

An Assessment of Individual and Institutional Research Productivity in DEA

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Abstract

Data Envelopment Analysis (DEA) has been used to measure the relative efficiencies of organizations, such as hospitals, universities, and restaurants. A total of 142 DEA theoretical articles were selected from OR related journals for a period 1991 through 1999. The purpose this paper is to: evaluate who are the top researchers in the DEA area, which institutions are most productive in publishing research in the OR related journals. The results of this study show that the University of Texas at Austin, University of Massachusetts, and Warwick University are the first three productive institutions in publishing DEA research. As to the productivity of researchers, Lawrence M. Seiford, Joe Zhu, William W. Cooper, and Jati K. Sengupta are the leading researchers. USA is the most dominant country, accounts for 50.70% of total published articles, in publishing DEA research. The second country, United Kingdom produced 22.54% of the total published articles in DEA.

1. Introduction

Often we wonder if a university, hospital, restaurant, or other business is operating efficiently. Data Envelopment Analysis Method (DEA) can be used to answer this question. As a powerful technique, DEA not only supplements traditional approaches but also provides a more comprehensive insight into how well a person or an organization is really performing.

To complement the subjective judgment about the leading DEA researches and institutions, this work has ranked the leading DEA publishers and institutions according to measurable objective criteria. It is the purpose of this study to assess research productivity of DEA researchers and institutions for the period 1991 through 1999 using measure-normal count, adjusted count. This paper attempts to answer the following question:

- Who are the top researchers in the DEA area?
- Which institutions are most productive in DEA area?
- Which countries are most productive in DEA area?

2. Methodology

IAOR(International Abstract of Operation) and EBSCO, Stockholm, ProQuest databases were selected to measure individual and institutional research productivity. Articles were chosen using keywords related to "Data Envelopment Analysis". However, book reviews, dissertation abstracts, letters, opinions, columns and editorials were excluded from the sample. In addition, the articles of DEA applications are eliminated. For the selected DEA articles, a record of their authors, affiliated institutions, the number of pages, and their country were compiled.

A total of 142 theoretical DEA articles were selected from OR related journals of the past decade, 1991 to 1999.

Table 1 shows the number of articles in selected journals.

Table 1. Numbers of Articles in selected journals

Journal	# of Articles	%
Annals of Operations Research	12	8.45%
Computers & Mathematics with Applications	1	0.70%
Computers & Operations Research	8	5.63%
EJOR	58	40.85%
INFOR	4	2.82%
Interfaces	3	2.11%
JORS	30	21.13%
Journal of the Operations Research Society of Japan	5	3.52%
Management Science	18	12.68%
Math. Prog.	1	0.70%
Omega	2	1.41%
Total	142	100.00%

To assess the research productivity of a given researcher, the normal and adjusted count approaches suggested by Lindsey [2] were used. In the normal count approach, all publications in which the researcher participates are counted. For example, an article with two or more co-authors provides a unit count for each of the researchers. Compared to the normal count method, the adjusted count approach provides a more realistic representation of the accomplishments of a researcher. Each co-author of a paper receives a fraction of a unit count. For example, an article with three co-authors yields a one-third credit for each of them.

3. Findings and Discussion

3.1 Individual Research Productivity

In the case of individual research productivity, normal count is the favored method among researchers in many disciplines [1]. The list of authors was sorted according to their values on the normal count. There are 18 authors identified as the most productive researchers with a normal count over 3. **Table 2** lists the score of these authors, and their ranking among the entire group of 149 researchers. When a tie occurred in the values on the normal count, the values on the adjusted count were used to list the authors in this table.

According to **Table 2**, the coefficient of Spearman's rank order correlation between normal count ranking and adjusted count ranking was 0.639 with two-tailed significance of 0.004. From this coefficient, it is clear that the two rankings for the top 18 researchers were not rather different from each other. **Table 2** shows that according to the normal count, Lawrence M. Seiford is the most productive researcher with 13 papers to his credit. Joe Zhu is ranked as the second most highly productive researcher with 10 papers. Nevertheless, if adjusted count was considered, Joe Zhu would be the most highly productive researcher. As **Fig. 1** illustrates, the top 5 researchers (6 persons represent 4.03% of the total number of researchers) provided 17.61% of the published articles. The top 18 researchers (12.08% of the total number of researchers) provided 37.68% of the published articles. It indicates that a small group of individual researchers have produced a considerable percentage of the published research.

Table 2 List of top 18 researchers

RANK		Author	SCORE		RANK	Author	SCORE	
N	A		N	A			N	A
1	2	Lawrence M Seiford	13	5 1/2	7	Li, Susan X.	5	2 2/3
2	1	Zhu, Joe	10	6 1/2	7	Doyle, John R.	5	2 1/3
3	8	Cooper, William W.	8	2 7/10	7	Green, Rodney H.	5	2 1/3
4	6	Athanassopoulos, A.D.	7	4 1/12	7	Rousseau, John J.	5	1 11/12
5	7	E. Thanassoulis	6	3 5/12	7	Cook, Wade D.	5	1 5/6
5	16	Brockett, Patrick L.	6	2 1/30	16	Semple, John H.	4	2 1/3
7	3	Sengupta, Jati K.	5	5	16	Yu, Gang	4	1 7/12
7	4	John Ruggiero	5	4 1/2	16	Robert G. Dyson	4	1 5/12
7	5	Sueyoshi, Toshiyuki	5	4 1/4	N=Normal Count; A=Adjusted Count			
7	9	Ali, Agha Iqbal	5	2 2/3				

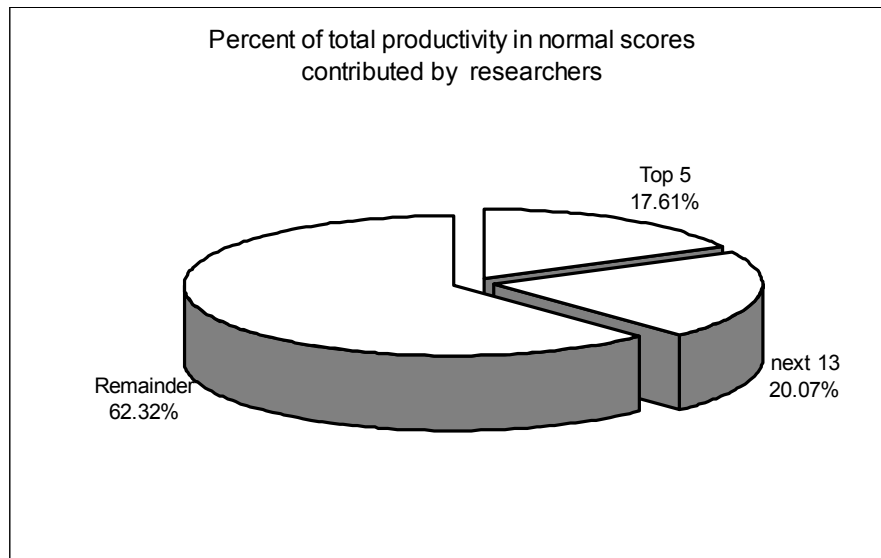


Fig. 1 Individual Productivity in Normal Count

3.2 Institutional Research Productivity

This study used the normal and adjusted counting methods for assessing institutional research productivity. The rankings for these two approaches were not considerable different from each other. Likewise, there was a break after the values on the normal count of 3 and a total 16 institutions were identified with the normal count of 3 at least. Based on **Table 3**, it is possible to identify a set of leading DEA research universities. Particularly, University of Texas at Austin, University of Massachusetts, and University of Warwick can be designated as leading-edge DEA research universities.

Fig. 2 shows another interesting result: the top 3 institutions (4.48% of the total number of 67 institutions) accounted for 30.99% of the total published articles. The top 18 researchers (26.86% of the total number of researchers) provided 64.79% of the published articles. Thus, it may conclude that more than half of the total research papers were published by a small number of institutions.

Table 3. List of top 16 institutions

RANK		Institution	SCORE		RANK	Institution	SCORE	
N	A		N	A			N	A
1	1	University of Texas, Austin	19	18	8	Odense University	3	3
2	2	University of Massachusetts	13	12	8	The University of Memphis	3	3
3	2	University of Warwick	12	12	8	University of Minnesota	3	3
4	4	University of Dayton	7	6 1/2	8	Adelphi University	3	2 1/2
5	5	University of California	5	5	8	Israel Institute of Technology	3	2 1/2
5	6	York University	5	4 1/2	8	National Cheng Kung Uni.	3	2 1/2
7	7	University of Bath	4	3 1/2	8	Southern Methodist Uni.	3	2 1/2
8	8	Ben-Gurion University	3	3	8	Worcester Polytechnic Inst.	3	1 1/2

3.3 Productivity by Country

Fig. 3 demonstrates the top 6 countries productivity in DEA research. It shows that the USA is the most highly productive in DEA research, and it provided 72 articles, which represents 50.70% of the total articles. The next is United Kingdom, which produced 32 articles, 22.54% of the selected papers. The rest countries are Israel, Denmark, Japan, and Taiwan. Each of them produced 5 articles, 3.52% of the total published articles. These 6 countries contributed a total of 87.32% of the all.

4. Conclusions

This study has examined individual, institutional and country research productivity in DEA by compiling a record of authors, institutions, and country for DEA articles published in the OR related journals between 1991 and 1999. Using the normal counting technique, we have identified 18 top DEA researchers and the top 16 DEA research

institutions in terms of their normal score. Additionally, the United States and United Kingdom are the most two dominant countries in DEA research. The result of this study also indicates that a considerable percentage of DEA research papers have been published by a small group of individual and institutional researchers.

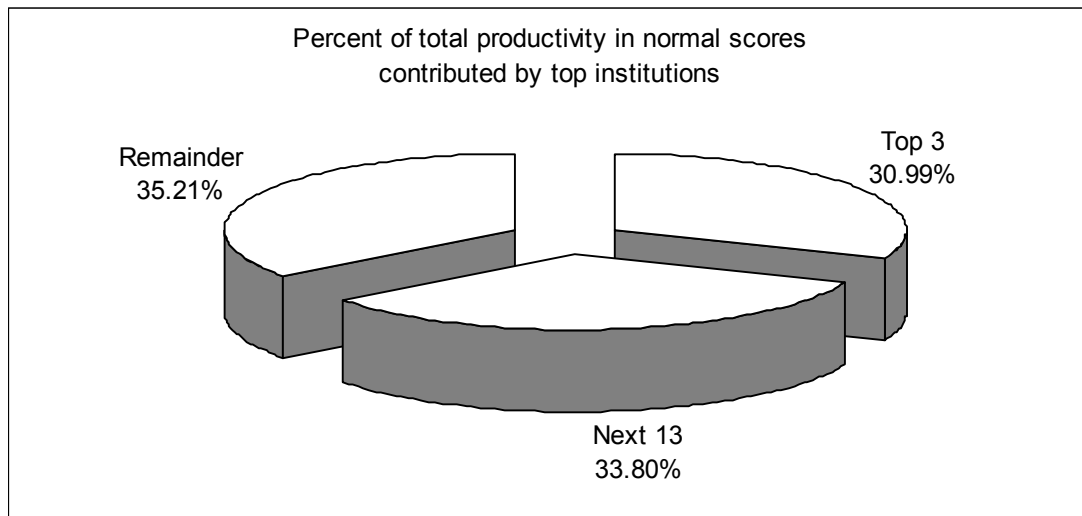


Fig 2. Institutional Productivity in Normal Count

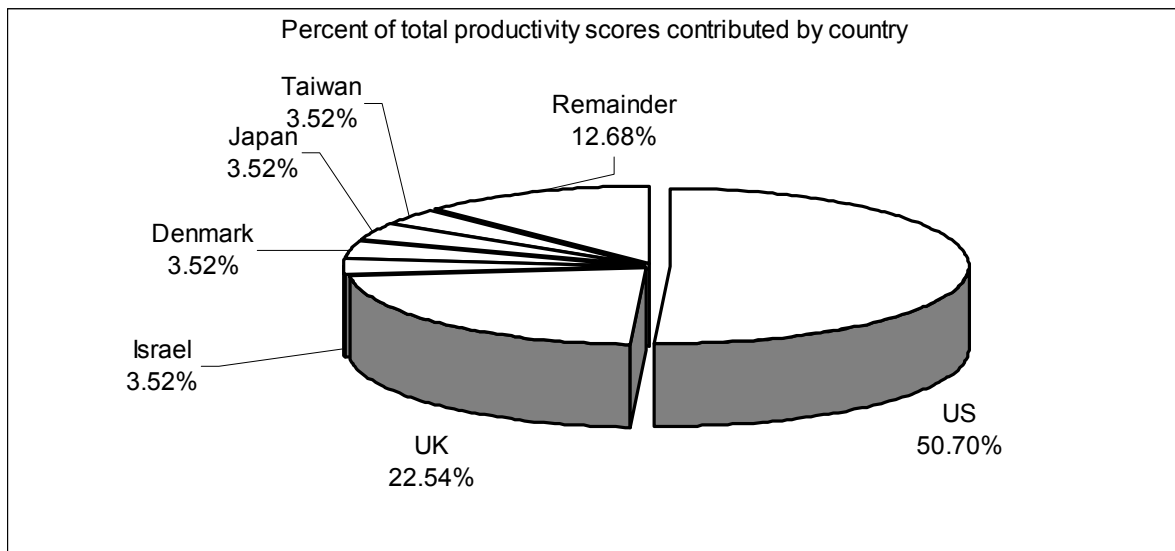


Fig. 3 Percent of total productivity contributed by countries.

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- [2] Lindsey, D., Production and Citation Measure in the Sociology of Science: The Problem of Multiple Authorship, Social Studies of Science, Vol. 10, pp. 145-162, 1980
- [3] The category of selected DEA articles, sorted by the order of Journal, Year, and Author.

Author	Article	Year	Journal	Volume & Page	Author Uni./Inst.	Country
Barr, Richard S., Seiford, Lawrence M. and Siems, Thomas F.	An envelopment-analysis approach to measuring the managerial efficiency of banks.	1993	Annals of Operations Research	45 1/4 Dec pp. 1-19.	Southern Methodist University, Dallas	US

Charnes, A., Rousseau, J. and Semple, J.	An effective non-Archimedean anti-degeneracy/cycling linear programming method especially for Data Envelopment Analysis and like models.	1993	Annals of Operations Research	46/47 1/4 Dec pp. 271-278.	The University of Texas at Austin	US
Arnold, Victor L., Bardhan, Indranil R., Cooper, William W. and Kumbhakar, Subal C.	New uses of DEA and statistical regressions for efficiency evaluation and estimation-With an illustrative application to public secondary schools in Texas.	1996	Annals of Operations Research	66 1 Aug pp. 255-257.	The University of Texas at Austin	US
Chilingerian, Jon A. and Sherman, H. David.	Benchmarking physician practice patterns with data envelopment analysis: A multi-stage approach for cost containment.	1996	Annals of Operations Research	67 1 Sep pp. 83-116.	Brandeis University	US
Cooper, W.W., Huang, Zhimin and Li, Susan X.	Satisficing DEA models under chance constraints.	1996	Annals of Operations Research	66 1 Aug pp. 279-295.	The University of Texas at Austin	US
Cooper, William W., Sinha, Kingshuk K. and Sullivan, Robert S.	Evaluating the information content of a measure of plant output: An application to high-technology manufacturing.	1996	Annals of Operations Research	68 1 Nov pp. 329-360.	The University of Texas at Austin	US
Morey, Richard C. and Dittman, David A.	Cost pass-through reimbursement to hospitals and their impacts on operating efficiencies.	1996	Annals of Operations Research	67 1 Sep pp. 117-139.	Cornell University	US
Sinha, Kingshuk K.	Moving frontier analysis: An application of Data Envelopment Analysis for competitive analysis of a high-technology manufacturing plant.	1996	Annals of Operations Research	66 1 Aug pp. 197-218.	University of Minnesota	US
Thrall, Robert M.	Duality, classification and slacks in DEA.	1996	Annals of Operations Research	66 1 Aug pp. 109-138.	privacy	US
Yu, Gang; Wei, Quanling and Brockett, Patrick.	A generalized data envelopment analysis model: A unification and extension of existing methods for efficiency analysis of decision making units.	1996	Annals of Operations Research	66 1 Aug pp. 46-89.	The University of Texas at Austin	US
Ali, Agha Iqbal, Catherine Sylvie Lerme	Comparative advantage and disadvantage in DEA	1997	Annals of Operations Research	vol. 73, pp. 215-232	The University of Massachusetts at Amherst	US
Allen, Rachel, Antreas D. Athanassopoulos, Robert G. Dyson, Emmanuel Thanassoulis	Weights restrictions and value judgements in data envelopment analysis: Evolution, development and future directions	1997	Annals of Operations Research	vol. 73, pp. 13-34.	Warwick University	UK
Sengupta, J.K.	A fuzzy-systems approach in data envelopment analysis.	1992	Comput. math. appl.	24 8/9 Aug/Sep pp. 259-266.	University of California	US
Sengupta, Jati K.	Robust decisions in economic models	1991	Comput. oper. Res	Vol. 18 #2, pp. 221 - 232	University of California	US
Kuo-Ping, C.; Yeah-Yuh, G.	Piecewise loglinear frontier and log efficiency measures	1995	Comput. oper. Res	Vol: 22, Issue: 10, pp. 1031-1037	National Tsing Hua University	ROC
Olesen, O.B.; Petersen, N.C	A presentation of GAMS for DEA	1996	Comput. oper. Res	Vol. 23 Issue 4, p323 ,17p	Odense Universitet	Denmark
Retzlaff-Roberts, Donna L.	Relating discriminant analysis and data envelopment analysis to one another	1996	Comput. oper. Res	Vol: 23, Issue: 4, pp. 311-322	The University of Memphis	US
Thore, Sten; Phillips, Fred, Ruefli, T.W. and Yue, P.	DEA and the management of the product cycle: The U.S. computer industry.	1996	Comput. oper. Res	23 4 Apr pp. 341-356.	University of Texas at Austin	US
Friedman, L.; Sinuany-Stern, Z.	Combining ranking scales and selecting variables in the DEA context: the case of industrial branches	1998	Comput. oper. Res	Vol: 25, Issue: 9, pp. 781-791	Ben-Gurion University, Israel	Israel
Seiford, L.M.; Zhu, J	An acceptance system decision rule with data envelopment analysis	1998	Comput. oper. Res	Vol: 25, Issue: 4, pp. 329-332	University of Massachusetts; Southeast University, Nanjing PROC	US
Seiford, Lawrence M.; Zhu, Joe	On piecewise loglinear frontiers and log efficiency measures	1998	Comput. oper. Res	Vol: 25, Issue: 5, pp. 389-395	University of Massachusetts at Amherst	US
Boussofiane, A., Dyson, R.G. and Thanassoulis, E.	Applied data envelopment analysis.	1991	EJOR	52 1 May pp. 1-15.	Warwick University	UK
Chang, Kuo-Ping and Guh, Yeah-Yuh	Linear production functions and the Data Envelopment Analysis.	1991	EJOR	52 2 May pp. 215-223.	National Tsing Hua University	ROC
Cook, Wade D. and Kress, Moshe.	A multiple criteria decision model with ordinal preference data.	1991	EJOR	54 2 Sep pp. 191-198.	York University	Canada
Cook, Wade D. , Kress, Moshe and Seiford, Lawrence M.	Prioritization models for frontier decision making units in DEA.	1992	EJOR	59 2 Jun pp. 319-323	York University	Canada

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Kao, Chiang	Efficiency improvement in data envelopment analysis.	1994	EJOR	73 3 Mar pp. 487-494.	National Cheng Kung University	ROC
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Athanassopoulos, A.D.	Goal programming & data envelopment analysis (GoDEA) for target-based multi-level planning: Allocating central grants to the Greek local authorities	1995	EJOR	Vol: 87, Issue: 3, pp. 535-550	University of Warwick	UK
Chilingerian, J.A.	Evaluating physician efficiency in hospitals: A multivariate analysis of best practices	1995	EJOR	Vol: 80, Issue: 3, pp. 548-574	Brandeis University	US
Day, D.L.; Lewin, A.Y.; Li, H.	Strategic leaders or strategic groups: A longitudinal Data Envelopment Analysis of the U.S. brewing industry	1995	EJOR	Vol: 80, Issue: 3, pp. 619-638	Rutgers University	US
Dusansky, R.; Wilson, P.W.	On the relative efficiency of alternative modes of producing a public sector output: The case of the developmentally disabled	1995	EJOR	Vol: 80, Issue: 3, pp. 608-618	University of Texas at Austin	US
El-Mahgary, S.; Lahdelma, R.	Data envelopment analysis: Visualizing the results	1995	EJOR	Vol: 83, Issue: 3, pp. 700-710	Helsinki University of Technology, Finland	Finland
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Wei, Q.L.; Sun, B.; Xiao, Z.J.	Measuring technical progress with data envelopment analysis	1995	EJOR	Vol: 80, Issue: 3, pp. 691-702	The People's University of China, Beijing	PROC
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Mickael Lothgren, and Magnus Tambour	Productivity and customer satisfaction in Swedish pharmacies: A DEA network model	1999	EJOR	Vol. 115, pp. 449 - 458	Stockholm School of Economics	UK
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