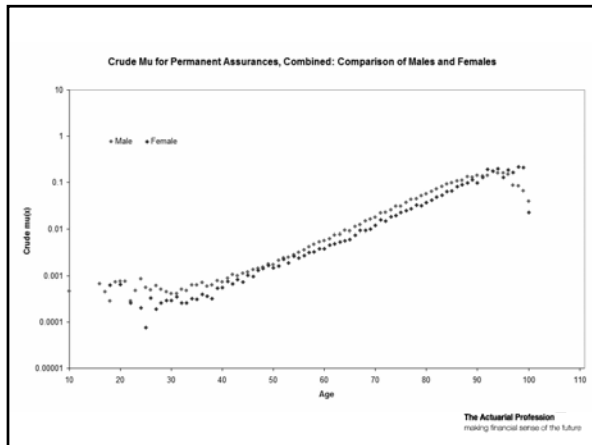The Actuarial Profession
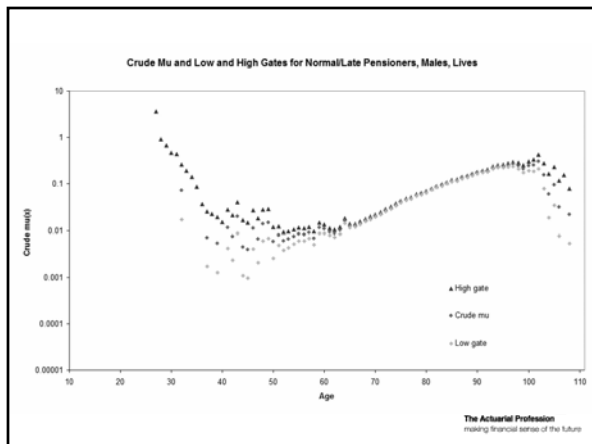making financial sense of the future

"00" Series, Other tables

- Publish when projections are ready
  - Life office pensioners, widows, annuitants, retirement annuities & personal pensions (new)
  - Vested, deferred & combined
  - Males & females
  - Lives and amounts
  - Early, late & combined
  - Only annuitants are select – 1yr
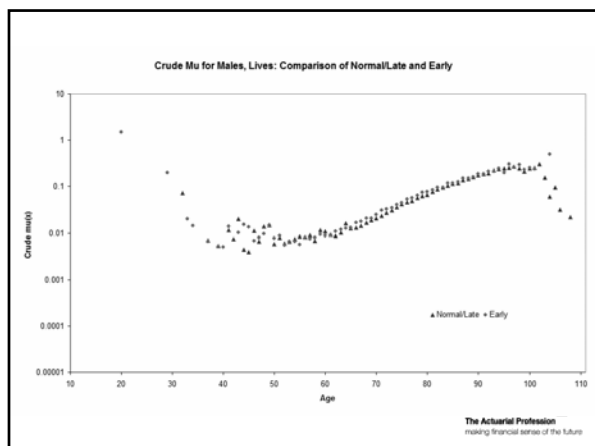 - i.e. 30 tables in total

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Crude Mu and Low and High Gates for Permanent Assurances, Males: Combined

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Crude Mu for Permanent Assurances, Males: Comparison of Smokers, Non-smokers and Combined

Crude Mu for Permanent Assurances, Combined: Comparison of Males and Females

Crude Mu and Low and High Gates for Normal/Late Pensioners, Males, Lives

Crude Mu for Males, Lives: Comparison of Normal/Late and Early

▲ Normal/Late + Early

Projections - sources of uncertainty

- Model uncertainty
- Parameter uncertainty
- Stochastic uncertainty
- Measurement error
- Heterogeneity
- Past experience may not be good guide
  (e.g. change in business mix)

Projections - conclusions so far

- Will use extrapolative parametric(?) methods
  - E.g. adjusted Lee-Carter and/or P-splines
  - Fitting difficult, over dispersion (shocks)
- Stochastic model(s) will be provided
- COD analyses may be used to "explain" results
- Model uncertainty, ignored, problem too big
- Parameter uncertainty, reflected in ci's
- Data risk, use the largest data sets

Dealing with risk in models for q_x

An example

- Consider a £10,000 pa annuity
- Male age 60, PMA92(B=1944)mc, 0%
- … traditional value = £261k
- 50% chance this is too big or too small – 100% chance that it is wrong
- … but used to reserve, calc transfer values etc.

Another way …

- What size fund will give me 99% certainty that the annuity can be paid?
- … easy calc for one life
- For age 60 just find y such that $\dfrac{l_y}{l_{60}} = 0.01$

- y = 103.8!
- Fund = (103.8 − 60) × £10k = £438k
- Note that y = 87.5 for 50% and, from the last slide, that $a_{60\ @\ 0\%}$ = 26.1
- i.e. (87.5 – 60) ≈ 26.1

So comparison is

- Pay £261k for the annuity and get 0% chance of insolvency with a 0% chance of surplus
- Or put £261k in fund => 50% chance of insolvency and a 50% chance of surplus
- Or put £438k in the => 1% chance of insolvency and a 99% chance of surplus
- Call the difference "Risk Capital" = £177k

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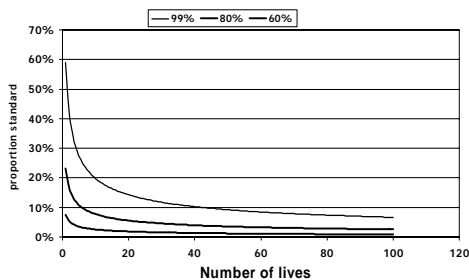making financial sense of the future

More lives?

- Need a different approach
- … one is stochastic.

$$0 \qquad\qquad p_x \qquad\qquad\qquad q_x \qquad 1$$

- Run this 1,000 times and look for 50% and 99% percentiles
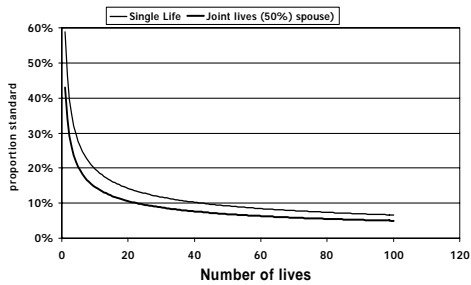
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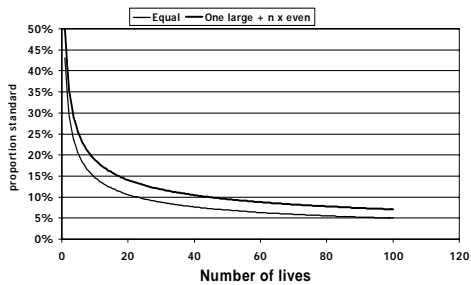making financial sense of the future

Risk capital by no. of lives

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Joint life v single life @ 99%

Comparing RC for uneven sized pensions (Joint lives)

Trend v diversifiable risk

- Only dealt with diversifiable risks, trend risk is same for all lives
- Stochastic models will generate sets of $q_{x,t}$
- Variations in $q_{x,t}$ will be noise + trend uncertainty, same for all lives
- Noise may be diversifiable across periods
- As before, can do calcs on one set of $q_{x,t}$ to look at diversifiable risk
- Vary $q_{x,t}$ to look at noise + trend uncertainty + diversifiable risk
- For a portfolio, need to run each life on same set of $q_{x,t}$

- **Much more work to do!**

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