



# Extension on Regularity Condition in DEA Models

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## Abstract

Data envelopment analysis (DEA) is a method to estimate the relative efficiency of decision making units (DMUs) performing similar tasks in a production system that consumes multiple inputs to produce multiple outputs. So far, a number of DEA models have been developed: The CCR model and the BCC model are well known as basic DEA models. The generic regularity condition for the CCR model is introduced so that each weakly efficient decision making unit in the CCR model of data envelopment analysis is also CCR-efficient. In this study, we give a general regularity condition under which each weakly efficient decision making unit in the BCC model and Additive model of data envelopment analysis is also BCC-efficient and Additive-efficient, respectively.

*Keywords* : Data Envelopment Analysis, Multi-objective Programming, Symmetric Model, General Position, Regularity Condition.

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## 1 Introduction

Data envelopment analysis (DEA) was suggested by Charnes, Cooper and Rhodes (CCR), and built on the idea of Farrell [7], which is concerned with the estimation of technical efficiency and efficient frontiers. The CCR model [4, 5] generalized the single output/single input ratio efficiency measure for each decision making unit (DMU) to multiple outputs/multiple inputs situations by forming the ratio of a weighted sum of outputs to a weighted sum of inputs. DEA is a method for measuring the relative efficiency of DMUs performing similar tasks in a production system that consumes multiple inputs to produce multiple outputs. The main characteristics of DEA are (a) it can be applied to analyze multiple outputs and multiple inputs without preassigned weights, (b) it can be used for measuring the relative efficiency based on the observed data without having information

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