

and executive decision-making. After reading this book, few international law scholars will wish to defend their positions on related matters without taking into account this author's eloquently formulated arguments.

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Tietenberg, Tom (ed.). *The Economics of Global Warming*. Cheltenham, UK, Brookfield, VT: Edward Elgar Publishing Limited, 1997. Pp. xxii, 619. Index. \$195.

Human-induced global warming has received extensive attention in the environmental economics literature. There are several reasons for the important role that economics plays in the issue of climate change. First, effective mitigation strategies must reduce the fossil fuel use, which is central in the functioning of the world's economies. Second, since carbon dioxide is a uniformly mixed pollutant, the temporal and spatial allocation of overall greenhouse gas emissions can exclusively follow the rule of economic efficiency. Third, the fact that the location of emissions is of little importance means that economic instruments, like a CO₂ tax or tradeable emission permits, can play a major role.

The Economics of Global Warming, edited by Tom Tietenberg, a leading US environmental economist, provides a thorough overview of the contribution of economic theory until 1995 to the debate on global warming. It is part of the 'International Library of Critical Writings in Economics' series, which, in presenting a selection of the most important articles on particular themes, provides a valuable reference for students, researchers, and lecturers.

Tietenberg groups the articles around three main themes: damage, costs and optimal control strategy (Part II), instrument choice (Part III), and ethics and intergenerational discounting (Part IV). Since each essay emphasizes a different aspect of the problem, or follows a different approach, the theme groups are illuminated from various perspec-

tives, providing the reader with an idea of the diversity of the debate. Part I comprises three articles: the problem of cooperation among countries (Barrett, 1990), introductory thoughts on the problem of global warming (Schelling, 1992), and Chichilnisky and Heal's (1993) essay on global warming as a risk to society. This last would have been more fruitfully placed in a later chapter on hedging strategies. Except for Schelling's piece, the articles cannot be considered helpful introductory pieces. A better introductory reading could have been, for instance, Nordhaus' text on 'Economic Approaches to Greenhouse Warming', published in Dornbusch and Poterba's *Global Warming* (1991).

Part II is well organized. The sub-chapters and the individual articles build upon each other. This part examines efforts to value the damages caused by global warming, to calculate the costs of reducing the release of greenhouse gas emissions into the atmosphere, and to search for optimal response strategies by comparing both the costs and the benefits of taking action. Most studies that estimate the damages caused by global warming have focused on the agricultural sector. The essays selected by Tietenberg estimate the damages caused by global warming to US agricultural production (Mendelsohn, Nordhaus and Shaw, 1994) and the agricultural vulnerability to climate change in developed and developing countries (Rosenzweig and Parry, 1994). The third analysis is the study by Cline (1992), which also includes non-agricultural damages such as the economic value of the loss of species and human life.

The section on the cost of control estimates begins with the two influential studies by Whalley and Wigle (1991) and Jorgenson and Wilcoxon (1993). They use different approaches to identify the costs of cutting CO₂ emissions. Whereas Jorgenson and Wilcoxon apply a disaggregated model to estimate the impact of a carbon tax in the US, Whalley and Wigle use a general equilibrium model with highly aggregated data. Following is Nordhaus' (1991) estimation of marginal and total cost functions of CO₂ reduction by combining existing estimates of control costs. The section

closes with a refreshing essay by Weyant (1993) in which he demonstrates how sensitive the projected control costs are to the key determinants of economic models.

Having described the various approaches to estimating climate change related costs and damages, the next logical step is to compare costs and benefits in order to derive the optimal control level. Tietenberg's selection covers four different models which calculate optimal control paths for greenhouse gases: Cline's (1992) estimation of benefit–cost ratios for different aggressive abatement strategies; Nordhaus' (1993) DICE model; the integrated assessment model MERGE developed by Manne, Mendelsohn and Richels (1995); and Richels and Edmonds' (1995) cost-effectiveness framework. The first three show an increasing level of integration, thus demonstrating the development of analytical techniques for this set of problems. Tietenberg, however, does not highlight this development well.

Part III contains essays on the most widely discussed policy instruments to curb greenhouse gas emissions, carbon taxes and tradeable permits. While the articles on carbon taxes by Hoel (1992, 1994) and Whalley and Wigle (1991) provide a useful background on the effectiveness of different forms of carbon taxes in the international arena, the study by Ingham, Maw and Ulph (1991) on the impact of a national carbon tax on the UK energy sector is too specific and insignificant in the environmental economics literature to be included in a reference book of this nature. The section on tradeable permits begins with a good overview of the concept and design of tradeable permits for the control of greenhouse gases by Bertram (1992). Since the major problem in the implementation of a tradeable permit system will be permit allocation, Tietenberg has included two articles (Larsen and Shah, 1994, Rose and Stevens, 1993) that examine the issue of permit allocation across nations with regard to efficiency and equity. Tietenberg's (1992) essay on domestic experience with tradeable permits and the lessons to be learned for greenhouse gas trading is a valuable starting point for

researchers who are interested in the practical implementation of such a system. Victor's (1991) article on the limits of tradeable permits to control greenhouse gases other than CO₂ is important in the light of the Kyoto Protocol which targets a basket of six greenhouse gases. Section three comprises three essays on hedging strategies by Kolstad (1994), Manne and Richels (1991) and Peck and Teisberg (1993). While the articles themselves, without doubt, reflect the state of economic expertise in this field, it is questionable whether hedging strategies rightly belong in the chapter on choice of instruments. Having previously discussed carbon taxes and tradeable permits, it would have been better to include examples of the literature that deal with the factors that influence the choice of policy instruments, especially taxes versus tradeable permits, in the climate change issue.

Part IV discusses the problem of intergenerational discounting, and includes the important articles by Lind (1995) and Schelling (1995). Defining appropriate discount rates is, however, more an ethical question than an area to which economic theory can contribute much. On the other hand, studies on other important issues, such as incentives for technological innovation in the form of energy efficiency improvements, which play a central role in the control of greenhouse gas emissions, have been left out.

In summary, this book provides a helpful reference for economists working on global warming. Part II includes the 'must reads' for every economist carrying out research on climate change. Unfortunately, a reference book such as this one cannot incorporate the most recent studies and articles. It would be desirable to have, at the end of each chapter, a list of more recent publications which could not be included in this book.

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