

Title: Assessing Resource Efficiency by the Input-Output Model with the Absorbing Markov Chain

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Abstract

Resource efficiency has been identified as one of the keys to sustainability challenges in technology, innovation, and industrial competitiveness. Increasing resource efficiency is expected to decouple economic growth from resource use, and to deliver greater value with less resource consumption. Resource efficiency actions include reducing the use of physical resources and encouraging innovation of production and consumption processes. To address the effect of resource efficiency and technological innovations of the industry, this study implemented the absorbing Markov chain (AMC) combined with the Input-Output Model (IO), interpreted as a resource-specific network, to describe in detail the embodied paths of resource through intermediate products and consumer products in an industrial system. Using water and energy as examples, the AMC-IO can identify the open and the embodied flows in the overall relationships of water and energy in the economy. Resource efficiency can then be redefined by the AMC-IO to rank the priorities in managing the quantity of water and energy, and to improve technological innovations of the production processes on targeted industries using different perspectives. After determining the open flow and the embodied flows through AMC-IO, the authorities can partner with specific industries according to the chosen effectiveness criteria and thus facilitate improvement in resources efficiency.