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Cost–benefit Analyses of Climate Change

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The United Nations Environment Programme (UNEP) estimated that the world would need to reduce greenhouse gas (GHG) emissions by 50–60 per cent from 1990 levels by 2050, with a future downward trajectory that is even more drastic, to have a probable chance of limiting a global temperature increase to 2ºC. It was also estimated that a 2ºC warming could lead to overall global losses of about 1 per cent of the world's gross domestic product (GDP). Models predict however that losses will be distributed in an unbalanced way. While countries in Africa and South Asia may experience losses of around 4–5 per cent of their GDP, models predict minimal short term GDP losses in rich countries (Nordhaus, 2007; Stern, 2007).

This means that mitigation efforts will need to be enormous and will require investments to enable a radical transformation of production structures and of consumption behaviour, with significant renovation of the capital stock and its technological content.

Therefore, the current debate on climate change centres on where and when mitigation and adaptation actions should be taken, and with what priority. In this context, economic science has developed models that attempt to quantify the difference between the cost of mitigation actions (and their benefits in terms of avoided negative impacts) and the costs of inaction, aiming to calculate the optimal mitigation strategy from an economic perspective.

Cost–benefit analysis of investments in climate change mitigation or adaptation actions depends on climate modelling of future emissions and their expected warming effects and of the expected geophysical impacts that would follow. These assessments are made using integrated assessment models (IAMs), which are computer simulation models of multiple equations that combine dynamic economic relations with the dynamics of the geophysical environment to analyse the economic effects of climate change.

Economic models then try to translate these climate patterns into economic effects. The decisions about the most efficient pattern of emissions reductions is based on the equalisation of the marginal cost of lowering consumption due to the need to reduce emissions and the marginal benefit of reducing climatic risks given an emissions path. Since these costs and benefits will take place over time, they are equalised at present values. Therefore, results are very sensitive to which discount rate is used. Also distributive effects will be heavily dependent on the curvature of the social welfare function adopted.

The emerging investment and consumption patterns that would result from this cost–benefit equalisation should maximise social welfare. The effects of public policies in terms of consumption patterns and emissions paths, gas concentrations and impacts are compared to a business as usual (BAU) scenario (one without mitigation and thus a baseline for comparisons), so that policymakers can decide whether or not to implement a proposed mitigation policy.

However, modelling and valuing impacts and comparing them with mitigation costs is not free from controversy. There are basically two groups of studies in this arena: the gradualist or 'climate ramp' approach (e.g. Nordhaus) and the approach that supports stronger and immediate actions (e.g. Stern). Their most important difference is the size of the discount rate each of them uses. The first uses larger discount rates than the second. The higher the assumed discount rate, the greater the individual preference for present consumption at the expense of future consumption. Thus their policy recommendations tend to support higher present consumption and the postponement of investment in mitigation and adaptation. Other important factors behind the differences are population growth and emissions projections, the specification of cost functions, the way regional effects are aggregated and the marginal utility elasticity.

The extreme lack of knowledge about the effects of potential catastrophic events that may occur with very low probabilities poses an additional challenge for economic modelling. Economists are used to dealing with mean effects analyses. With regards to climate change, explicitly including uncertainty in models is crucial for sound policy recommendations.

Therefore, a key question is whether economists should continue to study mean effects with high probabilities, or change their focus to calculating the costs and benefits of avoiding possible extreme effects. In terms of policymaking, this would be compared to buying 'climate insurance' or using the precautionary principle.

Despite the uncertainties involved in climate change cost–benefit analysis, it is important to highlight the existing converging points, such as the need to establish some sort of carbon price and the recognition that not only mitigation but also adaptation is an important issue and that whatever mitigation path is chosen, it is necessary to find economic instruments and incentives to minimise its costs.

Besides that, climate change cost–benefit analysis has already provided important insights to inform decision-makers, international negotiators and public opinion. Even though these studies are often not explicit cited, they underpin opinions of various stakeholders in the national and international arena, guide the positioning of most countries and will probably become even more important in the near future.

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