# Growth, Climate Change and Natural Limits

# Readings

- Cameron Hepburn and Alex Bowen (2013): ‘Prosperity with growth: Economic growth, climate change and environmental limits’ in Fouquet, R. (ed.) Handbook of Energy and Climate Change
- Servaas Storm(2009): Capitalism and Climate Change: Can the Invisible Hand Adjust the Natural Thermostat? *Development and Change 40(6)*

# Growth economics and natural limits

- Neoclassical growth economics initially did not have any role for natural limits but later incorporated a category of natural capital(to capture land and non-renewable resources) with diminishing returns
- The net result was a decrease in long run growth rate but it still remained positive in the presence of exogenous technological progress
- In the endogenous framework as well, analytically it is possible to guarantee positive long run growth rates as long as accumulation of human capital is able to overcome the diminishing returns to natural and physical capital
- But how far can the results of these analytical models taken seriously in the context of the very long run where the physical limits of the planet in terms of its resource base and ‘carrying’ capacity is reached?

# Environmental drag on long term growth

- Environmental drag- ‘true national income’ growth when resources are ‘superabundant (but not free)’ and there is no pollution, minus actual ‘true national income’ growth, with scarce resources and pollution. (Nordhaus, 1992)
- Two components of environmental drag-  a) constrained growth due to scarce resources and b) drag from pollution (increase in greenhouse gases in the atmosphere)
- Estimation of environmental drag and the sensitivity of parameters
- Earliest estimate by Nordhaus(1992) which has been continuously revised upwards

| | 1980-2050 (basis points per year) | (percentage reduction) |
|---|---|---|
| **Non-renewable resources** | | |
| Energy fuels | 15.5 | 10.3 |
| Nonfuel energy | 2.9 | 2.0 |
| Entropy | 0.0 | 0.0 |
| **Pollution** | | |
| Greenhouse warming | 2.9 | 2.0 |
| Local pollutants | 4.4 | 3.0 |
| **Land drag** | 5.2 | 3.6 |
| **Total** | **30.9** | **19.4** |

Figure 1: Estimates of environmental drag by Nordhaus (1992)

# The stationary state and a future of zero growth

- The idea of stationary state can be traced back to political economists like John Stuart Mill and reappeared in writings of Keynes and Hicks among others
- Whether stationary state of the global economy is imperative depends on assumptions as well as value judgements on the nature of substitution between natural and physical capital
- Weak vs Strong sustainability
- Decoupling economic growth from increasing environmental pressure

# Simple mathematics of decoupling

- IPAT equation following Ehrlich and Holden (1979)
- I^/I = P^/P + A^/A + T^/ T ( in terms of growth rate of the variables)

where I = Tonnes of $CO_2$ emission, P= population, A = GDP per capita and

T= emission efficiency of GDP

- Jackson (2009) estimates that current levels of growth in the right hand variables adds up to generate a 2 percent annual growth in emission of $CO_2$
- There is relative decoupling as T^/T is negative(-0.7 %) but absolute decoupling would need an unreasonably high rate of technological progress and corresponding increase in emission efficiency
- Even with zero growth and current rates of growth in emission efficiency absolute decoupling is not possible

# Where does it leave us ?

- Zero growth vs Green growth
- Growth of material production vs Growth of value
- The finiteness of the time horizon and the possible urgency of degrowth