



A three-stage Data Envelopment Analysis model on fuzzy data

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Abstract

Data envelopment analysis (DEA) is a methodology for measuring the relative efficiencies of a set of decision making units (DMUs) that use inputs to produce multiple outputs. The conventional DEA, requires crisp input and output data, but the observed values of the input and output data in real word applications are sometimes imprecise. This paper proposes a methodology for a fuzzy three-stage DEA model, where input-output data are treated as fuzzy numbers. A pair of two-level mathematical programs is formulated to calculate the upper bound and lower bound of the fuzzy efficiency score. Then can be transform this pair of two-level mathematical programs into a pair of conventional mathematical programs to calculate the bounds of the fuzzy efficiency score.

Keywords: Data Envelopment Analysis, Two-stage, Decision Making Unit, Fuzzy Data

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1 Introduction

Suppose the operation of a DMU can be divided into three stages. The first process applies input x_{ij} ($i = 1, \dots, m$) to produce intermediate products z_{tj}^1 ($t = 1, \dots, G$) and all of this intermediate products in the second process produce another intermediate products denote by z_{kj}^2 ($t = 1, \dots, F$), also in the third process this intermediate products applies to produce outputs y_{rj} ($r = 1, \dots, s$). The three-stage model to calculating the efficiency

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