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Will Technological Change Save the World? The Rebound Effect in International Transfers of Technology

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Experts in climate change have long stressed the need for a transfer of environmentally friendly technologies from developed to developing countries to help the latter adopt a low-carbon development path. It is typically argued that the spillover of resource-conserving technologies will reduce resource use in both developing and developed economies and hence potentially "save the world". Policy-makers have seized upon these simple conclusions to advocate straightforward policy prescriptions, such as "the importance of technology improvements, advanced technologies, and....induced technological change for achieving the stabilization targets...." (IPPC 2007). The problem is of course that the interaction between technological choices and environmental policy is not as simple or straightforward as this. Indeed, the manner in which regulated agents (consumers or industries) respond to technological change varies considerably. For this reason, the ultimate outcome of technology-focused policies is highly indeterminate.

As early as in the nineteenth century, English economist William Stanley Jevons first discussed the possibility of a rebound effect regarding the coal question, after observing that improved engine efficiency in coal use paradoxically translated in overall increase (rather than decrease) in coal usage. The modern proponents of the rebound effect once again argue that technological change in energy efficiency raises complicated problems regarding ultimate outcomes. The impacts on the economy of policy induced technical changes might be something other than the simple advance of energy efficiency and reduced energy use.

In this study, we analyse the policy of technology transfer from the perspective of the rebound effect literature. We argue that the policy implications derived in the rebound literature apply equally in the context of transfers of technology to developing states. Our specific enquiry is focused on the extent to which the transfer of advanced technologies to developing countries will also embed incentives in those societies to use them as would developed countries, or will transfers simply encourage the society concerned to pursue more rapidly a standard development path (using up resources even more rapidly)? To address this question, we make use of the framework of resource-based development to explain how and when developing countries alter their choices between natural capital and consumption goods in the presence of technology transfer. As a direct result, the benefits from the adoption of more efficient technologies will result in substitution away from the use of natural resources. The indirect - or rebound - effect is that the transfer of such technologies creates a larger set of options that may be expended in any way that the recipient of the technology views as welfare-improving. This means that, if the country is at an early stage of development at the time of the transfer, technology diffusion may result in enhanced rates of resource utilization, rather than reduced rates of use. Technologies mainly expand the set of options (similar to a wealth effect), but do not necessarily determine how those options need be

expended. Hence, on the one hand, developing countries may chart a path of environment and development that follows the so-called "Environmental Kuznets Curve" (EKC), implying reduced natural resource bases and increasing consumption over lower levels of development, followed by the maintenance of natural resource bases later in the process. On the other, the adoption of more efficient technology by developing countries, may simply result in a more rapid movement along the pre-existing pathway.

Will developing countries expend these sudden gains by expanding the stock of natural capital and its services, or will they simply continue (more rapidly) along the same development path that they were already following? Technology optimists would hope for the former, while believers in the rebound effect would contend that the latter outcome is more likely. The application of policies focused on technological transfer does not necessarily determine the path forward for developing countries, with regard to the way in which those technologies are used or the manner in which the implicit wealth transfer is applied. More fundamental preferences and institutions of the society concerned are at work to determine these outcomes. Thus, to pursue international policies of technological change and transfer, without providing additional incentives for using them in the desired manner, will not necessarily "save the world".