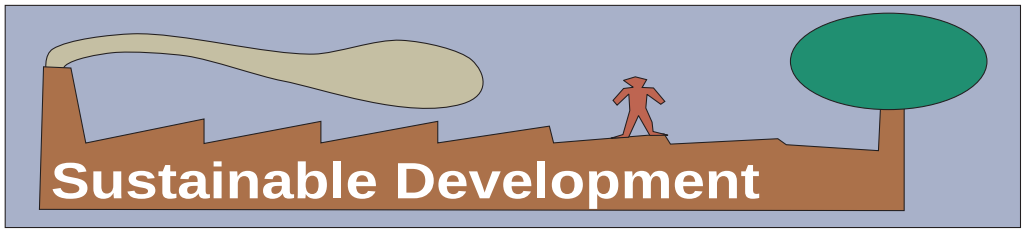

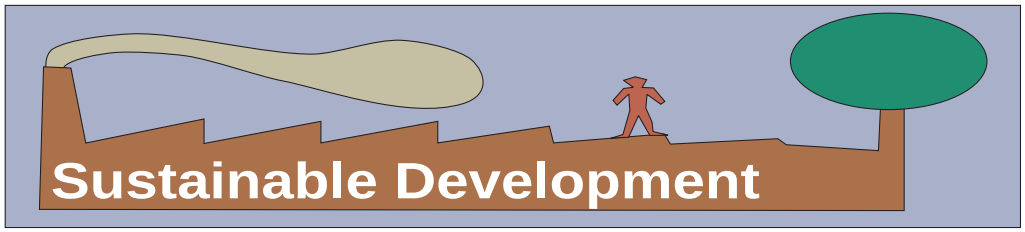

Introduction to the course

The subject matter, and (main) teacher

Aspects of sustainability

Aspects of sustainability

George Orwell in ‘The road to Wigan Pier’.

> The world is a raft sailing through space with, potentially, plenty of provisions for everybody; the idea that we must all co-operate and see to it that everyone does his fair share of the work and gets his fair share of the provisions seems so blatantly obvious that one would say that no one could possibly fail to accept it unless he had some corrupt motive for clinging to the present system.

Aspects of sustainability

Kenneth Boulding in
‘The economics of the coming Spaceship Earth’.

> The closed economy of the future might . . . be called the ‘spaceman’ economy, in which the earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man must find his place in a cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy.

Aspects of sustainability

We focus on the questions raised by Boulding rather than Orwell.

Thus we focus mainly on *economic* and *environmental* sustainability, and little on *social* sustainability. Not because the latter is unimportant!

We also focus mainly on resources and pollution, and little on biodiversity. (Partly because we offer the course *Management of biological resources*.)

1. Technological progress and economic growth
2. Production under resource constraints
3. Pollution and sustainability

Rob

Rob

Chemistry

5 years later . . .

Oxfam (international development)

1996, Sweden, environmental economics.

https://scholar.google.se/citations?hl=en&user=fNZtUakAAAAJ&view_op=list_works&sortby=pubd

Doing (macro)economics

Questions regarding management of the economy

Questions regarding management of the economy

1. (a) Engineer: What is feasible?
   (b) Philosopher: What is desirable?
   (c) Economist: What is optimal?

Economics, utilitarian, discounting:

$$\max \sum_h U^h,$$

where

$$U^h = \sum_t u^h(c_t)\beta^t.$$

Rawls, maximin:

$$\max\{\min\{u_1, u_2, \ldots, u_n\}\}.$$

Questions regarding management of the economy

Classic approach:

1. Build a model of the economic system, and find the allocation of resources (labour, capital, natural resources) given laissez-faire (no policy instruments) or business-as-usual (no new policy instruments);
2. Find how a benevolent social planner would allocate resources in the model economy, i.e. the socially optimal allocation of resources;
3. Find policy instruments that can move the economy from the laissez faire (or b.a.u.) allocation towards the social planner's allocation.

Questions regarding management of the economy

We focus on (1), building models to understand: resource allocation over time; outcomes in terms of natural-resource use and pollution; and what is likely to happen in the future.

We don't talk much about (2), finding the optimal allocation of resources. Instead we assume (for instance) that we want to move the economy towards allocations with lower pollution flows or lower resource use, and focus on (3) finding policy instruments that can achieve this.

How do we know if we have a good model?

How do we know if we have a good model?

Consider the following aggregate production function.

$$Y = (A_L L)^{1-\beta}(A_R R)^{\beta}.$$

Assuming perfect markets, this model predicts that the factor share of the natural resource, $w_R R/Y$, should be equal to β and hence constant. Assume this matches long-run data.

- Does this prove that the model is correct?
- Have we shown that the model can be used as a basis for policy?

See 'the Lucas critique': Lucas (1976), "Econometric Policy Evaluation: A Critique". See also `https://en.wikipedia.org/wiki/Lucas_critique`.

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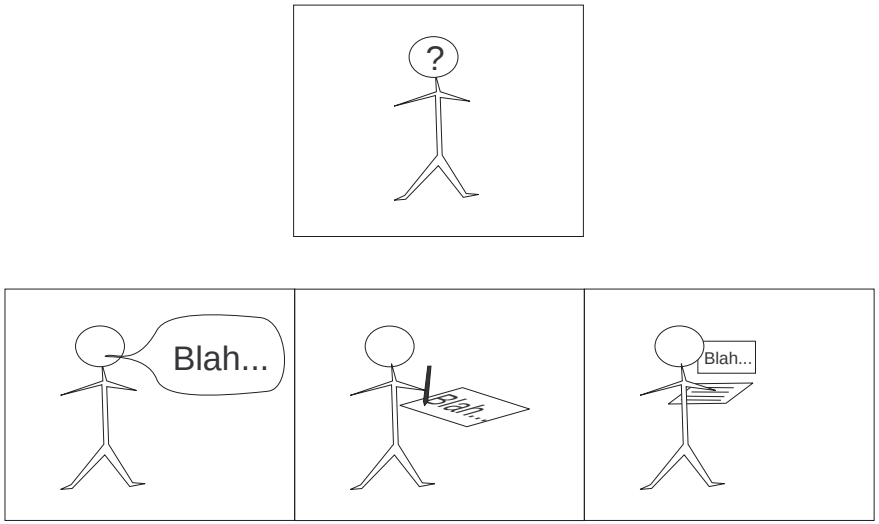
How do we know if we have a good model?

e also `https://`
e.

About the course

Your own development

Your own development



The pictures illustrate four skills. Learning to think, both imaginatively and analytically, is primary. You also need to learn to present your ideas, both orally and in writing. Furthermore, you need to learn to handle a computer, to program and simulate economic models. We will work mainly on the first three during the course.

Examination

Examination

See homepage, `http://www.ekoninternt.se/rob/susdev22/`, grading criteria.

In short, we have gobbets, a research paper, and the written examination. To pass the course you must pass all elements. To get higher grades you must collect bonus points, one for each point over 36 in the exam, a maximum of three per gobbet (but not more the 8 in total), and a maximum of 8 for an outstanding research paper (in all respects).

Schedule

Schedule

The schedule consists of the following.

- Pre-recorded core lectures, followed by discussion meetings (one per lecture).
- A pre-recorded presentation about the gobbets, with a Q&A session after one of the discussion meetings.
- A pre-recorded presentation about the research paper, a Q&A session, a meeting to discuss, and the seminar presentations.
- Pre-recorded explanations of how to solve the exercises, and a meeting to discuss.
- The written exam.

Course schedule.

The choice set, and choices

Human evolution

Human evolution

Homo, Homo sapiens, and technological progress.

- 2 million years.
- 300 000 years.
- 70 000 years.

Genetic and cultural evolution.

Three alternative choices

Three alternative choices

Blue tits and milk bottles.

- Reproductive success;
- Consumption;
- Leisure.

Humans?

The Malthusian phase

The Malthusian phase

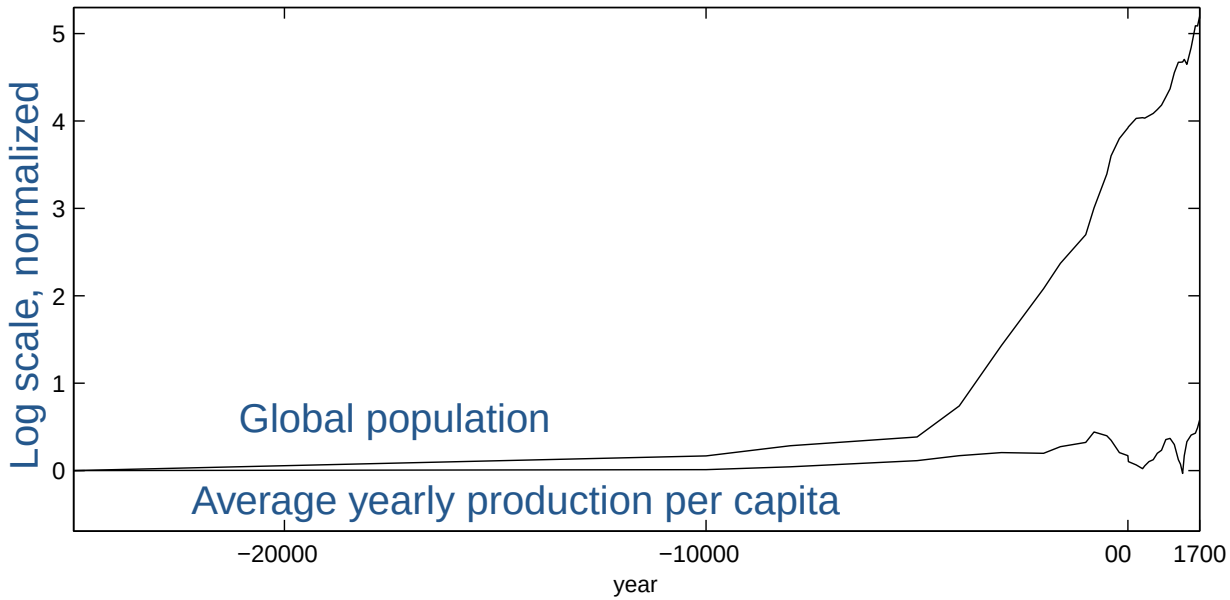


Figure 1: Global product and population, historical (data from Brad DeLong). Both variables are normalized to start at zero. Population grows by a factor of approximately $\exp[5]$, i.e. about 150. Average yearly production per capita is close to 100 USD throughout.

Average population growth rate: about 0.001 percent per year before the agricultural revolution, and about 0.1 percent per year after.

The Malthusian phase

The Malthusian phase

First *foraging*.

Very slow rate of technological progress.

Massive effects on other species, e.g. moa, Neanderthals.

Then *agriculture*.

Acceleration in technological progress, but still extremely slow.

Massive effects on other species, e.g. wheat, aurochs.

This phase is *over* in the industrialized countries.[1]

[1] See for instance ined for fertility data for rich countries, and World Bank for all countries.

The Malthusian phase

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Th

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s.[1]

What ended the Malthusian phase?

[1] See for instance ined for fertility data for rich countries, and World Bank for all countries.

The consumerist phase

The consumerist phase

- We are
  - getting richer and healthier . . .
  - reducing our fertility . . .
  - having more fun . . .
  - but trashing the planet.

The consumerist phase

Are we getting richer and healthier?

Yes. See for instance Jeffrey Sachs, 'The Age of Sustainable Development'. Or Hans Rosling.

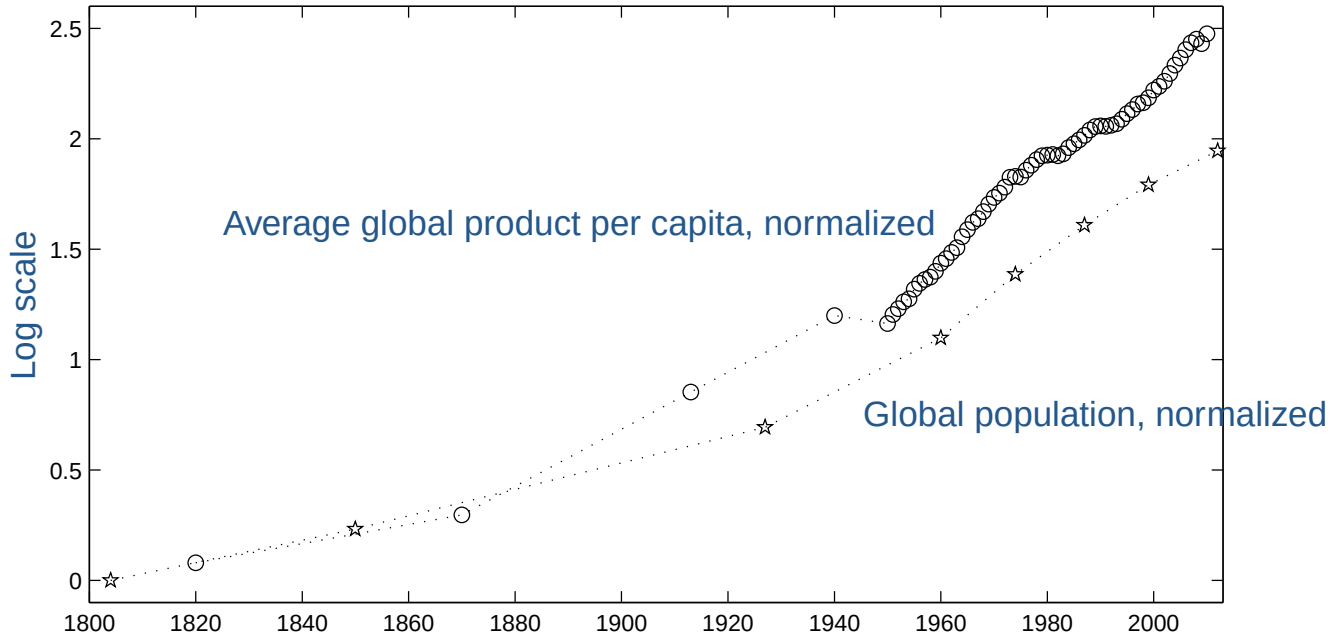

Figure 2: Global product and population, modern. For sources see EGSD.

The consumerist phase

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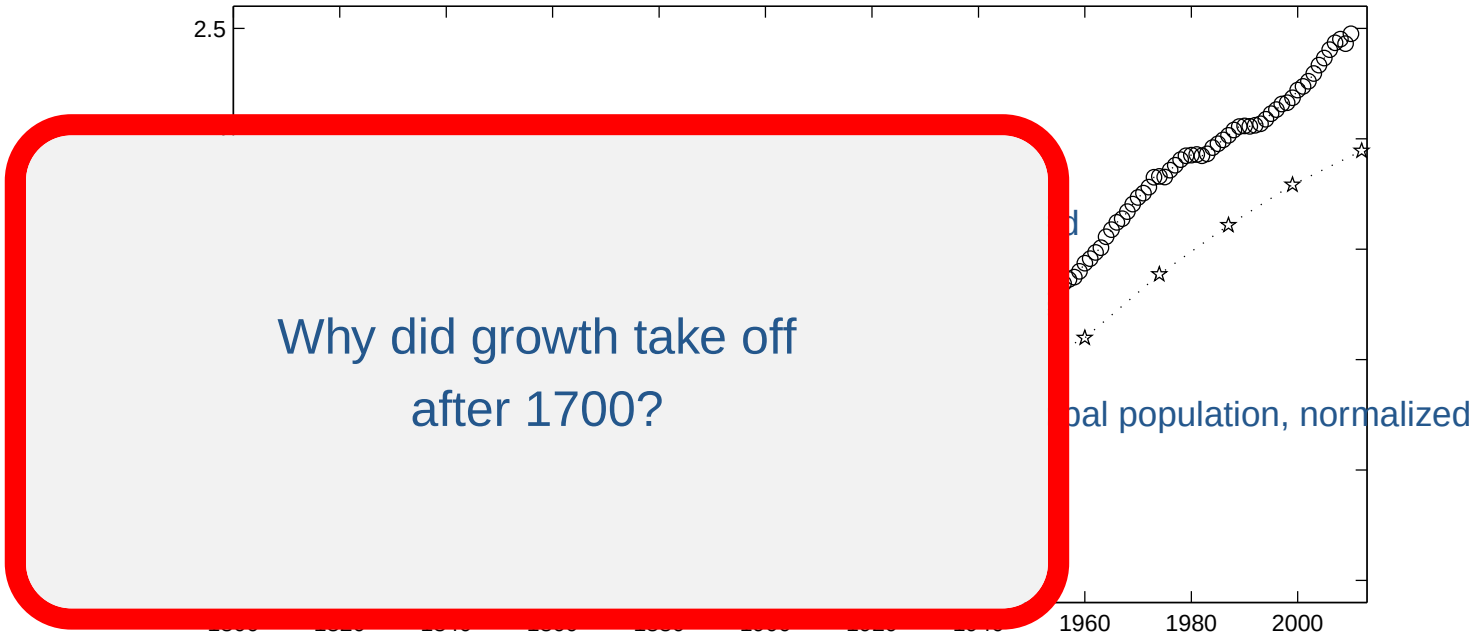

Figure 2: Global product and population, modern. For sources see EGSD.

The consumerist phase

Are we reducing our fertility?

The trend in fertility is down to 2 children per female birth, or less, in more and more countries. (Recall the World Bank data.)

There is a lag between this change and a levelling off in population, given increasing life expectancy and a large 'young' population.

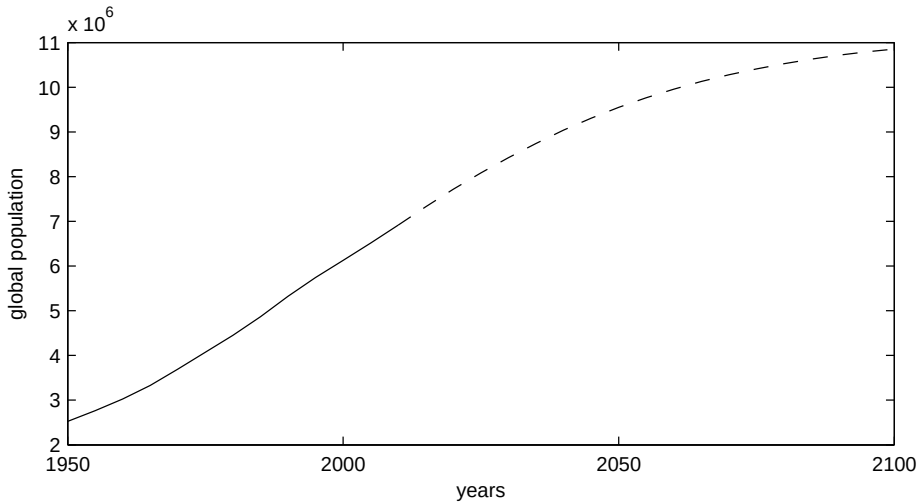

Figure 3: The UN 'medium' population prediction

The consumerist phase

Are we having more fun?

We are definitely increasing our leisure time.

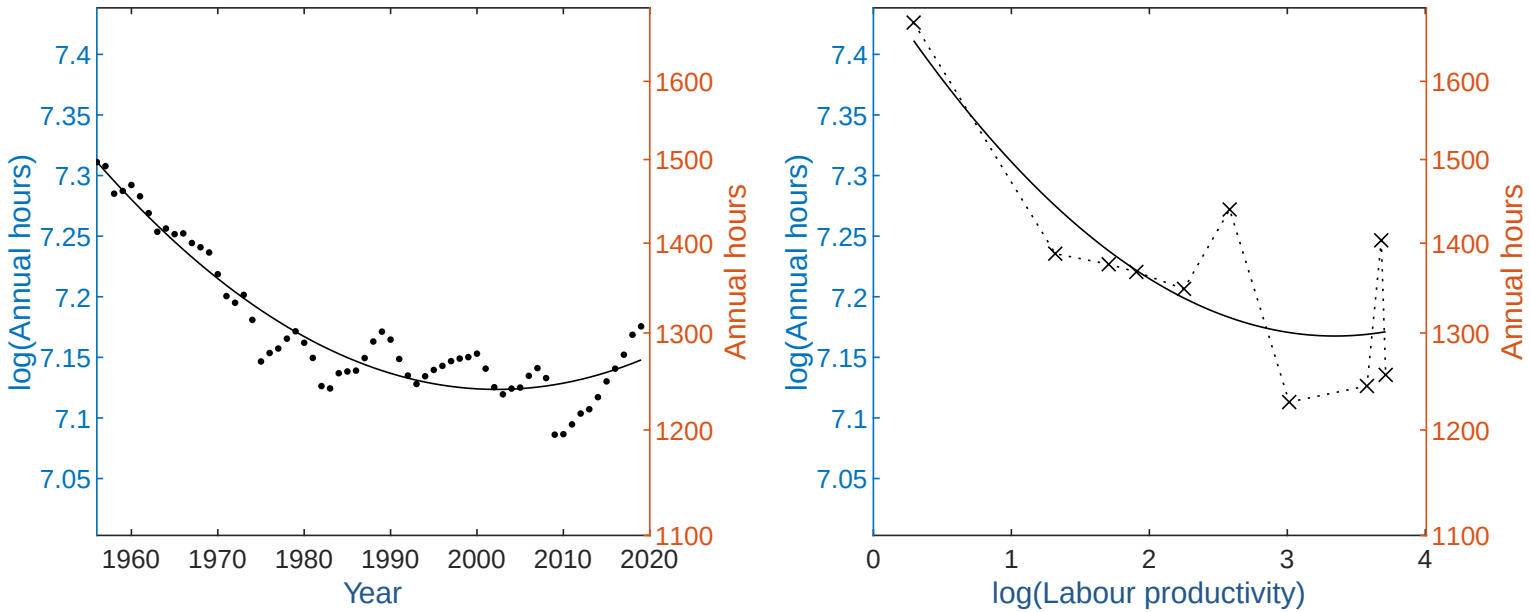

Figure 4: Data over aggregate annual hours per working-age adult, and the OLS fit: (a) Time-series data for the G7; (b) Cross-sectional data for 81 countries divided into population deciles according to productivity. Sources: OECD, GGDC Total Economy Database, and Bick et al. (2018), AER.

The consumerist phase

And the data seems to show that we are getting happier too!

Our world in data.

The consumerist phase

Are we trashing the planet?

Climate change

Significant changes in the climate are already happening and are certain to continue and strengthen. Also acidification of the oceans.

Species loss

- Thomas et al. Extinction risk from climate change. Nature 427, 145–148 (2004): 18–35 percent of species will be committed to extinction by 2050.
- He and Hubbell, Nature 473, 368–371 (2011): Thomas et al. estimate is high-end possibility. May be overestimate by a factor of around 6.

The consumerist phase

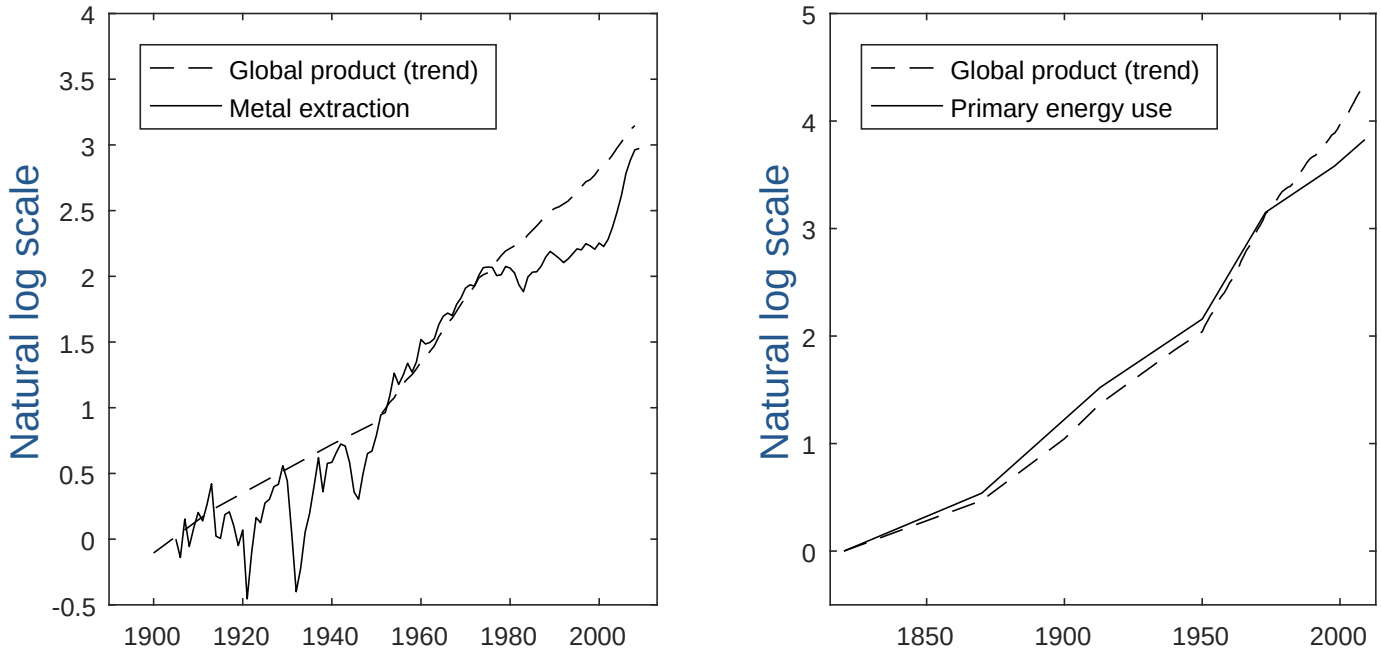

Figure 5: Long-run growth in total consumption compared to growth in total global product, for (a) Metals (tons extracted), and (b) Primary energy from combustion (joules burnt). For sources see EGSD.

The consumerist phase

The consumerist phase

But . . .

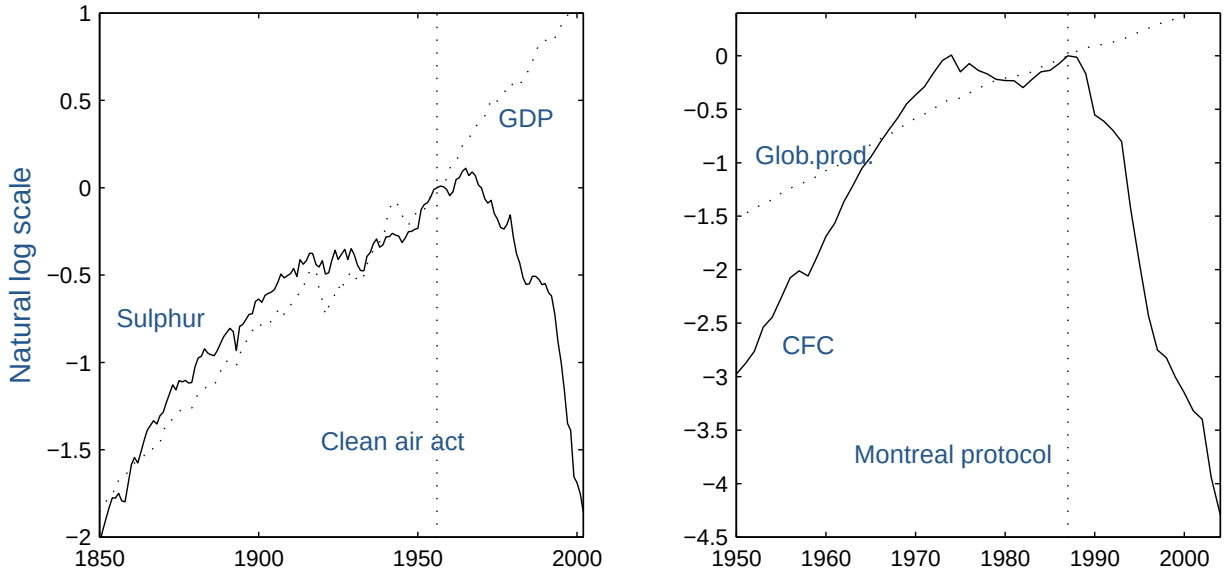

Figure 6: UK Sulphur emissions compared to total UK GDP, and global CFC production (CFC11+CFC12) compared to total global product. For sources see EGSD.

The consumerist phase

But . . .

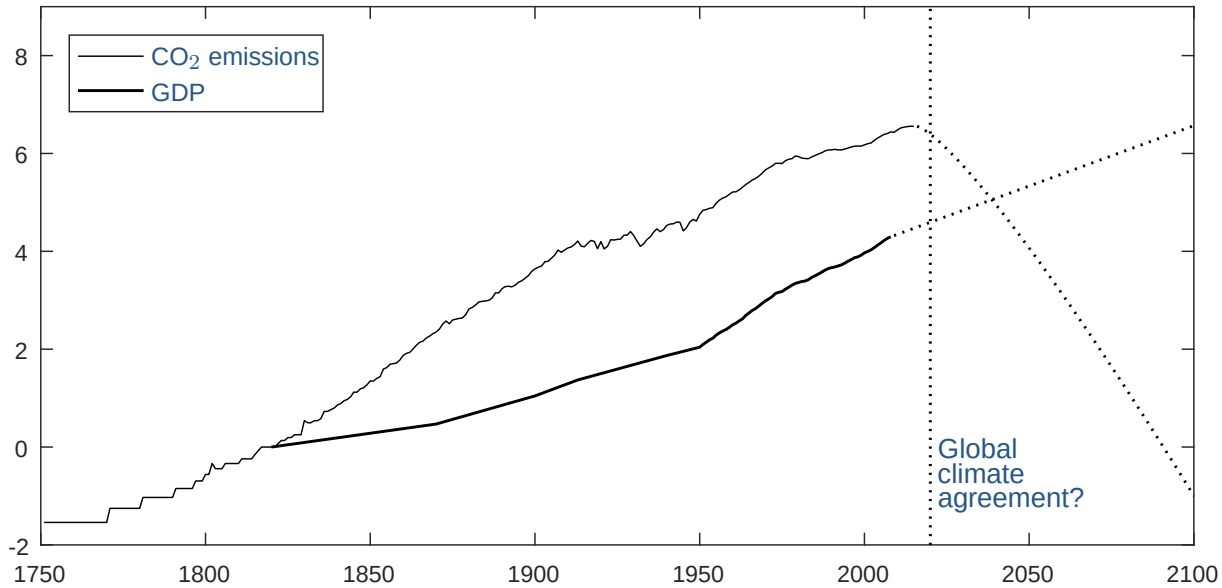

Figure 7: Global CO_2 emissions and gross global product: historical data from CDIAC, Maddison, and JRC, plus arbitrary projections into the future.

The consumerist phase

How do we explain all this?

And how do we manage it into the future?

We are going to try to answer these questions during the course.