

# Preface

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Does greater economic growth always hurt the environment? The debate over the role economic growth plays in determining environmental quality has been rapidly gaining importance. Three effects are key in determining the level of environmental pollution and resource use. First, increases in output require more inputs and, as a byproduct, imply more emissions. Economic growth therefore exhibits a scale effect that has a negative impact on the environment. Second, economic growth also has positive or negative impacts on the environment through a technique effect. Changes in income or preferences may induce changes in policy that in turn lead to changes in production methods and hence emissions per unit of output. This suggests that the relationship between income and pollution should vary across pollutants because their perceived damage is different. Third, economic growth has positive or negative impacts on the environment through a composition effect. As income grows, the structure of the economy might change; consequently, there might be an increase in cleaner or dirtier activities. In the case of general industrial pollutants, environmental degradation tends to increase during the structural transformation of an economy from the agricultural to the industrial phase and subsequently starts to fall with the structural change from an energy- to a technology-intensive economy, based on services and knowledge.

The combination of these three effects generates the environmental Kuznets curve (EKC). Taking the three effects into account, this study analyzes the fundamental characteristics of world pollutants/resource uses.

The distinction of the three effects is important for the following two reasons. First, confirmation of the EKC hypothesis does not justify policy inaction. Incentives to reduce pollution/resource use are provided by the technique effect. The tradeoff between economic growth and environmental quality depends critically on the technique effect. Therefore, estimation of the magnitude and trend of the technique effect would be useful in understanding the degree of policy stringency required. If there were no or little incentive to reduce pollution/resource use, policy makers would need to implement measures that induce technological changes or transfers. The measured effects of technological and productivity improvements are

known as the 'technique effect'. It is fair to say that measurements of EKC encompass all types of effect that influence emissions. Therefore, the EKC itself and its decompositions are central topics as long as environmental economics remains an important academic area.

An overall view based on global and local country-level analyses is essential to understand the problems, status, and solutions. One key dimension is that our study aims to understand technological change. Technological change is central to maintaining standards of living in modern economies with finite resources and increasingly stringent environmental goals. Successful environmental policies can contribute to efficiency by encouraging, rather than inhibiting, technological innovation.

However, little research to date has focused on the design and implementation of environmental regulations that encourage technological progress, or in ensuring productivity improvements in the face of depletion of natural resources and increasing stringency of environmental regulations. This book is an attempt to fill the gap.

Part I provides analyses on global data, asking questions such as (i) are there EKCs for different emissions and (ii) what factors alleviate pollution damage/increase technological progress, including trade openness and energy price increase? Part II focuses on the country level. This book aims to provide solutions to the following country- and industry-specific questions: (i) Is there an increasing return to pollution abatement? (ii) Do higher emissions trading prices encourage technological change? (iii) Do stringent environmental regulations improve productivity? (iv) Is trade good for the environment at the sector level? (v) Which policy factors reduce pollution?