

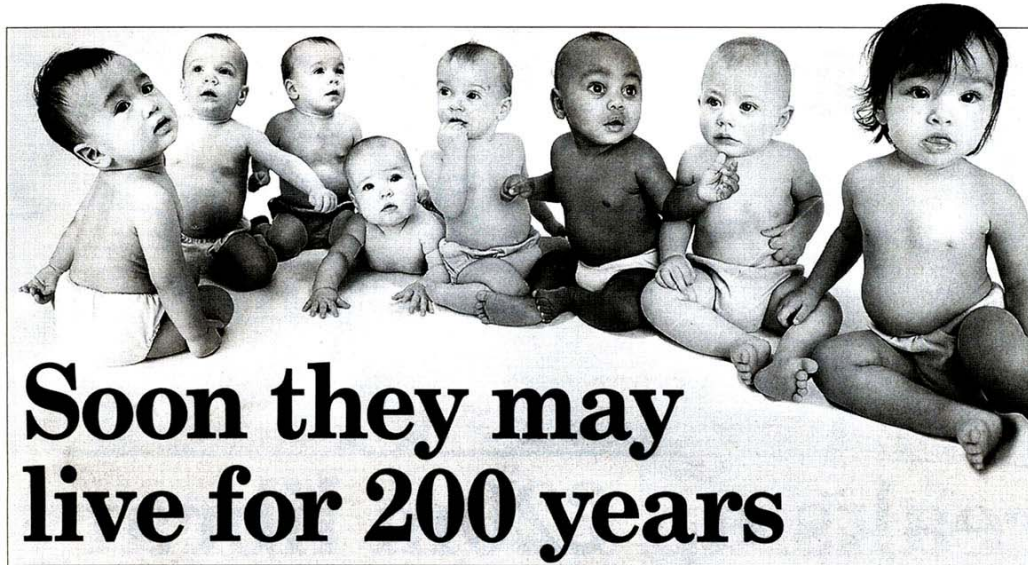
# Longevity risk

## The scale of the problem

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February 2005*

LEHMAN BROTHERS

# Longevity risk in the media (1)



THE day may come when people will celebrate the start of middle age on their 100th birthday. Some of the world's most eminent experts on ageing have predicted that average life expectancy in the developed world could rise to 200 years by the end of the century.

From the end of the 19th century to the present day, the average life span has almost doubled. In new research some scientists predict a jump of even greater proportions over the next 100 years, thanks to advances in genetic medicine.

Out of 60 experts on ageing who were asked to predict life expectancy for a baby born in 2100, more than half believed it would be more than 100 years. Seven who were interviewed in the research project for the Journal of Anti-Aging Medicine believed it could be between 150 and 200.

If such a change were to happen, it would mean a world dominated by the over-100s and a radical increase in the retirement age.

In the past century, increases in life expectancy were a result of cleaner living conditions and

**Roger Dobson and Nina Goswami**

the defeat or control of mass infectious diseases, such as smallpox and tuberculosis. Over the next century, scientists say genetic advances will push the average life span significantly higher.

Michael Fossel, clinical professor of medicine at Michigan State University, was among the experts who thought life expectancy could rise to 200 years or more. He said: "People haven't realised it, but we are in a similar position to the 1870s with regard to stopping the spread of infectious diseases.

"As you get older, your cells slowly stop repairing themselves. I think we are going to be able to reverse that process and, through genetic intervention, will be able to tell the cells to repair themselves."

Other experts interviewed for the study agreed that dramatic advances in genetic research may unlock the secrets to long life in this century. Elizabeth Blackburn, professor of biochemistry at the University of California San Francisco, said

life expectancy could reach 175 years in 2100.

She said: "In experiments in small animals, when some genes are mutated away from their natural form, they can increase life span twofold. We don't yet have an easy picture of how this might work in humans, but it's theoretically possible. We know there is a genetic component [affecting ageing] but don't yet know whether it will be a few genes or a large number."

The sequencing of the human genetic code — or genome — is the main reason for the predictions of such dramatic increases in average life spans. The breakthrough was made four years ago by two parallel projects to map human DNA: a private-sector venture led by American scientist Dr Craig Venter and the international state-funded human genome project, in which the Sanger Centre in Cambridge played a leading role.

The code offers huge potential in the battle against ageing and research has already shown that transplanted aged skin cells can be rejuvenated by manipulation of DNA. Other scientists are less convinced, however, believing the human body has a fixed limit on life span that it will not be possible to breach.

To date, though, there is no evidence of life expectancy levelling off. A male born in England in the 1850s had a life expectancy of just over 40 years while a female had a life expectancy of 42. By 2000, a man's life expectancy was 76 years and a woman's 80. The increase is expected to continue over the next few decades.

Professor Tom Kirkwood, head of biogerontology at Newcastle University's Institute for Ageing and Health, said many in the scientific community had been surprised that life expectancy is still rising.

He said: "Most people would have predicted that, with the removal of most causes of premature death through infectious disease, life expectancy would start to reach a plateau. What has taken people by surprise is

that over the past 25 years we have seen expectancy increase, which tells us the ageing process is undergoing change."

Kirkwood believes most of the gains in life expectancy have already been made and that there is little prospect of a genetic breakthrough this century that will reverse ageing. He estimates life expectancy will be 90 by the year 2100.

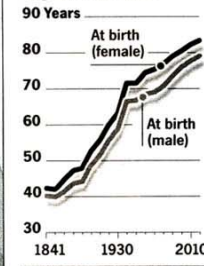
He said: "Living for 200 years is unrealistic. To do that we would have to wipe out things like cancer, heart disease and other major health problems. Despite the billions being spent on these areas, that type of eradication of disease is frustratingly slow."

It is not just genetic advances that may boost longevity. Research on animals has shown that reducing calorie intake can increase life span by 30%.

Scientists are now trying to develop a "magic bullet" that could simulate the effect of calorie restriction without people having to eat less. Research published last week suggested this could be done by a protein, Sirt1, which controls when cells store or release fat.

## The great leap

### Life expectancy in England and Wales



### Unlocking the secrets to long life

**DNA** Scientists believe interventions in the ageing genes may be able to counteract the effects of old age



**Nutrition** A significant reduction in calorie intake may be able to increase lifespan by up to 50%. Scientists are now trying to devise drugs that will mimic the effects of eating less

**Beating disease** Human trials are already being conducted

on cancer vaccines that stimulate the body to attack cancerous cells. In future decades, it may be possible to reverse heart disease by replacing diseased cells with healthy functioning ones



**Stem cell research** Doctors last month announced that within the next decade people may be able to grow new teeth from stem cells implanted in their gums. As the method develops, faulty organs could be replaced or repaired as the body begins to deteriorate



**The longest recorded lifespan for a human.** Jeanne-Louise Calment, a Frenchwoman, was born on February 21, 1875 and died in 1997 at the age of 122 years and 164 days

**Andorra in the Pyrenees has the highest life expectancy in the world, at 83 years. Mozambique has the lowest life expectancy in the world, at 31 years**

Sunday Times 06/06/04

*Older, bolder and better*  
The Magazine, pages 28-36

# Longevity risk in the media (2)

The Independent and The Financial Times 12/10/04

*Newspaper of the Year*

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## THE PENSIONS CRISIS

(Or everything you need to know about your future but may be too scared to ask)

<b>£110,000</b> The amount a non-smoking female needs to have saved at age 65 to buy a retirement income of £100 a week	<b>5%</b> The level of GDP the UK government spends on pensions	<b>11%</b> The level of GDP other EU governments spend on pensions	<b>18%</b> Percentage of the British population currently over pensionable age	<b>15</b> Average number of years people were living beyond 65 in 1978
<b>£500,000</b> Amount a non-smoking male needs to have saved to retire at 55 to provide an inflation-proof annual income of £20,000	<b>£57bn</b> A report for the Government today identifies this figure as the total gap between how much people are saving and how much they need to save to ensure a comfortable retirement		<b>25%</b> Predicted percentage of the British population over pensionable age by 2040	<b>18</b> Average number of years people live beyond age 65 today
<b>£30,000</b> The average pension pot at retirement age, buying an income of £30 a week	<b>1m</b> The number of UK pensioners living below the poverty line	<b>22%</b> How much of your earnings you need to put aside each month if you don't start saving for your pension until 40 years old	<b>60%</b> The percentage Britons working pay the pension of the 21% who have retired	<b>21</b> Average number of years people are predicted to live beyond 65 by 2030
<b>£70,000</b> The gap between how much people think they need to save for retirement and the reality	<b>12%</b> Amount of your earnings you should put aside if you start saving for your pension at the age of 25	<b>24%</b> Amount of earnings adults under 30 spend on restaurants, hotels, recreation, alcohol and tobacco	<b>56%</b> The percentage Britons working 2030 to pay the pensions of the 27% retired	Statistics compiled by James Daley

Further reports, pages 6-8 Comment, pages 34-35

## Pensions alert on life expectancy forecasts

The worry is that "we may still be underestimating life expectancy". Official projections are that life expectancy at 65 will rise from 19 years today to 21 by 2030. But if current trends continue, a man aged 65 could expect to live for another 24 years by 2030.

1978

2004

2030

By Nicholas Timmins, Public Policy Editor

The government actuary and pension providers may still be underestimating the rise in life expectancy and the costs it imposes on the state and private pension schemes. Adair Turner, the chairman of the Pensions Commission, will warn today. Mr Turner will say that the failure by actuaries to get these projections right is a cause of the pensions-saving shortfall. His warning will coincide with publication of the commission's interim report analysing Britain's pensions crisis and the options ahead. Tony Blair, prime minister, made clear yesterday that the government's reform proposals would await the commission's formal recommendations, which Mr Turner does not plan to produce until after the general election.

This meant the state earnings-related pension scheme had been designed on unrealistic assumptions about its cost. "It also means that anybody running a private sector defined-benefit company scheme in 1980 who was thinking about the underlying cost was getting it wrong by 30 per cent," Mr Turner said at a recent meeting organised by the Association of British Insurers.

In 1950, a man aged 65 could expect on average to live for another 12 years. In 1981, the government actuary projected a rise to 14.8 years by 2004. In fact, life expectancy for a 65-year-old man today is 19 years, he said.

# Longevity: a major private/public sector pensions issue

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- ◆ Rapid mortality improvements in the UK, often underestimated
- ◆ Uncertainty over longevity a concern for investors in UK insurers
- ◆ Focus shifting to the risk in defined benefit pension schemes
- ◆ Implications for unfunded public sector schemes
- ◆ Hedging longevity risk is not straightforward
- ◆ Ultimately increasing longevity has wider social implications

# The UK economy's exposure to longevity risk is high

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- ◆ c£70bn in UK life insurers' annuity liabilities
- ◆ Estimated £760bn in UK private defined benefit pension assets
- ◆ Approximately £350bn of unfunded public-sector liabilities
- ◆ >£1000bn of liabilities exposed, comparable with GDP
- ◆ Relatively long duration liabilities, spanning over decades

# Rapid mortality improvements over the 20<sup>th</sup> Century...

Figures 1a & 1b: Mortality improvements between 1901 and 2001, England and Wales population

Age	Reduction in mortality rate	
	Male	Female
5	98%	98%
25	82%	92%
45	80%	83%
65	63%	71%
85	37%	49%

Source: 'Longevity in the 21<sup>st</sup> Century' Willets et al, ELT7 (1901-10), GAD Interim Life Tables 2000-02

Year	Life expectancy at age 65	
	Males	Females
1901-10	75.8	77.0
1950-52	76.7	79.3
1980-82	78.0	82.0
2000-02	81.0	84.1

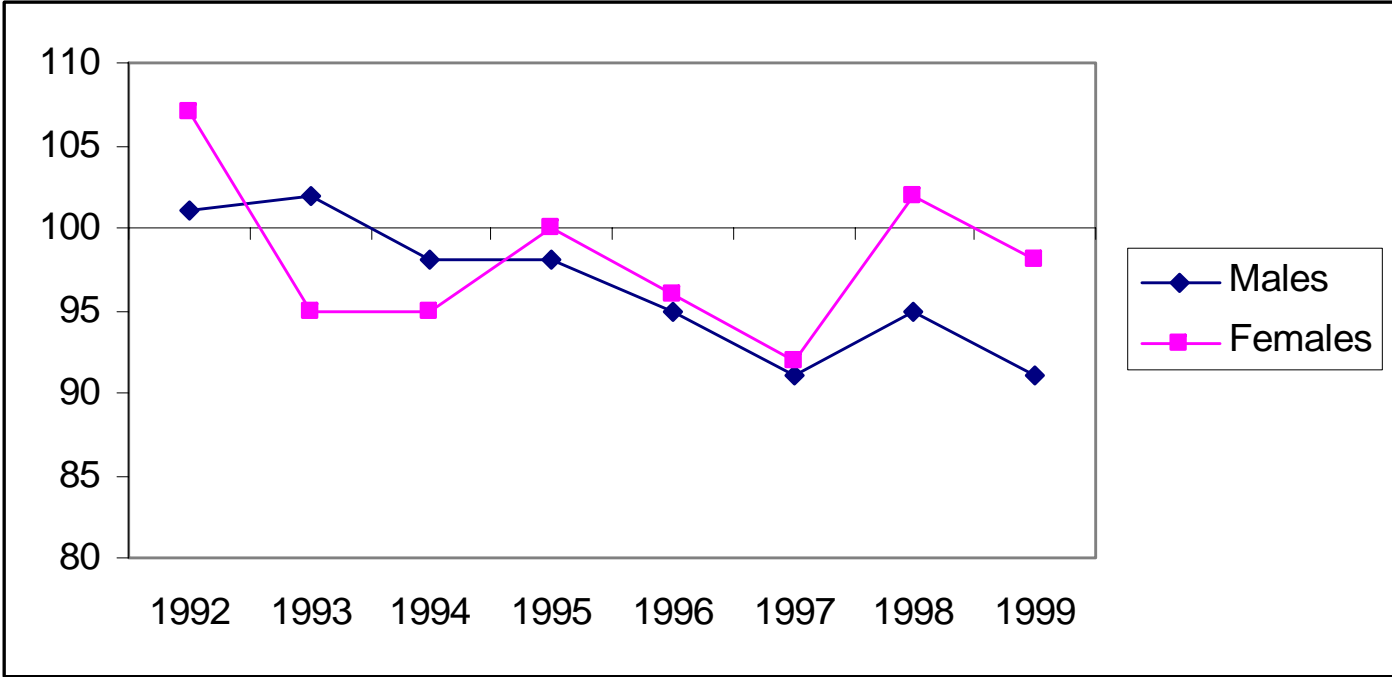
Source: 'Longevity in the 21<sup>st</sup> Century' Willets et al, ONS, GAD, ELT

## ◆ Life expectancy (for male/female reaching age 65):

- 1900: male 11 years, female 12 years
- 1980: male 13 years, female 17 years
- 2000: male 16 years, female 19 years

# ...often underestimated by life/pensions industry

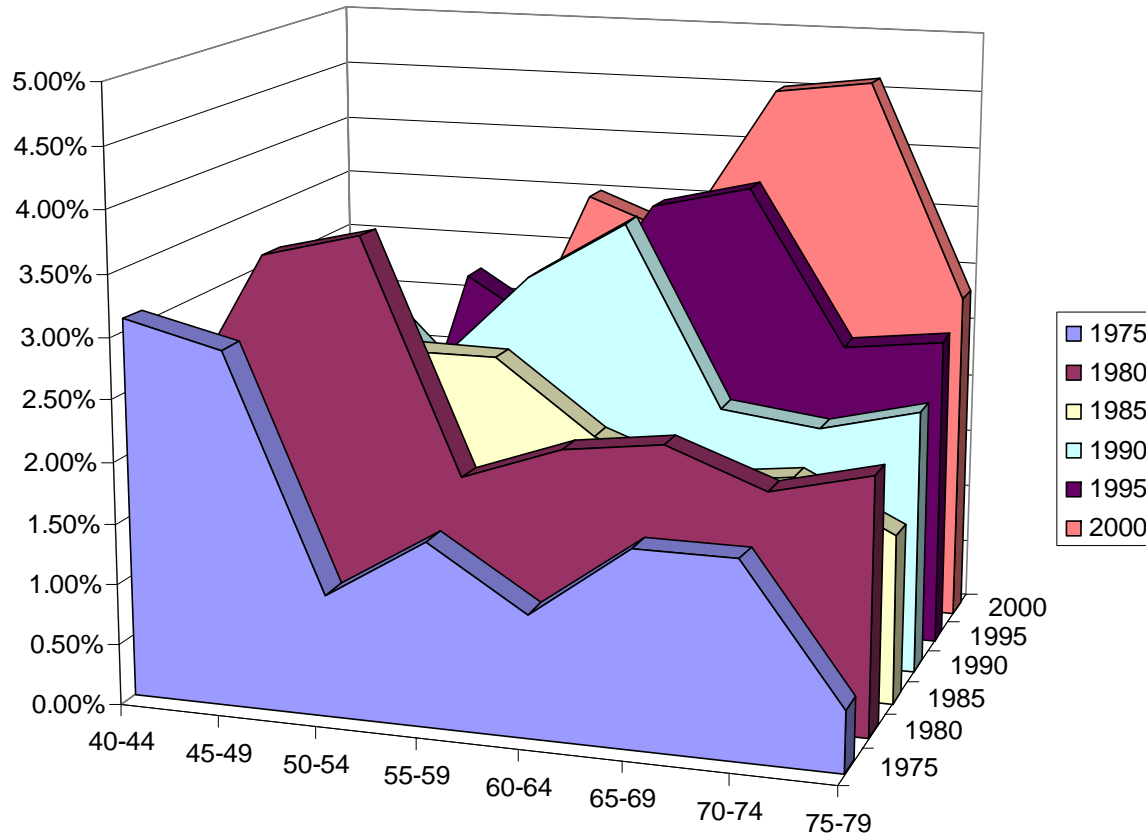
Figure 2: Life office pensioners (All Offices, normal retirements): actual vs. expected deaths using PMx92 series



Source: CMIB Working paper 1, 2002, appendix A4.1

# Mortality drivers are complex: the “cohort effect”

Figure 3: Average annual rate of mortality improvement (England and Wales) by age group and decade, males



◆ ‘Cohort’ of births (1910-1942), experiencing higher mortality improvement.

Source: Office of National Statistics (2003)

# Hedging longevity risk is not straightforward

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- ◆ Longevity risk is a ‘systematic’ risk (non diversifiable)
  - Need to spread the risk
  
- ◆ Potential solutions: reinsurance or capital markets?
  - Reinsurers reluctant
  - Traditional mortality models inadequate?
  - A long-term risk
  - Objective index of longevity

# Financial implications for UK insurers (1)

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- ◆ Longevity risk is topical for UK insurers and their investors
- ◆ Old mortality assumptions proved too light
- ◆ Three CMIB ‘interim’ bases: insurers have chosen ‘mid’ intensity
- ◆ Financial impact has varied according to annuity exposure

## Implications for UK insurers (2)

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- ◆ Investors remain wary of future longevity risk
- ◆ Potential for increased regulatory capital requirements?
- ◆ Concerns over ability to ‘price’ annuities correctly?
- ◆ Other implications: e.g. asset-liability duration issues

Figure 4: Estimated increase in cost of annuity in 2004 for male aged 65 assuming 5% interest rate

<b>Mortality table and cohort projection assumption</b>	<b>% increase in cost of annuity</b>
PMA92 original	0%
PMA92 short cohort	6%
PMA92 medium cohort	8%
PMA92 long cohort	12%

Source: 'Longevity in the 21<sup>st</sup> Century' Willets et al.

## **DB pension schemes: highly exposed to longevity risk**

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- ◆ Private sector DB schemes vs UK insurers
- ◆ In the past focus on equity market/investment risk
- ◆ Much less focus on longevity risk: over-optimistic assumptions
- ◆ Asset-liability matching issues as liabilities get longer

# DB pension schemes: potential costs

- ◆ Potentially high costs of more rigorous mortality assumptions
- ◆ Poor disclosure of current mortality assumptions
- ◆ “£20bn added to FTSE-100 scheme liabilities”?
- ◆ Large difference between DB scheme and UK insurer bases?

Figure 5: Estimated increase in cost of annuity in 2004 for male aged 65 assuming 5% interest rate

Mortality table and cohort projection assumption	% increase in cost of annuity
PA(90)-2	0%
PA(90)-6	11%
PMA92 original	15%
PMA92 short cohort	22%
PMA92 medium cohort	24%
PMA92 long cohort	29%

Source: 'Longevity in the 21<sup>st</sup> Century' Willets et al.

## **‘UK plc’ is exposed to longevity risk**

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- ◆ Schemes in deficit: poor equity markets/accounting disclosure
- ◆ Investor awareness of DB scheme longevity risk
- ◆ Changing rules/benefits an imperfect solution
- ◆ Buy-outs are expensive

## Wider economic and social implications

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- ◆ Ageing population and ability to fund state pension?
- ◆ Large unfunded public-sector liabilities exacerbated?
- ◆ Demise of DB and implications for long-term savings?
- ◆ Future tax receipts/changing working patterns?
- ◆ The state is the ‘insurer of last resort’?

# The European Insurance Equity Research Team

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