## Public Policy and the Science Base: Successes and Failures

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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



### Percentage of adult life spent in retirement

	Aver	age age of exit from workforce	Life expectancy a age of exit form workforce	t
1950	Men	67.2	10.8	1
	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	
2000	Women	62.0	20.6	
1990	Men	63.5	17.2	
	Women	60.9	23.2	
1995	Men	63 1	18 9	
2000	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



### Actual past differences in mortality rate forecasts

## Mortality rates forecast / measured in year

	1984	1985	1986	 1994	 2004		2014	
	Actual v	s 1983 fo	orecast		2003 for	ecast v	s 1983 fore	ecast
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?**

![](_page_8_Figure_1.jpeg)

#### **Reasonable judgement on uncertainty?**

![](_page_9_Figure_1.jpeg)

### Individual underestimates of life expectancy by age

![](_page_10_Figure_1.jpeg)

Women Men

### Trend in self-reported sickness by age

![](_page_11_Figure_1.jpeg)

Source: Pensions Commission First Report, 2004

### Health status of US over 65 population

![](_page_12_Figure_1.jpeg)

#### Trends in immobility by age

80-84 Year Olds

#### Unable to walk out of doors on own

![](_page_13_Figure_3.jpeg)

#### Unable to walk up and down stairs on own

![](_page_13_Figure_5.jpeg)

#### 85+ Year Olds

#### Unable to walk out of doors on own

![](_page_13_Figure_8.jpeg)

#### Unable to walk up and down stairs on own

![](_page_13_Figure_10.jpeg)

#### Saving for a pension: assumptions and reality

#### Neoclassical Rational Agent Assumption

- Assessment of potential life time earnings
- Allocation of consumption potential across life-cycle
- Maximise net present value of utility
- Using appropriate intertemporal discount rate

![](_page_14_Figure_6.jpeg)

#### Estimate of overall cost curve: % reduction in yield

![](_page_15_Figure_1.jpeg)

#### Percentage of employees in a 401 (k) pension scheme

![](_page_16_Figure_1.jpeg)

# Pension contribution rates with and without automatic enrolment

![](_page_17_Figure_1.jpeg)

Not automatic enrolment Automatic Enrolment

![](_page_18_Figure_0.jpeg)

#### **Global carbon dioxide emissions**

![](_page_19_Figure_1.jpeg)

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

# Global annual average of CO<sup>2</sup> concentration in parts per million (ppm)

![](_page_20_Figure_1.jpeg)

20

## CO<sup>2</sup>: The 60 million year trend

![](_page_21_Figure_1.jpeg)

#### Temperature and ice over 60 million years

![](_page_22_Figure_1.jpeg)

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

![](_page_23_Figure_1.jpeg)

Source: Hansen, Clim. Change 68, 2005

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

![](_page_24_Figure_1.jpeg)

WATER	Increased water availab Decreasing water availab	ility in moist tropics and hig bility and increasing drough	n latitudes t in mid-latitudes and semi	-arid low latitudes	Additional people		
	0.4 to 1.7 billion	1,0 to 2,0 billion		1.1 to 3.2 billion	water stress		
	Increasing amphibian extinction	About 20 to 30 reasingly high	% species at inc- risk of extinction	Major	extinctions around the globe		
ECOSYSTEMS	Increased coral bleaching	Most corals bleached	Widesprea	d coral mortality			
	Increasing species range s	hifts and wildfire risk	Terrestrial biosphere tend ~15%	ds toward a net carbon source ~40% o	, as: f ecosystems affected		
FOOD	Сгор	Low latitudes Decreases for some cereals		All cereals de	crease		
	productivity	Increases for some cereals Mid to high latitudes		Decreases in	some regions		
	Increased damage from	floods and storms					
COAST	Additional people coastal flooding e	at risk of ach year 0 to 3 million	*	About 30% loss of coastal wetlands 2 to 15 million			
	Increasing bu	rden from malnutrition diarr	hoeal cardio-respiratory a	nd infectious diseases			
	Increased morbidity and mortality from heatwayes, floods and droughts						
HEALTH	Increased morbidity and	mortality from neatwaves, i	oods and droughts				
	Changed distribution of	some disease vectors	Substanti	al burden on health services			
SINGULAR EVENTS	Local retreat of ice in Greenland and West Antarctic		Long term commitment to ▶ metres of sea-level rise d sheet loss	b several ue to ice	eading to reconfiguration ( coastlines world wide and undation of low-lying areas		
			Ecosystem changes due	to weakening of the meridion	al overturning circulation		
	1	2	3	4	5°C		
	Glo	bal mean annual ten	nperature change i	relative to 1850-1899	(°C)		
Source: Building	a low-carbon econom	v. Climate Change Cor	nmittee's Eirst Reno	rt. December 2008			

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ASIA AS		75 to 250 million	350 to 600 millio	Additional people with	increased water stress	
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NEW ZEALAND    -10%    Muray-Darling River flow    -50%      Decreasing water security in south and east Australia and parts of east New Zealand			3.000 to 5.000 more heat rela	ated deaths per year		
Decreasing water security in south and east Australia and parts of east New Zealand      EUROPE    +10 to +20%, Water availability      +5 to +15% in Northern Europe    +10 to +20%, Water availability      +2 to +10% in Northern Europe    +10 to +20%, Water availability      +2 to +10% in Northern Europe    +10 to +20%, Water availability      +2 to +10% in Northern Europe    +10 to +20%, Water availability      +2 to +10% in Northern Europe    +10 to +20%, HO to +30%, Wheat yield potential      America    Potential extinction of about 25%, Colspan="2">Potential extinction of about 25%, Anaconian tree species      North    Many tropical glaciers disappear    Many mid-latitude glaciers disappear      10 to 80 million    80 to 180 million    Additional people with increased water stress      Sto 20% increase crop yield potential    70 to 120% increase forest area burned in Canade      POLAR    Increase in depth of seasonal thaw of 10 to 15%, Arctic permafreet    30 to 50%, Arctic tundra replaced by forest      SMALL    Apricultural losses up to 5% GOP in how terrain islands    Africultural losses up to 5% GOP in how terrain islands    5% COP in how terrain islands      1    2    3    4    5%	NEW ZEALAND	-10%		Murray-Darling River flow	v	-50%
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Global mean annual temperature change relative to 1000-1000 ( 0)		G	obal mean annual te	mperature change re	ative to 1850-1899	(°C)

# Probabilities of exceeding global mean temperatures by 2100

![](_page_27_Figure_1.jpeg)

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

#### **Measures of increasing financial intensity**

![](_page_29_Figure_1.jpeg)

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#### **Neoclassical assumptions**

Adequately perfect(ible) markets

– even financial markets — E.M.H.

Rational agents — R.E.H.

Mathematically modellable risk

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

#### NASDAQ index: 1990 – 2002

![](_page_31_Figure_1.jpeg)

Source: Datastream

#### Market perception of private credit risk

Non-investment grade Average CDS of major corporate bond spreads financial firms 1400 1.2% 1200 1.0% 1000 **Option-adjusted spread** 0.8% **CDS-SENIOR** 800 0.6% 600 0.4% 400 0.2% 200 0.0% Dec 02 Dec 03 Dec 04 Dec 05 Dec 06 Dec 07 0 2002 2003 2004 2005 2006 2007 2008 Average CDS-SENIOR Global, non-financial corporates BB-rated

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

![](_page_33_Figure_1.jpeg)

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

![](_page_34_Figure_5.jpeg)

### **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

![](_page_36_Figure_1.jpeg)

#### **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

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

![](_page_39_Figure_5.jpeg)

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%"

![](_page_40_Figure_0.jpeg)