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The Enhanced Russell-Based Directional Distance Measure with Undesirable Outputs: Numerical Example Considering CO₂ Emissions

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Abstract

Following the spirit of the Enhanced Russell Graph Measure, this paper proposes an Enhanced Russell-Based Directional Distance Measure (ERBDDM) model for dealing with desirable and undesirable outputs in data envelopment analysis (DEA) and allowing some inputs and outputs to be zero. The proposed method is analogous to the output oriented slacks-based measure (OSBM) and directional output distance function approach because it allows the expansion of desirable outputs and the contraction of undesirable outputs. The ERBDDM is superior to the OSBM model and traditional approach since it is not only able to identify all the inefficiency slacks just as the latter, but also avoids the misperception and misspecification of the former, which fails to identify null-jointness production of goods and bads. The paper also imposes a strong complementary slackness condition on the ERBDDM model to deal with the occurrence of multiple projections. Furthermore, we use the Penn Table data to help us explore our new approach in the context of environmental policy evaluations and guidance for performance improvements in 111 countries.

Keywords: slacks-based model, directional distance function, undesirable output, Enhanced Russell graph measure

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