

## INTRODUCTION

# Introduction: special issue on the economics of climate change and sustainability (Part B)

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### Abstract

Climate change is considered to be one of the most significant and complex challenges facing the world in the twenty-first century. As such, it is essential to increase the knowledge base regarding climate change and how best to address its impacts through efficient policies. This special issue, which is divided into two parts – published in the previous and current issues of *Environment and Development Economics* – is a selection of papers related to ‘The Economics of Climate Change and Sustainability’, the topic of an international workshop organized by the Economics Department of the University of Bologna in April 2018. The papers in this special issue cover a wide range of climate-change-related topics, including endogenous growth and overlapping generation models; climate-related financing and green bonds; demography; location decisions and technology diffusion; quantitative relationships and experimental approaches. They aim at providing new insights into the economics of climate change and help to identify new directions for future research.

**Keyword:** climate change; sustainability

## 1. The economics of climate change and sustainability

Climate change is a challenge of enormous dimensions and holds the potential to redefine life on earth far into the future. It is therefore both logical and essential for scientists from all relevant disciplines to be studying the crucial impacts of climate change: it is now a given that successfully addressing the challenges posed by climate change requires an interdisciplinary approach and international collaboration. In 2006, Goulder and Pizer (2006: 4) emphasized that the economics of climate change has a unique focus because of ‘distinctive features of the climate problem – including the long time-scale, the extent and nature of uncertainties, the international scope of the issue, and the uneven distribution of policy benefits and costs across space and time’. In the same year, it was stated in the *The Economics of Climate Change: The Stern Review* that ‘Climate change is global in its causes and consequences, and international collective action will be critical in driving an effective, efficient and equitable response on the scale required’ (Stern, 2006: i).

The crucial importance of the economics of climate change is widely acknowledged. William D. Nordhaus, one of the pioneers in the field, was awarded the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel in 2018, jointly with Paul M. Romer, ‘for integrating climate change into long-run macroeconomic analysis’ (Nobel Prize Organization, 2018). The Royal Swedish Academy of Sciences, in announcing the award, honored both scientists for designing ‘methods for addressing some of our time’s most basic and pressing questions about how we create long-term sustained and sustainable economic growth’ and for significantly broadening ‘the scope of economic analysis by constructing models that explain how the market economy interacts with nature and knowledge’ (Nobel Prize Organization, 2018).

In an interview immediately following the announcement of the award, Professor Per Krusell, a Member of the Prize Committee for Economic Sciences, praised the two Nobel Laureates for framing important questions that have led to an explosion of research in the field, but also pointed out that we do not have final answers and that further research is necessary (Krusell, 2018). In fact, the prize was awarded just a day after the Intergovernmental Panel on Climate Change (IPCC) – the world’s most well-known and respected authority on climate change – released a special report on global warming, *Global Warming of 1.5°C*, warning that urgent actions are needed to keep climate change to a maximum of 1.5°C (IPCC, 2018). Clearly the need for ongoing research regarding the economics of climate change is vital. In this vein, the Economics Department of the University of Bologna organized a workshop on the ‘The Economics of Climate Change and Sustainability’ in Bertinoro, Italy in 2018.

## 2. Contents of the special issue

This special issue consists of nine papers related to the topic of the abovementioned workshop. The articles provide a good example of the diverse areas of economics which are related to climate change and which can provide important results and meaningful policy recommendations when coupled with climate. They cover a number of climate-change-related topics, starting from a simple macroeconomic growth model which studies policy options to climate change, and continuing on to non-convexities; overlapping generation models resulting in local and global indeterminacies, and multiple steady states; financing of climate-change-related investments and green bonds; the impact of demographics on climate change; location decisions under climate change and technology diffusion; quantitative relationships between emissions, output and abatement; and concluding with monitoring and punishment networks in an experimental common pool resource dilemma.

The papers are divided into Part A and Part B: the papers in Part A appeared in the previous (December 2019) issue of *Environment and Development Economics*, while the papers in Part B compose the current (February 2020) issue of the journal. The papers included in Part A are described in detail in the Introduction to that issue. Part B specializes in the macroeconomics of climate change and discusses policy-related issues which are of empirical importance.

The four contributions included in this issue – Part B of the special issue – start with ‘Demographic change and climate change’ by Michael Rauscher, which addresses a problem that has become increasingly important in the economics of climate change, and yet has been largely neglected in the public debate. The author introduces demographic variables into the basic climate change model. Increasing longevity and lower fertility lead to population ageing globally, to long-term shrinking of population in developed countries,

and to a slowdown of population growth in most developing countries. The author suggests an innovative approach to isolate the effects of age structure in a theoretical framework, while leaving other variables constant, such as population size, preferences for specific consumption goods and family status. It is found that increasing longevity accelerates global warming in a business-as-usual scenario without any climate policy. If a binding emission target is set exogenously and implemented via a cap-and-trade system, then the price of emission permits is increasing in longevity. Longevity, however, seems to have no effect on the optimal solution of the climate problem if perfect intergenerational transfers are feasible.

In the second paper, 'North-South diffusion of climate-mitigation technologies: the crowding-out effect on relocation', Julie Ing and Jean-Philippe Nicolai analyze the relationship between the firms' incentive to relocate and the various kinds of climate-mitigation technologies transfers. They specialize their work on the effect of North-South diffusion of climate-mitigation technologies in the long run, focusing successively on three main policies: the adoption of technology by foreign firms in the international market, public transfers and firms' relocation.

Neophyta Empora, Theofanis P. Mamuneas and Thanasis Stengos, in the third paper 'Output and pollution abatement in a U.S. state emission function', take a fresh look at the environmental Kutznets curve (EKC) and study the empirical relationship between emissions, output and pollution abatement by defining an emissions function in a way that is consistent with the residual (emissions) generation mechanism and firms' optimizing behavior. They employ a dataset for U.S. emissions originally used in two EKC related studies, but the novelty here is to explicitly take into account both pollution abatement and regulations. These latter are specified through an environmental policy function where environmental stringency depends on various levels of per capita income. Using nonparametric econometric techniques and threshold regressions, their empirical results show that there is a positive nonlinear relationship between emissions and output, rejecting the standard inverted-U relationship between the two variables.

In the fourth and final paper, 'Monitoring and punishment networks in an experimental common pool resource dilemma', Ganga Shreedhar, Alessandro Tavoni and Carmen Marchiori develop an experimental study of monitoring and punishment in a common pool resources appropriation dilemma, which is a typical context for nature and the environment. They compare a case of perfect monitoring and punishment with two 'imperfect' networks and find that the specific network topology has an impact on the type of punishment. In particular, the undirected circle induces more severe and prosocial punishment than other types of networks and imperfect networks turn out to be relatively more efficient.

Although the economics of climate change has been extensively analyzed, there are still a large number of open issues in terms of both theory and applied policy. We believe the papers in this special issue provide some new answers and insights and help to identify new directions for future research.

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