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ANALYSIS

Income inequality and the environment: aggregation bias in environmental Kuznets curves

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Abstract

The environmental Kuznets curve assumes an inverted U-shaped relation between environmental damage and per capita income. Recently it has been argued in the literature that in addition to income levels, the inequality in the distribution of power and income is (positively) related to environmental degradation. We provide an additional argument, based on simple aggregation, for including a measure of income dispersion in empirical analyses. When the relationship between environmental damage and household income is concave (e.g. resembles an environmental Kuznets curve), then income inequality is negatively related to total environmental damage. Results from an empirical analysis of cross-national variation indicate that the aggregation effect can run counter to and outweigh the political economy effect for some environmental indicators.

Keywords: Environmental Kuznets curve; Income inequality; Households

1. Introduction

According to the environmental Kuznets curve (EKC) hypothesis, environmental damage first increases, but after a 'turning point' declines with per capita income. One reason for this inverted U-shaped relation is that the so-called 'scale effect', capturing the simple intuition that more output, *ceteris paribus*, results in more adverse effects for the environment, is (partly) offset by the 'composition effect' (due to changes in the underlying structure of the economy) and the 'technique effect' (referring to possible changes in the methods of production). The extent to which these factors operate depend on the incentives faced by economic actors and policy makers. As incomes increase, both the demand for improvements in environmental quality and the resources

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available for environmentally friendly investments will rise. Another, more simple, reason is put forward by Andreoni and Levinson (1998) who propose an explanation derived directly from the technological link between consumption and abatement of the undesirable byproduct (pollution). For empirical support for some damage indicators, see e.g. Shafik and Bandyopadhyay (1992), Cropper and Griffiths (1994), Selden and Song (1994), Grossman and Krueger (1995), Panayotou (1995) and studies in the special issue of Ecological Economics (vol. 25, 1998) on this topic. For critical discussions of progress on the EKC concept, see Stern et al. (1996) and Stern (1998).

One approach to progressing research in this field is to add distribution issues. Boyce (1994) hypothesises that the inequality of power and income may be an important determinant of environmental degradation, which is examined empirically by Torras and Boyce (1998). More specifically, it is argued that greater equality of incomes results in lower levels of environmental degradation. This conclusion is challenged by Scruggs (1998) on both theoretical and empirical grounds.

Boyce (1994) and Torras and Boyce (1998) take a public choice approach to explain the importance of income distribution. We call this the *political economy* argument. For example, redistributing income will affect society's demand for environmental quality (Magnani, 2000), and thus affect the 'induced policy response' (Grossman and Krueger, 1995). Also, an equitable distribution may contribute to social harmony that is conducive for the long-term perspective that investments in environmental quality require.

In addition to this political economy argument, a simple *aggregation argument* can be used to motivate the importance of income inequality in explaining environmental degradation. The aggregation argument is based on two observations: (i) for some environmental problems, a non-linear (e.g. an inverted U-shaped) relation between income and degradation can be found at the micro (household) level; and (ii) aggregating over households with unequal incomes subject to such a non-linear relation will result in biased estimates of both the level and turning point of the aggregate relation (EKC?) when a measure of income dispersion is not included.

The paper therefore makes two contributions. First, it adduces an additional reason for including measures of income inequality in EKC-type analyses of the relation between income and national level environmental degradation. Second, it demonstrates the importance of examining household level relations between income and environmental pressure, which can affect the sign and magnitude of the overall inequality effect.

2. EKC for households?

While it is common to assume that households consume, it is well-documented that in developing countries households often are both producers and consumers. When markets for factors or commodities are imperfect (as is often the case in developing countries), consumption and production decisions cannot be analysed separately (e.g. Singh et al., 1986; De Janvry et al., 1991; Benjamin, 1992). Households affect environmental quality both by their consumption and, especially for agricultural households in developing countries, their production decisions.

As household income increases, the ability of households to change consumption and production patterns improves. Many indicators of environmental quality/impact will be non-linearly related to household income. Indeed, some of those relations will have a turning point, although this is not relevant for the analysis below. At the consumption side, for example, it can be hypothesised that rising incomes may first increase demand for fuelwood, but at higher income levels, fuelwood will be increasingly replaced by modern energy sources (Cropper and Griffiths, 1994). Demand for energy in toto is also likely to be non-linearly related to income, although less likely to have a turning point.[1] At the production side, similar effects are expected. Godoy et al.

[1] Evidence for urban households in the Netherlands indicates that the total energy requirements follow a concave curve when incomes increase (Vringer and Block, 1995).