

Abstract

Because port operations have rapidly been extending, air pollution resulted from ports has been increased and become a persistent concern for environmentalist and policy makers. The objective of this paper is to measure the environmental efficiency of ports in Korea. The main characteristic of the environmental efficiency assessment problem is that undesirable output of carbon dioxide (CO₂) emissions and exogenous fixed input of the terminal area of ports should concurrently be considered. By analysing the impacts of the exogenous fixed input and undesirable outputs on decision making units (DMUs) performance, a super efficiency slacks-based measure in data envelopment analysis (SE-SBM-DEA) approach is proposed. The proposed approach consists of two models: slacks-based measure (SBM) model and super efficiency SBM (SE-SBM) model. The models effectively discriminate between efficient and inefficient ports, and rank their efficiencies. To restrict any decreases or increases in the fixed input levels, the slacks of fixed inputs are removed from the target functions and their relevant constraints of the proposed approach. In addition, the undesirable outputs are formulated according to the weak disposability assumption, so that they can only be reduced with the reduction of certain desirable outputs. Hence, its slack should also be removed from the SBM and SE-SBM models. As a result, the scalar measures of the models only deal with the discretionary inputs and desirable outputs of a DMU being evaluated. We examine the applicability of the proposed approach, using real data, for 19 ports in Korea.