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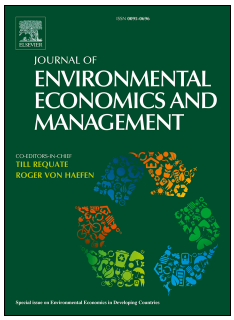

Rebound, directed technological change, and aggregate demand for energy

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Rebound, directed technological change, and aggregate demand for energy[☆]

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Abstract

We analyse the long-run role of energy in aggregate production. The factor share of energy has been remarkably constant, despite the relative decline in the price of energy. We analyse possible explanations for this observation, ruling out the idea that endogenous directed technological change has led to a failure of energy-augmenting technology to keep pace with labour-augmenting technology. Instead we propose a model in which a combination of income and substitution effects has driven both shifts in consumption patterns towards existing energy-intensive goods and the emergence of new such goods.

Keywords: energy, technology, directed technological change, structural change, rebound.
JEL codes: O41, Q43.

1. Introduction

Over the last 150 years the increase in global aggregate energy efficiency has been modest, even though the energy efficiency of individual production processes (such as the generation of motive power or artificial light from primary energy inputs) increased greatly over the same period. This seems paradoxical: why doesn't an increase in the efficiency of individual production processes result in an increase in aggregate efficiency? In this paper we argue that the explanation for the paradox is a shift in consumption patterns over time towards energy-intensive goods, including the endogenous introduction of new product varieties which are intrinsically energy-intensive.

Our model is relevant to three fields which have rarely been connected in the literature: the explanation of the high long-run aggregate elasticity of demand for energy; growth and structural change; and the rebound effect. We now discuss these in turn. Regarding aggregate energy demand, we discuss two approaches in the literature, neither of which allows for changes in consumption patterns between final goods differing in energy intensity: the first is the putty–clay

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