

## **Ethical implications of efficiency in climate economics**

Climate change brings up fundamental questions related to intragenerational and intergenerational equity. Economists have traditionally drawn a sharp distinction between equity on the one hand (a question for ethics and politics), and efficiency on the other (a question for positive economics) (Daly & Farley, 2004). More recent studies, however, have argued that the two are intimately linked: Howarth and Norgaard showed that efficiency is not (as earlier believed) sufficient to guarantee a sustainable resource allocation over time; the initial distributions of endowments and rights matter (Howarth & Norgaard, 1992). Pascual et al. and Muradian et al. have argued that although payment for ecosystem services (PES) conceptualization separates efficiency from equity considerations, these are in practice interdependent, and Corbera et al. argue for the need to not only consider efficiency, but also equity, in the design and implementation of PES policies (Corbera, Brown, & Adger, 2007; Muradian, Corbera, Pascual, Kosoy, & May, 2010; Pascual, Muradian, Rodríguez, & Duraiappah, 2010).

This paper extends the investigation of the relationship between equity and efficiency by investigating the role of economic efficiency in Integrated Assessment Models (IAMs). IAMs are quantitative models that combine scientific and socio-economic aspects of climate change for the purpose of assessing policy options (Kelly & Kolstad, 1999). They are designed to assess the risks of climate change and to balance short-term costs of mitigation against long-term damages (Jones & Yohe, 2008). As the debate over climate policy is shifting from scientific uncertainty to economic feasibility, the results of IAMs are growing in importance (Ackerman, DeCanio, Howarth, & Sheeran, 2009; Pindyck, 2013) and a number of IAMs have recently been used to evaluate alternative abatement policies and to estimate the social cost of carbon that is now used in all US federal regulatory analysis that has an impact on greenhouse gas emissions (EPA & Energy, 2013). The limitations of IAMs have been pointed out both by researchers in the field (Kelly & Kolstad, 1999; Rotmans & Asselt, 2003; Schneider, 1997) and by others (Ackerman et al., 2009; Pindyck, 2013). None of these researchers, however, discuss the appropriateness of core economic principles, like efficiency, in general.

The above studies indicate that economic efficiency and equity might be related. If this is true, it will have important consequences for how we use economic theories and models in designing policies for a sustainable society, which is intimately linked to both intragenerational and intergenerational equity. This paper analyzes the relationship between economic efficiency and equity in the FUND (climate Framework for Uncertainty, Negotiation and Distribution) integrated assessment model. The FUND model is one of the models used by the US government to determine the social cost of carbon (which has incorporated distributional aspects by including equity weighting into its utility function). This paper conducts a quantitative analysis of the impacts on the outputs of the FUND model from different assumptions regarding efficiency. It investigates how theory has been translated into practice in the application of the FUND model by the US government, and how this might have given different results had the efficiency assumptions been different. The paper also reviews the role of efficiency within classical political economics and ecological economics and compares this to the notion in neoclassical economics.

The goal of IAMs is to integrate knowledge from natural sciences and economics into a single framework that can be used to identify best responses to climate change. This, however, challenges the idea of the degrowth movement that a transition towards a sustainable society should be democratic and based on (collective) choice. Understanding the ways in which efficiency constrains or otherwise shapes the outputs of IAMs is important in order to understand the role that mainstream economics plays in relation to a sustainable society. If IAMs provide best responses to climate change, what are the premises? It might be that an ecologically desirable state of the economy is not efficient at all, in the narrow sense defined by neoclassical economics.

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