Public Policy and the Science Base: Successes and Failures

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Centre for Science and Policy

Cambridge, 27 February 2013

- Low Pay Commission: 2001 – 2005
- Health Service Trends and efficiency issues: 2001 – 2002
- Pensions Commission: 2002 – 2006
- Economic and Social Research Council: 2007 – 2008
- Climate Change Committee: 2008 – 2012
- Financial Services Authority: 2008 – 2013

Issues not covering

- Physical science and technological progress
- Public policies to foster science and technology base
    - Development
    - Deployment

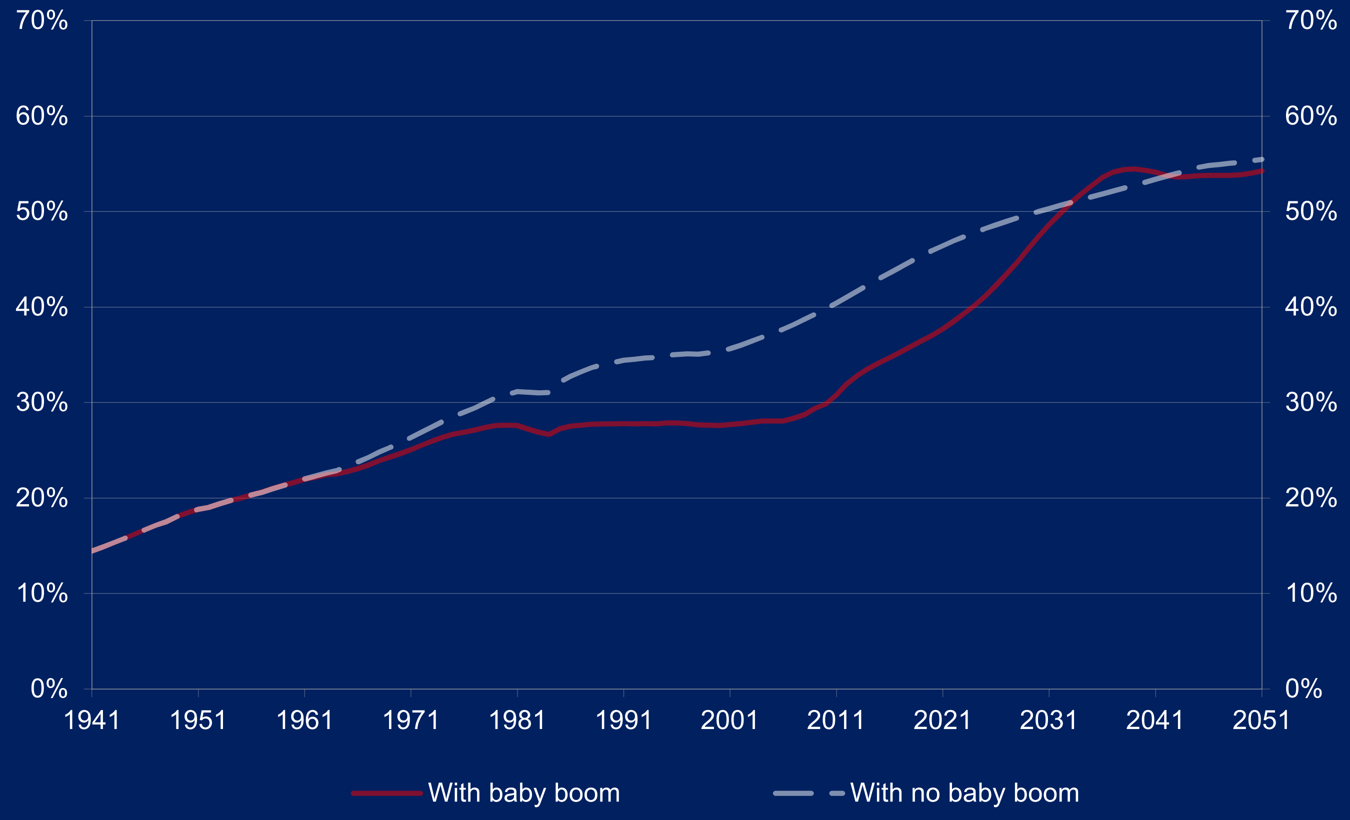
UK Pension Policy late 1970s – 2005: A study in failure

- Realisation that UK basic state pension insufficient
  - — SERPS introduced
- Realisation that SERPS "too expensive"
  - — Made less generous
  - — Opting out encouraged
- Large scale purchase of high administration cost personal pension:
  - — Poor value
  - — Miss-selling scandal and redress
- Gold standard employer defined benefit plans
  - — Erode
  - — And then collapse
- Basic state pension
  - — Available at unchanged 60/65 state pension age
  - — But indexed to prices and falling as % of earnings

By 2005:

- Over 50% of private employees wholly dependent on state pension
- Failing pension contributions as % GDP
- State Pension provision increasingly means-tested

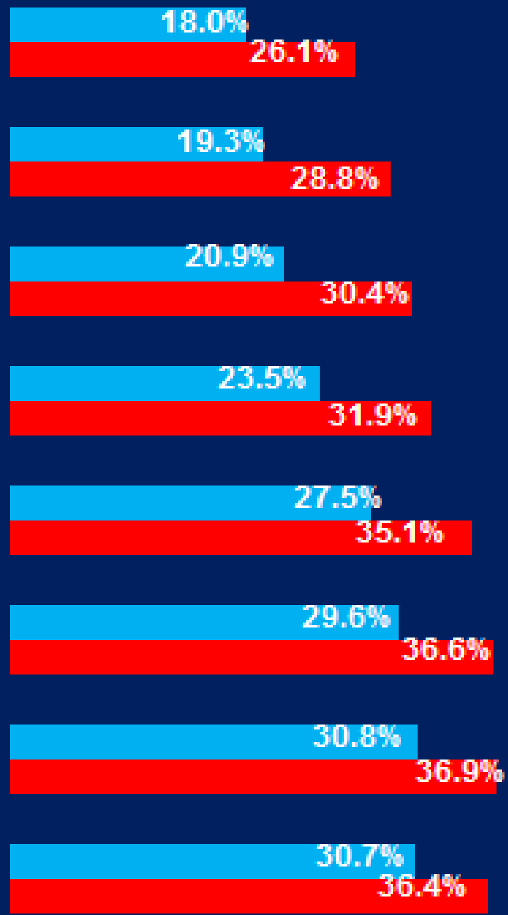
Impact of the 1940s-1960s baby boom on 65+/20-64 ratio



Source: Pensions Commission First Report, 2004

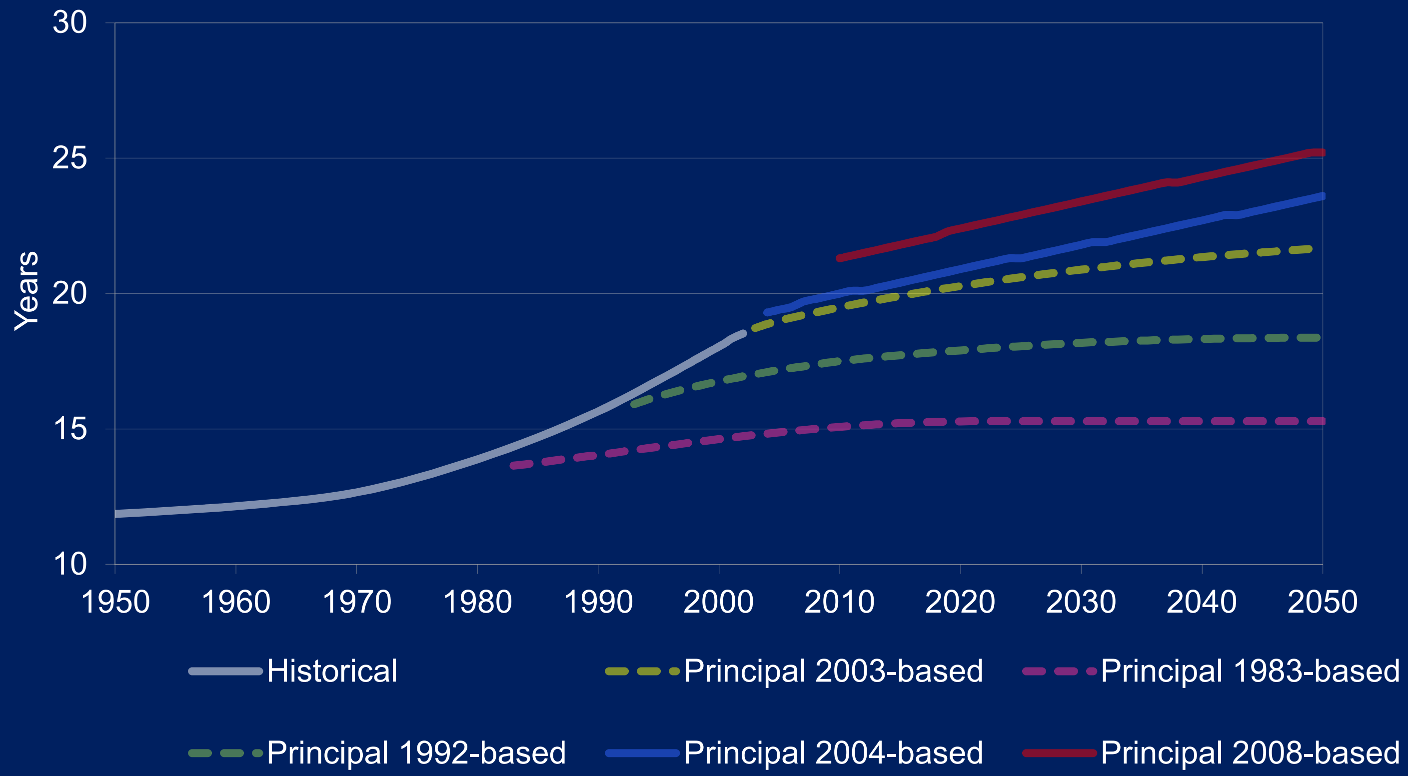
Percentage of adult life spent in retirement

		Average age of exit from workforce	Life expectancy at age of exit form workforce
1950	Men	67.2	10.8
	Women	63.9	16.2
1960	Men	66.2	11.5
	Women	62.7	18.1
1970	Men	65.4	12.5
	Women	62.4	19.4
1980	Men	64.6	14.3
	Women	62.0	20.6
1990	Men	63.5	17.2
	Women	60.9	23.2
1995	Men	63.1	18.9
	Women	60.7	24.7
2000	Men	63.3	20.2
	Women	61.1	25.2
2005	Men	64.0	20.4
	Women	61.9	25.1



Source: Pensions Commission Second Report, 2005

Male cohort life expectancy at 65

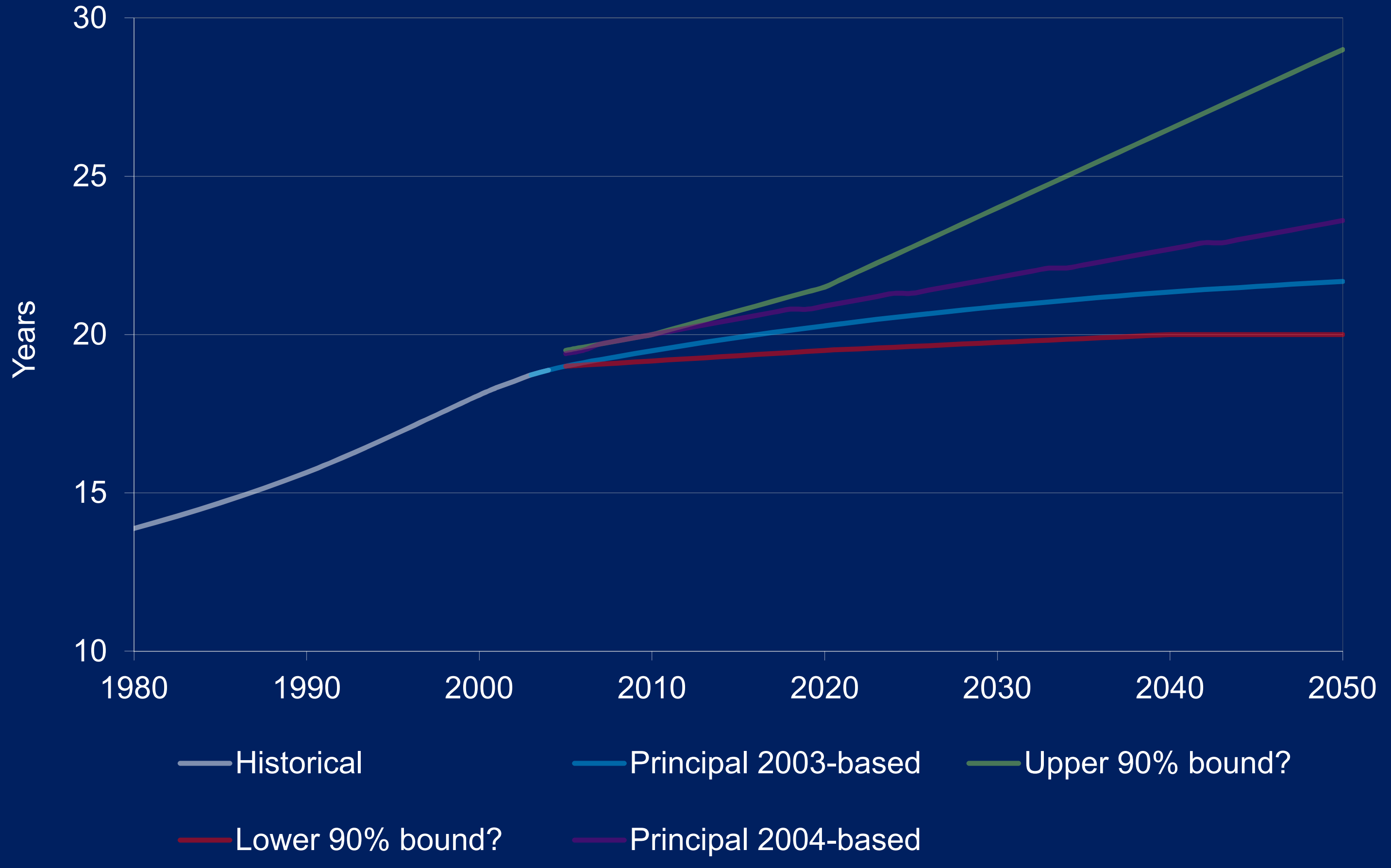


Source: Pensions Commission Second Report, 2005

Actual past differences in mortality rate forecasts

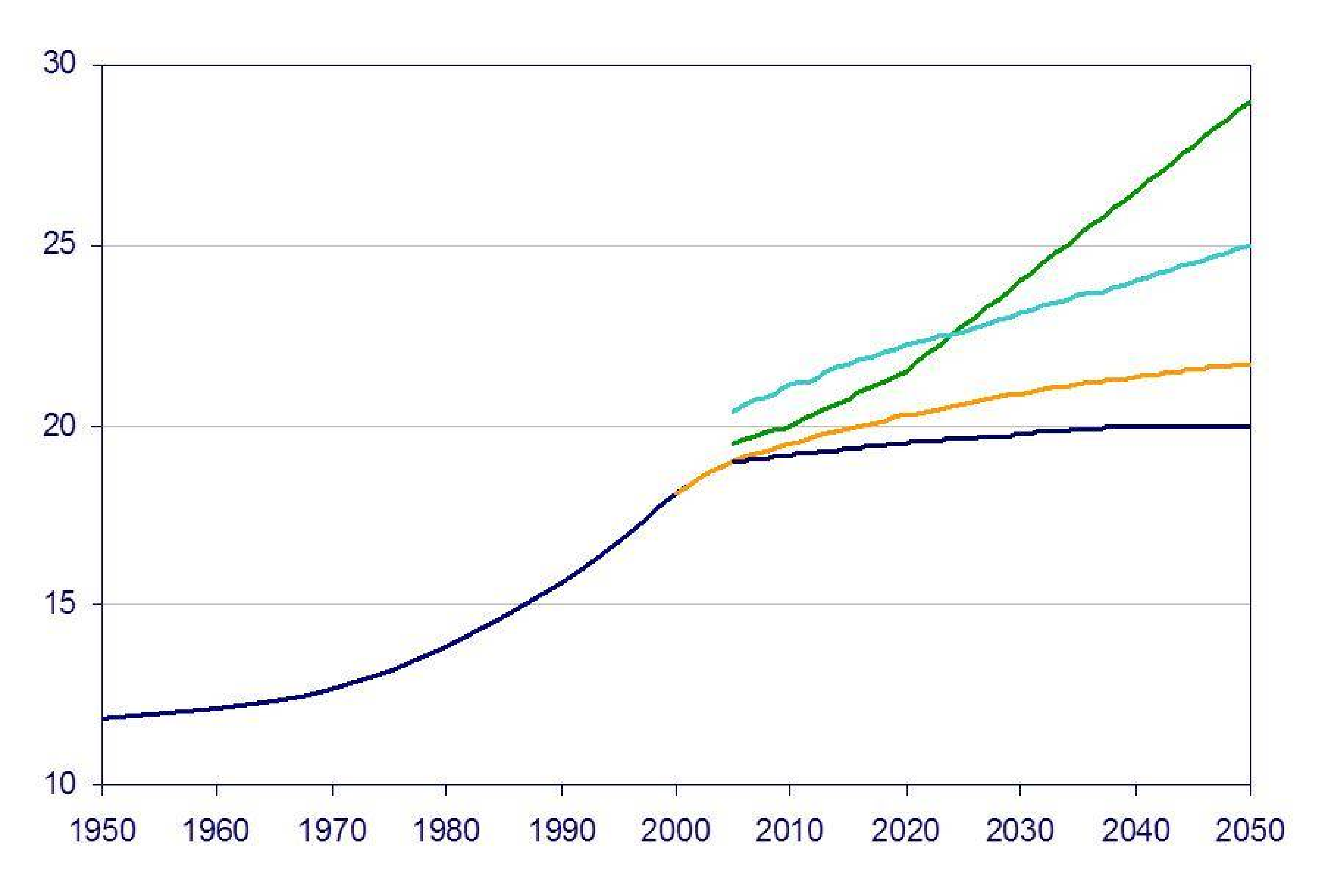
	Mortality rates forecast / measured in year								
	1984	1985	1986	…..	1994	…..	2004	…..	2014
	Actual vs 1983 forecast						2003 forecast vs 1983 forecast		
Male at age 65	-8%	-0%	-3%	……	-17%	….	-41%	……	-46%
Male at age 75	-4%	-1%	-4%	……	-17%	…..	-28%	…..	-43%
Male at age 85	+2%	+3%	+1%	……	-6%	…..	-12%	…..	-24%

Reasonable judgement on uncertainty?



Source: Pensions Commission Second Report, 2005

Reasonable judgement on uncertainty?



Upper 90% bound?

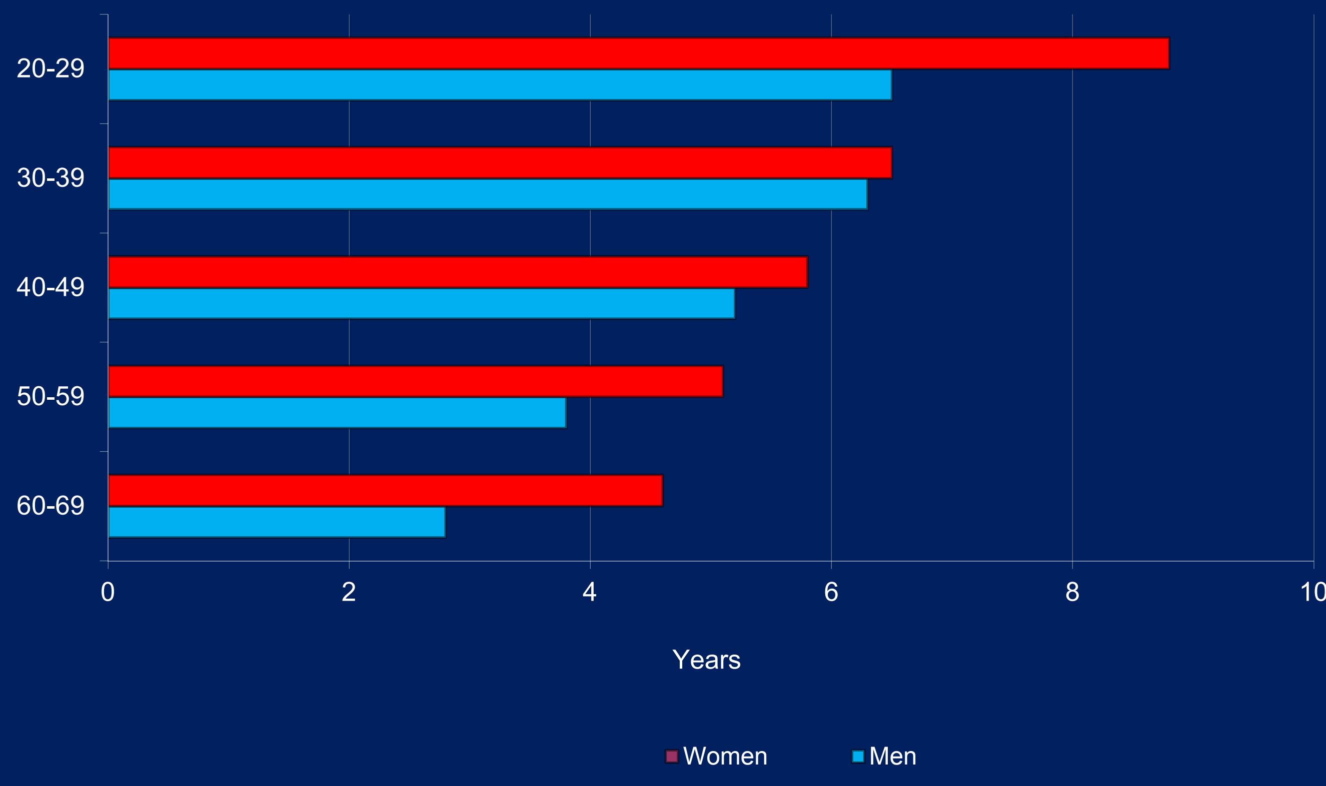
GAD 2006-based Principal Projection

GAD 2003-based Principal Projection

Lower 90% bound?

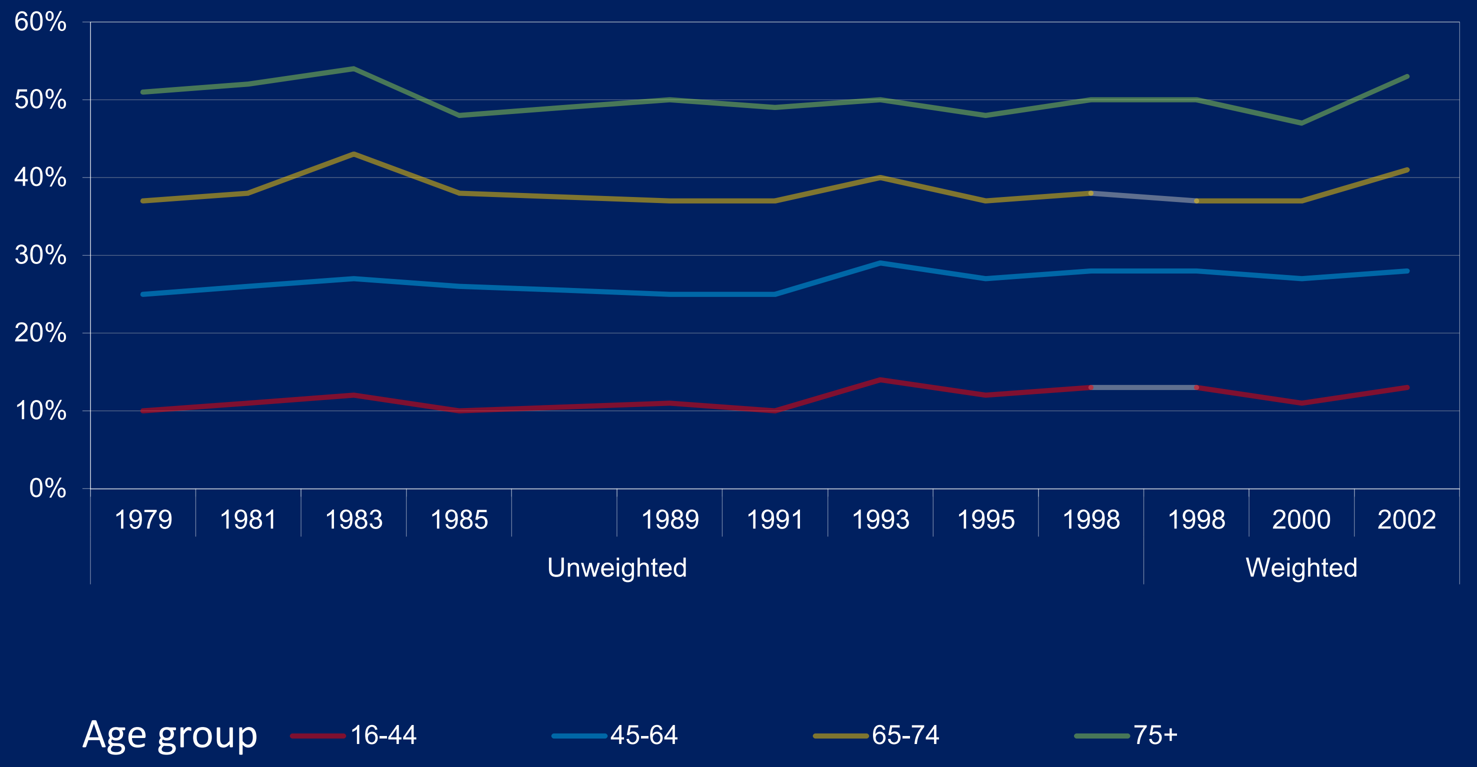
Source: Pensions Commission Second Report, 2005

Individual underestimates of life expectancy by age



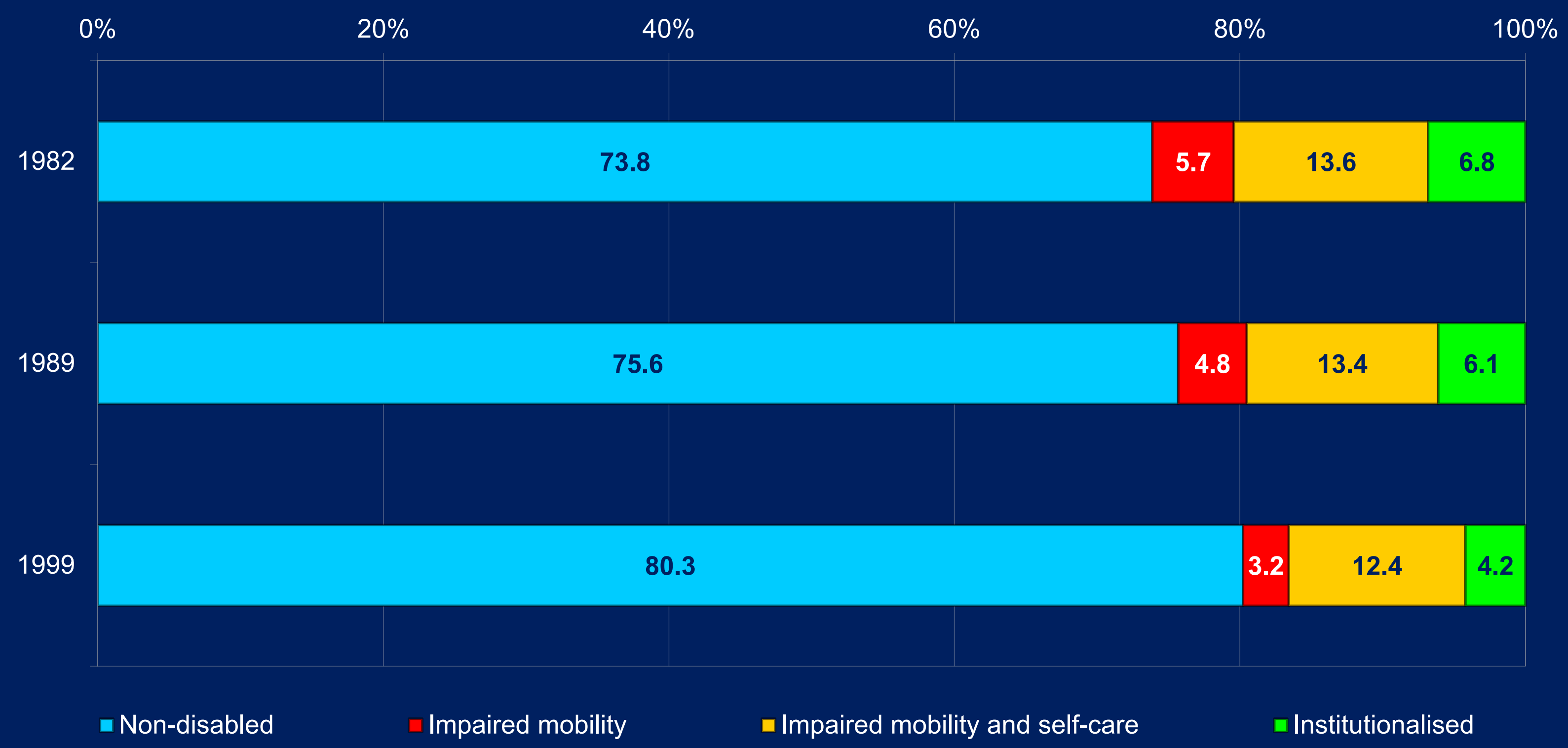
Source: Pensions Commission Second Report, 2005

Trend in self-reported sickness by age



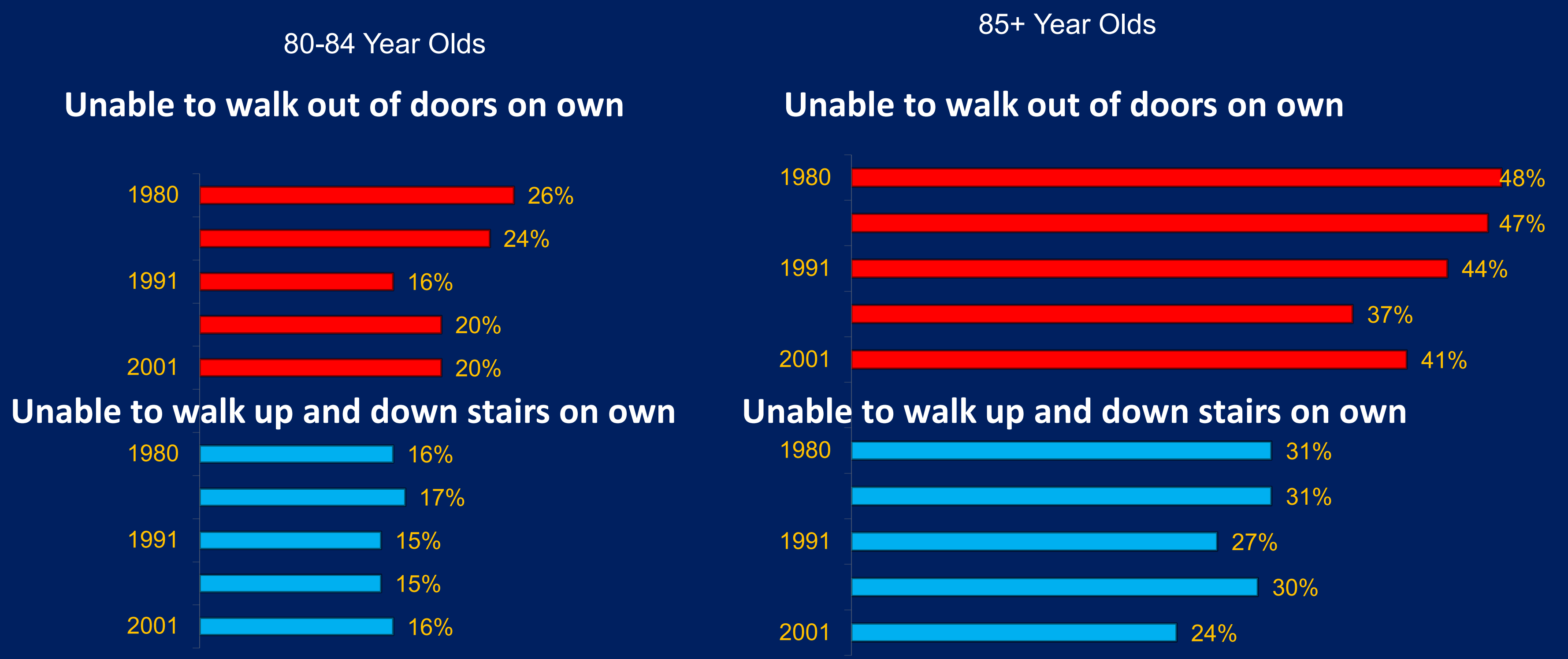
Source: Pensions Commission First Report, 2004

Health status of US over 65 population



Source: Pensions Commission First Report, 2004

Trends in immobility by age

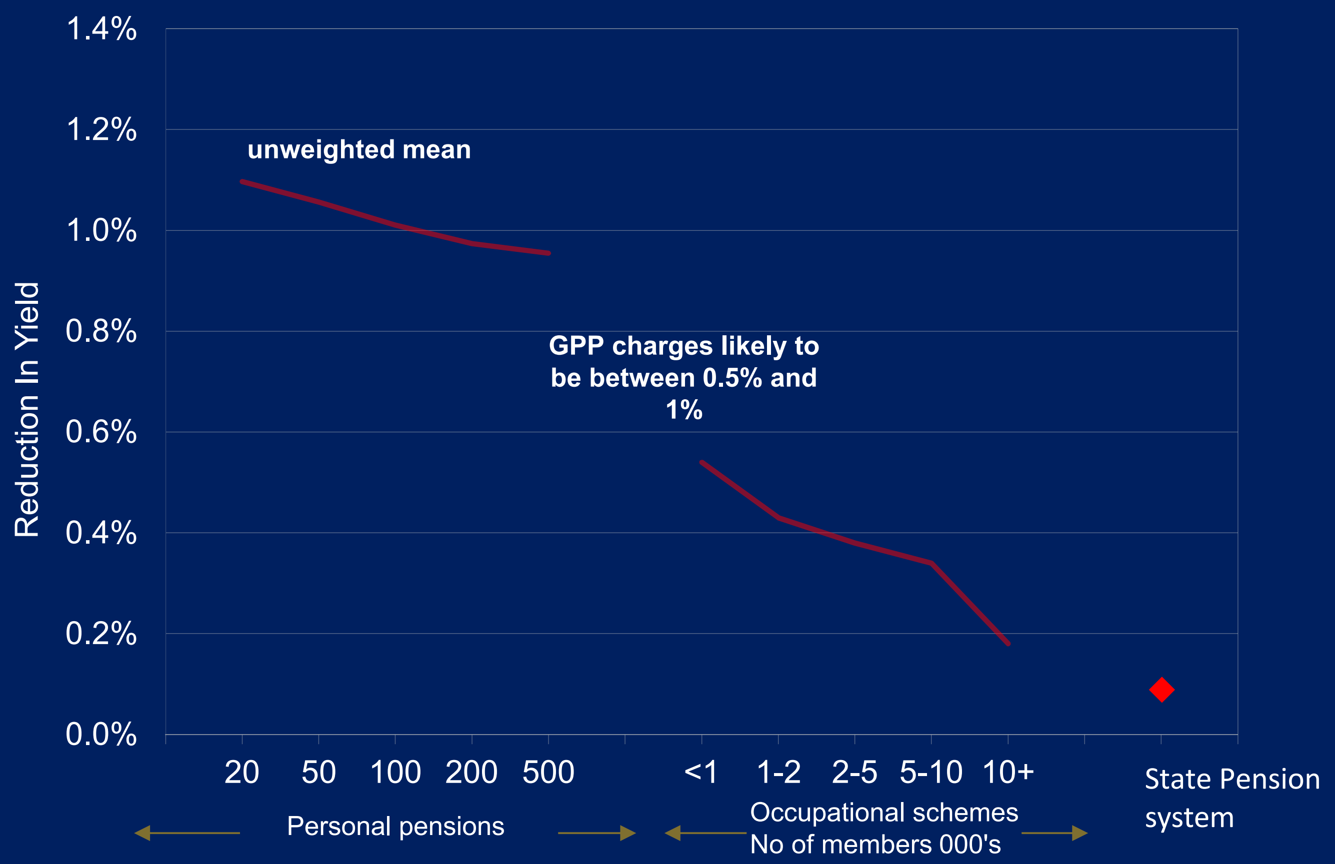


Source: Pensions Commission First Report, 2004

Saving for a pension: assumptions and reality

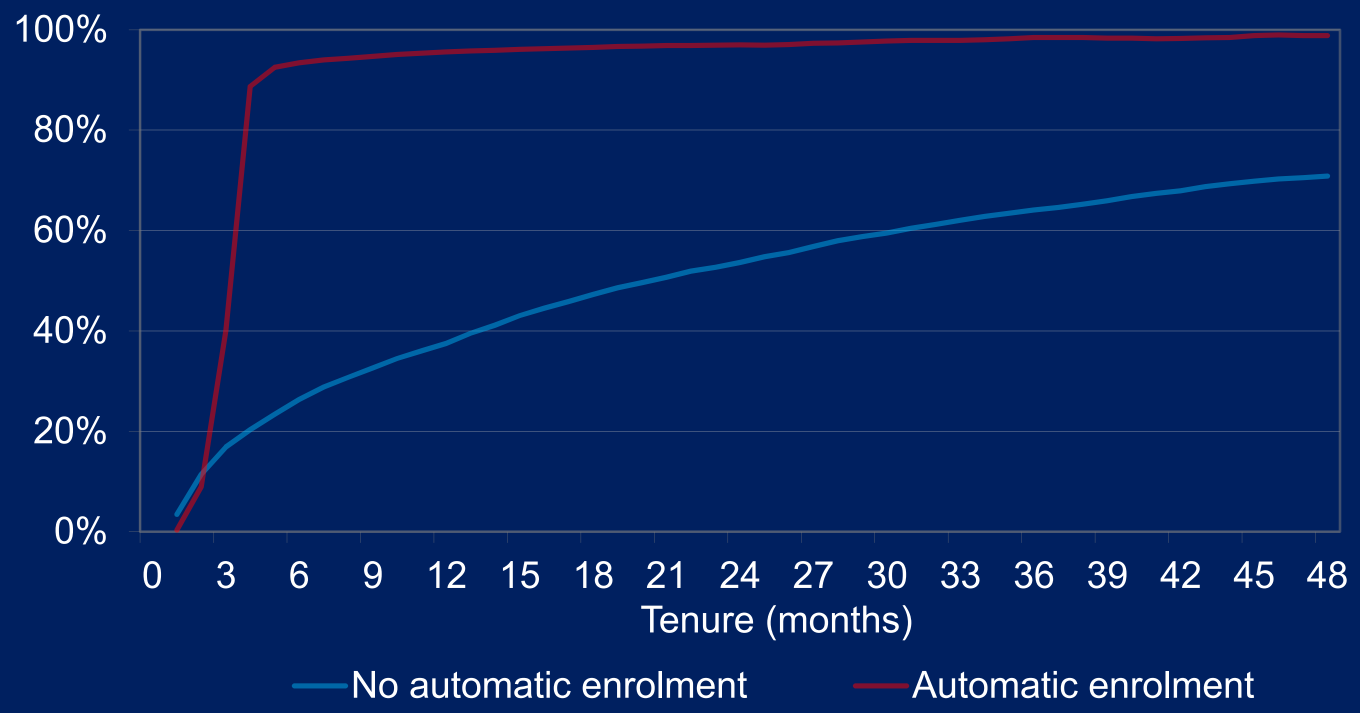
Neoclassical Rational Agent Assumption	Reality
Assessment of potential life time earnings	State requirement
Allocation of consumption potential across life-cycle	By product of contract of employment
Maximise net present value of utility	Insurance company sales push
Using appropriate inter-temporal discount rate	

Estimate of overall cost curve: % reduction in yield



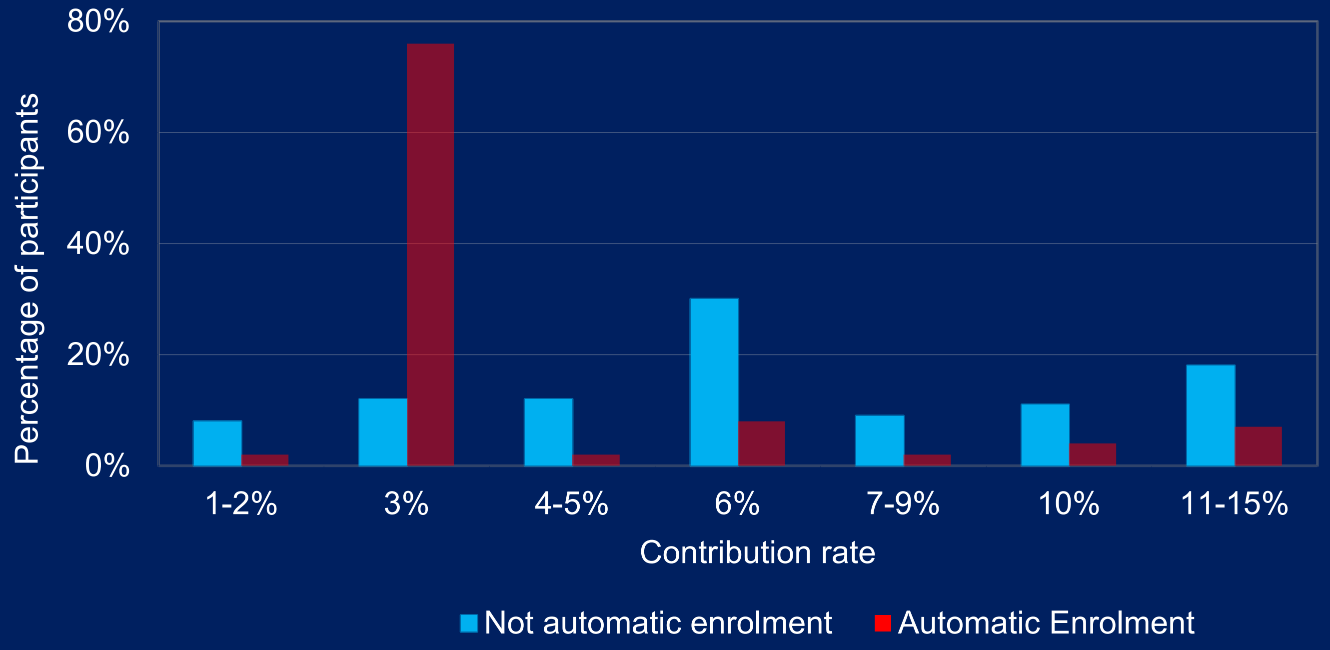
Source: Pensions Commission First Report, 2004

Percentage of employees in a 401 (k) pension scheme



Source: Pensions Commission First Report, 2004

Pension contribution rates with and without automatic enrolment



Source: Pensions Commission First Report, 2004

Emissions of green house gasses

- GDP growth
- Energy intensity of GDP
- Carbon intensity of energy

Cumulative stock of green house gases in atmosphere

- Rate of dissipation

Average global temperature

- Direct effects
- Feed-back loops
  - Amplifying
  - Dampening

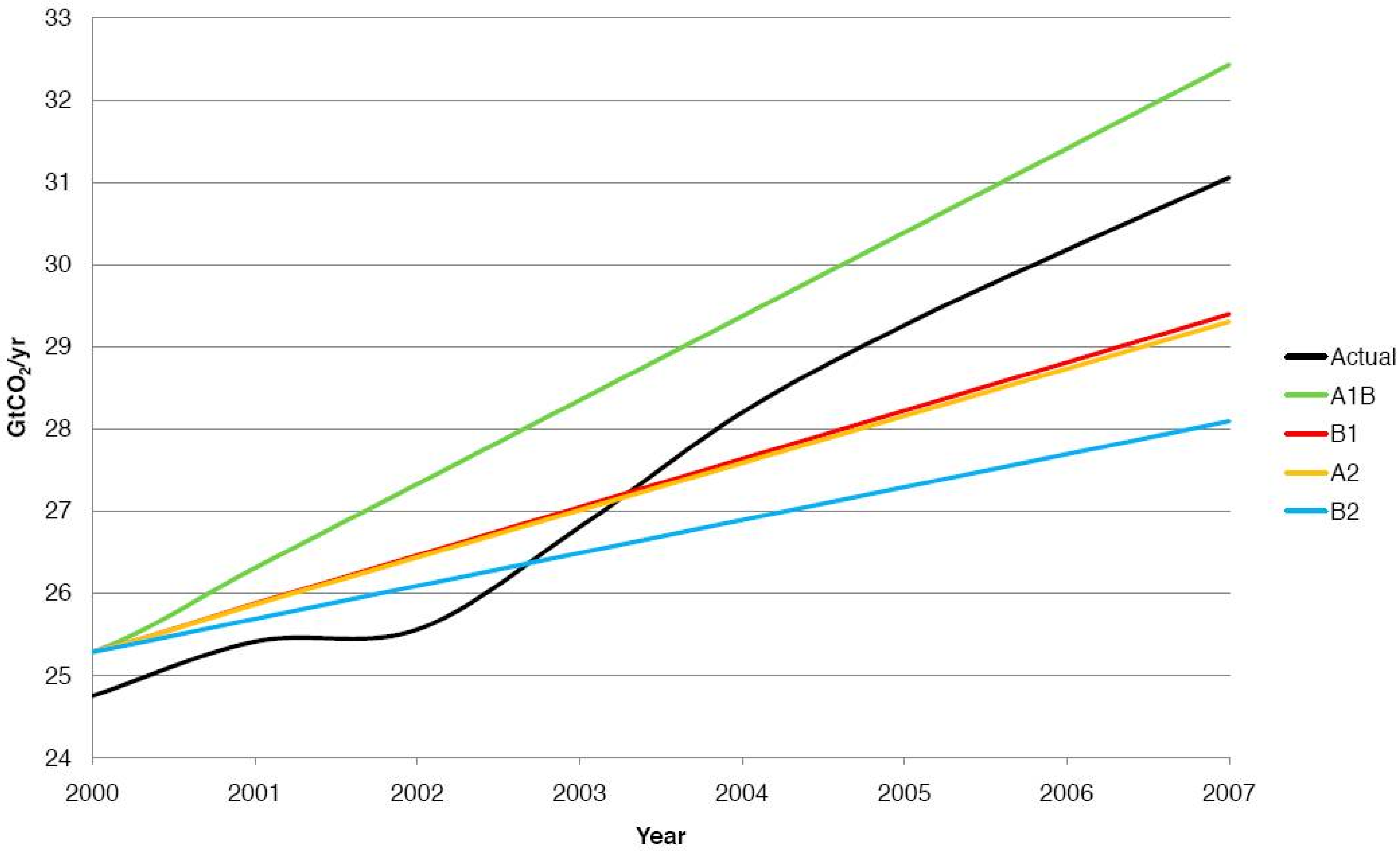
Regional climates

- Complex climate models

Economic & Social consequences

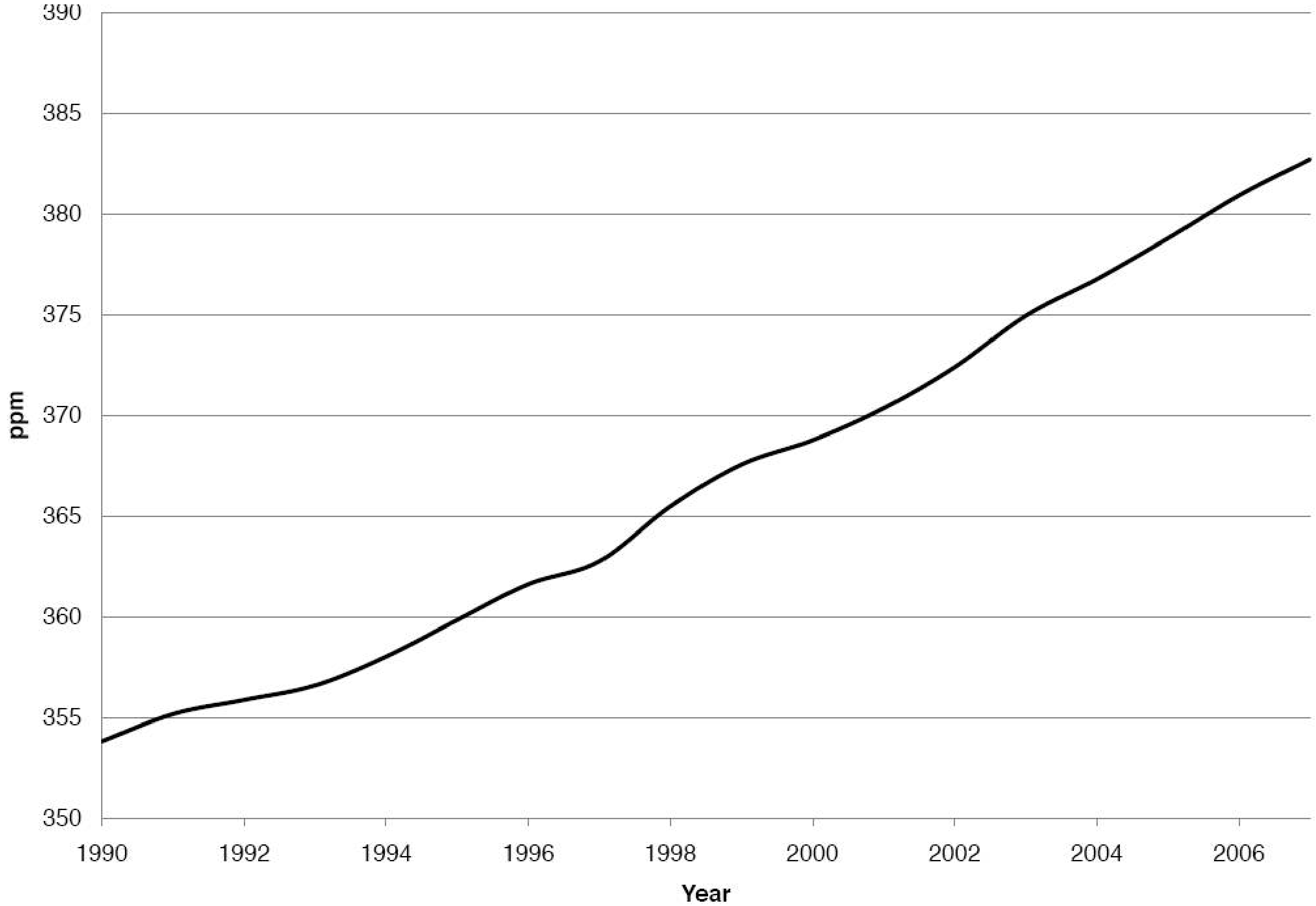
- Non-linear relationship to temperature increase

Global carbon dioxide emissions



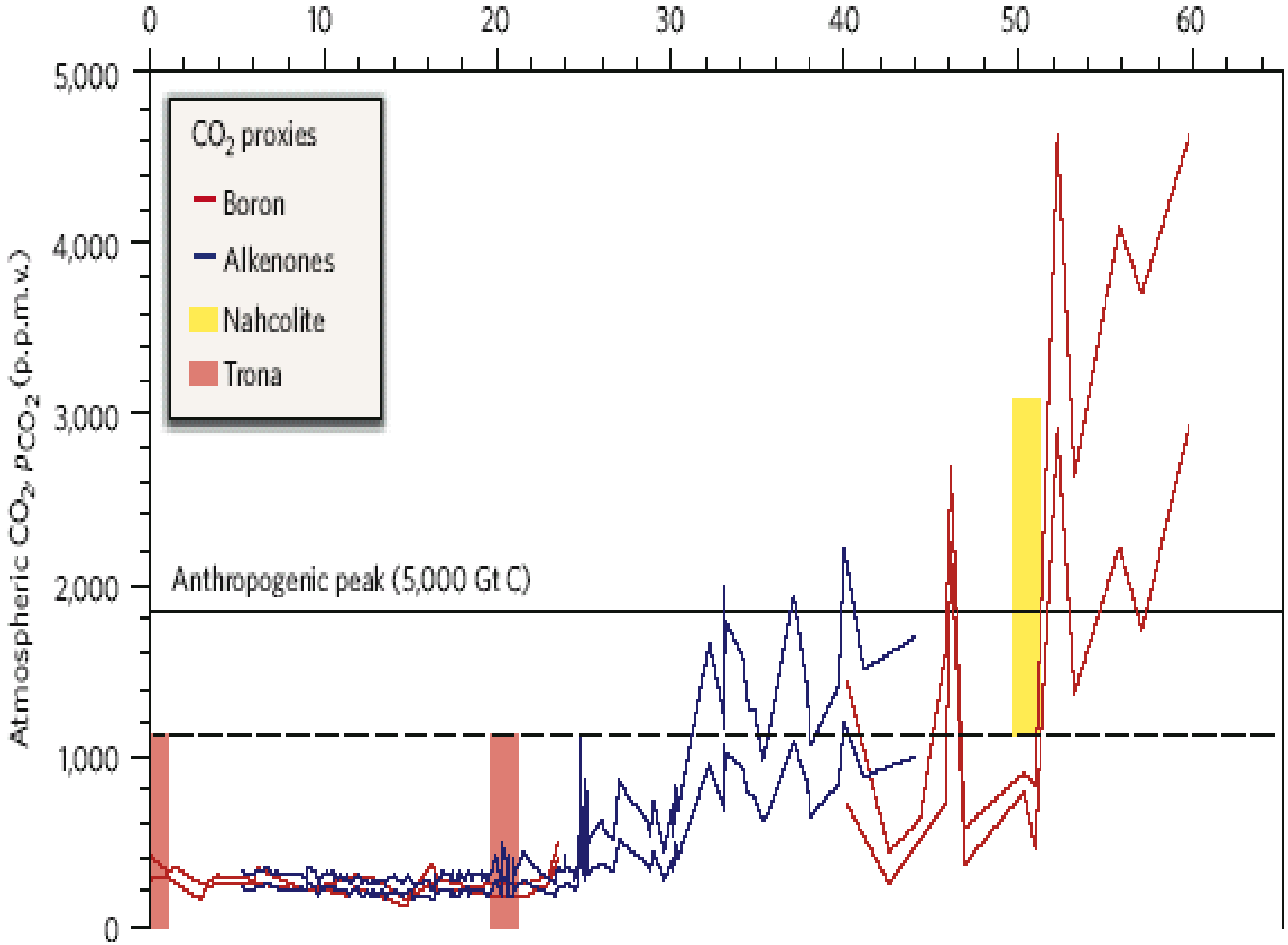
Source: Building a low-carbon economy, Chapter 1, Climate Change Committee's First Report, December 2008

Global annual average of CO^2 concentration in parts per million (ppm)

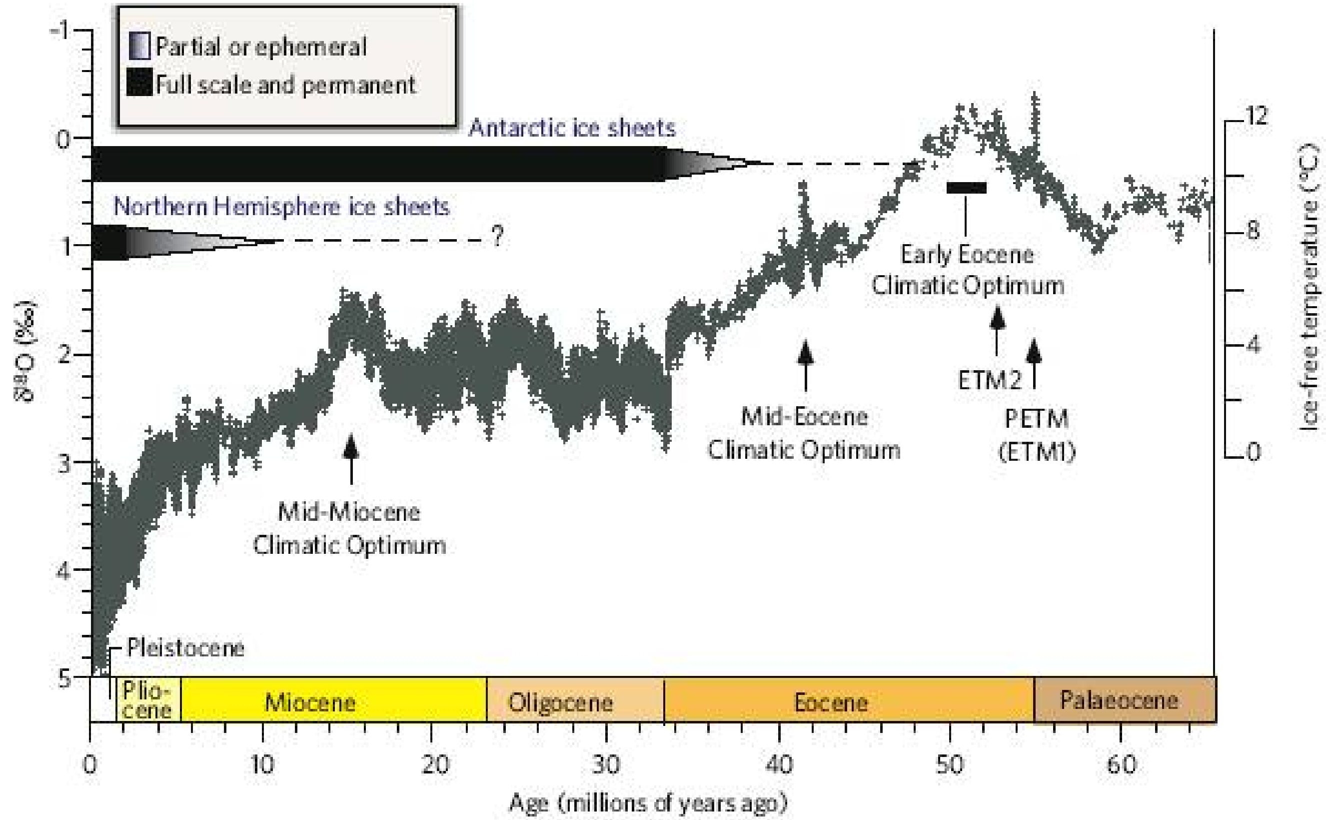


Source: NOAA/ESRL (www.esrl.noaa.gov/gmd/ccgg/trends/)

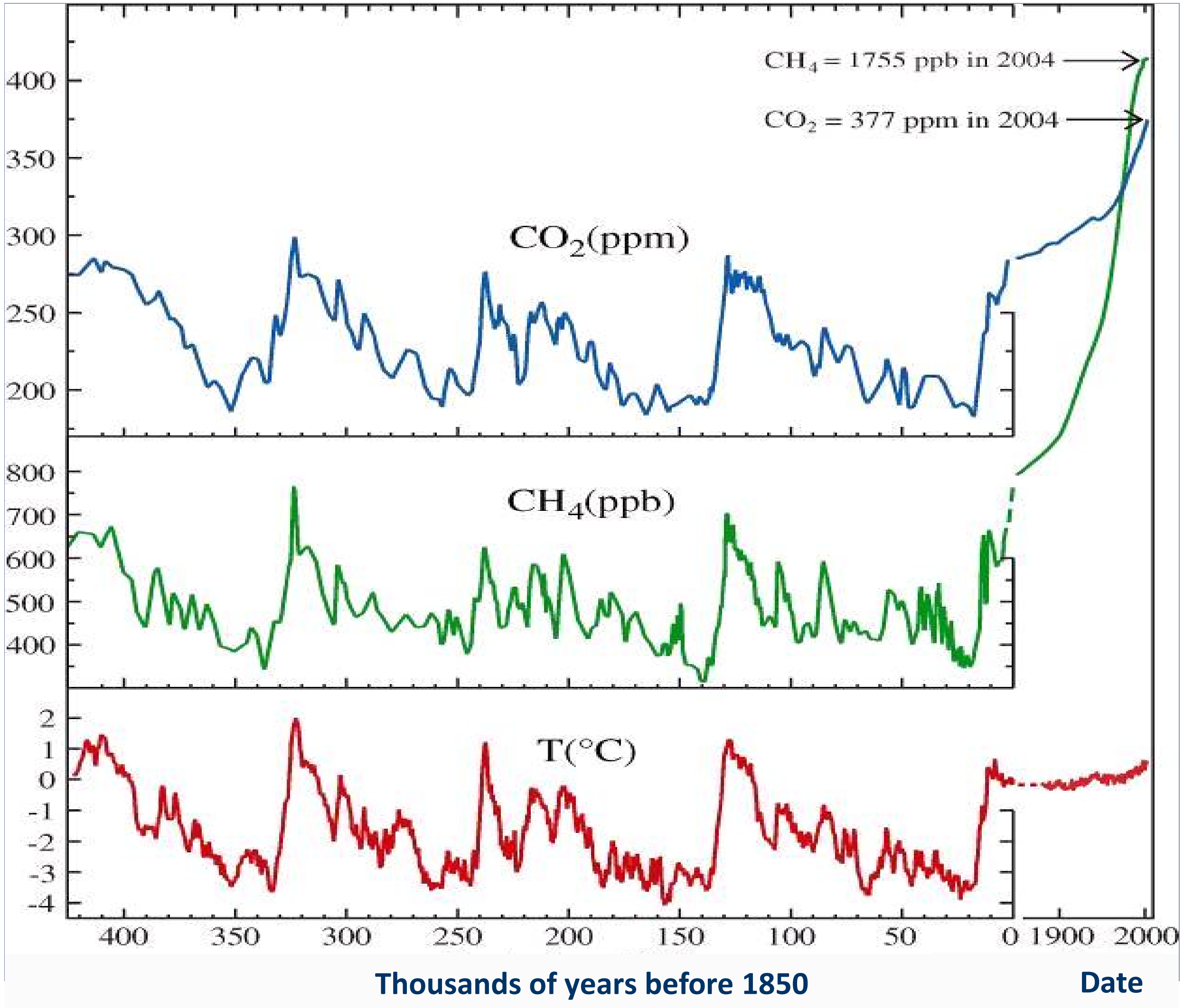
CO^2: The 60 million year trend



Temperature and ice over 60 million years

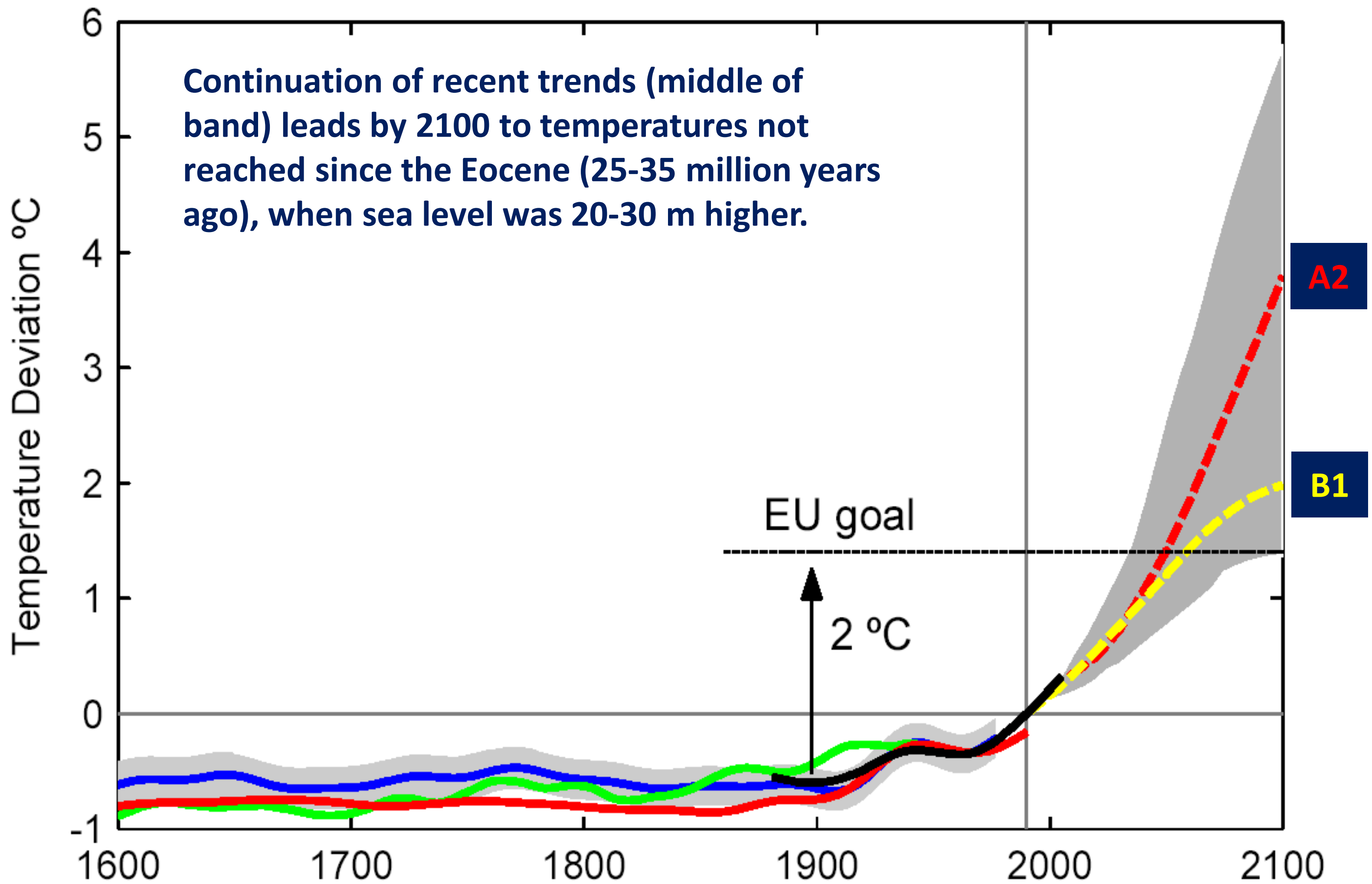


The last 450,000 years of natural change compared to the last century

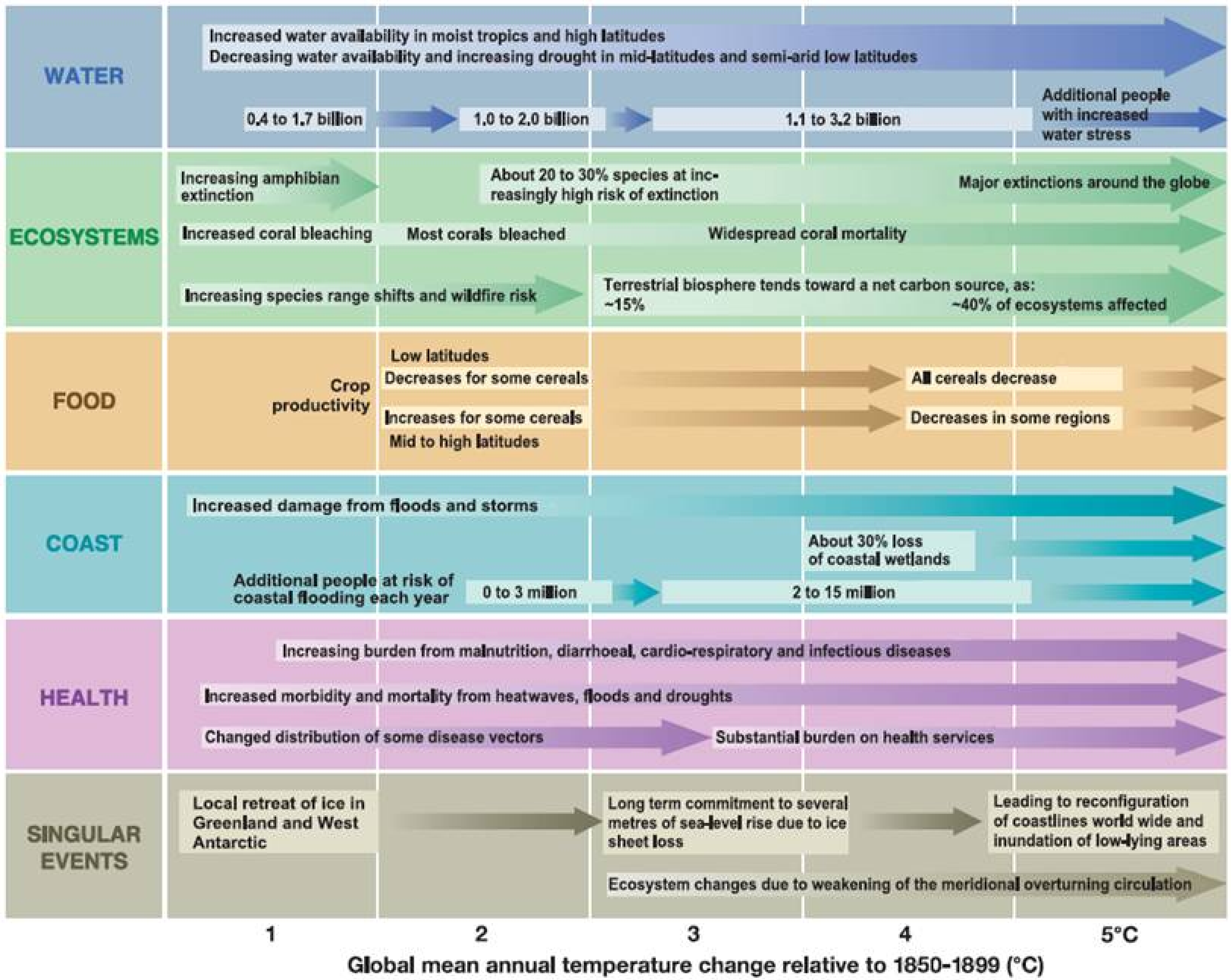


Source: Hansen, Clim. Change 68, 2005

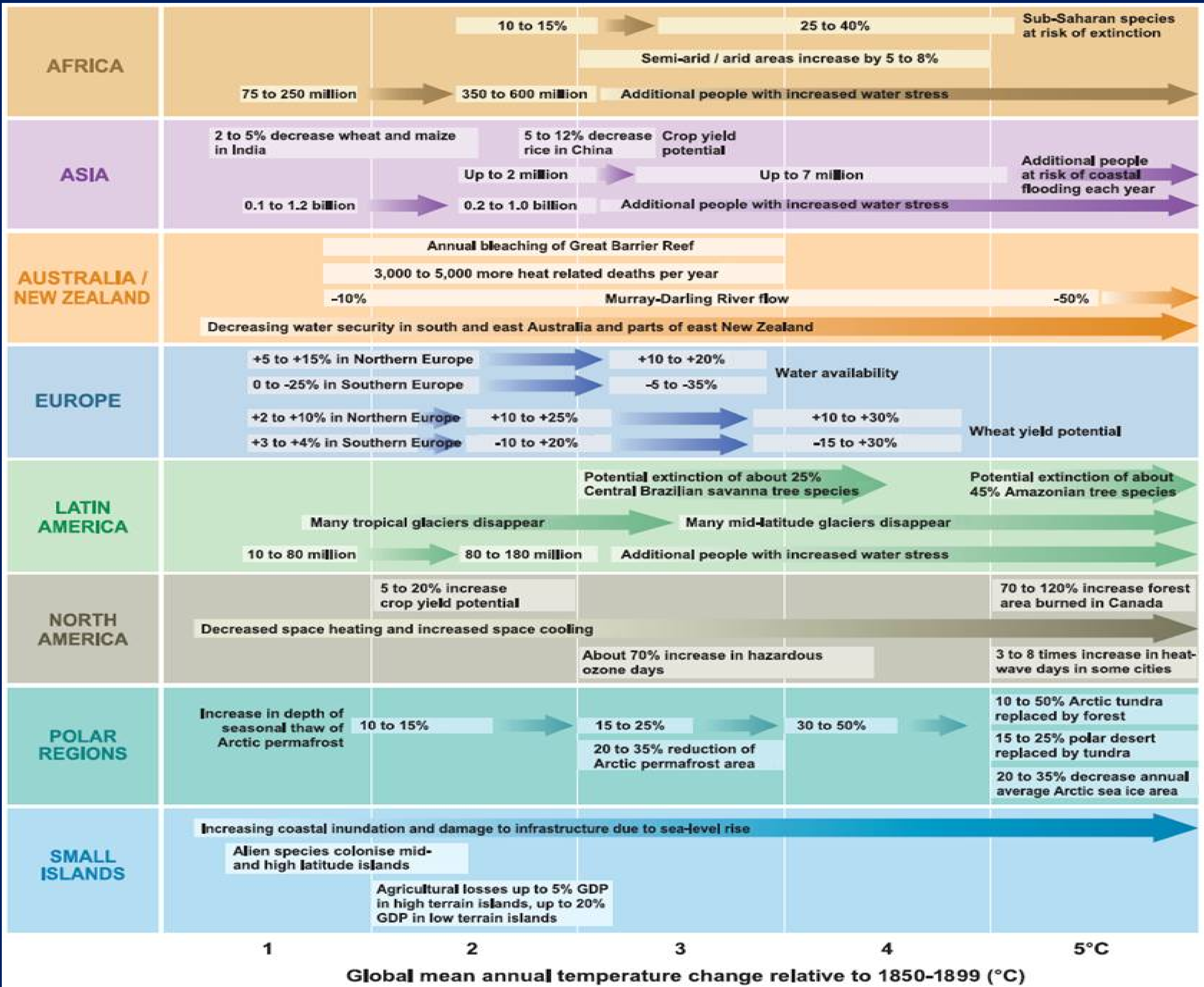
The climate implications of where we're headed: the next 100 years compared to the last 400



Source: Professor John Holdren, Harvard University

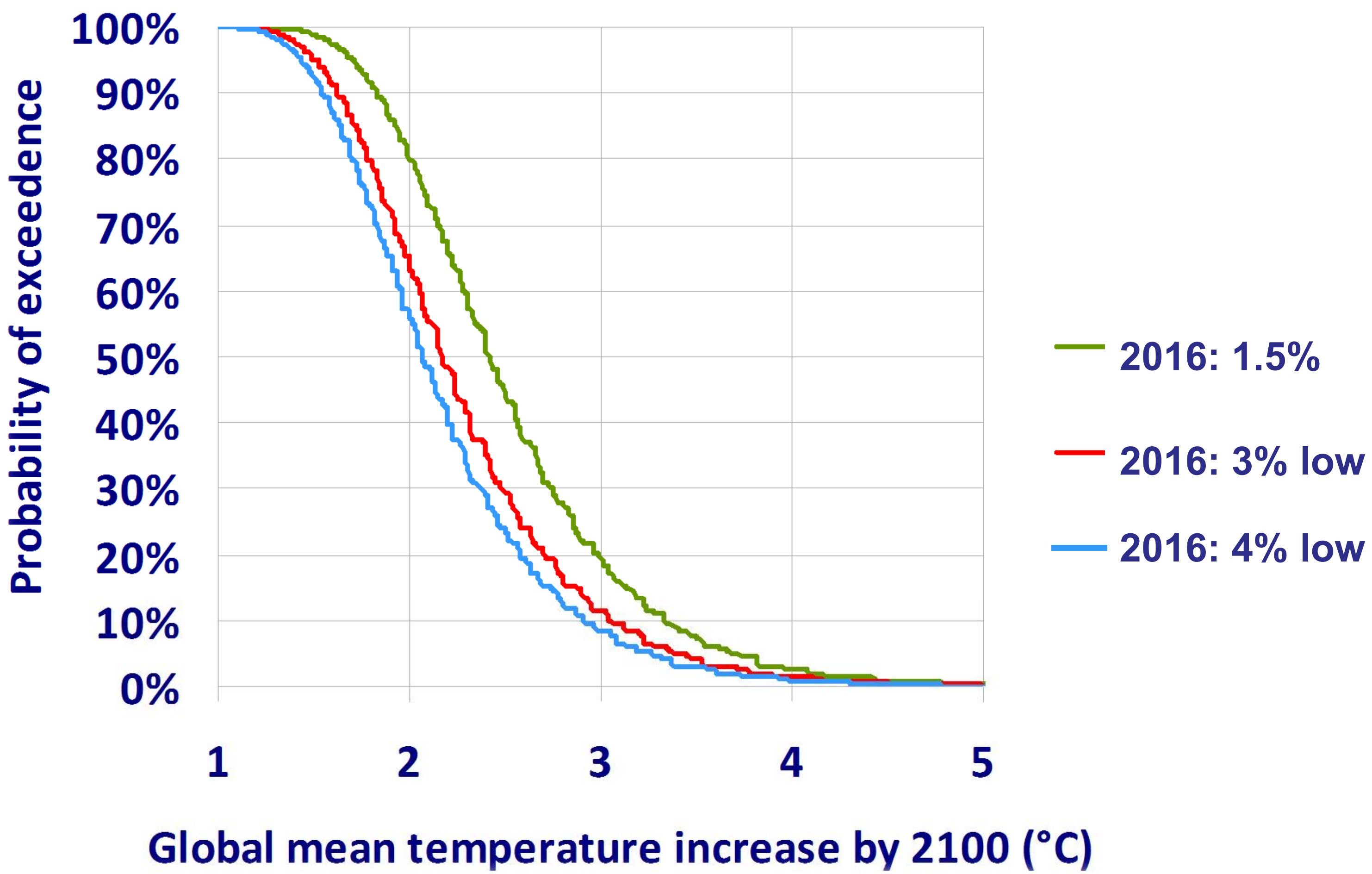


Source: Building a low-carbon economy, Climate Change Committee’s First Report, December 2008



Source: Building a low-carbon economy, Climate Change Committee’s First Report, December 2008

Probabilities of exceeding global mean temperatures by 2100



Source: Building a low-carbon economy, Chapter 1, Climate Change Committee's First Report, December 2008

The financial crash:
"Why didn't anyone see it coming?"*

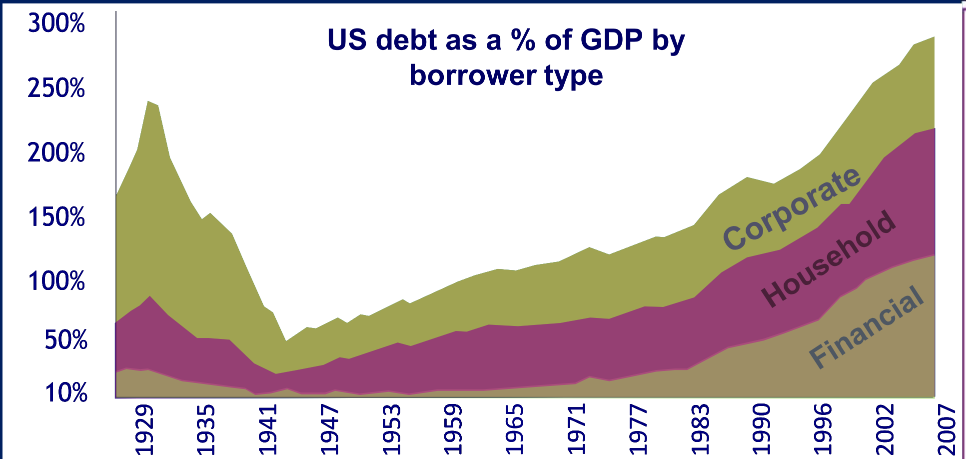
"There is growing recognition that the dispersion of credit risk by banks to a broader and more diverse group of investors, rather than warehousing such risk on their balance sheets, has helped make the banking and overall financial system more resilient."

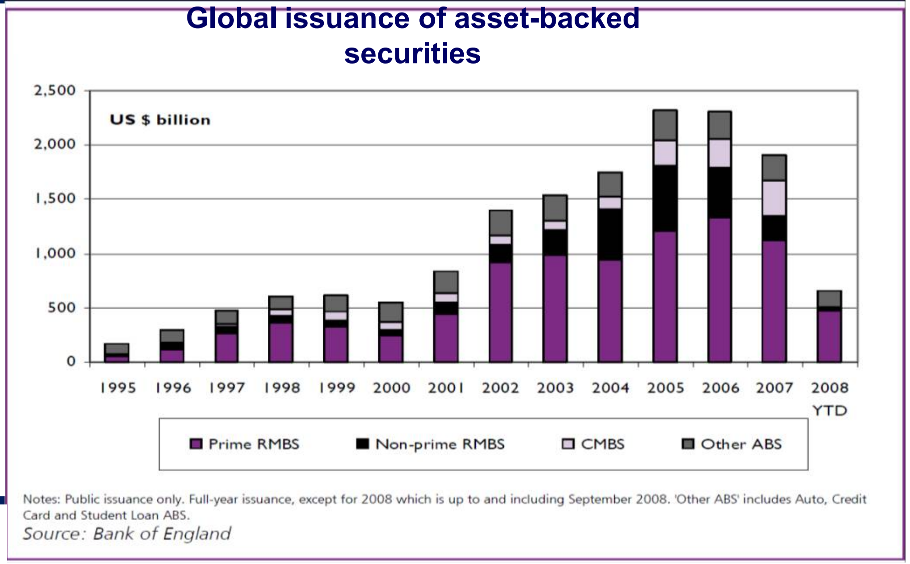
"The improved resilience may be seen in fewer bank failures and more consistent credit provision. Consequently the commercial banks may be less vulnerable today to credit or economic shocks."

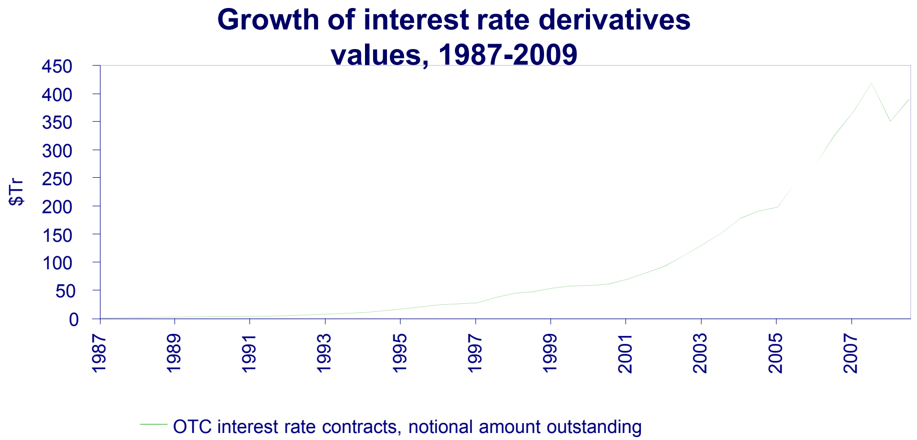
IMF Global Financial Stability Report, April 2006

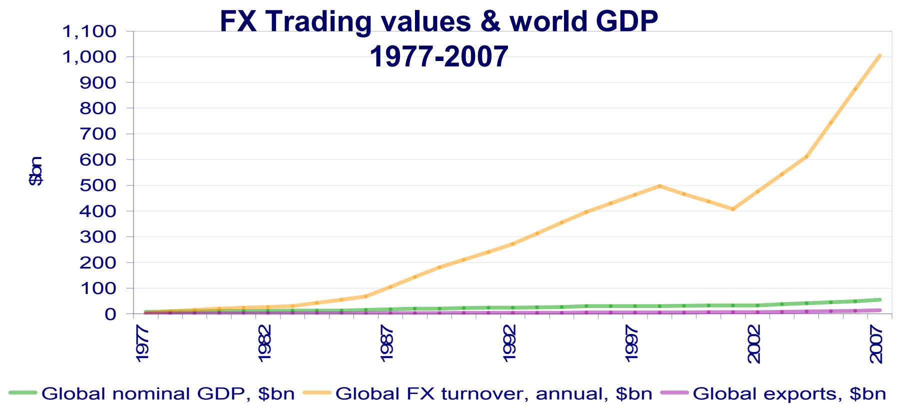
* The Queen, London School of Economics, 2009

Measures of increasing financial intensity









Neoclassical assumptions

- Adequately perfect(ible) markets

  – even financial markets $\longrightarrow$ E.M.H.

- Rational agents $\longrightarrow$ R.E.H.

- Mathematically modellable risk

“The construction of a mechanical artificial world populated by robots”
(Robert Lucas, 2001)

NASDAQ index: 1990 – 2002

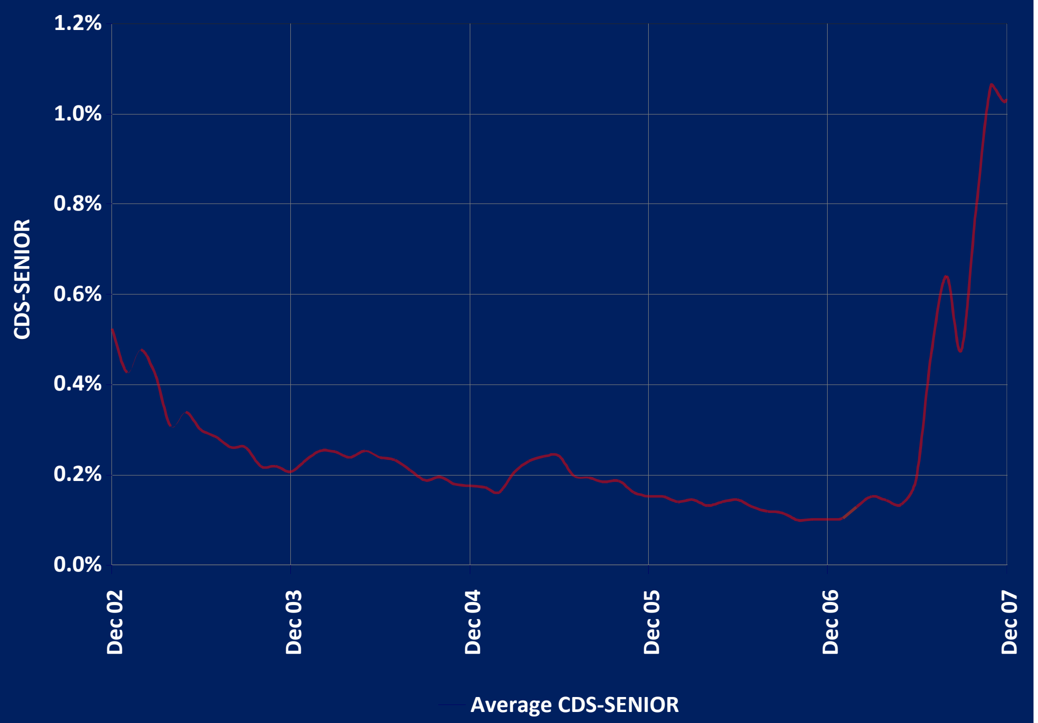
Source: Datastream

Market perception of private credit risk

Non-investment grade corporate bond spreads

Source: Merrill Lynch

Average CDS of major financial firms



Firms included: Ambac, Aviva, Banco Santander, Barclays, Berkshire Hathaway, Bradford & Bingley, Citigroup, Deutsche Bank, Fortis, HBOS, Lehman Brothers, Merrill Lynch, Morgan Stanley, National Australia Bank, Royal Bank of Scotland and UBS
CDS series peaks at 6.54% in September 2008.

Source: Moody's KMV, FSA calculations

Three deficiencies in conventional wisdom

Financial markets like other markets:

- Rational
- Efficient
- Adequately stable

Financial markets deeply imperfect

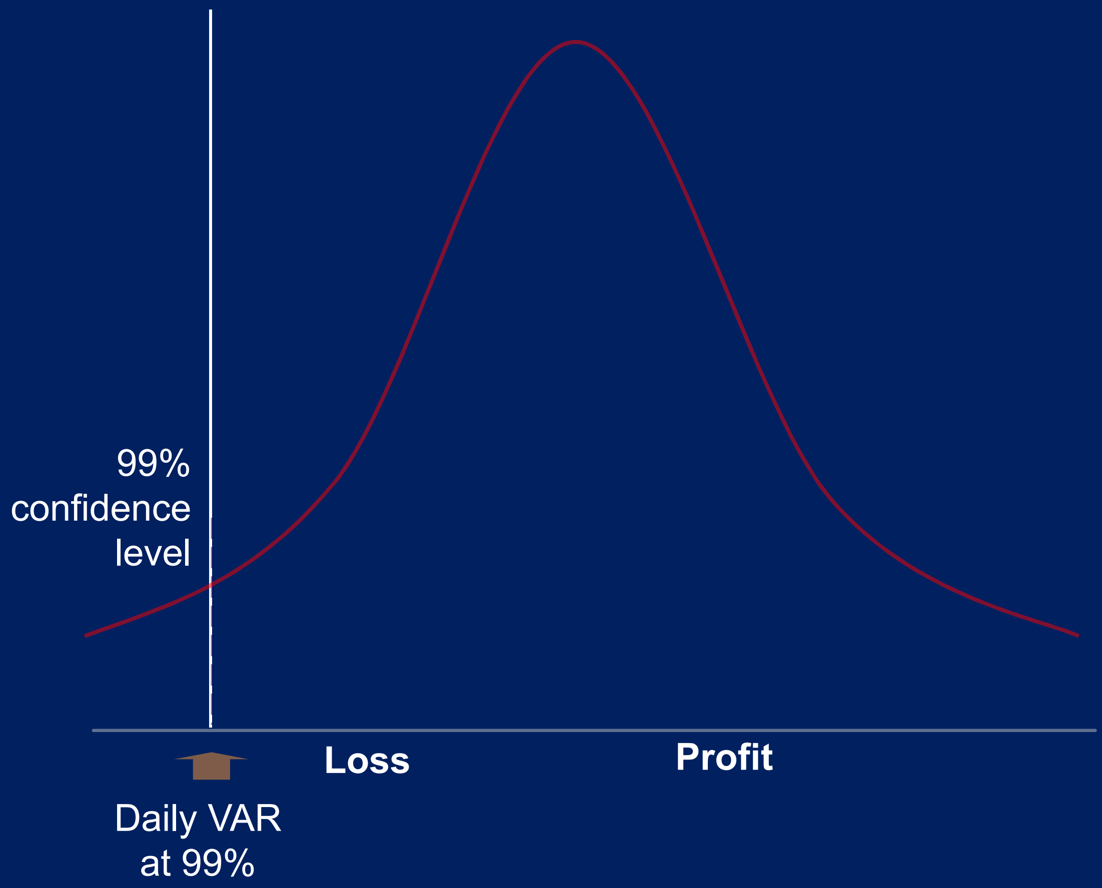
- Information and contractual relationships inherently imperfect
- Human nature: brain structure – part rational, part instinctive
- Inherent irreducible uncertainty – not mathematically modellable risk

Deficiencies in VAR based estimates of risk

Basic concept:

- Observe over a past period (e.g. last year) the distribution of profits / loss resulting over a defined time period (e.g. 10 days) from a given gross position.
- Hold capital sufficient to cover some multiple of this 'Value at Risk'

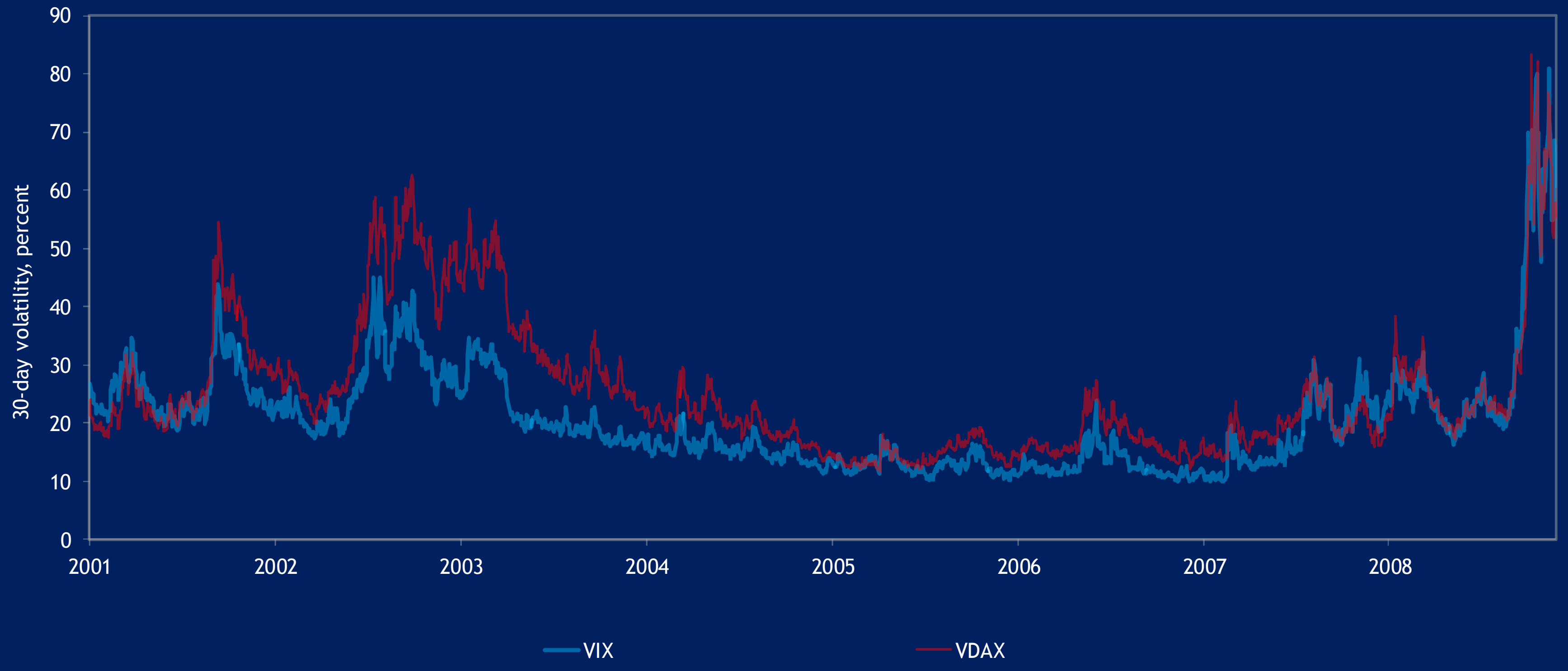
Frequency distribution of observed daily trading Profit/Loss



Deficiencies in VAR based estimates of risk

- Failure to capture fat-tail risks
- Procyclicality
- Failure to capture systemic/network risks

Implied volatility of the S&P 500 and DAX



Source: Turner Review, March 2009

Deficiencies in VAR based estimates of risk

- Failure to capture fat-tail risks
- Procyclicality
- Failure to capture systemic/network risks
- Category error? Uncertainty, not risk

"There are probably less genuinely 'deep' (and therefore stable) parameters or relationships in economics, as distinct from in the physical sciences, where the laws of gravity are as good an approximation to reality one day as the next"

Mervyn King at al, Royal Society Conference on Uncertainty in Science, London 2010

“The term ‘risk’ as loosely used in everyday speech and in economic discussions really covers two things which, functionally at least, … are categorically different. The essential fact is that ‘risk’ means in some cases a quantity susceptible of measurement, while at other times it is distinctly not of this character; and there are far reaching and crucial differences in the bearings of the phenomenon depending on which of the two is really present and operating.”

Frank Knight, *“Risk, Uncertainty and Profit”*, 1921

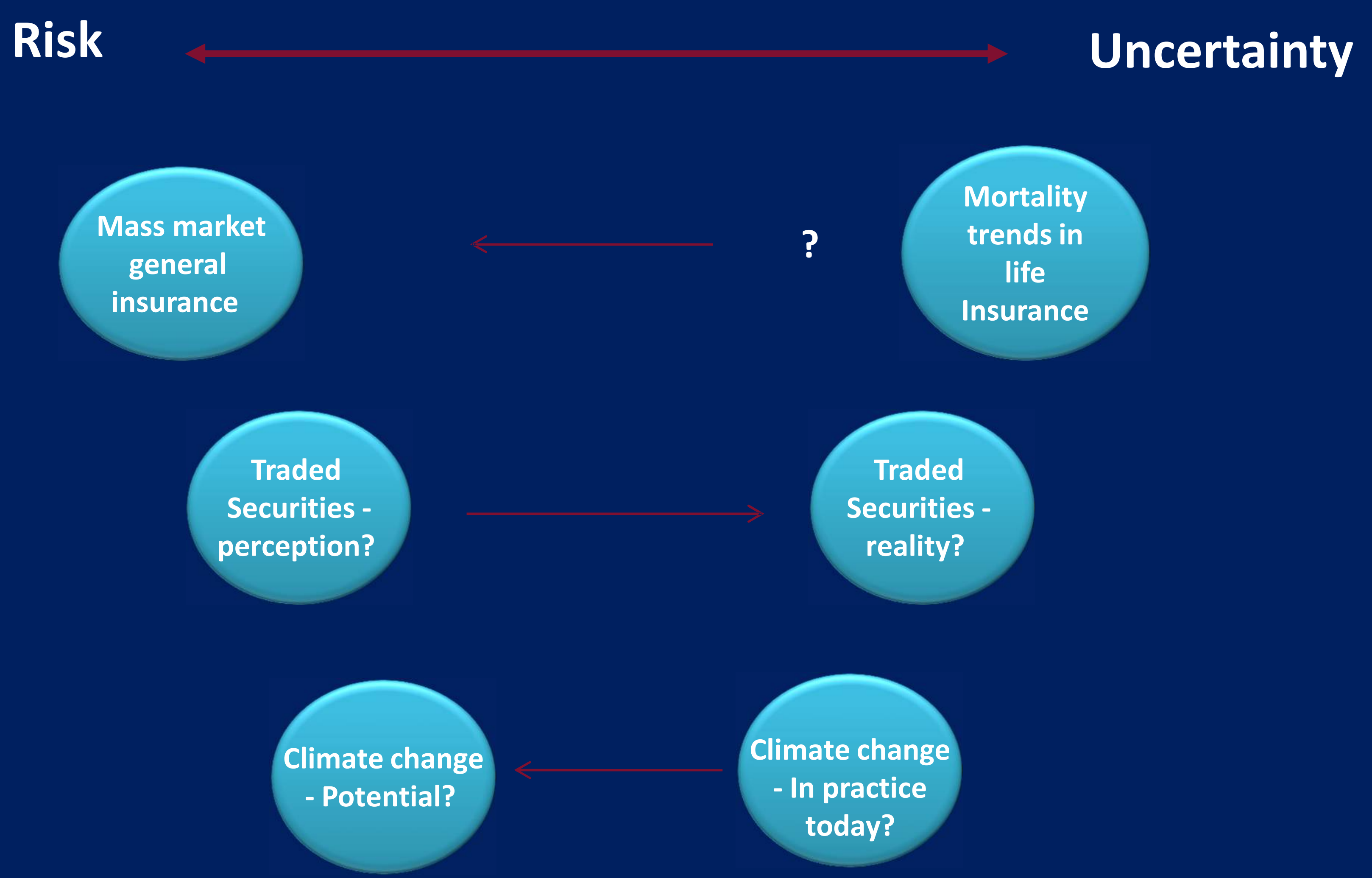
Risk ↔ **Uncertainty**

Risk that a value estimated by sampling is different from the true value within the sampled universe

"There is a 95% probability that the error does not exceed +/- X%"

Uncertainty over future outcome of a complex physical or geopolitical process

"Experts rate the chances of regime change in country A within 5 years over 50%"


Risk
Uncertainty
Mass market general insurance
?
Mortality trends in life Insurance
Traded Securities - perception?
Traded Securities - reality?
Climate change - Potential?
Climate change - In practice today?