

# **Download File Chapter 2 Data Envelopment Analysis Explained Pdf File Free**

## **Introduction and Comparison of Data Envelopment**

**Analysis Software Packages** Dec 16 2021 "This book presents and compares 11 software packages of Data Envelopment Analysis (DEA). Performance measurement is done by various methods, one of which is DEA. Due to the ability of DEA models to meet practical requirements, extensive research can be conducted in the fields of mathematics, management, economics, and engineering. Therefore, during recent decades, the use of this method has been considered with significant growth among researchers. DEA evaluates the performance of Decision Making Units (DMUs) by using linear programming. Since linear programming should be solved for each DMU, performance measurement for a large number of DMUs is difficult and time-consuming. For this purpose, various software packages have been designed and developed to address these problems. Each of these software's is designed for different purposes and has different features and applications. The main objectives of this book are to introduce, express the advantages and disadvantages of each of these software packages, as well as their comparisons"--

**Data Envelopment Analysis** Jan 25 2020 Using the neo-classical theory of production economics as the analytical framework, this book, first published in 2004, provides a unified and easily comprehensible, yet fairly rigorous, exposition of the core literature on data envelopment analysis (DEA) for readers based in different disciplines. The various DEA models are

developed as nonparametric alternatives to the econometric models. Apart from the standard fare consisting of the basic input- and output-oriented DEA models formulated by Charnes, Cooper, and Rhodes, and Banker, Charnes, and Cooper, the book covers developments such as the directional distance function, free disposal hull (FDH) analysis, non-radial measures of efficiency, multiplier bounds, mergers and break-up of firms, and measurement of productivity change through the Malmquist total factor productivity index. The chapter on efficiency measurement using market prices provides the critical link between DEA and the neo-classical theory of a competitive firm. The book also covers several forms of stochastic DEA in detail.

### **Performance Measurement with Fuzzy Data Envelopment**

**Analysis** Jul 11 2021 The intensity of global competition and ever-increasing economic uncertainties has led organizations to search for more efficient and effective ways to manage their business operations. Data envelopment analysis (DEA) has been widely used as a conceptually simple yet powerful tool for evaluating organizational productivity and performance. Fuzzy DEA (FDEA) is a promising extension of the conventional DEA proposed for dealing with imprecise and ambiguous data in performance measurement problems. This book is the first volume in the literature to present the state-of-the-art developments and applications of FDEA. It is designed for students, educators, researchers, consultants and practicing managers in business, industry, and government with a basic understanding of the DEA and fuzzy logic concepts.

### **Data Envelopment Analysis: Theory, Methodology, and**

**Applications** Mar 02 2023 This book represents a milestone in the progression of Data Envelopment Analysis (DEA). It is the first reference text which includes a comprehensive review and comparative discussion of the basic DEA models. The

development is anchored in a unified mathematical and graphical treatment and includes the most important modeling extensions. In addition, this is the first book that addresses the actual process of conducting DEA analyses including combining DEA and 1 parametric techniques. The book has three other distinctive features. It traces the applications driven evolution and diffusion of DEA models and extensions across disciplinary boundaries. It includes a comprehensive bibliography to serve as a source of references as well as a platform for further developments. And, finally, the power of DEA analysis is demonstrated through fifteen novel applications which should serve as an inspiration for future applications and extensions of the methodology. The origin of this book was a Conference on New Uses of DEA in 2 Management and Public Policy which was held at the IC Institute of the University of Texas at Austin on September 27-29, 1989. The conference was made possible through NSF Grant #SES-8722504 (A. Charnes and 2 W. W. Cooper, co-PIs) and the support of the IC Institute.

**Extension of Data Envelopment Analysis with Preference Information** Jan 17 2022 This book provides an introduction to incorporating preference information in Data Envelopment Analysis (DEA) with a special emphasis in Value Efficiency Analysis. In addition to theoretical considerations, numerous illustrative examples are included. Hence, the book can be used as a teaching text as well. Only a modest mathematical background is needed to understand the main principles. The only prerequisites are a) familiarity with linear algebra, especially matrix calculus; b) knowledge of the simplex method; and c) familiarity with the use of computer software. The book is organized as follows. Chapter 1 provides motivation and introduces the basic concepts. Chapter 2 provides the basic ideas and models of Data Envelopment Analysis. The efficient

frontier and production possibility set concepts play an important role in all considerations. That's why these concepts are considered more closely in Chapter 3. Since the approaches introduced in this study are inspired by Multiple Objective Linear Programming, the basic concepts of this field are reviewed in Chapter 4. Chapter 5 also compares and contrasts Data Envelopment Analysis and Multiple Objective Linear Programming, providing some cornerstones for approaches presented later in the book. Chapter 6 discusses the traditional approaches to take into account preference information in DEA. In Chapter 7, Value Efficiency is introduced, and Chapter 8 discusses practical aspects. Some extensions are presented in Chapter 9, and in Chapter 10 Value Efficiency is extended to cover the case when a production possibility set is not convex. Three implemented applications are reviewed in Chapter 11.

Data Envelopment Analysis Dec 28 2022 This volume systematically details both the basic principles and new developments in Data Envelopment Analysis (DEA), offering a solid understanding of the methodology, its uses, and its potential. New material in this edition includes coverage of recent developments that have greatly extended the power and scope of DEA and have lead to new directions for research and DEA uses. Each chapter accompanies its developments with simple numerical examples and discussions of actual applications. The first nine chapters cover the basic principles of DEA, while the final seven chapters provide a more advanced treatment.

**Handbook on Data Envelopment Analysis** Nov 27 2022 This handbook covers DEA topics that are extensively used and solidly based. The purpose of the handbook is to (1) describe and elucidate the state of the field and (2), where appropriate, extend the frontier of DEA research. It defines the state-of-the-

art of DEA methodology and its uses. This handbook is intended to represent a milestone in the progression of DEA. Written by experts, who are generally major contributors to the topics to be covered, it includes a comprehensive review and discussion of basic DEA models, which, in the present issue extensions to the basic DEA methods, and a collection of DEA applications in the areas of banking, engineering, health care, and services. The handbook's chapters are organized into two categories: (i) basic DEA models, concepts, and their extensions, and (ii) DEA applications. First edition contributors have returned to update their work. The second edition includes updated versions of selected first edition chapters. New chapters have been added on: different approaches with no need for a priori choices of weights (called "multipliers) that reflect meaningful trade-offs, construction of static and dynamic DEA technologies, slacks-based model and its extensions, DEA models for DMUs that have internal structures network DEA that can be used for measuring supply chain operations, Selection of DEA applications in the service sector with a focus on building a conceptual framework, research design and interpreting results.

Introduction to the Theory and Application of Data Envelopment Analysis Aug 12 2021 1 DATA ENVELOPMENT ANALYSIS Data Envelopment Analysis (DEA) was initially developed as a method for assessing the comparative efficiencies of organisational units such as the branches of a bank, schools, hospital departments or restaurants. The key in each case is that they perform feature which makes the units comparable the same function in terms of the kinds of resource they use and the types of output they produce. For example all bank branches to be compared would typically use staff and capital assets to effect income generating activities such as advancing loans, selling financial products and carrying out banking transactions on behalf of their clients. The

efficiencies assessed in this context by DEA are intended to reflect the scope for resource conservation at the unit being assessed without detriment to its outputs, or alternatively, the scope for output augmentation without additional resources. The efficiencies assessed are comparative or relative because they reflect scope for resource conservation or output augmentation at one unit relative to other comparable benchmark units rather than in some absolute sense. We resort to relative rather than absolute efficiencies because in most practical contexts we lack sufficient information to derive the superior measures of absolute efficiency. DEA was initiated by Charnes Cooper and Rhodes in 1978 in their seminal paper Charnes et al. (1978). The paper operationalised and extended by means of linear programming production economics concepts of empirical efficiency put forth some twenty years earlier by Farrell (1957).

**Handbook of Research on Strategic Performance Management and Measurement Using Data Envelopment Analysis** May 29 2020 Organizations can use the valuable tool of data envelopment analysis (DEA) to make informed decisions on developing successful strategies, setting specific goals, and identifying underperforming activities to improve the output or outcome of performance measurement. The Handbook of Research on Strategic Performance Management and Measurement Using Data Envelopment Analysis highlights the advantages of using DEA as a tool to improve business performance and identify sources of inefficiency in public and private organizations. These recently developed theories and applications of DEA will be useful for policymakers, managers, and practitioners in the areas of sustainable development of our society including environment, agriculture, finance, and higher education sectors.

*Sensitivity Analysis in Data Envelopment Analysis 2 Apr 20 2022*

**Network Data Envelopment Analysis** Jan 29 2023 This book presents the underlying theory, model development, and applications of network Data Envelopment Analysis (DEA) in a systematic way. The field of network DEA extends and complements conventional DEA by considering not only inputs and outputs when measuring system efficiency, but also the internal structure of the system being analyzed. By analyzing the efficiency of individual internal components, and more particularly by studying the effects of relationships among components which are modeled and implemented by means of various network structures, the “network DEA” approach is able to help identify and manage the specific components that contribute inefficiencies into the overall systems. This relatively new approach comprises an important analytical tool based on mathematical programming techniques, with valuable implications to production and operations management. The existing models for measuring the efficiency of systems of specific network structures are also discussed, and the relationships between the system and component efficiencies are explored. This book should be able to inspire new research and new applications based on the current state of the art. Performance evaluation is an important task in management, and is needed to (i) better understand the past accomplishments of an organization and (ii) plan for its future development. However, this task becomes rather challenging when multiple performance metrics are involved. DEA is a powerful tool to cope with such issues. For systems or operations composed of interrelated processes, managers need to know how the performances of the various processes evaluated and how they are aggregated to form the overall performance of the system. This book provides an advanced exposition on performance evaluation of systems with network structures. It explores the

network nature of most production and operation systems, and explains why network analyses are necessary.

**Handbook of Operations Analytics Using Data Envelopment Analysis** Oct 14 2021 This handbook focuses on Data Envelopment Analysis (DEA) applications in operations analytics which are fundamental tools and techniques for improving operation functions and attaining long-term competitiveness. In fact, the handbook demonstrates that DEA can be viewed as Data Envelopment Analytics. Chapters include a review of cross-efficiency evaluation; a case study on measuring the environmental performance of OECS countries; how to select a set of performance metrics in DEA with an application to American banks; a relational network model to take the operations of individual periods into account in measuring efficiencies; how the efficient frontier methods DEA and stochastic frontier analysis (SFA) can be used synergistically; and how to integrate DEA and multidimensional scaling. In other chapters, authors construct a dynamic three-stage network DEA model; a bootstrapping based methodology to evaluate returns to scale and convexity assumptions in DEA; hybridizing DEA and cooperative games; using DEA to represent the production technology and directional distance functions to measure bank performance; an input-specific Luenberger energy and environmental productivity indicator; and the issue of reference set by differentiating between the uniquely found reference set and the unary and maximal types of the reference set. Finally, additional chapters evaluate and compare the technological advancement observed in different hybrid electric vehicles (HEV) market segments over the past 15 years; radial measurement of efficiency for the production process possessing multi-components under different production technologies; issues around the use of accounting information in DEA; how to use DEA



environmental assessment to establish corporate sustainability; a summary of research efforts on DEA environmental assessment applied to energy in the last 30 years; and an overview of DEA and how it can be utilized alone and with other techniques to investigate corporate environmental sustainability questions.

**Quantitative Models for Performance Evaluation and Benchmarking** Jun 29 2020 The author is one of the prominent researchers in the field of Data Envelopment Analysis (DEA), a powerful data analysis tool that can be used in performance evaluation and benchmarking. This book is based upon the author's years of research and teaching experiences. It is difficult to evaluate an organization's performance when multiple performance metrics are present. The difficulties are further enhanced when the relationships among the performance metrics are complex and involve unknown tradeoffs. This book introduces Data Envelopment Analysis (DEA) as a multiple-measure performance evaluation and benchmarking tool. The focus of performance evaluation and benchmarking is shifted from characterizing performance in terms of single measures to evaluating performance as a multidimensional systems perspective. Conventional and new DEA approaches are presented and discussed using Excel spreadsheets — one of the most effective ways to analyze and evaluate decision alternatives. The user can easily develop and customize new DEA models based upon these spreadsheets. DEA models and approaches are presented to deal with performance evaluation problems in a variety of contexts. For example, a context-dependent DEA measures the relative attractiveness of similar operations/processes/products. Sensitivity analysis techniques can be easily applied, and used to identify critical performance measures. Two-stage network efficiency models can be utilized

to study performance of supply chain. DEA benchmarking models extend DEA's ability in performance evaluation. Various cross efficiency approaches are presented to provide peer evaluation scores. This book also provides an easy-to-use DEA software — DEAFrontier. This DEAFrontier is an Add-In for Microsoft® Excel and provides a custom menu of DEA approaches. This version of DEAFrontier is for use with Excel 97-2013 under Windows and can solve up to 50 DMUs, subject to the capacity of Excel Solver. It is an extremely powerful tool that can assist decision-makers in benchmarking and analyzing complex operational performance issues in manufacturing organizations as well as evaluating processes in banking, retail, franchising, health care, public services and many other industries.

**Decision Making and Performance Evaluation Using Data Envelopment Analysis** Apr 27 2020 This book offers new transparent views and step-by-step methods for performance evaluation of a set of units using Data Envelopment Analysis (DEA). The book has twelve practical chapters. Elementary concepts and definitions are gradually built in Chapters 1-6 based upon four examples of one input and one output factors, two input factors, two output factors, and four input and three output factors. Simultaneously, the mathematical foundations using linear programming are also introduced without any prerequisites. A reader with basic knowledge of mathematics and computers is able to understand the contents of the book. In addition, to prevent pre-judgment about the available concepts and definitions in the DEA literature, some new phrases are introduced and, after elucidating each phrase in detail in Chapters 1-6, they are reintroduced for industry-wide accuracy in Chapter 7. After that, some of the more advanced DEA topics are illustrated in Chapters 8-12, such as: production-planning problems, output-input ratio analysis, efficiency over different

time periods, Malmquist efficiency indexes, and a delta neighborhood model. A clear overview of many of the elementary and advanced concepts of DEA is provided, including Technical Efficiency, Relative Efficiency, Cost/Revenue/Profit Efficiency, Price/Overall Efficiency, the DEA axioms, the mathematical background to measure technical efficiency and overall efficiency, the multiplier/envelopment form of basic DEA models in input/output-orientation, the multiplier/envelopment of Additive DEA model, the multiplier/envelopment of slacks-based models, and others. The book also covers a variety of DEA techniques, input-output ratio analysis, the natural relationships between DEA frontier and the ratio of output to input factors, production-planning problems, planning ideas with a centralized decision-making unit, context-dependent DEA, Malmquist efficiency index, efficiency over different time periods, and others. End-of-chapter exercises are provided for each chapter.

**Dynamics of Data Envelopment Analysis** Apr 08 2021 Data envelopment analysis develops a set of nonparametric and semiparametric techniques for measuring economic efficiency among firms and nonprofit organizations. Over the past decade this technique has found most widespread applications in public sector organizations. However these applications have been mostly static. This monograph extends this static framework of efficiency analysis in several new directions. These include but are not limited to the following: (1) a dynamic view of the production and cost frontier, where capital inputs are treated differently from the current inputs, (2) a direct role of the technological progress and regress, which is so often stressed in total factor productivity discussion in modern growth theory in economics, (3) stochastic efficiency in a dynamic setting, where reliability improvement competes with technical efficiency, (4) flexible manufacturing systems, where flexibility of the

production process and the economies of scope play an important role in efficiency analysis and (5) the role of economic factors such as externalities and input interdependences. Efficiency is viewed here in the framework of a general systems theory model. Such a view is intended to broaden the scope of applications of this promising new technique of data envelopment analysis. The monograph stresses the various applied aspects of the dynamic theory, so that it can be empirically implemented in different situations. As far as possible abstract mathematical treatments are avoided and emphasis placed on the statistical examples and empirical illustrations.

**Service Productivity Management** May 21 2022 Here is an in-depth guide to the most powerful available benchmarking technique for improving service organization performance — Data Envelopment Analysis (DEA). The book outlines DEA as a benchmarking technique, identifies high cost service units, isolates specific changes for elevating performance to the best practice services level providing high quality service at low cost and most important, it guides the improvement process.

**Health Care Benchmarking and Performance Evaluation** Nov 03 2020 This new edition continues to emphasize the use of data envelopment analysis (DEA) to create optimization-based benchmarks within hospitals, physician group practices, health maintenance organizations, nursing homes and other health care delivery organizations. Suitable for graduate students learning DEA applications in health care as well as for practicing administrators, it is divided into two sections covering methods and applications. Section I considers efficiency evaluations using DEA; returns to scale; weight restricted (multiplier) models; non-oriented or slack-based models, including in this edition two versions of non-controllable variable models and categorical variable models; longitudinal (panel) evaluations and the

effectiveness dimension of performance evaluation. A new chapter then looks at new and advanced models of DEA, including super-efficiency, congestion DEA, network DEA, and dynamic network models. Mathematical formulations of various DEA models are placed in end-of-chapter appendices. Section II then looks at health care applications within particular settings, chapter-by-chapter, including hospitals, physician practices, nursing homes and health maintenance organizations (HMOs). Other chapters then explore home health care and home health agencies; dialysis centers, community mental health centers, community-based your services, organ procurement organizations, aging agencies and dental providers; DEA models to evaluate provider performance for specific treatments, including stroke, mechanical ventilation and perioperative services. A new chapter then examines international-country-based applications of DEA in health care in 16 different countries, along with OECD and multi-country studies. Most of the existing chapters in this section were expanded with recent applications. Included with the book is online access to a learning version of DEA Solver software, written by Professor Kaoru Tone, which can solve up to 50 DMUs for various DEA models listed in the User's Guide at the end of the book.

Data Envelopment Analysis Jun 22 2022 This handbook compiles state-of-the-art empirical studies and applications using Data Envelopment Analysis (DEA). It includes a collection of 18 chapters written by DEA experts. Chapter 1 examines the performance of CEOs of U.S. banks and thrifts. Chapter 2 describes the network operational structure of transportation organizations and the relative network data envelopment analysis model. Chapter 3 demonstrates how to use different types of DEA models to compute total-factor energy efficiency scores with an application to energy efficiency. In chapter 4, the

authors explore the impact of incorporating customers' willingness to pay for service quality in benchmarking models on cost efficiency of distribution networks, and chapter 5 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 examines efficiency and productivity of U.S. property-liability (P-L) insurers using DEA, while chapter 7 presents a two-stage network DEA model that decomposes the overall efficiency of a decision-making unit into two components. Chapter 8 presents a review of the literature of DEA models for the performance assessment of mutual funds, and chapter 9 discusses the management strategies formulation of the international tourist hotel industry in Taiwan. Chapter 10 presents a novel use of the two-stage network DEA to evaluate sustainable product design performances. In chapter 11 authors highlight limitations of some DEA environmental efficiency models, and chapter 12 reviews applications of DEA in secondary and tertiary education. Chapter 13 measures the relative performance of New York State school districts in the 2011-2012 academic year. Chapter 14 provides an introductory prelude to chapters 15 and 16, which both provide detailed applications of DEA in marketing. Chapter 17 then shows how to decompose a new total factor productivity index that satisfies all economically-relevant axioms from index theory with an application to U.S. agriculture. Finally, chapter 18 presents a unique study that conducts a DEA research front analysis, applying a network clustering method to group the DEA literature over the period 2000 to 2014.

*Advances in Data Envelopment Analysis* Oct 22 2019 Data Envelopment Analysis (DEA) is often overlooked in empirical work such as diagnostic tests to determine whether the data conform with technology which, in turn, is important in

identifying technical change, or finding which types of DEA models allow data transformations, including dealing with ordinal data. Advances in Data Envelopment Analysis focuses on both theoretical developments and their applications into the measurement of productive efficiency and productivity growth, such as its application to the modelling of time substitution, i.e. the problem of how to allocate resources over time, and estimating the "value" of a Decision Making Unit (DMU).

Contents: Acknowledgements Preface Introduction: The DEA Technology and Its Representation (Axiomatic) Properties of the DEA Model Appendix Looking at the Data in DEA: Data Diagnostics Technical Change Data Translation Appendix: Distance Functions DEA and Intensity Variables: On Shephard's Duality Theory Adjoint Transformations in DEA The Diet Problem Pricing Decision Making Units DEA and Directional Distance Functions: Directional Vectors Aggregation and Directional Vectors Endogenizing the Directional Vector Appendix DEA and Time Substitution: Theoretical Underpinning Reassessing the EU Stability and Growth Pact Method Some Limitations of Two DEA Models: The Non-Archimedean and DEA Super-Efficiency and Zeros References Readership: Advanced postgraduate students and researchers in operations research and economics with a particular interest in production theory and operations management. Keywords: Optimization Techniques; Multifactor Productivity; Intertemporal Firm Choice; Technological Change: Choices and Consequences; Diffusion Processes; Data Envelopment Analysis; Operations Research

**New Efficiency Theory** Nov 22 2019 New efficiency theory refers to the various parametric and semi-parametric methods of estimating production and cost frontiers, which include data envelopment analysis (DEA) with its diverse applications in management science and operations research. This monograph

develops and generalizes the new efficiency theory by highlighting the interface between economic theory and operations research. Some of the outstanding features of this monograph are: (1) integrating the theory of firm efficiency and industry equilibrium, (2) emphasizing growth efficiency in a dynamic setting, (3) incorporating uncertainty of market demand and prices, and (4) the implications of group efficiency by sharing investments. Applications discuss in some detail the growth and decline of the US computer industry, and the relative performance of mutual fund portfolios.

**Handling Proportional Data and Weight Constraints in Data Envelopment Analysis (DEA)** Aug 24 2022 This dissertation addresses two problems when handling proportional data and weight constraints frequently arise in Data Envelopment Analysis (DEA), motivated by several healthcare studies. DEA is a mathematical method for measuring the relative efficiencies of multiple decision making units (DMUs) at transforming multiple inputs (e.g., number of medical staff, number of beds, per patient costs) into multiple outputs (e.g., mortality, clinical outcomes, patient satisfaction), also computing target values and optimal weights for each input and output, where here the DMUs could be hospitals, departments, healthcare systems, physicians, public policies, and so on. The primary contributions of this research are methods for (1) handling proportional and bounded data, (2) rationally constraining the input-output weights, and (3) measuring efficiency robustness over ranges of possible weight constraints. The first problem is motivated by the fact that in some DEA applications the usual assumption is violated that all data must only be nonnegative, namely for proportional data bound between 0 and 1 (e.g., mortality, adverse event, defect, or market penetration rates). Solving conventional constant-returns-



to-scale (CRS) DEA models in such cases can produce output targets exceeding their upper bounds (e.g., 130 percent survival). Values bound on a fixed interval (e.g., satisfaction scores between 1 and 5) present a similar problem. Given the common use of CRS models, this research proposes and investigates an odds-ratio transformation that forces all targets between their bounds. The second problem is motivated by periodic "irrational" weights, such as placing less (or no) weight on mortality than on patient satisfaction. Since the two most common approaches in the literature (rank ordering or setting lower bounds for individual weights) have scale, solution feasibility, and arbitrariness limitations, we propose and compare a method that constrains each weight by a percent of the total (POT) of all weights. To remove the subjectivity of these percentages and as a measure of efficiency robustness, iterative search, numeric, and Monte Carlo algorithms (the last implemented in an Excel-based program) are developed that determine POT regions within which each DMU is on the frontier and compute an overall "hyper efficiency" score. All methods are demonstrated on several analyses of VA medical facilities, the U.S. News and World Report (USNWR) "best" departments, and national healthcare systems using data from the World Health Organization (WHO). Interestingly, results for U.S. hospitals and national healthcare systems both are poorly correlated with the more arbitrary weighted USNWR and WHO rankings.

**The Measurement of Productive Efficiency and Productivity Growth** Mar 19 2022 When Harold Fried, et al. published *The Measurement of Productive Efficiency: Techniques and Applications* with OUP in 1993, the book received a great deal of professional interest for its accessible treatment of the rapidly growing field of efficiency and productivity analysis. The first several chapters, providing the background, motivation, and

theoretical foundations for this topic, were the most widely recognized. In this tight, direct update, these same editors have compiled over ten years of the most recent research in this changing field, and expanded on those seminal chapters. The book will guide readers from the basic models to the latest, cutting-edge extensions, and will be reinforced by references to classic and current theoretical and applied research. It is intended for professors and graduate students in a variety of fields, ranging from economics to agricultural economics, business administration, management science, and public administration. It should also appeal to public servants and policy makers engaged in business performance analysis or regulation.

**Benchmarking with DEA, SFA, and R** Mar 07 2021 This book covers recent advances in efficiency evaluations, most notably Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) methods. It introduces the underlying theories, shows how to make the relevant calculations and discusses applications. The aim is to make the reader aware of the pros and cons of the different methods and to show how to use these methods in both standard and non-standard cases. Several software packages have been developed to solve some of the most common DEA and SFA models. This book relies on R, a free, open source software environment for statistical computing and graphics. This enables the reader to solve not only standard problems, but also many other problem variants. Using R, one can focus on understanding the context and developing a good model. One is not restricted to predefined model variants and to a one-size-fits-all approach. To facilitate the use of R, the authors have developed an R package called Benchmarking, which implements the main methods within both DEA and SFA. The book uses mathematical formulations of models and assumptions, but it de-emphasizes the formal proofs - in part by

placing them in appendices -- or by referring to the original sources. Moreover, the book emphasizes the usage of the theories and the interpretations of the mathematical formulations. It includes a series of small examples, graphical illustrations, simple extensions and questions to think about. Also, it combines the formal models with less formal economic and organizational thinking. Last but not least it discusses some larger applications with significant practical impacts, including the design of benchmarking-based regulations of energy companies in different European countries, and the development of merger control programs for competition authorities.

*Modeling Data Irregularities and Structural Complexities in Data Envelopment Analysis* Oct 26 2022 In a relatively short period of time, data envelopment analysis (DEA) has grown into a powerful analytical tool for measuring and evaluating performance. DEA is computational at its core and this book is one of several Springer aim to publish on the subject. This work deals with the micro aspects of handling and modeling data issues in DEA problems. It is a handbook treatment dealing with specific data problems, including imprecise data and undesirable outputs.

**Data Envelopment Analysis in the Financial Services Industry** Dec 04 2020 This book presents the methodology and applications of Data Envelopment Analysis (DEA) in measuring productivity, efficiency and effectiveness in Financial Services firms such as banks, bank branches, stock markets, pension funds, mutual funds, insurance firms, credit unions, risk tolerance, and corporate failure prediction. Financial service DEA research includes banking; insurance businesses; hedge, pension and mutual funds; and credit unions. Significant business transactions among financial service organizations such as bank mergers and acquisitions and valuation of IPOs have also been the focus of DEA research. The book looks at the range of DEA

uses for financial services by presenting prior studies, examining the current capabilities reflected in the most recent research, and projecting future new uses of DEA in finance related applications.

Data Envelopment Analysis with R May 09 2021 This book introduces readers to the use of R codes for optimization problems. First, it provides the necessary background to understand data envelopment analysis (DEA), with a special emphasis on fuzzy DEA. It then describes DEA models, including fuzzy DEA models, and shows how to use them to solve optimization problems with R. Further, it discusses the main advantages of R in optimization problems, and provides R codes based on real-world data sets throughout. Offering a comprehensive review of DEA and fuzzy DEA models and the corresponding R codes, this practice-oriented reference guide is intended for masters and Ph.D. students in various disciplines, as well as practitioners and researchers.

Data Envelopment Analysis and Its Applications to Management Jan 05 2021 Data envelopment analysis (DEA), a non-parametric technique, has emerged as a popular management tool for measuring the performance of a set of entities, known as decision making units. This book, *Data Envelopment Analysis and Its Applications to Management*, is a collection of contributions from DEA experts from various countries. It covers a wide range of research papers from the theoretical development of DEA to its applications in various sectors such as economy, banking, education, revenue management, sports, branch networks, cities, and live stock production systems. The book is useful for researchers as well as practitioners who intend to apply DEA to their strategic and managerial decisions.

**Data Envelopment Analysis** Sep 01 2020 This volume systematically details both the basic principles and new

developments in Data Envelopment Analysis (DEA), offering a solid understanding of the methodology, its uses, and its potential. New material in this edition includes coverage of recent developments that have greatly extended the power and scope of DEA and have led to new directions for research and DEA uses. Each chapter accompanies its developments with simple numerical examples and discussions of actual applications. The first nine chapters cover the basic principles of DEA, while the final seven chapters provide a more advanced treatment.

*Environmental Assessment on Energy and Sustainability by Data Envelopment Analysis* Jul 31 2020 Introduces a bold, new model for energy industry pollution prevention and sustainable growth. Balancing industrial pollution prevention with economic growth is one of the knottiest problems faced by industry today. This book introduces a novel approach to using data envelopment analysis (DEA) as a powerful tool for achieving that balance in the energy industries—the world's largest producers of greenhouse gases. It describes a rigorous framework that integrates elements of the social sciences, corporate strategy, regional economics, energy economics, and environmental policy, and delivers a methodology and a set of strategies for promoting green innovation while solving key managerial challenges to greenhouse gas reduction and business growth. In writing this book the authors have drawn upon their pioneering work and considerable experience in the field to develop an unconventional, holistic approach to using DEA to assess key aspects of sustainability development. The book is divided into two sections, the first of which lays out a conventional framework of DEA as the basis for new research directions. In the second section, the authors delve into conceptual and methodological extensions of conventional DEA for solving

problems of environmental assessment in all contemporary energy industry sectors. Introduces a powerful new approach to using DEA to achieve pollution prevention, sustainability, and business growth Covers the fundamentals of DEA, including theory, statistical models, and practical issues of conventional applications of DEA Explores new statistical modeling strategies and explores their economic and business implications Examines applications of DEA to environmental analysis across the complete range of energy industries, including coal, petroleum, shale gas, nuclear energy, renewables, and more Summarizes important studies and nearly 800 peer reviewed articles on energy, the environment, and sustainability Environmental Assessment on Energy and Sustainability by Data Envelopment Analysis is must-reading for researchers, academics, graduate students, and practitioners in the energy industries, as well as government officials and policymakers tasked with regulating the environmental impacts of industrial pollution.

**Uncertain Data Envelopment Analysis** Sep 13 2021 This book is intended to present the milestones in the progression of uncertain Data envelopment analysis (DEA). Chapter 1 gives some basic introduction to uncertain theories, including probability theory, credibility theory, uncertainty theory and chance theory. Chapter 2 presents a comprehensive review and discussion of basic DEA models. The stochastic DEA is introduced in Chapter 3, in which the inputs and outputs are assumed to be random variables. To obtain the probability distribution of a random variable, a lot of samples are needed to apply the statistics inference approach. Chapter 4 and 5 provide two uncertain DEA methods to evaluate the DMUs with limited or insufficient statistical data, named fuzzy DEA and uncertain DEA. In order to evaluate the DMUs in which uncertainty and randomness appear simultaneously, the hybrid DEA based on

chance theory is presented in Chapter 6.

Data Envelopment Analysis Feb 18 2022 This handbook represents a milestone in the progression of Data Envelopment Analysis (DEA). Written by experts who are often major contributors to DEA theory, it includes a collection of chapters that represent the current state-of-the-art in DEA research. Topics include distance functions and their value duals, cross-efficiency measures in DEA, integer DEA, weight restrictions and production trade-offs, facet analysis in DEA, scale elasticity, benchmarking and context-dependent DEA, fuzzy DEA, non-homogenous units, partial input-output relations, super efficiency, treatment of undesirable measures, translation invariance, stochastic nonparametric envelopment of data, and global frontier index. Focusing only on new models/approaches of DEA, the book includes contributions from Juan Aparicio, Mette Asmild, Yao Chen, Wade D. Cook, Juan Du, Rolf Färe, Julie Harrison, Raha Imanirad, Andrew Johnson, Chiang Kao, Abolfazl Keshvari, Timo Kuosmanen, Sungmook Lim, Wenbin Liu, Dimitri Margaritis, Reza Kazemi Matin, Ole B. Olesen, Jesus T. Pastor, Niels Chr. Petersen, Victor V. Podinovski, Paul Rouse, Antti Saastamoinen, Bires K. Sahoo, Kaoru Tone, and Zhongbao Zhou.

**Data Envelopment Analysis** Jul 23 2022 This handbook serves as a complement to the Handbook on Data Envelopment Analysis (eds, W.W. Cooper, L.M. Seiford and J. Zhu, 2011, Springer) in an effort to extend the frontier of DEA research. It provides a comprehensive source for the state-of-the-art DEA modeling on internal structures and network DEA. Chapter 1 provides a survey on two-stage network performance decomposition and modeling techniques. Chapter 2 discusses the pitfalls in network DEA modeling. Chapter 3 discusses efficiency decompositions in network DEA under three types of structures, namely series,

parallel and dynamic. Chapter 4 studies the determination of the network DEA frontier. In chapter 5 additive efficiency decomposition in network DEA is discussed. An approach in scale efficiency measurement in two-stage networks is presented in chapter 6. Chapter 7 further discusses the scale efficiency decomposition in two stage networks. Chapter 8 offers a bargaining game approach to modeling two-stage networks. Chapter 9 studies shared resources and efficiency decomposition in two-stage networks. Chapter 10 introduces an approach to computing the technical efficiency scores for a dynamic production network and its sub-processes. Chapter 11 presents a slacks-based network DEA. Chapter 12 discusses a DEA modeling technique for a two-stage network process where the inputs of the second stage include both the outputs from the first stage and additional inputs to the second stage. Chapter 13 presents an efficiency measurement methodology for multi-stage production systems. Chapter 14 discusses network DEA models, both static and dynamic. The discussion also explores various useful objective functions that can be applied to the models to find the optimal allocation of resources for processes within the black box, that are normally invisible to DEA. Chapter 15 provides a comprehensive review of various type network DEA modeling techniques. Chapter 16 presents shared resources models for deriving aggregate measures of bank-branch performance, with accompanying component measures that make up that aggregate value. Chapter 17 examines a set of manufacturing plants operating under a single umbrella, with the objective being to use the component or function measures to decide what might be considered as each plant's core business. Chapter 18 considers problem settings where there may be clusters or groups of DMUs that form a hierarchy. The specific case of a set off electric power plants is examined in this context.



Chapter 19 models bad outputs in two-stage network DEA. Chapter 20 presents an application of network DEA to performance measurement of Major League Baseball (MLB) teams. Chapter 21 presents an application of a two-stage network DEA model for examining the performance of 30 U.S. airline companies. Chapter 22 then presents two distinct network efficiency models that are applied to engineering systems.

**Nonparametric Estimation of Educational Production and Costs using Data Envelopment Analysis** Feb 06 2021 This book provides a complete analysis of educational production and costs using the nonparametric technique known as Data Envelopment Analysis (DEA). The book focuses on estimation of technical, allocative and scale efficiency in the public sector characterized by the influence of exogenous socio-economic variables. State of the art DEA models will be presented and fully discussed. Specific education topics important to policy makers including adequacy, technical, allocative and scale efficiency, productivity and environmental costs will be analyzed. To illustrate how these techniques can be applied to school systems worldwide, the authors use data on Australian elementary and high schools to develop nonparametric measures that will help inform current policy debate in Australia. The purpose of the book is to provide a comprehensive analysis of educational production using numerous public sector DEA models. We provide a review of DEA with SAS programming code to estimate technical, scale and allocative efficiency in chapter 2. In chapter 3, we extend the DEA models to control for exogenous factors of production. SAS code is also provided to estimate all public sector models. We use simulated data to illustrate the results. Chapters 4–6 provide a complete analysis of the primary and secondary schools. We analyze input and output oriented models and derive measures of technical, allocative and scale efficiency.

We also provide estimates of environmental costs that arise from schools facing different operating environments based on socioeconomic conditions. In addition, we show how DEA can provide insight on adequacy—the minimum cost of providing a pre-defined adequate education. The models presented are consistent with public sector production in general and educational production in particular. We also provide a complete analysis of educational productivity for both primary and secondary schools using state of the art public sector Malmquist measures. The authors use current data on Australian schools to highlight important policy questions related to efficiency and productivity given concerns that schools are not allocatively scarce resources in an economic efficient way. This research focus comes at an important watershed moment in the Australian Federal Governments' current involvement in designing new nationally consistent funding models for both government and non-government schooling sectors with effect from 2014. A new National School Resourcing Standard is proposed to be implemented signaling a move to resource adequacy, school efficiency and value for money dimensions. These standards are consistent with the measures presented and estimated in this book. As a result, the models implemented in this book can serve as the basis to evaluate the funding changes associated with the transition from a 'centralized' to a new 'decentralized' set of school funding arrangements.

*Research Methodology on Data Envelopment Analysis (DEA)* Feb 24 2020 Data Envelopment Analysis (DEA) represents a milestone in the progression of a continuously advancing methodology for data analysis, which finds extensive use in industry, society and even in education. This book is a handy encyclopedia for researchers, students and practitioners looking for the latest and most comprehensive references in DEA. J.K.

Mantri has specifically selected 22 research papers where DEA is applied in different fields so that the techniques discussed in this book can be used for various applications. In *A Bibliography of Data Envelopment Analysis (1978-2001)*, Gabriel Tavares states that DEA is a mathematical programme for measuring performance efficiency of organizations popularly named as decision-making units (DMU). The DMU can be of any kind such as manufacturing units, a number of schools, banks, hospitals, police stations, firms, etc. DEA measures the performance efficiency of these kinds of DMUs, which share a common characteristic: they have a non-profit organization where measurement is difficult. DEA assumes the performance of the DMU using the concepts of efficiency and productivity, which are measured as the ratio of total outputs to total inputs. The efficiencies estimated are relative to the best performing DMU, which is given a score of 100%. The performance of other DMUs varies between 0% and 100%.

*An Introduction to Efficiency and Productivity Analysis* Dec 24 2019 Softcover version of the second edition Hardcover. Incorporates a new author, Dr. Chris O'Donnell, who brings considerable expertise to the project in the area of performance measurement. Numerous topics are being added and more applications using real data, as well as exercises at the end of the chapters. Data sets, computer codes and software will be available for download from the web to accompany the volume.

**Data Envelopment Analysis** Jun 10 2021 CD-ROM contains: DEA-Solver and sample problems -- Comprehensive bibliography.

**Data Envelopment Analysis and Effective Performance Assessment** Mar 27 2020 For any organization, analysis of performance and effectiveness through available data allows for informed decision making. Data envelopment analysis, or DEA, is a popular, effective method that can be used to measure

productive efficiency in operations management assessment. Data Envelopment Analysis and Effective Performance Assessment addresses the myriad of practical uses and innovative developments of DEA. Emphasizing the importance of analyzing productivity by measuring inputs, goals, economic growth, and performance, this book covers a wide breadth of innovative knowledge. This book is essential reading for managers, business professionals, students of business and ICT, and computer engineers.

**Data Envelopment Analysis: Theory, Methodology, and Applications** Sep 25 2022 This book represents a milestone in the progression of Data Envelopment Analysis (DEA). It is the first reference text which includes a comprehensive review and comparative discussion of the basic DEA models. The development is anchored in a unified mathematical and graphical treatment and includes the most important modeling extensions. In addition, this is the first book that addresses the actual process of conducting DEA analyses including combining DEA and 1 parametric techniques. The book has three other distinctive features. It traces the applications driven evolution and diffusion of DEA models and extensions across disciplinary boundaries. It includes a comprehensive bibliography to serve as a source of references as well as a platform for further developments. And, finally, the power of DEA analysis is demonstrated through fifteen novel applications which should serve as an inspiration for future applications and extensions of the methodology. The origin of this book was a Conference on New Uses of DEA in 2 Management and Public Policy which was held at the IC Institute of the University of Texas at Austin on September 27-29, 1989. The conference was made possible through NSF Grant #SES-8722504 (A. Charnes and 2 W. W. Cooper, co-PIs) and the support of the IC Institute.

*Introduction to Data Envelopment Analysis and Its Uses* Nov 15 2021 Introduction to Data Envelopment Analysis and Its Uses: With DEA-Solver Software and References has been carefully designed by the authors to provide a systematic introduction to DEA and its uses as a multifaceted tool for evaluating problems in a variety of contexts. The authors have been involved in DEA's development from the beginning. William Cooper (with Abraham Charnes and Edwardo Rhodes) is a founder of DEA. Lawrence Seiford and Kaoru Tone have been actively involved as researchers and practitioners from its earliest beginnings. All have been deeply involved in uses of DEA in practical applications as well as in the development of its basic theory and methodologies. The result is a textbook grounded in authority, experience and substance.

*Data Envelopment Analysis for Simplified Neutrosophic Sets* Oct 02 2020 In recent years, there has been a growing interest in neutrosophic theory, and there are several methods for solving various problems under neutrosophic environment. However, a few papers have discussed the Data envelopment analysis (DEA) with neutrosophic sets. So, in this paper, we propose an input-oriented DEA model with simplified neutrosophic numbers and present a new strategy to solve it. The proposed method is based on the weighted arithmetic average operator and has a simple structure. Finally, the new approach is illustrated with the help of a numerical example.

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