



Institute
and Faculty
of Actuaries

Limits to Growth

Highlights of Life Conference 2013 Dublin

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Society of Actuaries in Ireland – Wider Fields Group

2nd April 2014



Objective for this session

- Summarise facts and findings presented in the report from January 2013
- Outline actuarial activity and involvement

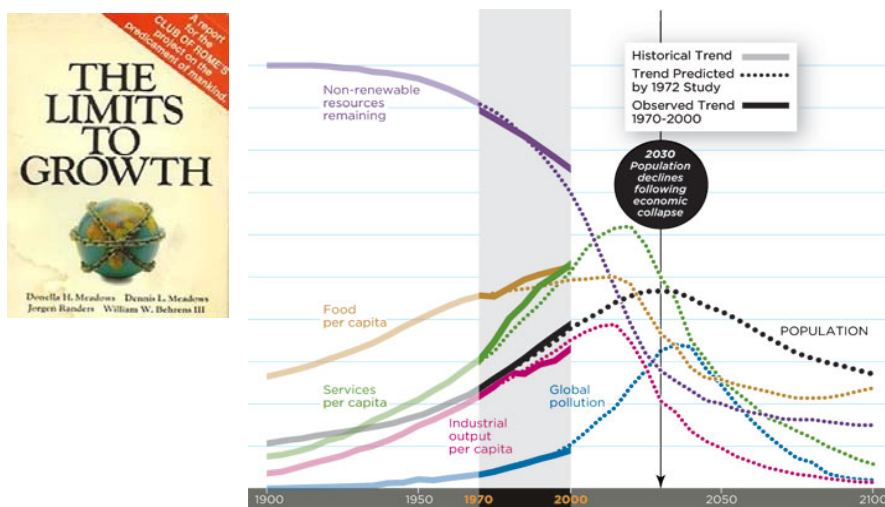


Agenda

- Background
- Summary of: *Resource constraints: sharing a finite world*
- Actuarial Activity and Involvement
 - Activity of the Wider Fields Group

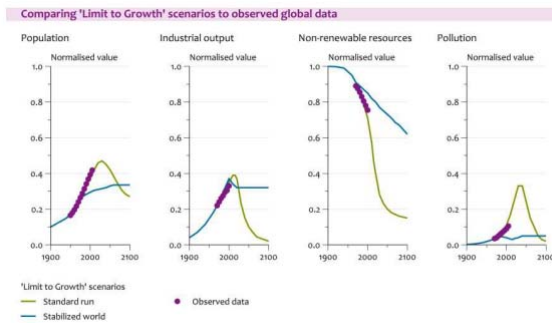
3

Background



4

Limits to Growth – Predictions



Limits to Growth (30 Year Update)

The 1972 LtG paper used a systems dynamics model (World 3) to explore the feedback between;

- Population
- Industry
- Food
- Non-renewable resources
- Pollution system.

The green lines represent the "standard scenario" – which is a business as usual (growth agenda).

The purple observations show the realised observations.

Netherlands Environmental Assessment Agency / Turner (2008)

5

Why should Actuaries get involved?

- **Global problems made worse by:**
 - Lack of understanding of risk and uncertainty
 - Lack of understanding of exponential growth
 - Disregard for science and data
- **Actuaries' core skills are in the following areas:**
 - Risk and uncertainty
 - Exponential growth
 - Actuarial science and data based decisions

6

Scope of Research Project

- What do scarce resources potentially mean for the system flows in a global economy and in particular to financial capital?
 - Energy availability
 - Food availability
 - Water availability
 - Land availability
 - Commodity availability
 - Social mobility (including migration, equity, health and wellbeing)
 - Environmental loading

7

- How do these system flows interact with the financial system and what does this imply for particular actuarial issues?
 - Interest rates
 - Discount rates
 - Investment returns
 - Inflation
 - Salary growth
 - Equity risk premia
 - Credit spreads
 - Mortality and morbidity
 - Catastrophic risk

8

Agenda

- Background
- Summary of Resource Constraints: Sharing a Finite World
- Actuarial Activity and Involvement

9

Resource Constraints: Sharing a Finite World

- Limitations of economic growth measurements
- Four main narratives around Limits-to-Growth
- Evidence for potential constraints on physical resources
- Pension fund case study

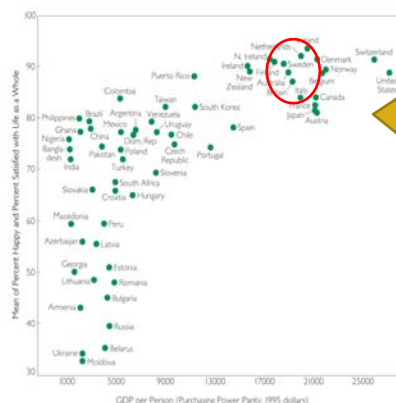
10

Quotes

- “The welfare of a nation can scarcely be inferred from a measure of national income” – Simon Kuznets, the Nobel laureate economist attributed with making national income accounts a standard.
- Robert Kennedy – “It [GNP] measures everything, in short, except that which makes life worthwhile.”
- The Actuary magazine - Soapbox piece - June 2013 - Claire Jones

11

Does Growth Make You Happy?



Does growth make you happy?

The graph % of people content versus GDP per person at PPP.

Economic growth remains the dominant concern of politics even in rich countries yet beyond the levels achieved by countries like Ireland, South Korea or New Zealand the positive correlation between GDP / person and happiness breaks down.

Source: Jackson, T. (2009) Prosperity without growth? Economics for a finite planet,

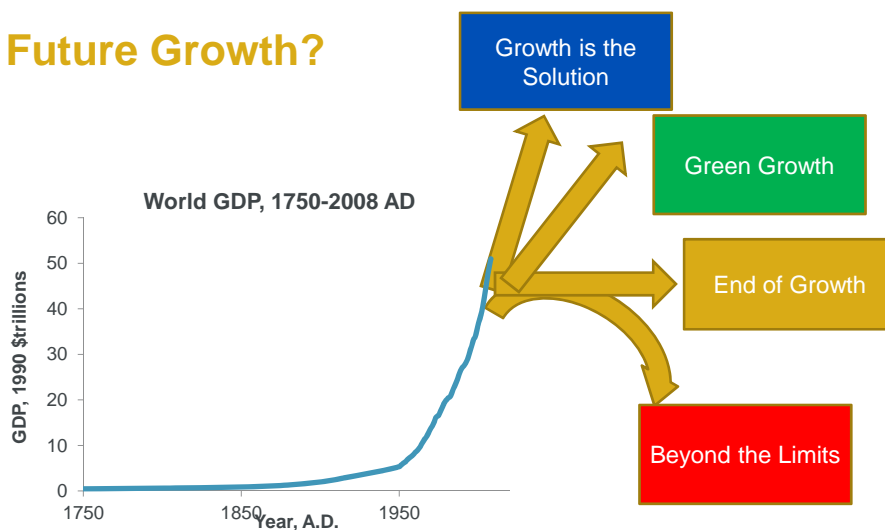
12

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13

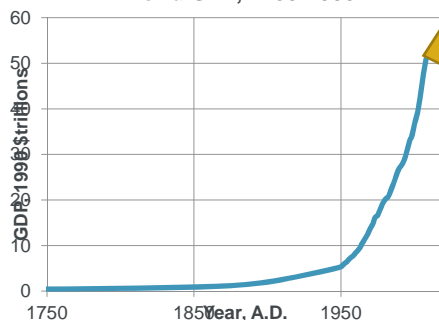
Future Growth?



14

Opinions: Growth is the Solution

World GDP, 1750-2008 AD



Exponential Growth

World GDP growth has been exponentially growing.

- In real terms world GDP has grown at average rate of c.3% per year in recent decades = doubling time 23 years.
- 2012 to 2100 is almost 4 doubling periods.
- If 3% growth continues, world economy would grow 14 times as large in 2100 as it is now.

15

Opinions: Green Growth

Next 20 years increase of 3bn more middle class consumers.

Three scenarios offered:

1. Productivity static (supply expansion)
2. Productivity response (most demand met by productivity)
3. "Climate response case" – move to low carbon energy, reforestation, land restoration, carbon capture

First two scenarios don't avoid two degree warming.

Opinions: End of Growth

- Limits-to-Growth stressed (reiterated) that humanity is on course to overshoot. Profound change needed soon to avoid collapse.
- Overshoot caused by:
 - Rapid Change
 - Limits / barriers to change
 - Errors / delays in perceiving limits / controlling change
- Concludes that physical growth will ultimately cease completely whether we like it or not.

17

Opinion: End of Growth

- Richard Heinberg (End of Growth) states that the global economy is playing a zero sum game with an ever shrinking pot divided among the winners.
- He cites the causes:
 - Depletion of natural resources
 - Negative environmental impacts
 - Inability of financial systems to service debt accumulated over recent years
- Monetary systems are designed to need growth to sustain them because they are based on unsustainable debt
- Debt is a claim on resources that don't exist

18

Opinion: Beyond Limits

- WWF 2010 Living Planet Report tells us tropical diversity has reduced by 60%. They find 5 threats to biodiversity which underpin human ecosystems (freshwater, carbon storage, agriculture):
 - Habitat loss, fragmentation, alteration
 - Over-exploitation of wild species (food, materials, medicine)
 - Pollution (excessive fertiliser, pesticides)
 - Climate change
 - Invasive species
- WWF highlight water as the main link between ecosystems and climate – current demand placed on freshwater ecosystems is already beyond sustainable levels

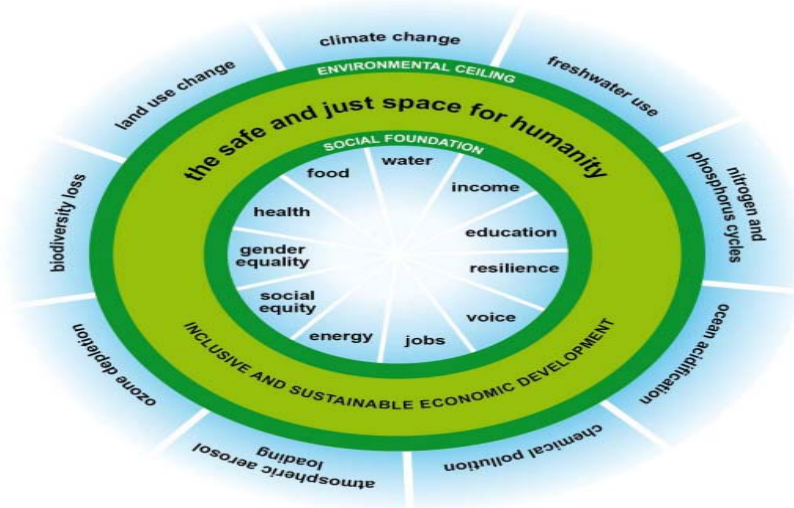
19

Opinion: Beyond Limits

- Carbon Tracker Initiative (Unburnable Carbon) tell us we have used one third of our budget for carbon to 2050 in order to remain within 2 degrees of global warming
- Only 20% of global carbon reserves are burnable to stay within 2 degrees. What we use this budget for is a key question.

20

Doughnut Economics



Source: Oxfam, Kate Raworth

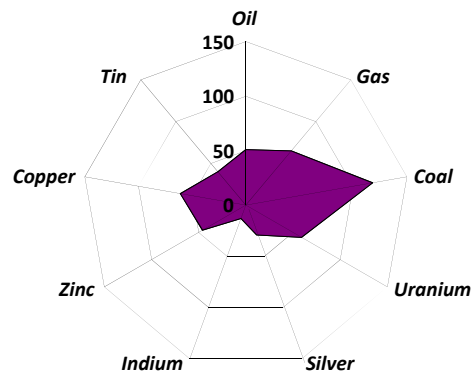
21

Resource Constraints: Sharing a Finite World

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22

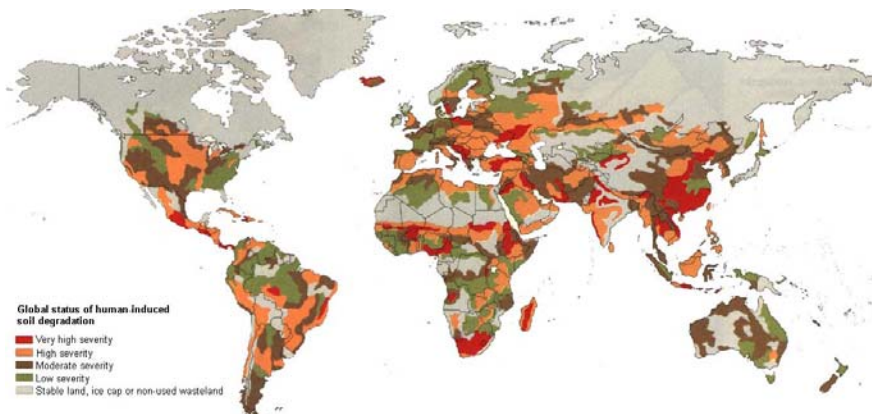
Global challenges: Fuel, Metals, Minerals



[1] Current global reserves divided by current annual consumption (assuming no growth in demand).
 [2] Data taken from BP Statistical Review 2012, <http://bp.com/statisticalreview> and David Cohen, 'Earth's natural wealth: an audit', *New Scientist*, Issue 2605 (23 May 2007) pp. 34-41

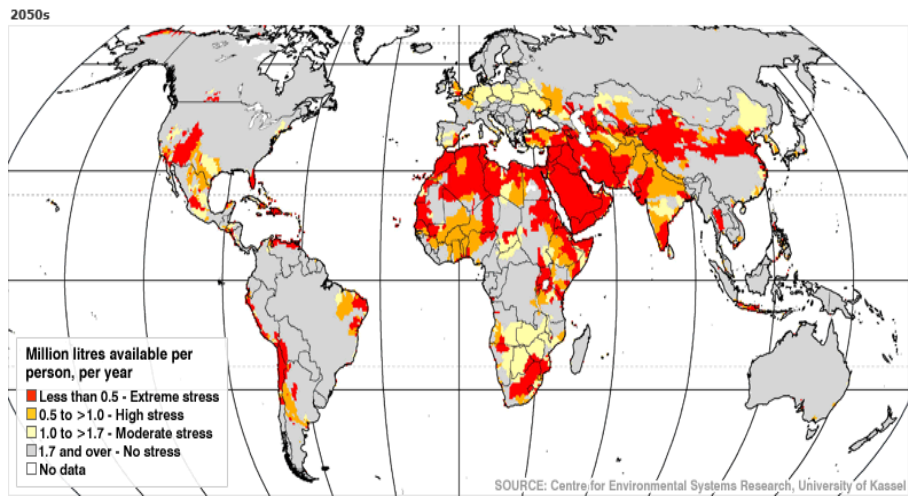
23

Local challenges: Degradation of soils



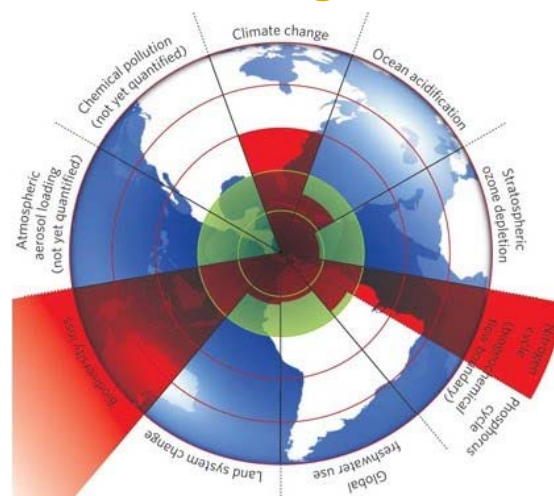
24

Local challenges: Water availability



25

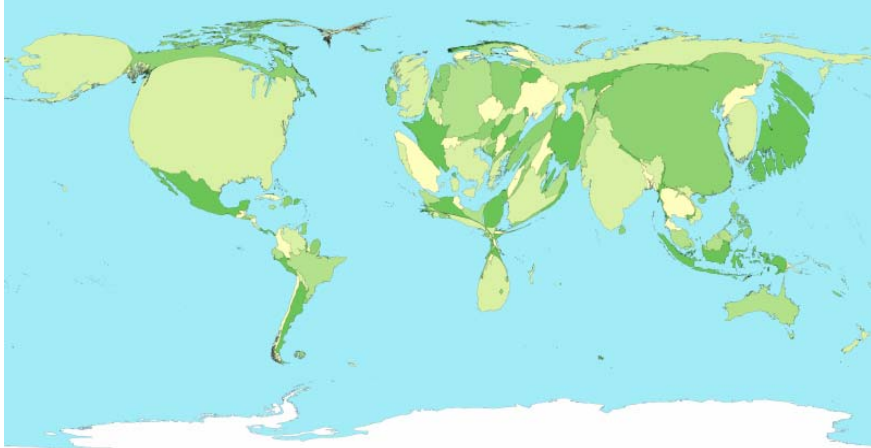
Global challenges: Environmental Loading



Rockstrom et al, Nature 461, Sept 2009, Stockholm University Resilience Centre

26

Global challenges: Anthropogenic emissions



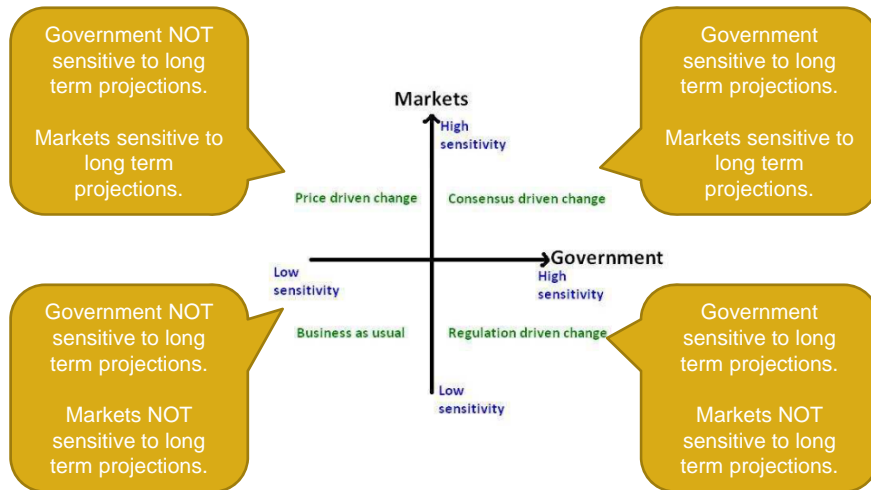
27

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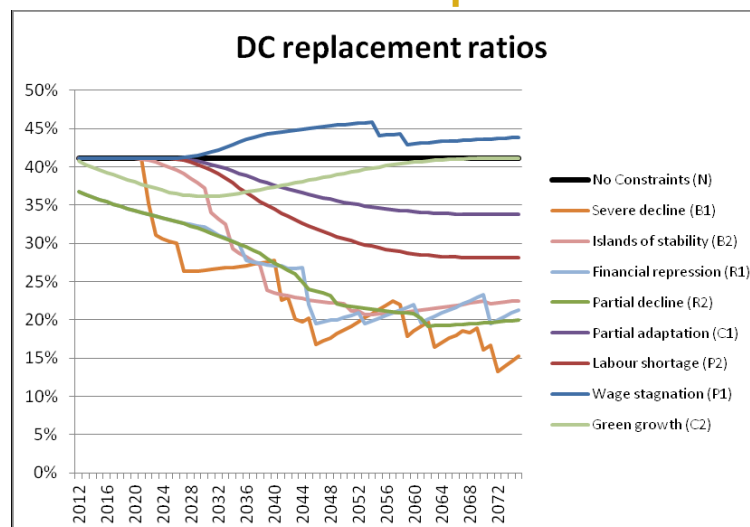
28

Actuarial - Scenarios



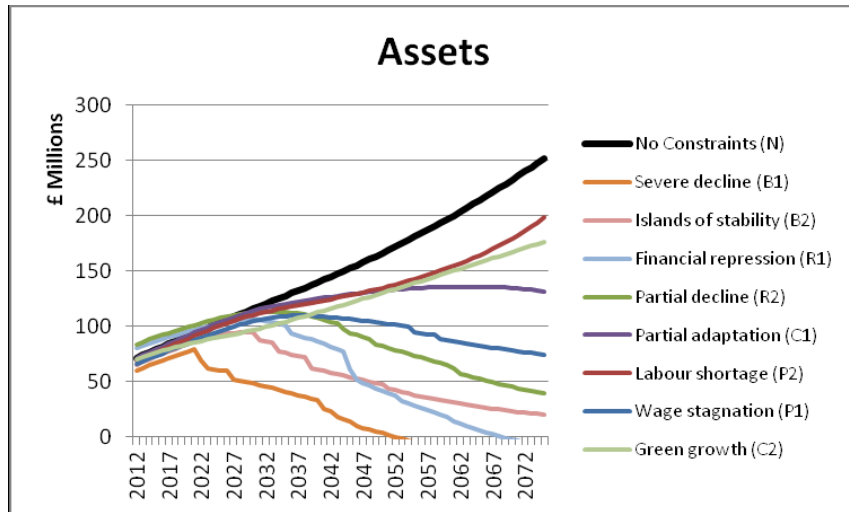
29

Defined contribution replacement ratios



30

Defined benefit assets



31

Possible actuarial impacts

- Reduced economic growth
- Reduced access to many commodities, and hence increased prices (or price shocks) or lack of availability
- Reduced international security and coordination
- Repression of investment returns by governments
- Possible changes to life expectancy and morbidity

32

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33

Actuarial Activity and Involvement

- Institute and Faculty of Actuaries
 - Resource & Environment promoted to Board status
 - Member Interest Group
 - <http://www.actuaries.org.uk/members/pages/commissioned-research-limits-growth>
- Society of Actuaries in Ireland
 - Wider Fields Group
- International Actuarial Association
 - Resource and Environment Working Group

34

Acknowledgements and thanks for selected slides

- Tracey Zalk
- Dr Aled Jones
- Oliver Bettis
- Elliot Varnell
- Claire Jones

35

Actuarial Activity – Wider Fields Group

- Society of Actuaries in Ireland
 - Wider Fields Group
- Climate Change in Ireland – An Actuarial Perspective
 - Economics – the Dismal Science – Malthusian Economics
 - The Great Divergence
 - Rate of Technological Advance (30 times faster than 1200-1800)
 - Main risk
 - The rate of technological advance falling relative to the rate of increase in consumption levels
 - LTG is just one side of the analysis
 - ERM analysis of climate change and resource availability

36

Actuarial Activity – Wider Fields Group

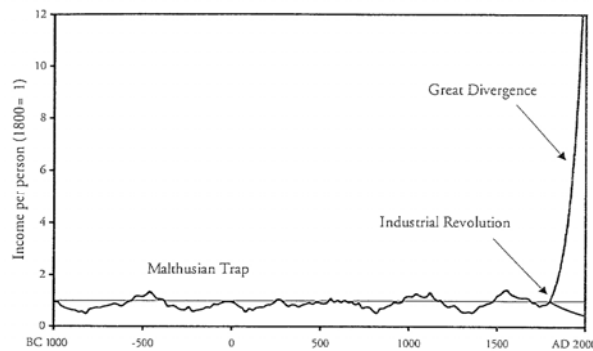


Figure 1.1 World economic history in one picture. Incomes rose sharply in many countries after 1800 but declined in others.

From 'A Farewell to Alms' by Gregory Clark – 2007 Princeton University Press

37



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