

THE EFFECT OF TECHNOLOGICAL CHANGE IN ENVIRONMENTAL ECONOMICS

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Within the field of environmental economics, the role of technological change has received much attention. The long-term nature of many environmental problems, such as climate change, makes understanding the evolution of technology an important part of projecting future impacts. In many cases environmental problems cannot be addressed, or can only be addressed at great cost, using existing technologies. Providing incentives to develop new environmentally-friendly technologies then becomes a focus of environmental policy. The goals are to introduce technological change economists to how the lessons of the economics of technological change have been applied in the field of environmental economics, and suggest ways in which scholars of technological change could contribute to the field of environmental economics.

Environmental technologies include technologies like changes in production process, such as improved energy efficiency, that lead to reduced environmental impacts. Because the benefits of environmental technologies tend to accrue to society at large, rather than the adopter of such technologies, market forces alone provide little incentive for developing environmental technologies. Instead, environmental regulation or public funding of research and development often provides the first impetus for developing new environmental technologies. These induced effects of environmental policy on technology may have substantial implications for the normative analysis of policy decisions. Indeed, in many cases, environmental problems cannot be addressed, or can only be addressed at great cost, using existing technologies. As a result, understanding the interactions between environmental policy and technology may have quantitatively important consequences in the context of cost-benefit or cost-effectiveness analyses of such policies. Understanding the environmental impact of overall technological change is also important to assess the long-term sustainability of economic growth. The environmental impact of economic activity is profoundly affected by the rate and direction of technological change. Costs tend to fall, quality tends to improve, and a wider variety of technologies tend to become available as time passes. New technologies may create or facilitate increased pollution, or may mitigate or replace existing polluting activities.

Further, because many environmental problems and policy responses are evaluated over time horizons of decades or centuries, the cumulative impact of technological changes is likely to be large. Indeed, uncertainty about the future rate and direction of technological change is often an important sensitivity in forecasts of the severity of environmental problems. This is best explained by the example of climate change, in which different assumptions about the potential for future technological change lead to greatly different assessments about both the potential for reducing carbon emissions and the optimal rate at which such reductions should occur. Projections of future technological change are an important driver of these differences, and affect not only the cost of reducing emissions, but also predictions of what emissions levels will occur in the absence of climate policy initiatives. This is a large task, inevitably requiring unfortunate but necessary omissions. In particular, we confine ourselves to the relationship between technology and problems of environmental pollution, leaving aside a large literature on technological change in agriculture and natural resources more broadly. The goal is to introduce technological change economists to how lessons from the study of technological change have been applied in the field of environmental economics, and to suggest ways in which scholars of technological change might contribute to the field of environmental economics.