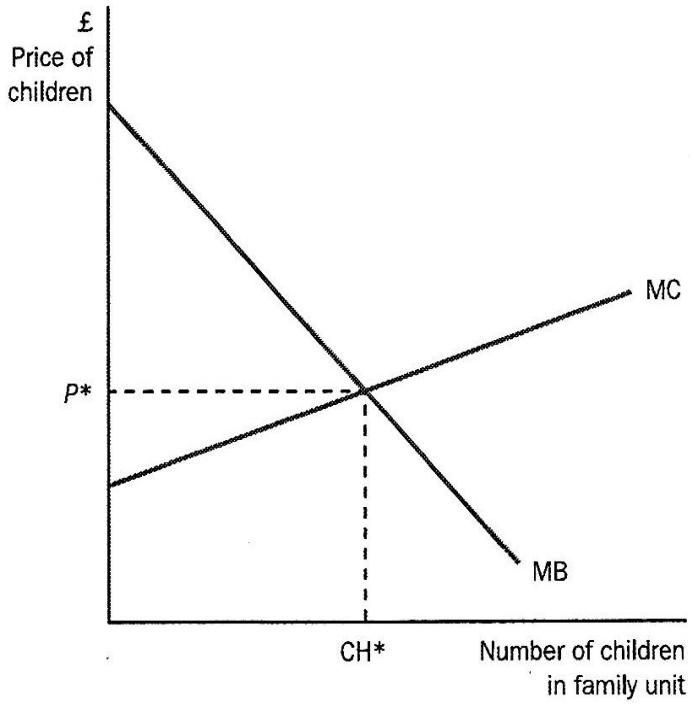
Microeconomics of desired family size



MC = The marginal cost to the family of a child
MB = The marginal benefit to the family of a child
= (the demand curve for children)

Figure 2.7 The microeconomics of fertility

Costs depend on

- costs of childbearing
- costs of rearing and educating
- opportunity costs of parental time

Benefits depend on

- religious and cultural beliefs
- child contribution to family income
- social security system

This suggests how government might influence desired family size to reduce the population growth rate.

Examples

- increased education for women
- welfare system incentives
- old age pensions

Economic development itself will operate on these costs and benefits

Growth and the environment

- Label the *per capita* emissions of some pollutant into the environment as *e*, and per capita income as *y*

$$e = \alpha y$$

- 'The view that greater economic activity inevitably hurts the environment is based on **static** assumptions about **technology**, **tastes, and environmental investments**.

$$e = \beta_0 y - \beta_1 y^2$$

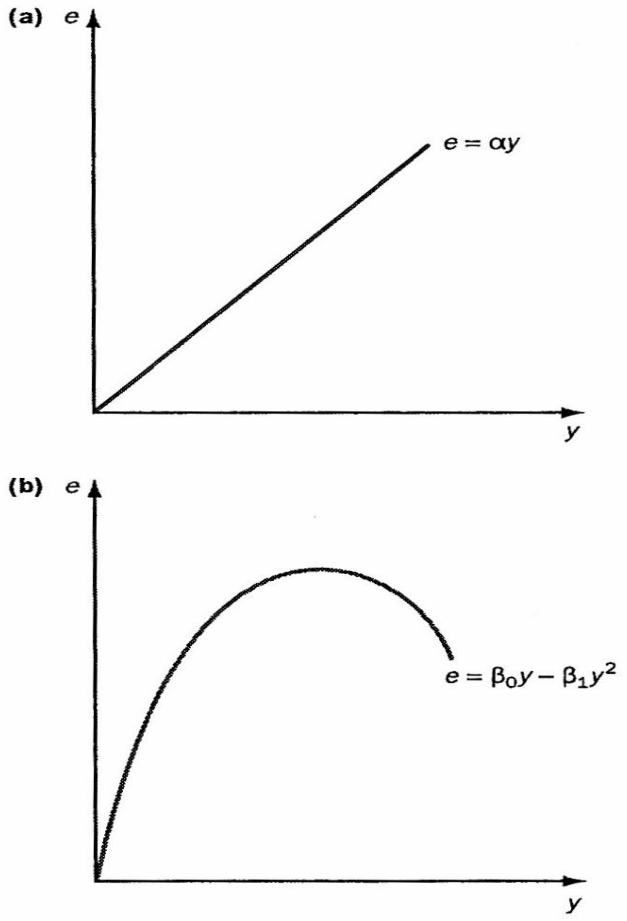
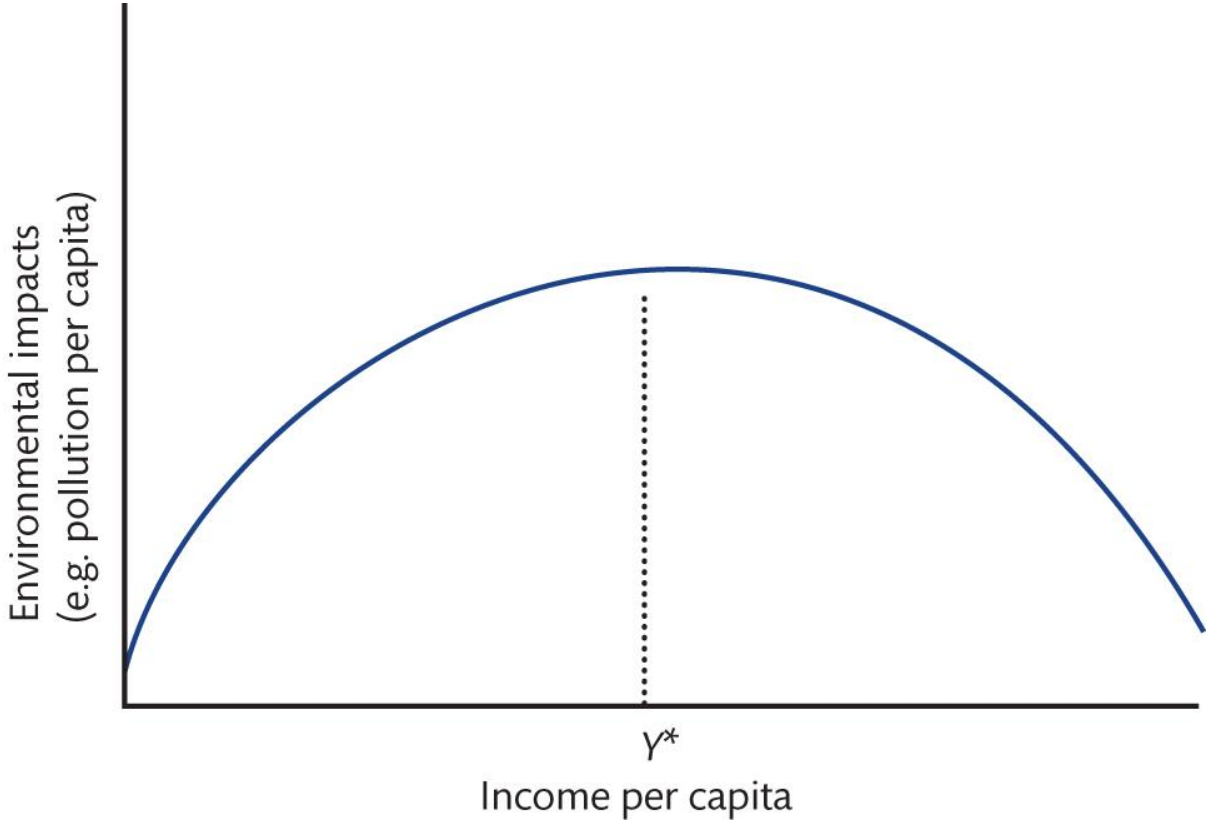


Figure 2.8 Environmental impact and income
Source: Adapted from Common (1996)

Growth and the environment /Short Run)



- Originally dealing with inequality (Kuznets, 1955)
  - Inverted U-shaped curve
- Up to Y*
  - Growth = increase of resources used (scale effect)
  - From agriculture to manufacturing = increase waste produced (structural effect)
- Above Y*
  - Increased demand for environmental quality
  - Technological improvement
  - From manufacturing to services
  - Scarcity of environmental quality increases relative prices, marginal cost of damage, incentives to protect the environment

Panayotou (1993)

- “At low levels of development both the quantity and intensity of environmental degradation are limited due to the subsistence economic level.
- As economic development accelerates with the intensification of
  - agriculture
  - resource extraction
  - industrialization
- the rates of resource depletion begin to exceed the rates of resource regeneration, and waste generation increases in quantity and toxicity.

- At higher levels of development, **structural change towards information-intensive industries and services**, coupled with **increased environmental awareness**, **enforcement of environmental regulations**, **better technology,** and **higher environmental expenditures**, result in leveling off and the gradual **decline of environmental degradation**.”

Implications of the EKC

- The EKC hypothesis implies that economic growth is the means to environmental improvement instead of being a threat to the environment.

- As countries develop economically, moving from lower to higher levels of per capita income, overall levels of **environmental degradation will eventually fall**.

- Economic growth is the only feasible means of **poverty eradication** and is good for the environment.

Empirical evidence on the EKC

Shafik and Bandyopadhyay (1992):

"It is possible to 'grow out of' some environmental problems, but there is nothing automatic about doing so. Action tends to be taken where there are generalized local costs and substantial private and social benefits. "

Lack of clean water	Decline uniformly with increasing income
Lack of urban sanitation	Decline uniformly with increasing income
Ambient levels of suspended particulate matter in urban areas	Conform to EKC
Urban concentrations of sulphur dioxide	Conform to EKC
Change in forest area between 1961 and 1986,	Do not depend on income.
Change in rate of deforestation between 1961 and 1986,	Do not depend on income.
Dissolved oxygen in rivers	River quality tends to worsen with increasing income
Faecal coliforms in rivers	River quality tends to worsen with increasing income
Municipal waste per capita	Rise with income
Carbon dioxide emissions per capita	Rise with income

Empirical evidence on the EKC

- For sulfur dioxide (SO_2); nitrogen oxide (NO_x); suspended particulate matter (SPM); deforestation

- Panayotou (1993) found fitted relationships that are inverted U shaped, consistent with the EKC hypothesis

- For municipal waste per capita and GHG other authors demonstrate a positive monotonic relationship.

- The EKC hypothesis might hold for **some environmental impacts** but not for all!

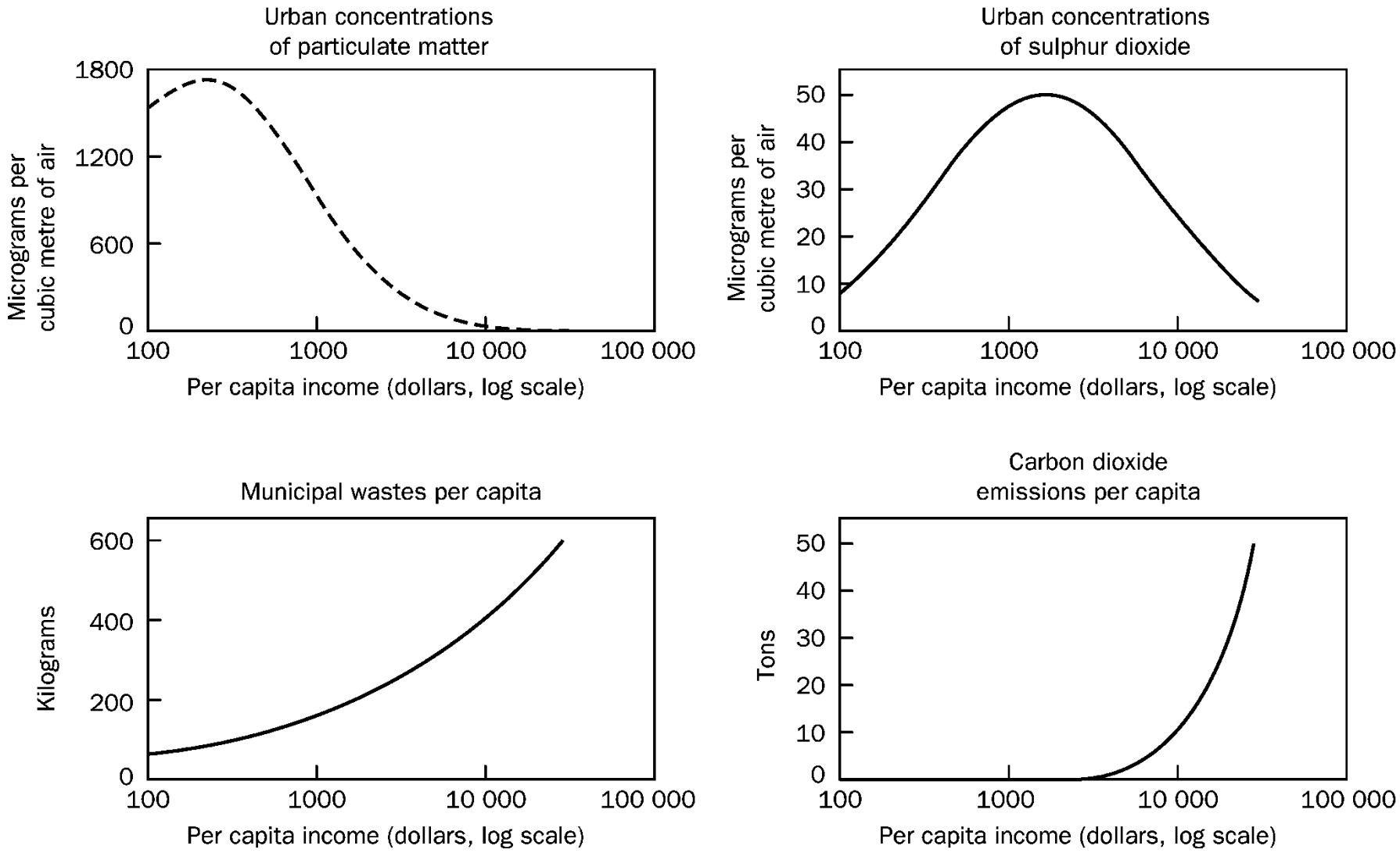


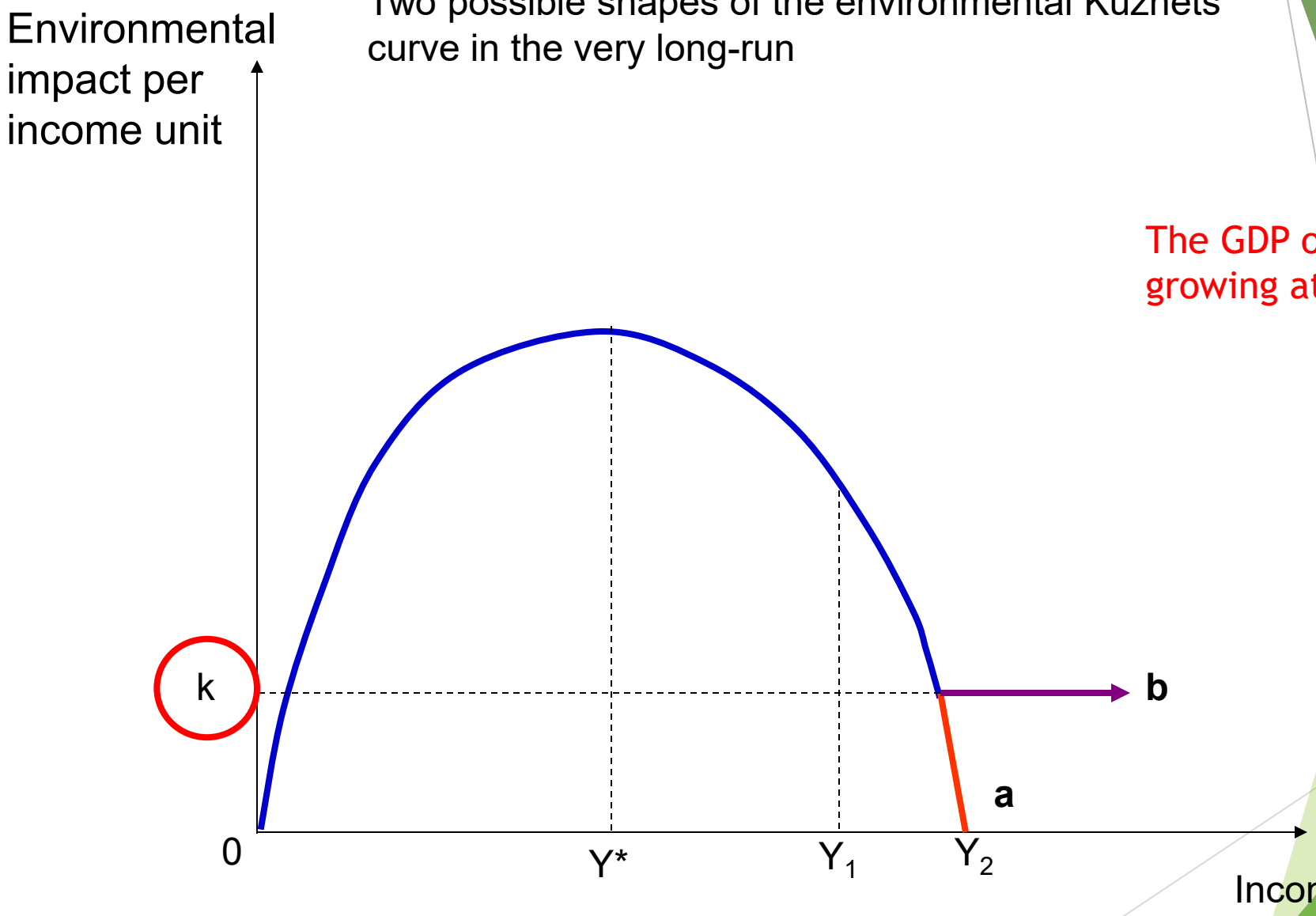
Figure 2.9 Some evidence on the EKC. Estimates are based on cross-country regression analysis of data from the 1980s
Source: Adapted from IBRD (1992)

The Environmental Kuznets Curve and environmental impacts in the very long run

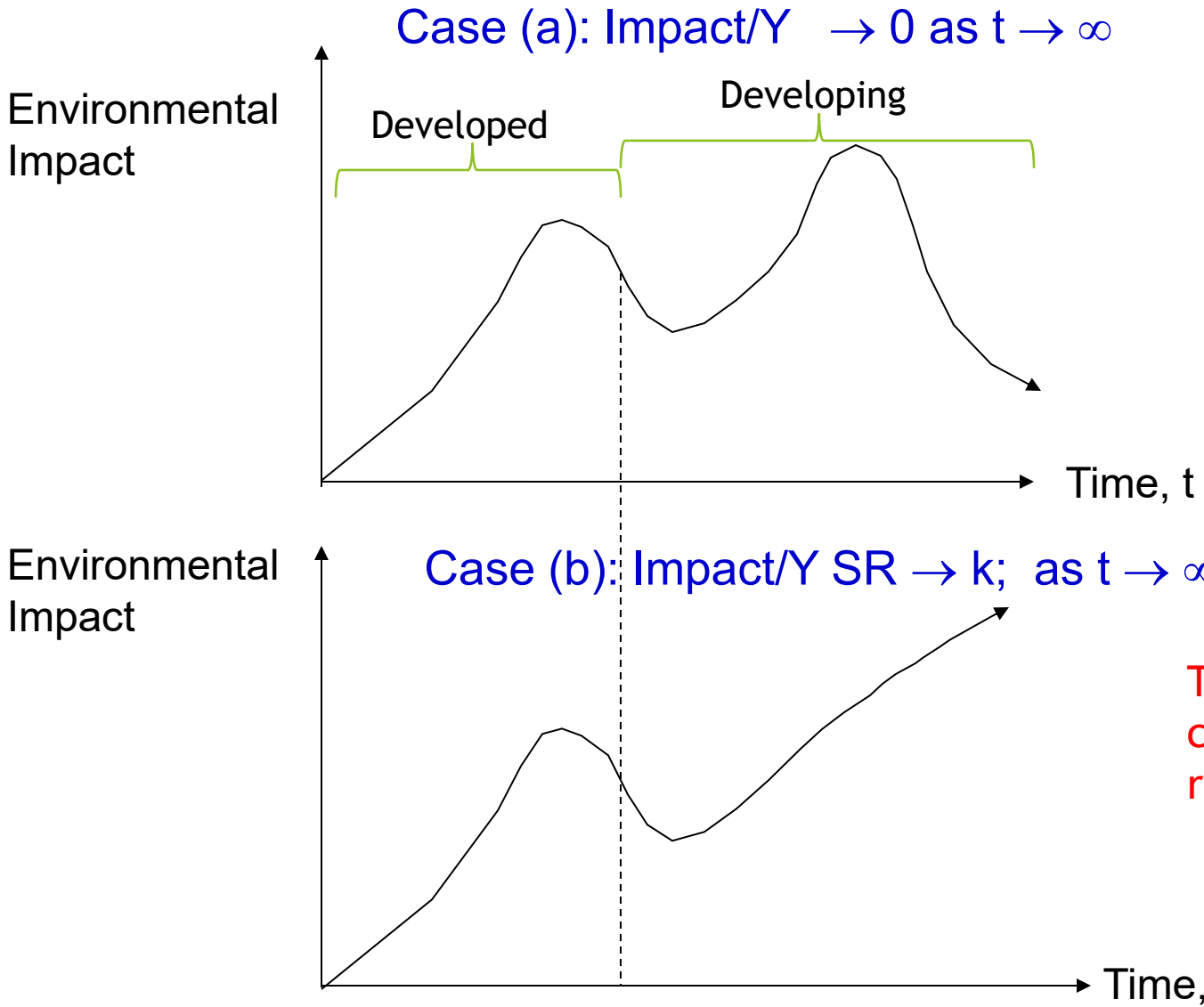
- Even if an EKC relationship between income and environmental impact is generally applicable,
- given continuing exponential income growth,
- it is only in very special circumstances that, in the long run, there will not be a positive relationship between income and environmental impact.

- Common (1995) examines the implications of the EKC hypothesis for the long-run relationship between environmental impact and income.

Two possible shapes of the environmental Kuznets curve in the very long-run



The GDP of each country is growing at a fixed rate of g!



The GDP (read it Y) of each country is growing at a fixed rate of g!

Two scenarios for the time profile of environmental impacts

The environmental Kuznets curve and environmental impacts in the very long run

- Which of these two possibilities – case **a** or case **b** – is the more plausible?
- **Common** argues that the laws of thermodynamics imply that *k* must be greater than zero.
- If so, **the very-long-run** relationship between total environmental impacts and the level of world income would be of a **linear** form shown.
- The inference from the inverted U shape of the EKC that growth will reduce environmental damage in the very long run would be incorrect.

Limits to growth?

The Limits to Growth published in 1972 by **Meadows** reported the results of an exercise using a simulation model, World3, to consider possible futures for the world system in the light of environmental limits.

World3 represented the world economy as a single economy and included interconnections between that economy and its environment.

It incorporated a limit to the:

land available for agriculture;
agricultural output producible per unit of land in use;
non-renewable resources available for extraction;
ability of the environment to assimilate wastes caused by production and consumption,

The behavior of the economic system was represented as a continuation of past trends in key variables, subject to those trends being influenced by the relationships between the variables represented in the model.

These **relationships** were represented in terms of **positive and negative feedback effects**.

The behavior over time of each key variable depends on that of others and affects that of others.

Base run projections of the World3 model

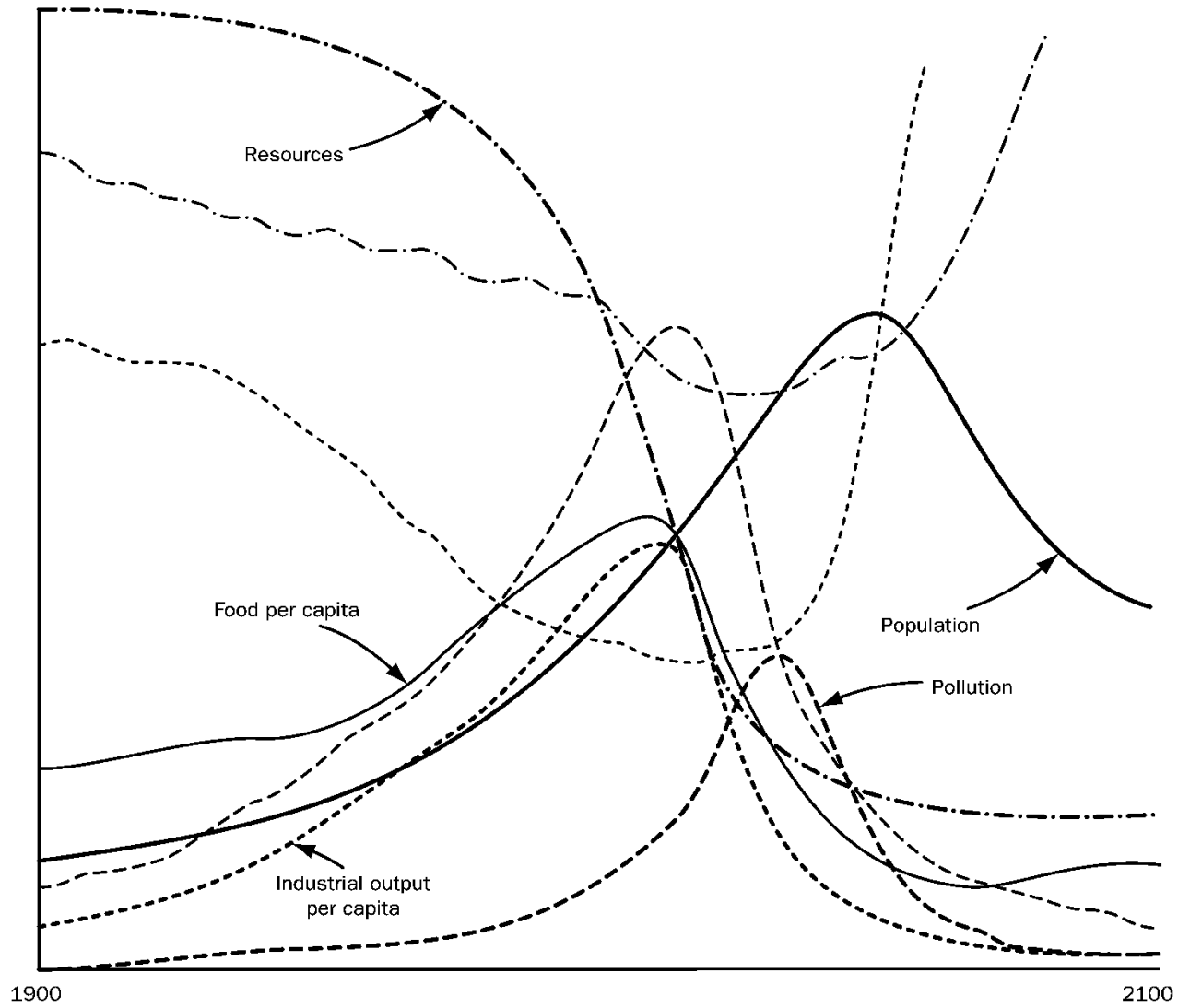


Figure 2.13 Base run projections of the 'limits to growth' model
Source: Meadows *et al.* (1972), page 124

World3 based conclusions 1972

On the basis of many runs of World3 successively relaxing constraints and modifying trends, the conclusions were

1. If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next 100 years. The most probable result will be a sudden and uncontrollable decline in both population and industrial capacity.

2. It is possible to alter these trends and establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied, and each person has an equal opportunity to realize his or her individual human potential.

3. If the world's people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success.

(Meadows et al., 1992 p xiii)

World3 based conclusions 1992 and 2005

Beyond the Limits was published in 1992 using only a slightly modified World3 model. It concluded

'As far as we can tell from the global data, from the World3 model, and from all we have learned in the past twenty years, the three conclusions we drew in *The Limits to Growth* are still valid, but they need to be strengthened.' (Meadows et al 1992 pxv)

Limits to Growth: The 30-Year Update was published in 2005, using a further, slightly, modified World3 model. The authors state themselves to be 'much more pessimistic about the global future' than previously, and that

'It is a sad fact that humanity has largely squandered the past 30 years in futile debates and well-intentioned, but halfhearted, responses to the global ecological challenge. We do not have another 30 years to dither. Much will have to change if the ongoing overshoot is not to be followed by collapse during the twenty-first century.' (Meadows et al 2005 p xvi)

Criticisms to *Beyond the Limits*

- The feedback loops in World3 were poorly specified in that they failed to take account of behavioral adjustments operating through the price mechanism
  - However, for many environmental resources and services, **markets do not exist** or function badly where they did.
- It was argued that such 'market failure' could be corrected by the proper policy responses to emerging problems.
  - However, this presumes some degree of **substitutions for environmental services** which is not always the case.

Social limits to growth

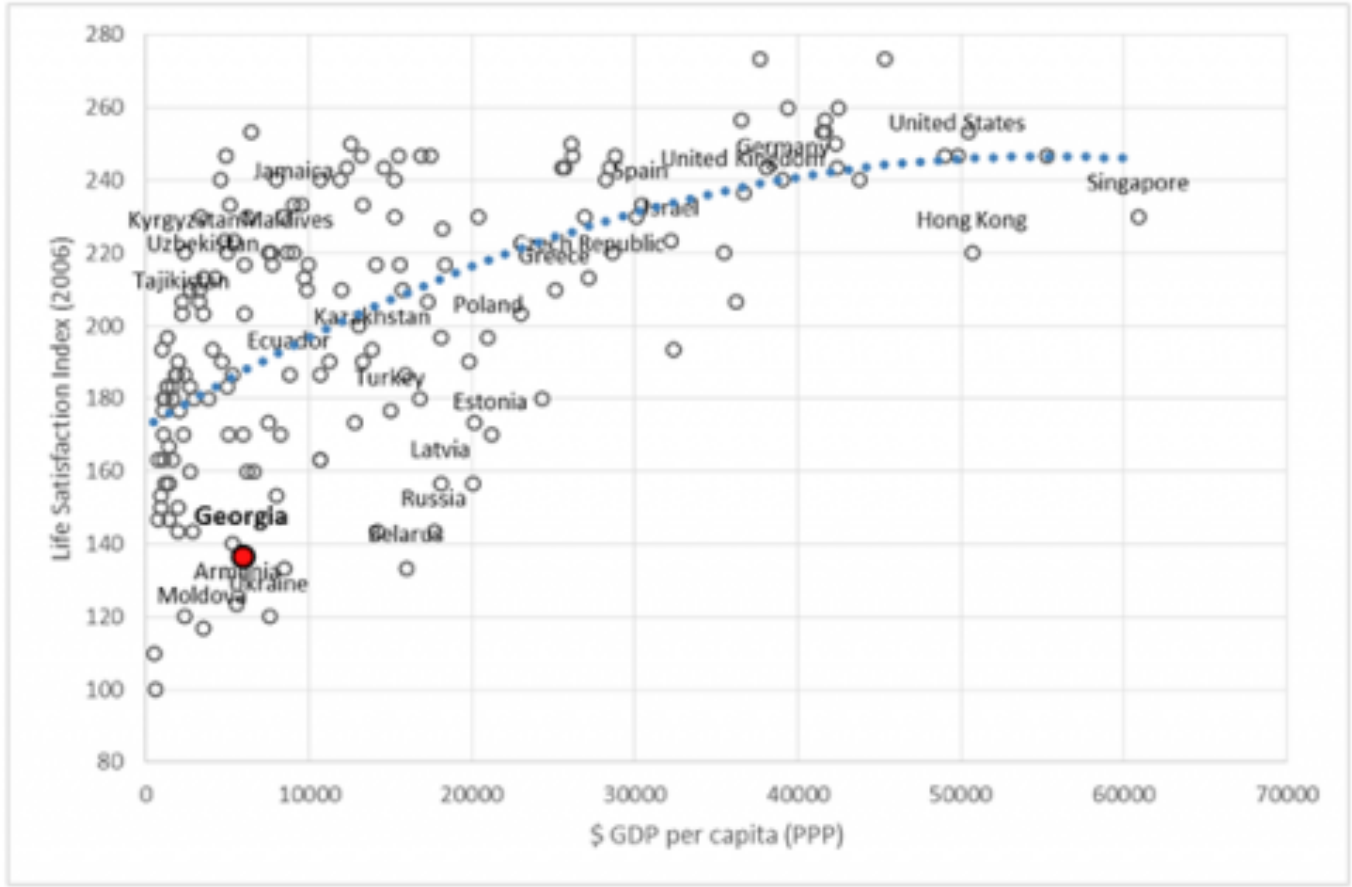
- 'Social limits to growth': first advanced in a book with that title by Hirsch (1977), five years after *The Limits to Growth*.
- Hirsch: the process of economic growth becomes increasingly unable to yield the satisfaction which individuals expect from it, once the general level of material affluence has satisfied the main biological needs for life-sustaining food, shelter and clothing. As the average level of consumption rises, an increasing portion of consumption takes on a social as well as an individual aspect, so that "*the satisfaction that individuals derive from goods and services depends in increasing measure not only on their own consumption but on consumption by others as well*". *(Hirsch, 1977, p. 2)*

- Once basic material needs are satisfied, further economic growth is associated with an increasing proportion of income being spent on such positional goods.
- As a consequence, growth in developed economies is a much less socially desirable objective than economists have usually thought. It does not deliver the increased personal satisfactions that it is supposed to.
- Traditional utilitarian conceptions of social welfare may be misleading in such circumstances, as utilities are interdependent.

Social limits to growth

- Since the 1950s surveys have asked individuals about how satisfied with their lives, or happy, they are.
- There is now a substantial body of data that can, among other things, be used to study the relationship between economic growth and happiness.
- The evidence from these data is consistent with Hirsch's argument.
- If we look at a plot of happiness against per capita national income across countries at a point in time, we find that happiness increases with income but at a decreasing rate.
- Across rich countries, in terms of the national average, additional per capita national income delivers little in terms of self-assessed happiness.

The Economics of Happiness



https://iset-pi.ge/en/blog/552-the-economics-of-happiness

The Brundtland Report 1987

Sustainable development was put on political agendas in 1987 by *Our Common Future*, often referred to as The Brundtland Report after the chairman of the World Commission on Environment and Development (WCED) which wrote it.

'**Environment and development are** not separate challenges: they are inexorably **linked**. Development cannot subsist on a deteriorating environmental base; the environment cannot be protected when growth leaves out of account the costs of environmental protection.' (p37)

The report defines **sustainable development** as development that:

seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the **future**.(p43)

and the report states that:

'Far from requiring the cessation of economic growth, it [sustainable development] recognizes that the problems of **poverty and underdevelopment** cannot be solved unless we have a new era of growth in which developing countries play a large role and reap large benefits.' (p40)

Questions

- Describe the classification of natural resources.
- Describe, also diagrammatically, the economy–environment interdependence.
- Describe, also diagrammatically, the materials balance principle.
- What is the difference between stability and resilience?
- What is the ecological footprint measuring, how does it differ globally, and what countries have the highest ecological reserve?
- Why is biodiversity important and how do we measure it?
- What has been the biodiversity loss over the last 50 years, and what countries have the highest BII?

…questions

- Describe the IPAT identity and the change of the factors affecting it over time.
- Describe, also diagrammatically, the theory of the demographic transition.
- Describe the Environmental Kuznets Curve and its implications.
- Is the empirical evidence in line with the EKC?
- Describe the position of Commons on the EKC applied in the long run.
- Describe the simulation model proposed by Meadows on the limits to growth and the criticisms moved against it.
- Describe the social version of the limits to growth by Hirsch.
- What is the Brundtland report?

Readings and a question!

- Perman, R., Ma, Y., McGilvray, J., Common, M. Natural resource and environmental economics, Pearson Education. 3 ed. - Chapter 2
- UN (2022) Global Population Growth and Sustainable Development, https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/undesa_pd_2022_global_population_growth.pdf
- WWF (2022) LIVING PLANET REPORT 2022 https://wwfint.awsassets.panda.org/downloads/embargo_13_10_2022_lpr_2022_full_report_single_page_1.pdf
- A new way to look at the problem. Three tough truths about climate. Bill Gates https://www.gatesnotes.com/home/home-page-topic/reader/three-tough-truths-about-climate
  - How would you debate against Bill Gates' view on the basis of the theories and models we have studied?