William W Cooper (right), with his wife, Ruth Cooper, at Carnegie Mellon University.
A SPECIAL ISSUE ON “DATA ENVELOPMENT ANALYSIS: THEORIES AND APPLICATIONS” IN HONOR OF WILLIAM W. COOPER

Guest Editors

ZHIMIN HUANG* and SUSAN X. LI†
School of Business, Adelphi University
Garden City, NY 11530, USA
Fax: 516-877-4607
*huang@adelphi.edu
†li@adelphi.edu

JOE ZHU
Department of Management, Worcester Polytechnic Institute
Worcester, MA 01609, USA
Fax: 508-831-5720
jzhu@wpi.edu

This special issue of the International Journal of Information Technology and Decision Making on DEA is in honor of Dr. William W. Cooper on his 90th birthday for his pathbreaking contributions to diverse fields including DEA.

Dr. Cooper is the Foster Parker Centennial Professor Emeritus of Finance and Management at the Red McCombs School of Business and the Nadya Kozmetsky Scott Centennial Fellow at the IC² Institute, The University of Texas at Austin. He taught at Bard College, the University of Chicago, Carnegie Mellon University, and at Harvard University’s Graduate School of Business prior to coming to The University of Texas at Austin. He was the founding Dean of the School of Urban and Public Affairs (now the H. J. Heinz School of Management and Public Policy) and a founding member of the Graduate School of Industrial Administration (now the Tepper School of Business), both at Carnegie Mellon University. Erskine Fellow Lecturer at the University of Canterbury in New Zealand, he was also Distinguished Visiting IBM Professor of Systems Theory at Aoyama Gakuin University in Japan.

A founder and the first president of The Institute of Management Sciences, Dr. Cooper has also served on the editorial boards of Management Science, Operations Research, Naval Research Logistics Quarterly, Accounting Review, European Journal of Operational Research, Journal of Productivity Analysis, and
Socio-Economic Planning Sciences. He was also the first (founding) editor-in-chief of Auditing: A Journal of Practice and Theory.

Author of coauthor of some 500 professional-scientific articles and coauthor or coeditor of 24 books and monographs, Dr. Cooper is a member of the Accounting Hall of Fame, and a fellow of the Econometric Society, INFORMS (Institute for Operations Research and Management Science) and the American Association for the Advancement of Science. He holds honorary degrees from Ohio State, Carnegie Mellon and Harvard Universities in the US and the degree of Doctorado Honoris Causa from the University of Alicante in Spain. He has been awarded the John Von Neumann Theory Medal by the Institute of Management Sciences and Operations Research Society of America and the Gold Medal of the International Society for Multi-Criteria Decision Making as well as being awarded the Distinguished Contributor to the Auditing Literature by the American Accounting Association’s Auditing Section and the Lifetime Contributions to Management Accounting by the Management Accounting Section, the Notable Contributions to the Accounting Literature Award by the Governmental and Nonprofit Section and the Outstanding Accounting Educator Award by the American Accounting Association. Finally, he has received three McKinsey Foundations awards for the most valuable article of the year on a management topic and the American Institute of Accountants award for the most valuable article on an accounting topic.

Dr. Cooper has served as a consultant to more than 200 private corporations and governmental agencies. The following statement from Dr. George Kozmetsky at a conference held in honor of Dr. Cooper on the occasion of his 75th birthdays has aptly summarized Dr. Cooper’s contributions.

As an academic entrepreneur, Bill’s inputs have had important impacts on the fields of accounting, finance, economics, marketing, quantitative methods, managerial strategy, risk management, human resources management, management science and ethics. These contributions are legendary. They have been insightful, far-reaching and practical.

With the late Dr. Abraham Charnes in their more than 40 years of collaboration, Dr. Cooper has initiated and made significant contributions to a number of areas in management science and operations research. Among these are linear programming, goal programming, chance constrained programming, inequality constrained regressions, semi-infinite programming, and, more recently, data envelopment analysis (DEA), which, despite its recency, has accumulated an extensive record of applications and stimulated numerous publications by others that are documented in Cooper, Seiford, and Tone and Cooper, Seiford, and Zhu.

As will be evident from the papers in this volume, DEA is directed to evaluating the performance of entities, called Decision Making Units (DMUs), which convert multiple inputs into multiple outputs. DEA does not require explicit specification of
functional forms between inputs and outputs or require externally imposed weights, or like artifacts, for its use. It proceeds by means of a piecewise linear envelopment of observed input-output data derived from the optimizations of each DMU in a collection of DMUs with “similar” inputs and outputs. The development of DEA models has been dramatically accelerated during the past two decades to allow a wide range of choices from various models. Among these models are the variable-returns-to-scale BCC model of Banker, Charnes, and Cooper\(^1\) for measuring scale efficiency, the nonoriented additive model of Charnes\(^4\) et al., the cone ratio model,\(^6,7\) the assurance region models,\(^18\) models for dealing with qualitative data,\(^8,10\) the free disposal hull (FDH) model,\(^19\) non-discretionary variable models,\(^2,18\) as well as stochastic models\(^13,15,16\) and benchmarking models.\(^21\)

Recent years have seen a great variety of applications of DEA for use in evaluating the performances of many different kinds of DMUs engaged in many different activities in many different contexts and in many different countries. These DEA applications have been used to evaluate the performance of various forms of entities, such as hospitals, US Air Force wings, universities, cities, courts, countries and regions, business firms, and others. Because it requires very few assumptions, DEA has also opened up possibilities for use in cases which have been resistant to other approaches because of the complex (often unknown) nature of the relations between the multiple inputs and multiple outputs that are involved in the DMU performances.\(^12\)

Since the initial development of the “CCR model” by Charnes, Cooper, and Rhodes,\(^5\) more than 5,000 articles have appeared in the literature. Researchers in many fields have recognized that DEA is a powerful methodology that can be utilized to model operational processes. The empirical orientation and the minimal requirement of a priori assumptions in DEA have resulted in its use in a great many studies involving efficient frontier estimation in the nonprofit sector, the regulated sector, and the private sector. Extensions to the original CCR study have resulted in sophisticated DEA models which encompass a variety of alternate approaches to evaluate performances. See, for instance, Cooper, Seiford and Tone\(^11\) and Cooper, Seiford and Zhu.\(^12\)

This special issue is intended to contribute to the continuing development of DEA theory and its applications. It is organized into two categories: (i) DEA theory; and (ii) DEA extensions and their applications. The first article, by Fred Phillips, offers a historical overview of DEA development over the past 25 years based on his own experience working with Drs. Charnes and Cooper. His paper offers an excellent opportunity for scholars to look back at the philosophies underlying this fascinating methodology, their meaning for O.R. and other disciplines, such as economics, and their consequences for practical efficiency measurement in organization and societal performances.

The first category consists of four papers: In “A Monte Carlo Evaluation of Several Tests for the Selection of Variables in DEA Models”, Sirvent, Ruiz, Borras, and Pastor present a design of a Monte Carlo Experiment and the results
of an extensive simulation study to evaluate the performances of two existing tests
that can be utilized for the selection of variables in DEA models. In “Ranking
the Efficiency Performance Within a Set of Decision Making Units by Data Envel-
opment Analysis”, Li and Zhu provide a way to rank the efficiency performance
of DMUs based on the DEA framework. In “Impact Assessment of Input Omis-
sion on DEA”, Ruggiero looks at the issue of input selection and uses simulation
analysis to develop statistical procedures to provide guidelines for input selection.
The paper “Aggregated Ratio Analysis in DEA”, by Wu, Liang, Huang, and Li
proposes several aggregated ratio models to evaluate relative efficiency of DMUs
and then shows that their proposed ratio models are equivalent to the CCR DEA
models. This equivalence offers expanded opportunities for DEA to be interpreted
and applied in different ways.

The second category consists of seven papers. In “Context-Dependent DEA
with An Application to Tokyo Public Libraries”, Chen, Morita and Zhu present a
methodology of context-dependent DEA uses with their application. This approach
provides an “attractiveness measure” and “finer” DEA results. In “Slack and Net
Technical Efficiency Measurement: A Bootstrap Approach”, Richmond extends
bootstrap methods in stochastic DEA to permit investigation of the properties
of estimates of inefficiencies due to the slack in the use of resources as well as
technical efficiency. The model is applied to electricity production in the US. In
“On Preference Structure in Data Envelopment Analysis”, the paper by Chen dis-
cusses the DEA preference model and its relation to the multiple objective linear
programming techniques. In the paper on “Modeling Output Gains and Earnings’
Gains”, Fukuyama and Weber examine the potential gains in physical outputs or
earnings on outputs from an optimal reallocation of inputs. The authors provide
three additional gain functions which are constructed as ratios of indirect to direct
efficiency. The three proposed measures are empirically applied to the Japanese
banking industry for the period 2000–2003. In “Financial Liberalization and Effi-
ciency in the Tunisian Banking Industry: DEA Tests”, Cook, Hababou and Liang
apply DEA to study the impacts of financial reforms on the efficiency of the bank-
king system in Tunisia, a country in which the economy has been reshaped since
1987 by IMF/World Bank prescribed economic adjustment plans. In “Productiv-
ity Growth, Technical Efficiency, and Returns to Scale in The Washington State
Sawmilling Industry”, Helvoigt and Grosskopf examine technical efficiency, scale
efficiency, and productivity growth in the state of Washington’s sawmilling industry.
They found that while the sawmill industry experienced slightly declining produc-
tivity in the 1970s, it also experienced rapid growth in productivity during the 1980s
Envelopment Analysis”, Ardehali, Paradi and Asmild use a DEA model to score
risk tolerance of investors. The model provides the risk profile of an investor and
a guide, or matching process, that provides risk ratings of the investment vehicles
for investor use.
Acknowledgement

We received 32 submissions in response to our call-for-papers. All submitted manuscripts were peer-reviewed by at least two referees. Based on referee reports and the reports of the editors, i.e. based on the guest editors own reviews, thirteen revised papers were accepted. The guest editors would like to thank the reviewers for their hard work, time, efforts, and valuable comments and suggestions that made this special issue possible.

References

3. P. Beach, His beautiful mind: They made a movie about his student, but this UT economist is a legend in the world of number crunchers, *Austin American Statesman* (March 4, 2002).


