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Data envelopment analysis for environmental assessment: comparison between public and private ownership in petroleum industry.

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Summary: Environmental assessment recently becomes a major policy issue in the world. This study discusses how to apply data envelopment analysis (DEA) for environmental assessment. An important feature of the DEA environmental assessment is that it needs to classify outputs into desirable (good) and undesirable (bad) outputs because private and public entities often produce not only desirable outputs but also undesirable outputs as a result of their production activities. This study proposes the three types of unification for DEA environmental assessment by using non-radial DEA models. The first unification considers both an increase and a decrease in the input vector along with a decrease in the direction vector of undesirable outputs. This type of unification measures "unified efficiency". The second unification considers a decrease in an input vector along with a decrease in the vector of undesirable outputs. This type of unification is referred to as "natural disposability" and measures "unified efficiency under natural disposability". The third unification considers an increase in an input vector but a decrease in the vector of undesirable outputs. This type of unification is referred to as "managerial disposability" and measures "unified efficiency under managerial disposability". All the unifications increase the vector of desirable outputs. To document their practical implications, this study has applied the proposed approach to compare the performance of national oil firms with that of international oil firms. This study identifies two important findings on the petroleum industry. One of the two findings is that national oil companies under public ownership outperform international oil companies under private ownership in terms of unified (operational and environmental) efficiency and unified efficiency under natural disposability. However, the performance of international oil companies exhibits an increasing trend in unified efficiency. The other finding is that national oil companies need to satisfy the environmental standard of its own country while international oil companies need to satisfy the international standard that is more restricted than the national standards. As a consequence, international oil companies outperform national oil companies in terms of unified efficiency under managerial disposability.

Keywords: petroleum industry; data envelopment analysis; environmental assessment
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