

Chapter 1

Technological progress and the human takeover of spaceship Earth

Human evolution

• Human evolution

• Three alternative choices

• The Malthusian phase

• The consumerist phase

• A technotopian phase?





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Homo, Homo sapiens, and technological progress.

- -2 million years.
- $-\ 300\ 000$ years.
- $-70\,000$ years.

Genetic and cultural evolution.





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Blue tits and milk bottles.

- Reproductive success;
- Consumption;
- Leisure.

Humans?







The Malthusian phase

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Human evolution 5 • Three alternative Log scale, normalized **Global population** 0 Average yearly production per capita -20000 1700 -1000000 year

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.







The Malthusian phase



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Very slow rate of technological progress.

Massive effects on other species:

- Moa;
- Wheat.

Key innovations?

What ended the Malthusian phase?





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2.5 2 Average global product per capita, normalized Log scale 1.5 1 Global population, normalized 0.5 0 ⊢☆ 1920 1840 1860 1880 1900 1940 1960 1980 1800 1820 2000

Figure 2: Global product and population, modern.





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Figure 3: 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).





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Figure 4: UK Sulphur emissions compared to total UK GDP, and global CFC production (CFC11+CFC12) compared to total global product.





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Rapid technological progress: labour productivity and (e.g.) energy productivity.

Slow increase in leisure.

Rapid increase in production and consumption; shifts in consumption *patterns*.

Rapid increase in resource and energy use.

EKC?

What might end the consumerist phase?





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Figure 5: Global CO_2 emissions and gross global product: historical data from CDIAC, Maddison, and JRC, plus arbitrary projections into the future.





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Environmental quality



Environmental quality

Figure 6: Alternative preferences yielding clean and dirty futures.



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Other dimensions: nature, and leisure.

Another factor: uncertainty and incompetence.



