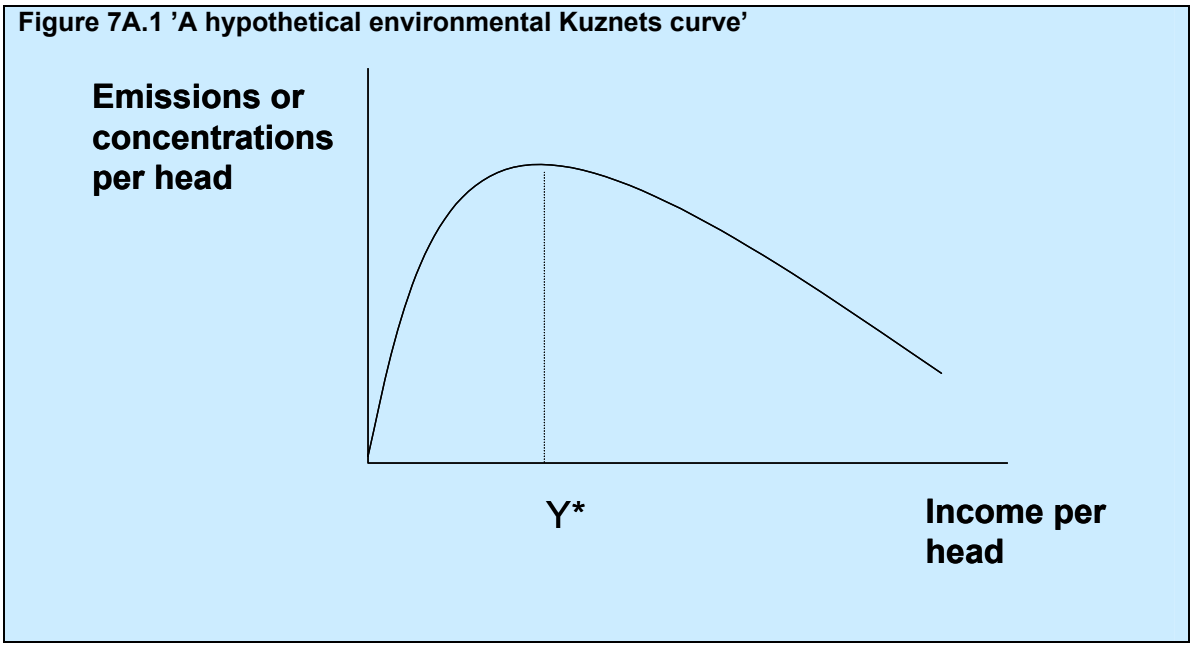
Annex 7A Climate Change and the Environmental Kuznets Curve

Some evidence indicates that, for local pollutants like oxides of nitrogen, sulphur dioxide and heavy metals, there is an inverted-U shaped relationship between income per head and emissions per head: the so-called 'environmental Kuznets curve', illustrated in Figure 7.7[52]. The usual rationale for such a curve is that the demand for environmental improvements is income elastic, although explanations based on structural changes in the economy have also been put forward. So the question arises, is there such a relationship for CO_2? If so, economic development would ultimately lead to falls in global emissions (although that would be highly unlikely before GHG concentrations had risen to destructive levels).

Figure 7A.1 'A hypothetical environmental Kuznets curve'

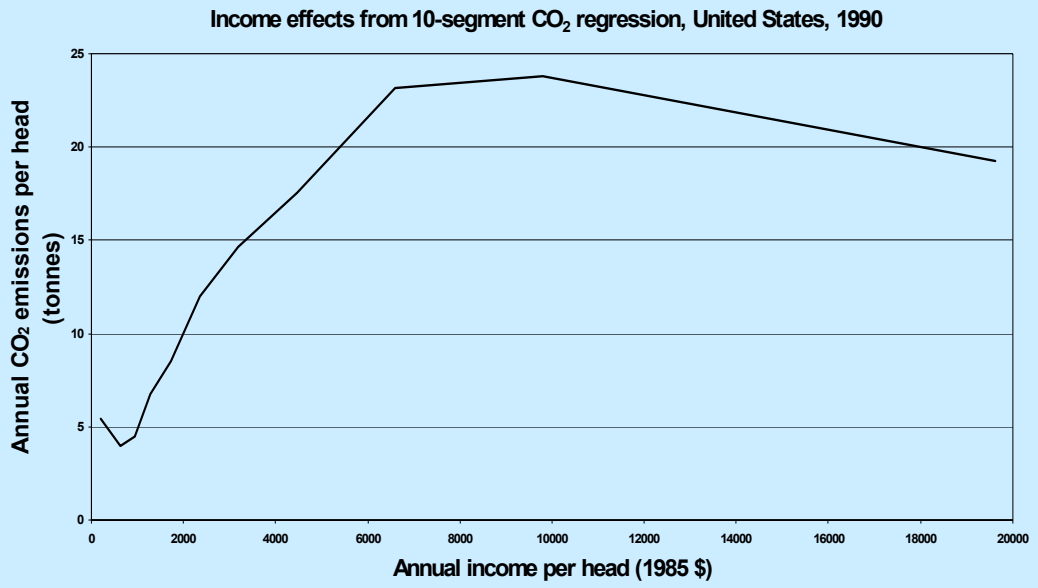


In the case of greenhouse gases, this argument is not very convincing. As societies become richer, they may want to improve their own environment, but they can do little about climate change by reducing their own CO_2 emissions alone. With CO_2, the global nature of the externality means that people in any particular high-income country cannot by themselves significantly affect global emissions and hence their own climate. This contrasts with the situation for the local pollutants for which environmental Kuznets curves have been estimated. It is easier than with greenhouse gases for the people affected to set up abatement incentives and appropriate political and regulatory mechanisms. Second, CO_2 had not been identified as a pollutant until around 20 years ago, so an explanation of past data based on the demand for environmental improvements does not convince.

Nevertheless, patterns like the one in Figure 7.4 suggest that further empirical investigation of the relationship between income and emissions is warranted. The relationship could reflect changes in the structure of production as countries become better off, as well as or instead of changes in the pattern of demand for environmental improvements. Several empirical studies[53] have found that a relationship looking something like the first half of an environmental Kuznets curve exists for CO_2 (after allowing for some other explanatory factors in some, but not all, cases). Figure 7.8 illustrates this, using Schmalensee et al's estimates for the United States.

[52] See Seldon and Song (1994) and Harbaugh et al (2002)
[53] See, inter alia, Neumayer, op. cit., Holtz-Eakin and Selden (1995) and Schmalensee et al, op. cit.

Figure 7A. 2 'Income effects from 10-segment CO_2 regression, USA, 1990'



Source: Schmalensee et al (1998)

Even if this finding *were* robust, however, it does not imply that the global relationship between GDP per head and CO_2 emissions per head is likely to disappear soon. The estimated turning points at which CO_2 emissions start to fall are at very high incomes (for example, between $55.000 and $90,000 in Neumayer's cross-country study, in which the maximum income level observed in the data was $41,354). Poor and middle-income countries will have to grow for a long time before they get anywhere near these levels. Schmalensee et al found that, using their estimates – *with* an implied inverted-U shape – as the basis for a projection of future emissions, emissions growth was likely to be positive up to their forecast horizon of 2050; indeed, they forecast more rapid growth than in nearly all the 1992 IPCC scenarios, using the same assumptions as the IPCC for future population and income growth.

In any case, it is not clear that the link between emissions and income does disappear at high incomes. First, the apparent turning points in some of the studies may simply be statistical artefacts, reflecting the particular functional forms for the relationship assumed by the researchers[54]. Second, the apparent weakening of the link may result from ignoring the implications of past changes in energy technology; after controlling for the adoption of new technologies that, incidentally, were less carbon-intensive, the link may reappear, as argued by Huntington (2005).

[54] This is not the case with the 'piecewise segments' approach of Schmalensee et al.