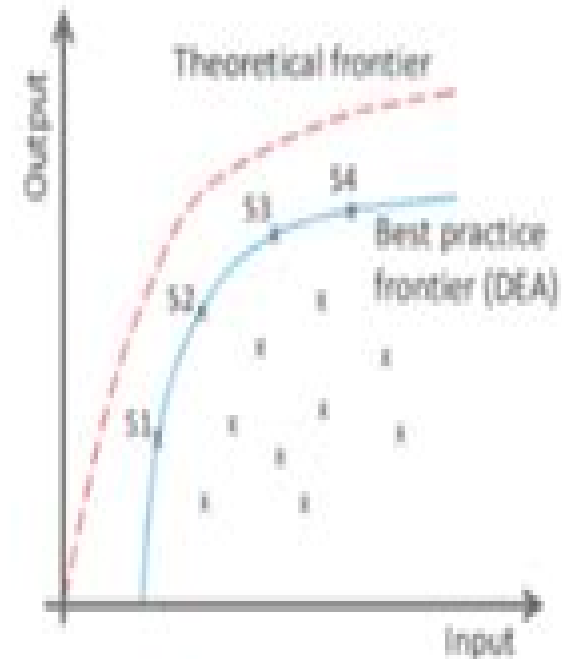


# Data Envelopment Analysis



Quantitative Analytical  
Technique Evaluating



Relative Efficiency of Decision-  
Making Units (DMUs) In  
Converting Inputs Into Outputs

# Data Envelopment Analysis Data Envelopment Analysis

**William W. Cooper, Lawrence M.  
Seiford, Joe Zhu**



## **Data Envelopment Analysis Data Envelopment Analysis:**

Data Envelopment Analysis: Theory, Methodology, and Applications Abraham Charnes, William W. Cooper, Arie Y. Lewin, Lawrence M. Seiford, 1995-07-31 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

*An Introduction to Data Envelopment Analysis* R Ramanathan, 2003-08-18 From the Foreword This book is an excellent tool for practitioners who are interested in the merits and pitfalls of the technique The author's research is an example of inventiveness diligence and accuracy Freerk A Lootsma Delft Institute of Technology Data envelopment Analysis is a Mathematical Programme for measuring performance efficiency of organizational units The organizational units termed as decision making units DMU can be of any kind manufacturing units a set of schools banks hospitals power plants police stations prisons a set of firms etc DEA has been unsuccessfully applied to measure the performance efficiency of these different kinds of DMUs which share a common characteristic that they are non profit organization where measurement of performance efficiency is difficult DEA has been employed for assessing the relative performance of a set of firms that use a variety of identical inputs say in the case of a school quality of students teachers grants etc to produce a variety of identical outputs number of students who pass the final year average grades obtained by the students in the final year etc DEA assumes the performance of the DMUs by using the concepts of efficiency or productivity which is measured as the ratio of total outputs to total inputs Also the efficiencies estimated are relative to the best performing DMU or DMUs The best performing DMU is given a score of 100% and the performance of other DMUs vary between 0 100% Handbook on Data Envelopment Analysis William W. Cooper, Lawrence M. Seiford, Joe Zhu, 2004-03-31 This Handbook has been developed as a comprehensive reference for researchers students and practitioners It reflects the state of the art in Data Envelopment Analysis It also represents a milestone in the progression of a continuously advancing methodology which has extensive utility Written by experts who are the major research contributors to the topics covered the Handbook is organized in three

sections The first section is a comprehensive examination of the basic DEA models and DEA extensions The second section consists of a collection of coverages by persons experienced in applications to the areas of banking education sports retailing health care etc The final section is a review of current DEA software technology

*Data Envelopment Analysis* William W. Cooper, Lawrence M. Seiford, Kaoru Tone, 2007-01-10 Data Envelopment Analysis A Comprehensive Text with Models Applications References And DEA Solver Software 2nd Edition is designed to provide a systematic introduction to DEA and its uses as a multifaceted tool for evaluating problems in a variety of contexts Each chapter accompanies its developments with simple numerical examples and discussions of actual applications Emphasis is placed on the use as well as an understanding of DEA and the topics in this book have been selected and treated accordingly The first nine chapters cover the basic principles of DEA and the final seven chapters are more advanced treatment of DEA These final chapters were completely revised into new chapters reflecting recent developments that greatly extend the power and scope of DEA and lead to new directions for research and DEA uses Together with the first ten chapters of the basic principles they will provide students and researchers with a solid understanding of the methodology its uses and its potential

**Measuring Efficiency** Richard H. Silkman, 1986

*Data Envelopment Analysis* Joe Zhu, 2015-03-18 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 Fare Julie Harrison Raha Imanirad Andrew Johnson Chiang Kao Abolfazl Keshvari Timo Kuosmanen Sungmook Lim Wenbin Liu Dimitri Margaritis Reza Kazemi Martin Ole B Olesen Jesus T Pastor Niels Chr Petersen Victor V Podinovski Paul Rouse Antti Saastamoinen Biresh K Sahoo Kaoru Tone and Zhongbao Zhou

**Advances In Data Envelopment Analysis** Rolf Fare, Shawna Grosskopf, Dimitris Margaritis, 2015-03-26 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

*Data Envelopment Analysis* Subhash C. Ray, 2004-06-07 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

*Research Methodology on Data Envelopment Analysis (DEA)* Jibendu Kumar Mantri, 2008 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%

Data Envelopment Analysis (DEA) Methods for Maximizing Efficiency Ajibesin, Adeyemi Abel, Vajjhala, Narasimha Rao, 2024-01-16 In today's highly competitive and rapidly evolving global landscape the quest for efficiency has become a crucial factor in determining the success of organizations across various industries Data Envelopment Analysis DEA Methods for Maximizing Efficiency is a comprehensive guide that delves into the powerful mathematical tool of DEA is designed to assess the relative efficiency of decision making units DMUs and provides valuable insights for performance improvement This book presents a systematic overview of DEA models and techniques from fundamental concepts to advanced methods showcasing their practical applications through real world examples and case studies Catering to a broad audience this book is designed for students researchers consultants decision makers and enthusiasts in the field of efficiency analysis and performance measurement Consultants and practitioners will gain practical insights for applying DEA in various contexts and decision makers will be equipped to make informed decisions for maximizing efficiency Additionally individuals with a general interest in data

analysis and performance measurement will find this book accessible and informative This book covers a wide range of topics including mathematical foundations of DEA DEA models and variations DEA efficiency and productivity measures DEA applications in various industries such as healthcare finance supply chain management environmental management education management and public sector management

**Extension of Data Envelopment Analysis with Preference Information** Tarja Joro, Pekka J. Korhonen, 2015-01-02 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

An Introduction to Data Envelopment Analysis Ramu Ramanathan, 2003 From the Foreword This book is an excellent tool for practitioners who are interested in the merits and pitfalls of the technique The author s research is an example of inventiveness diligence and accuracy Freerk A Lootsma Delft Institute of Technology Data envelopment Analysis is a Mathematical Programme for measuring performance efficiency of organizational units The organizational units termed as decision making units DMU can be of any kind manufacturing units a set of schools banks hospitals power plants police stations prisons a set of firms etc DEA has been unsuccessfully applied to measure the performance efficiency of these different kinds of DMUs which share a common characteristic that they are non profit organization where measurement of performance efficiency is difficult DEA has been employed for assessing the relative performance of a set of firms that use a variety of identical inputs say in the case of a school quality of students teachers grants etc to produce a variety of identical outputs number of students who pass the final year average grades obtained by the students in the final year etc DEA assumes the performance of the DMUs by using the concepts of efficiency or productivity which is measured as the ratio of total outputs to total inputs Also the efficiencies estimated are relative to the best performing DMU or DMUs The best

performing DMU is given a score of 100% and the performance of other DMUs vary between 0 100%      *Data Envelopment Analysis* Wade D. Cook, Joe Zhu, 2014-07-08 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      **Modeling Data Irregularities and Structural Complexities in Data Envelopment Analysis** Joe Zhu, Wade D. Cook, 2007-06-08 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      **Network Data Envelopment Analysis** Chiang Kao, 2023-07-24 This second edition systematically presents the underlying theory model development and applications of network Data Envelopment Analysis DEA It discusses the models used to measure the efficiency of systems in specific network structures and introduces readers to the latest applications It demonstrates how the network DEA approach helps identify and manage the specific components that cause inefficiencies in the overall system The existing models for measuring the efficiency of systems in specific network structures are also discussed and the relationships between system efficiency and component efficiency are explored Moreover the book provides an advanced exposition on performance evaluation of systems with network structures It explores the networked nature of most production and operation systems and explains why network analyses are necessary Accordingly the book will inspire new research and applications based on the state of the art In this new edition the latest research advances and discoveries are discussed Two new chapters on Linkage Efficiency and External and Internal Evaluations have been added This book is mainly aimed at researchers and graduate students who are interested in performance evaluation DEA and multi criteria decision analysis Practitioners who want to measure the performance of production operation or any type of decision making units will also find it useful

**Data Envelopment Analysis** Wade D. Cook, Joe Zhu, 2008 The current book introduces the methodology of data envelopment analysis DEA DEA uses mathematical programming techniques and models to evaluate the performance of peer units e g bank branches hospitals and schools in terms of multiple inputs used and multiple outputs produced DEA examines the resources available to each unit and monitors the conversion of these resources inputs into the desired outputs The book gives an overview of the various models from the literature and the geometric interpretations provided permit the reader to go beyond the mathematics Various topics are covered relating to important practical considerations These include dealing with time series data as well as methods for restricting multipliers The book will thus provide students researchers and practitioners with a solid understanding of the methodology its uses and its potential      **Dynamics of Data Envelopment Analysis** Jati Sengupta, 2013-11-11 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     Introduction to the Theory and Application of Data Envelopment Analysis Emmanuel

Thanassoulis,2001-07-31 The book aims to introduce the reader to DEA in the most accessible manner possible It is specifically aimed at those who have had no prior exposure to DEA and wish to learn its essentials how it works its key uses and the mechanics of using it The latter will include using DEA software Students on degree or training courses will find the book especially helpful The same is true of practitioners engaging in comparative efficiency assessments and performance management within their organisation Examples are used throughout the book to help the reader consolidate the concepts covered     *Introduction and Comparison of Data Envelopment Analysis Software Packages* Alireza Alinezhad,Seyyed Hamed Mirtaleb,Javad Khalili,2021-01-27 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     **Advanced Topics in Inverse Data Envelopment Analysis** Mehdi Soltanifar,Mojtaba Ghiyasi,Farhad

Hosseinzadeh Lotfi,Mohammadreza Shahriari,2025-07-11 **Advanced Topics in Inverse Data Envelopment Analysis** Approaches for Handling Ratio Data explores and tackles the most significant challenges encountered by researchers and practitioners in decision analysis and performance evaluation This book delves into the sophisticated realm of Ratio Data Envelopment Analysis DEA R offering a thorough examination of advanced methodologies practical examples and insights into managing complex problems involving both non negative and negative data Filling crucial gaps in existing literature this comprehensive resource focuses on the emerging field of Inverse DEA R equipping readers with the necessary tools and knowledge to address a wide range of challenging data types This book serves as an essential guide for making informed and efficient decisions guiding researchers and graduate students in computer science applied mathematics industrial engineering and finance navigating the complexities of decision analysis in today s data driven world Offers an in depth

exploration of Inverse DEA R models making it an invaluable resource for researchers seeking to understand and apply these advanced techniques Includes numerous practical examples and case studies across different industries demonstrating how Inverse DEA R can be applied to real world scenarios Highlights potential areas for further research and development within Inverse DEA R encouraging readers to explore new avenues and contribute to the advancement of the field

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