

# Preface

This handbook complements *Handbook on Data Envelopment Analysis* (eds, W.W. Cooper, L.M. Seiford, and J. Zhu, 2011, Springer), *Data Envelopment Analysis: A Handbook of Modeling Internal Structures and Networks* (eds, W.D. Cook and J. Zhu, 2014, Springer), and *Data Envelopment Analysis: A Handbook of Models and Methods* (ed. J. Zhu, 2015, Springer). Data envelopment analysis (DEA) is a “data-oriented” approach for evaluating the performance of a set of entities called decision-making units (DMUs) whose performance is categorized by multiple metrics. These performance metrics are classified or termed as inputs and outputs under DEA. Although DEA has a strong link to production theory in economics, the tool is also used for benchmarking in operations management, where a set of measures is selected to benchmark the performance of manufacturing and service operations. In the circumstance of benchmarking, the efficient DMUs, as defined by DEA, may not necessarily form a “production frontier,” but rather lead to a “best-practice frontier” (Cook, Tone, and Zhu, 2014).

Over the years, we have seen a variety of DEA empirical applications. This handbook aims to compile state-of-the-art empirical studies and applications using DEA. It includes a collection of 18 chapters written by DEA experts.

Chapter 1, by Chen, Gregoriou, and Rouah, examines the performance of chief executive officers (CEOs) of US banks and thrifts. The authors find evidence that best-practice CEOs who have a DEA efficiency score of one are rewarded with higher compensation compared to underperforming CEOs who have a DEA efficiency score greater than one. They also find DEA efficiency score to be a highly significant predictor of CEO compensation.

Chapter 2, by Yu and Chen, is dedicated to describe the network operational structure of transportation organizations and the relative network data envelopment analysis model. Route-based performance evaluation, environmental factors, undesirable outputs, and multi-activity framework are incorporated into their application.

Chapter 3, by Hu and Chang, demonstrates how to use different types of DEA models to compute the total-factor energy efficiency scores with an application to energy efficiency.

Chapter 4, by Growitsch, Jamasb, Müller, and Wissner, explores the impact of incorporating customers' willingness to pay for service quality in benchmarking models on cost efficiency of distribution networks.

Chapter 5, by Volz, provides a brief review of previous applications of DEA to the professional baseball industry followed by two detailed applications to Major League Baseball.

Chapter 6, by Cummins and Xie, examines efficiency and productivity of US property-liability (P-L) insurers using DEA. The authors estimate pure technical, scale, cost, revenue, and profit efficiency over the period 1993–2011. Insurers' adjacent year total-factor productivity changes, and their contributing factors are also investigated.

Chapter 7, by Premachandra, Zhu, Watson, and Galagedera, presents a two-stage network DEA model that decomposes the overall efficiency of a decision-making unit into two components and demonstrates its applicability by assessing the relative performance of 66 large mutual fund families in the USA over the period 1993–2008.

Chapter 8, by Basso and Funari, presents a comprehensive review of the literature of DEA models for the performance assessment of mutual funds along with an empirical application on real market data, considering different risk measures. The authors consider different holding periods, which include both a period of financial crisis and one of financial recovery.

Chapter 9, by Hwang and Chang, discusses the management strategies formulation of the international tourist hotel industry in Taiwan based on the efficiency evaluation. The result of this chapter provides useful information for future business management needs of managers and can be served as valuable reference to the relevant authority of tourism.

Chapter 10, by Chen, Zhu, Yu, and Noori, presents a novel use of the two-stage network DEA to evaluate the sustainable product design performances. A two-stage network DEA model is developed for sustainable design performance evaluation with an "industrial design module" and a "bio design module." Test results show that sustainable design does not need to mean compromise between traditional and environmental attributes.

Chapter 11, by Chen and Ang, highlights limitations of some DEA environmental efficiency models, including directional distance function and radial efficiency models, under weak disposability assumption and various return-to-scale technologies. The empirical results show that the directional distance function and radial efficiency models may generate spurious efficiency estimates, and thus it must be with caution when they are used for decision support.

Chapter 12, by Thanassoulis, De Witte, Johnes, Johnes, Karagiannis, and Portela, reviews applications of DEA in secondary and tertiary education, focusing on the opportunities that this offers for benchmarking at institutional level.

Chapter 13, by Sexton, Comunale, Higuera, and Stickle, measures the relative performance of New York State school districts in the 2011–2012 academic year and provided detailed alternative improvement pathways for each district.

Chapter 14, by Iyer and Grewal, provides an introductory chapter as prelude to Chap. 15, by Grewal, Levy, Mehrotra, and Sharma, and Chap. 16, by Grewal, Iyer, Kamakura, Mehrotra, and Sharma. Both Chaps. 15 and 16 provide detailed applications of DEA in marketing.

Chapter 17, by O'Donnell, shows how to decompose a new total-factor productivity index that satisfies all economically relevant axioms from index theory with an application to US agriculture.

This handbook concludes with Chap. 18, by Liu, Lu, and Lu. This unique study conducts a DEA research front analysis. The large amount of DEA literature makes it difficult to use any traditional qualitative methodology to sort out the matter. Thus, this study applies a network clustering method to group the literature through a citation network established from the DEA literature over the period 2000–2014. The findings are helpful in many ways, including identifying coherent topics or issues addressed by a group of research articles in recent years.

I hope that this handbook, along with other aforementioned DEA handbooks, can serve as a reference for researcher and practitioners using DEA and as a guide for further development of DEA. I am indebted to the many DEA researchers worldwide for their continued effort in pushing the DEA research frontier. Without their work, many of the DEA models, approaches, and applications would not exist. I would like to thank the support from the Priority Academic Program Development of Jiangsu Higher Education Institutions in China.

Worcester, MA, USA  
October 2015

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Data Envelopment Analysis

A Handbook of Empirical Studies and Applications

Zhu, J. (Ed.)

2016, XIII, 587 p. 97 illus., 56 illus. in color., Hardcover

ISBN: 978-1-4899-7682-6