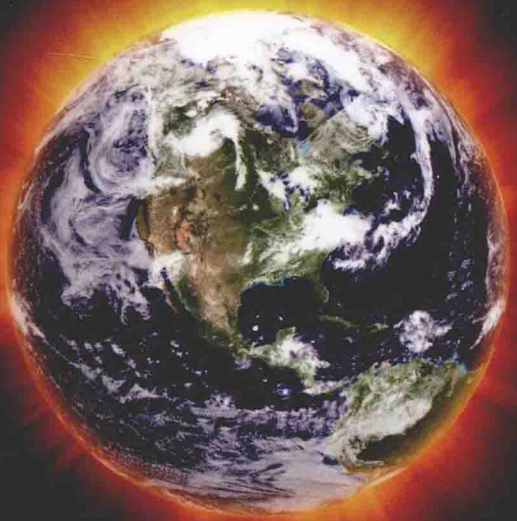
CHARLES S. PEARSON

ECONOMICS and the CHALLENGE of GLOBAL WARMING



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Economics and the Challenge of Global Warming

Economics and the Challenge of Global Warming is a balanced, rigorous, and comprehensive analysis of the role of economics in confronting global warming, the central environmental issue of the twenty-first century. It avoids a technical exposition to reach a wide audience and is up to date in its theoretical and empirical underpinnings. It is addressed to all who have some knowledge of economic concepts and a serious interest in how economics can (and cannot) help in crafting climate policy. The book is organized around three central questions. First, can cost-benefit analysis guide us in setting warming targets? Second, what strategies and policies are cost-effective? Third, and most difficult, can a global agreement be forged between rich and poor, the global North and South? Although economic concepts are foremost in the analysis, they are placed within an accessible ethical and political matrix. The book serves as a primer for the post-Kyoto era.

Charles S. Pearson is Senior Adjunct Professor of International Economics and Environment at the Diplomatic Academy of Vienna and Professor Emeritus at the School of Advanced International Studies (SAIS), Johns Hopkins University, Washington, DC. During his tenure at SAIS, he directed the International Economics Program for seventeen years and taught at all three campuses in Washington, Bologna, and Nanjing. His teaching and research reflect a deep interest in international environmental economics. He pioneered seminars on trade and environment, the role of multinational corporations, and environmental cost-benefit analysis. His books reflect these interests, with research on global warming published as early as 1978. They include *Environment: North and South*, *International Marine Environment Policy*, and *Economics and the Global Environment* (Cambridge University Press, 2000). He has been Adjunct Senior Associate at World Resources Institute and the East-West Center, and consultant to the U.S. government, international organizations, and industrial, financial, and legal organizations in the private sector. He received his Ph.D. in economics from Cornell University.

To the grandchildren – Ryan, Emily, Emma, Jack, Grace,
Scott – and to their children, yet to come

The summer is over, the harvest is in, and we are not yet saved.
Jeremiah 8:20

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Introduction and a Road Map

An economist's guess is liable to be as good as anybody else's.
Will Rogers, American humorist

Scope and Focus

Global warming is *the* environmental issue of the twenty-first century. Many believe it ranks with war and poverty as one of the greatest challenges to human well-being. But unlike war and poverty, which humanity has confronted for millennia, global warming is a recent concern. And unlike war and poverty, global warming is mainly a prospective threat and one that can in principle be met with pre-emptive action.

Understanding and responding to global warming requires many scientific disciplines including meteorology, climatology, and oceanography; the full array of biological and ecological sciences; and the engineering disciplines. But while science is a necessary component of policy, it is not sufficient.

Global warming presents both old and new political challenges. Measures to limit global warming involve near-term costs with only a promise of benefits, often far in the future. Such actions are inherently difficult for politicians focused on the next election. More fundamentally, virtually all measures to address global warming will affect existing de facto property rights and create winners and losers. And the distribution of the tens of billions of dollars in gains and losses depends on the specifics of policy – abatement targets chosen, economic sectors

penalized or subsidized, the market and regulatory tools employed. Politics permeates the rearrangement of property rights.

Confronting global warming is also an international political problem of great complexity and will require statecraft of the highest order. All countries, large and small, North and South, rich and poor, generate greenhouse gas emissions and contribute to the problem, albeit at very different historical, current, and projected levels. At the same time all countries and virtually all groups within countries will be affected by global warming – a few positively, most negatively. The daunting international political challenge is to reconcile these greatly divergent interests and capabilities, and to undertake a potentially costly program of mitigation and adaptation measures, all within an international political system that lacks an international environmental protection agency with the authority to compel emission reductions.

Global warming raises profound ethical issues. The most serious of these is the responsibility of this generation to bequeath to future generations an acceptable environmental inheritance. This question of stewardship is present in many environmental decisions – maintaining wilderness areas, conserving genetic diversity, and the long-term management of nuclear wastes. But the magnitude of our ability – this generation's ability – to affect future well-being through global climate change is unprecedented and raises ethical issues to a new level of concern. What trade-offs exist and what balance should be struck between inter-generational equity and efficiency? What do we owe the future? On the other hand, ethical concerns have a double edge. Should we sacrifice our use of cheap fossil fuel energy today so that generations yet unborn, who presumably will be richer than we are, can avoid adjusting to a warmer world?

Other, more practical ethical questions arise. How should the near-term costs of mitigating global warming be allocated among countries in a fair and efficient fashion? A global effort is needed, but without at least a perception of fairness, governments will not participate. Much the same question arises within countries. Both a concern for social justice and a need to secure political support for mitigation efforts will require some protection or compensation for those that will bear the heaviest abatement and adaptation costs. Ethics are again conflated with efficiency.

The science, politics, and ethics of global warming are not the whole story. This book is primarily about the economics of global warming. Economics offers a powerful set of theoretical and empirical techniques for formulating appropriate responses. But the economics of global warming are not detached from the scientific, political, and ethical dimensions. On the contrary, they are closely linked. Economic modeling of global warming and mitigation policies employs the results of scientific work as a starting point. These combinations of science and economics are known as integrated assessment models and are discussed later. The point here is that economic analysis of the costs and benefits is critically dependent on the underlying scientific research. Moreover, there is a close connection between political analysis and economics in devising global warming policies that are economically efficient and that have some prospect for success. Political economy is central to evaluating the policy instruments and tools to accomplish greenhouse gas abatement. And international political economy is the starting point for analyzing international environmental agreements to limit global warming.

Finally, economics rests on certain value (ethical) assumptions and can help clarify ethical choices. Although economics cannot determine an optimal distribution of wealth and income – an ethical question within the domain of moral philosophy – it can trace out the distributional consequences of policies at a point in time and over future generations. It can also trace the distributional impacts of doing nothing, or following a "business as usual" path. In short, economics can help us understand: Which countries and groups will bear the costs of global warming? Which generations? Are these distributional results equitable? How would various policies change the distributional consequences? The interplay of efficiency and equity comes out most sharply in inter-generational questions. Economics uses the tool of discounting to express future monetary values in terms of present values. It is, in effect, an inter-temporal exchange rate. Discounting has an efficiency objective – the efficient use of resources over time. But as we shall see, it also lies at the heart of the inter-generational distribution of welfare, and hence has an unavoidable ethical dimension.

To summarize, this book is primarily about the role that economics can play in the global warming debate, but it is set within a richer

matrix that includes the contributions of science, national and international politics, and equity.

Motivation and Audience

The concept underlying this book is that major events in the world are powerful drivers of advances in economics. The development of national income accounting in the 1930s was closely related to needs created by the Great Depression. Economic planning in World War II contributed to the development of input-output analysis. The burst of public interest in environment in the early 1970s led to major advances in the theory of environmental policy. Events can also overturn conventional economic wisdom. Ricardo wrote of "the inherent indestructibility of the soil," but the Dust Bowl more than 100 years later laid that idea to rest. In the seventeenth century, Grotius, the father of the freedom-of-the-seas doctrine, asserted that the vagrant waters of the sea should necessarily be free as neither navigation nor fishing could exhaust their services. That claim rings hollow with today's fishing technology and fleets.

This book contends that global warming is having a similar impact on economic research. The areas directly affected include discounting and inter-generational efficiency and equity, situating economic systems within an environmental matrix and examining interactions, the design of policy tools in second-best situations, policy formation under extreme uncertainty and potential catastrophe, and our understanding of coalition theory and the supply of global public goods.

These recent advances rest on foundations carefully laid down earlier. We believe that collecting and organizing them in a coherent fashion serves two purposes. First, it underlines how far economics has come and how far it still needs to go to successfully address global warming. Second, much of the recent analysis is appearing in working papers and technical journals or in collected volumes dealing with a narrow slice of the issues and addressed to economist colleagues who are working in this field. It is useful to organize, consolidate, and interpret these advances for those who have not had the opportunity to follow the issues in detail.

We have avoided a technical exposition to reach a wide audience, but have attempted to be accurate and current in terms of

presenting the economic underpinnings. Much of the specialized literature relies on mathematical presentation of underlying models and extensive charts and tables to present results. Because this book does not report new research, but synthesizes and interprets recent advances, we have chosen a different route. Our goal is to present complex theory in the simplest fashion possible while respecting the basic logic. We have also summarized the results and policy implications of many different empirical studies and assessed their strengths. For readers who wish to dig deeper, we have included references to the detailed studies on which this manuscript is based. If we are successful, the readers will emerge with an appreciation for the complexities of the economics but also with a firmer foundation for their own beliefs.

Structure

The book contains ten chapters. Chapter 1 starts with a brief review of the science of global warming and of international efforts to moderate climate change. It simply sets a context for readers unfamiliar with the problem and policy initiatives to date. The following chapters are structured around three questions: What amount of global warming is acceptable and what is too warm? What strategies and tools for moderating warming can be deployed? How can we mount a global effort at limiting warming in a world of sovereign states pursuing their narrow self-interest?

Chapter 2 considers whether benefit cost (BC) is an appropriate technique for framing the global warming problem and devising policy. In the BC approach, the benefits of actions to mitigate global warming are the costs averted – the monetary value of future global warming damages that are avoided by reducing greenhouse gas emissions now. The costs of the policy are opportunity costs, the valuable goods and services that the world forgoes by using real resources such as labor, physical and human capital, and technology to reduce emissions. These costs include economic output lost as less polluting but more expensive fuels and energy are used, the costs of sequestering greenhouse gas emissions, and the costs of prematurely scrapping physical capital to reduce emissions. A comprehensive framework also allows consideration of the costs and benefits of *adapting* to

global warming, the actions taken to minimize damages occurring when warming takes place. The deceptively simple conclusion from BC – that a policy is justified if the marginal costs of the policy equal marginal benefits, and total benefits exceed total costs, all properly discounted – is shown to conceal many profound complexities. An understanding of the weaknesses as well as the strengths of benefit-cost analysis is needed.

The chapters immediately following elaborate on the benefit-cost approach. Chapter 3 examines the contentious issue of discounting, a procedure that frequently divides economists and environmentalists, but one that also is hotly debated among economists in the context of global warming. As it turns out, the inter-generational equity dimension of discounting is closely linked to the issue of social (equity) weighting – the practice of giving different weights to costs and benefits accruing to individuals at different income levels. Benefit-cost analysis was originally designed to evaluate projects and policies *within* a country and *within* a single generation. But global warming is necessarily *international* and *inter-generational* in scope. This creates additional problems for discounting and social weighting of costs and benefits.

Benefit-cost analysis requires monetary values. In the case of global warming, this means monetary values for the harm (damages) that global warming will produce and for the costs of mitigation or adaptation. Finding monetary values is inherently difficult as many of the effects involve non-marketed goods and services for which there are no market prices to indicate values. Other complications are the high level of scientific uncertainty, the very long time horizons, and our inability to fully anticipate technological advances. In short, it is not surprising that the estimates are contentious. They are, however, central to attempts for a rational policy response to global warming. Chapter 4 explains how the numbers are generated. It is not always reassuring.

Chapter 5 is a transitional chapter. Mitigation – reduction in the emissions of greenhouse gases – is the centerpiece of efforts to control global warming. Putting a price on emissions is at the center of efforts at reduction. However, mitigation takes place within a larger strategic policy space. This chapter considers the broader context,