



ISSN 2161-6248

From Knowledge to Wisdom

# US-China US-China Education Review

# B

Volume 4, Number 3, March 2014

Education Theory

David Publishing Company  
[www.davidpublishing.com](http://www.davidpublishing.com)

# **US-China Education Review B**

Volume 4, Number 3, March 2014 (Serial Number 34)



David Publishing Company  
[www.davidpublishing.com](http://www.davidpublishing.com)

**Publication Information:**

*US-China Education Review B* (Earlier title: Journal of US-China Education Review, ISSN 1548-6613) is published monthly in hard copy (ISSN 2161-6248) by David Publishing Company located at 240 Nagle Avenue #15C, New York, NY 10034, USA.

**Aims and Scope:**

*US-China Education Review B*, a monthly professional academic journal, covers all sorts of education-theory researches on Higher Education, Higher Educational Management, Educational Psychology, Teacher Education, Curriculum and Teaching, Educational Technology, Educational Economics and Management, Educational Theory and Principle, Educational Policy and Administration, Sociology of Education, Educational Methodology, Comparative Education, Vocational and Technical Education, Special Education, Educational Philosophy, Elementary Education, Science Education, Lifelong Learning, Adult Education, Distance Education, Preschool Education, Primary Education, Secondary Education, Art Education, Rural Education, Environmental Education, Health Education, History of Education, Education and Culture, Education Law, Educational Evaluation and Assessment, Physical Education, Educational Consulting, Educational Training, Moral Education, Family Education, as well as other issues.

**Editorial Board Members:**

Asst. Prof. Dr. Güner Tural	Associate Prof. Rosalinda Hernandez	Prof. Aaron W. Hughey
Prof. Alexandro Escudero	Prof. Cameron Scott White	Prof. Deonarain Brijlall
Prof. Diane Schwartz	Prof. Ghazi M. Ghaith	Prof. Gil-Garcia, Ana
Prof. Gordana Jovanovic Dolecek	Prof. Grigorios Karafillis	Prof. James L. Morrison
Prof. Käthe Schneider	Prof. Lihshing Leigh Wang	Prof. Mercedes Ruiz Lozano
Prof. Michael Eskay	Prof. Okechukwu Sunday Abonyi	Prof. Peter Hills
Prof. Smirnov Eugeny	Prof. Yea-Ling Tsao	

Manuscripts and correspondence are invited for publication. You can submit your papers via Web submission, or E-mail to teacher@davidpublishing.com or teacher@davidpublishing.org. Submission guidelines and Web submission system are available at <http://www.davidpublishing.com>.

**Editorial Office:**

240 Nagle Avenue #15C, New York, NY 10034, USA  
Tel: 1-323-984-7526, 323-410-1082  
Fax: 1-323-984-7374, 323-908-0457  
E-mail: teacher@davidpublishing.com, teacher@davidpublishing.org, edu1658@yahoo.com

Copyright©2014 by David Publishing Company and individual contributors. All rights reserved. David Publishing Company holds the exclusive copyright of all the contents of this journal. In accordance with the international convention, no part of this journal may be reproduced or transmitted by any media or publishing organs (including various Websites) without the written permission of the copyright holder. Otherwise, any conduct would be considered as the violation of the copyright. The contents of this journal are available for any citation. However, all the citations should be clearly indicated with the title of this journal, serial number and the name of the author.

**Abstracted/Indexed in:**

Database of EBSCO, Massachusetts, USA  
Chinese Database of CEPS, Airiti Inc. & OCLC  
Chinese Scientific Journals Database, VIP Corporation, Chongqing, P.R.C.  
Ulrich's Periodicals Directory  
ASSIA Database and LLBA Database of ProQuest

Excellent papers in ERIC  
Norwegian Social Science Data Service (NSD), Norway  
Universe Digital Library Sdn Bhd (UDLSB), Malaysia  
Summon Serials Solutions  
Google Scholar  
J-GATE

**Subscription Information:**

Price (per year):  
Print \$600 Online \$480  
Print and Online \$800

David Publishing Company  
240 Nagle Avenue #15C, New York, NY 10034, USA  
Tel: 1-323-984-7526, 323-410-1082  
Fax: 1-323-984-7374, 323-908-0457  
E-mail: order@davidpublishing.org



David Publishing Company  
[www.davidpublishing.com](http://www.davidpublishing.com)

# US-China Education Review B

Volume 4, Number 3, March 2014 (Serial Number 34)

## Contents

### Educational Research

- Prospective Foreign Language Teachers in Greece as Dictionary Users: An Empirical Survey** 151

*Konstantinos D. Chatzidimou*

- Becoming a “Full” Woman: Emirati Women’s Experience of Postgraduate Studies** 164

*Muriel Wells, Eileen Honan*

### Educational Policy and Management

- Indicator and Institution Selection for a HELENA European University Efficiency Analysis** 175

*Matthias Klumpp*

- Differentiated Supervision Model: A Way of Improving School Leadership in Saudi Arabia** 186

*Rashid Alabdulkareem*

- Reading Deficiencies Among Primary and Secondary School Pupils: A Case of Zimbabwe** 193

*Stella Muchemwa*

### Educational Psychology

- Validity and Reliability of the Academic Resilience Scale in Egyptian Context** 202

*Mustafa Ali Khalaf*

### Language and Education

- Literate Practices, Archiving, and the Concept of Authorship** 211

*Anderson de Carvalho Pereira, Leda Verdiani Tfouni*

### Language and Culture

- An Analysis of the Euphemisms in a Press Conference in the Light of Politeness Principle** 219

*Wang Xiao-yan*

# Indicator and Institution Selection for a HELENA European University Efficiency Analysis\*

Matthias Klumpp

University of Duisburg-Essen; HELENA Research Group, Essen, Germany

This paper presents a comparison of 67 European universities selected from the leading rankings: Academic Ranking of World Universities (ARWU), Leiden, and Times Higher Education (THE) World University Rankings, as well as the European University Data Collection Project (EUMIDA) dataset, in order to obtain as many different reliable data as possible for evaluating universities' performance. This is combined with the budget data of these leading European universities in order to calculate a data envelopment analysis (DEA) regarding the overall efficiency of these institutions. The results help to further the discussion about the role and message of rankings in the light of efficient and effective service provided in higher education systems.

*Keywords:* university efficiency, data envelopment analysis (DEA), indicator selection, European universities

## Introduction

University rankings, for example, the Times Higher Education (THE) World University Rankings, Leiden, or Academic Ranking of World Universities (ARWU), are a major field of discussion in academics and higher education managers alike. Most rankings do not include the efficiency perspective and lack a proper discussion of the selection algorithm (e.g., Why are colleges/universities of applied sciences/Fachhochschulen excluded?) of ranked universities as well as the indicators used in correlation with the prospective type of excellent universities depicted in the ranking. The suggested European University Efficiency Ranking is based on European University Data Collection Project (EUMIDA), THE World University Rankings, ARWU, and budget data. It clearly states the relevance of the used indicators and the threshold of included versus excluded institutions based on the data envelopment analysis (DEA) efficiency calculation method used in the German Higher Education Global Efficiency Analysis (HELENA) federal research project on higher education efficiency.

One of the major faults of the existing ranking systems is their lack of input and efficiency data leading to a “competition for size” instead of a “competition for excellence” by the universities pushing for high ranking position under the notion of world class university's concepts. As Shin and Toutkoushian (2012) put it in one of the latest books on university rankings:

Occasionally, the raters of universities and the consumers of rankings do not pay much attention to the fact that

---

\* **Acknowledgement:** This research was enabled by German federal research funding by the German Federal Ministry of Education and Research (BMBF) under the funding No. 01PW11007 within the research project HELENA.

Matthias Klumpp, Ph.D., senior researcher, Institute for Production and Industrial Information Management, University of Duisburg-Essen; HELENA Research Group.

rankings were initially conceived as a tool for measuring the effectiveness of higher education institutions. It is often assumed that highly-ranked institutions are more productive, have higher quality teaching and research, and contribute more to society than lower-ranked institutions. However, the three main dimensions of institutions—teaching, research, and service, can differ or even conflict with each other, and thus institutions that are performing well in one area may perform poorly along other dimensions. For example, a small institution may be very efficient in educating a given number of students with limited resources, but not very efficient in the production of research. On the other hand, we might find a large institution that is very efficient in knowledge production but not in teaching undergraduate students. (pp. 3-4)

As many rankings focus on output and outcome indicators, such as the number of publications and citations, the number and success of graduates, internationalization, academic awards, or industry income, in many cases, the input (e.g., budget, faculty numbers, etc.) is neglected. Therefore, the described productivity perspective usually gets lost, urging the university leaders to look out for institutional growth by the way of mergers and increasing input.

This gap in institutional research by most of the existing ranking schemes is addressed by the HELENA research project in Germany regarding higher education efficiency research. Within this approach, a new method, the already broadly used DEA (Charnes, Cooper, & Rhodes, 1978) is suggested as it exactly heals the above described deficit: As this method is a non-parametric and relative efficiency measurement calculation, it allows all calculated institutions to have individual focal points of their strategy and productivity and calculates individual weightings of these areas in the most favorable way for each single institution. Therefore, no institution gets punished for concentrating on one or several of the multi-perspective output areas in higher education, whether be it teaching, research, or third mission (service). As several researchers in higher education have been suggesting for calculating efficiencies of universities operations (Cohn, Rhine, & Santos, 1989; Beasley, 1995; Dundar & Lewis, 1995; Glass, McKillop, & O'Rourke, 1998; Ng & Li, 2000; Korhonen, Tainio, & Wallenius, 2001; Kocher, Luptacik, & Sutter, 2006; Kao & Hung, 2008; Sarrico, 2010; Worthington & Higgs, 2011; Zangouinezhad & Moshabaki, 2011), this contribution is combining several output indicators from different datasets (EUMIDA, THE World University Rankings, Leiden, and ARWU) as well as input budget data from about 67 leading European universities in order to show the ranking effects of such an efficiency calculation using DEA.

### **European Universities' Performance and Budget Data**

The proposed institutional efficiency analysis is being conducted by utilizing a method from the DEA-family to calculate the relative efficiency of higher education institutions (Cooper, Seiford, & Tone, 2000; Sarrico & Dyson, 2004; Taylor & Harris, 2004). A major focus of DEA evaluations is the question of viable objectives and performance data, especially if universities from different countries are involved (Ramsden, 1994; Stahl, Leap, & Wei, 1998; Worthington & Lee, 2008; Sarrico, Teixeira, Rosa, & Cardoso, 2009). In this case, the following performance indicators have been selected in order to allow for a broad and comprehensive evaluation band for all universities included into the efficiency measurement:

1. The THE World University Rankings total score (O1);
2. The Shanghai Ranking ARWU total score (O2)—in the cases of ranking places 101-150 and 151-200 replaced with assumed scores of 20 and 10;
3. The Leiden Ranking total publication number score (Thomson Reuters) (O3);
4. The number of Doctor of Philosophy (Ph.D.) graduates and Bachelor of Arts (B.A.) students from the

EUMIDA dataset (O4 and O5);

5. The university budget (2011).

Table 1 represents the complete dataset used for the DEA efficiency analysis. Interestingly, the THE World University Rankings and the Leiden Ranking provide the most comprehensive listing of European universities among the top 200 (with THE a slight “focus” on the UK institutions), or in other words, in the ARWU, there are the least European universities represented.

Table 1

*Dataset for 67 Universities Plus Five Residuals*

Unit name	O1 THE score	O2 ARWU score	O3 Leiden score	O4 Ph.D. graduates	O5 B.A. students	Budget 2011 (€)
U Oxford, UK	93.7	55.9	12,208	850	19,583	1,093,538,183
U Cambridge, UK	92.6	69.6	11,742	950	17,837	942,019,645
Imperial C, London, UK	90.6	41.6	10,098	725	11,027	837,396,247
ETH Zürich, CH	87.8	43.5	7,257	581	10,364	1,189,794,717
University C, London, UK	85.5	43.0	11,208	610	17,181	953,219,017
U Edinburgh, UK	76.1	30.5	6,320	520	20,823	773,930,364
ETH Lausanne, CH	73.0	<b>20.0</b>	4,139	266	4,749	646,111,066
Karolinska Inst., SE	72.4	32.7	6,920	352	6,416	604,377,426
LMU München, DE	70.4	29.5	6,896	1,270	39,297	488,600,000
U Manchester, UK	70.1	0.0	8,531	830	33,640	962,018,693
King's C, London, UK	66.2	28.8	5,964	305	19,215	623,243,038
KU Leuven, BE	66.1	20.0	8,909	529	26,226	720,631,780
U Leiden, NL	65.1	27.8	5,524	302	17,736	514,700,000
U Utrecht, NL	64.1	30.4	8,179	438	29,276	767,354,000
U Göttingen, DE	63.2	<b>20.0</b>	4,131	758	20,529	412,101,313
U Wageningen, NL	63.2	<b>20.0</b>	3,951	210	5,161	710,000,000
EU Rotterdam, NL	62.9	<b>10.0</b>	6,036	265	19,584	542,000,000
U Bristol, UK	62.5	29.2	5,502	355	15,807	486,122,672
TU Delft, NL	61.6	0.0	3,957	236	15,461	520,600,000
U Heidelberg, DE	61.4	30.2	6,359	1,039	22,922	316,700,000
U Durham, UK	60.7	0.0	2,533	200	14,928	295,978,310
U Lund, SE	60.3	<b>20.0</b>	6,507	425	29,090	700,000,000
U Amsterdam, NL	60.1	<b>20.0</b>	7,128	353	28,325	600,000,000
U Groningen, NL	58.8	24.9	6,268	306	24,814	576,000,000
U Zürich, CH	58.8	29.7	6,345	670	20,330	1,008,015,049
U Ghent, BE	58.4	25.5	7,630	389	24,806	410,000,000
HU Berlin, DE	57.5	0.0	4,955	455	24,925	339,400,000
U York, UK	57.1	0.0	2,488	250	12,070	303,579,328
TU München, DE	56.8	30.6	5,408	708	22,612	1,095,000,000
U Uppsala, SE	56.6	28.0	5,545	364	23,311	596,410,285
U St Andrews, UK	56.5	0.0	1,999	145	7,421	199,550,503
U Helsinki, FI	56.4	27.2	6,428	466	30,092	643,056,100
Trinity C, Dublin, IR	56.2	0.0	2,619	269	13,581	265,745,000
U Sussex, UK	56.2	<b>20.0</b>	1,712	175	11,476	197,160,321
U Sheffield, UK	56.2	<b>20.0</b>	5,002	430	22,453	511,332,556
TU Eindhoven, NL	55.6	0.0	2,943	191	7,066	312,600,000
U Maastricht, NL	55.5	0.0	3,730	185	12,990	343,421,000

(Table 1 to be continued)

U Nottingham, UK	54.8	25.6	5,905	540	29,185	607,653,340
U Warwick, UK	54.4	0.0	3,153	275	26,995	498,251,956
RU Nijmegen, NL	54.0	<b>20.0</b>	5,727	260	17,706	500,250,000
FU Berlin, DE	53.7	0.0	5,177	574	28,010	392,500,000
U Lausanne, CH	53.6	0.0	2,955	186	9,494	333,360,595
U Southampton, UK	53.6	0.0	4,977	480	21,851	519,585,226
U Geneva, CH	53.5	28.7	4,118	272	10,256	604,511,700
U Glasgow, UK	53.0	<b>10.0</b>	4,243	340	22,138	535,347,349
VU Amsterdam, NL	52.9	<b>20.0</b>	5,825	264	21,045	459,700,000
KTH Royal Inst. of Techn., SE	52.9	0.0	3,320	235	14,120	443,481,686
U Basel, CH	52.8	25.6	3,464	365	9,150	366,100,074
U Leeds, UK	52.8	<b>10.0</b>	5,377	460	30,185	575,339,501
U Freiburg, DE	52.3	24.3	4,123	716	18,640	280,900,000
Queen Mary, U London, UK	52.1	0.0	2,099	195	12,571	356,743,644
U Lancaster, UK	52.1	0.0	1,586	215	12,320	214,902,371
KIT Karlsruhe, DE	51.5	0.0	3,941	351	17,737	397,000,000
U Bern, CH	51.5	<b>10.0</b>	4,086	496	11,152	603,582,236
U Exeter, UK	51.3	0.0	1,941	175	13,356	292,767,617
RWTH Aachen, DE	51.1	0.0	4,070	725	27,337	605,130,013
U Vienna, AU	50.2	<b>10.0</b>	3,128	594	61,788	509,700,000
U Liverpool, UK	49.0	<b>20.0</b>	4,028	260	17,946	475,658,192
U Bonn, DE	49.0	<b>20.0</b>	4,152	651	23,273	534,400,000
U Reading, UK	48.8	0.0	1,871	190	13,613	258,880,538
U East Anglia, UK	48.8	0.0	1,834	205	14,783	229,546,698
U Aberdeen, UK	48.8	0.0	2,637	135	13,193	261,612,006
U Newcastle, UK	48.6	0.0	3,595	300	17,228	454,491,402
U Twente, NL	47.9	0.0	2,409	160	8,135	279,400,000
U Col, Dublin, IR	47.9	0.0	3,728	255	19,236	442,000,000
U Leicester, UK	46.7	0.0	2,639	220	14,040	416,200,918
U Frankfurt, DE	46.4	<b>20.0</b>	3,869	589	30,511	489,500,000
U Catholique de Louvain, BE	50.0	<b>20.0</b>	2,779	-	-	370,000,000
TU Denmark, DK	51.7	<b>10.0</b>	3,876	-	-	558,000,000
U Copenhagen, DK	53.6	33.8	9,241	-	-	1,047,874,149
U Aarhus, DK	55.3	26.0	6,167	-	-	789,599,000
U Paris-Sud, FR	58.6	34.5	4,940	-	-	450,000,000

Note. Bold italic: assumed scores.

## Results

The efficiency results with the DEA methodology were calculated with the Charnes, Cooper, and Rhodes (CCR) input-oriented model (assuming constant returns to scale). Table 2 outlines the results here. The efficiency leaders include (if all outputs are taken into account) the UK universities, such as St. Andrews, Sussex, as well as Heidelberg and Vienna. The lowest efficiency score is realized by the universities of Zurich, the TU Munich, and Wageningen. The further discussion section and detailed figures regarding the different combinations of the included five output measures are shown in order to analyze the DEA results further. This may lead to further organization and management insights for higher education management concepts.



Table 2

*Efficiency Results*

Unit name	Score
U St Andrews, UK	100.00%
U Sussex, UK	100.00%
U Heidelberg, DE	100.00%
U Vienna, AU	100.00%
LMU München, DE	94.80%
U Ghent, BE	92.70%
U Freiburg, DE	92.10%
HU Berlin, DE	91.30%
U Lancaster, UK	90.90%
U East Anglia, UK	88.90%
FU Berlin, DE	82.40%
Trinity C, Dublin, IR	81.90%
U Durham, UK	79.20%
U Aberdeen, UK	76.70%
U Reading, UK	76.10%
U Cambridge, UK	75.90%
U Göttingen, DE	71.20%
U York, UK	71.10%
U Basel, CH	70.70%
TU Eindhoven, NL	70.30%
U Maastricht, NL	69.30%
U Exeter, UK	68.60%
U Twente, NL	66.60%
U Frankfurt, DE	66.20%
U Lausanne, CH	64.40%
VU Amsterdam, NL	63.20%
U Bristol, UK	62.30%
U Amsterdam, NL	62.20%
KIT Karlsruhe, DE	61.70%
KU Leuven, BE	61.60%
U Warwick, UK	60.60%
Imperial C, London, UK	60.10%
U Leiden, NL	59.80%
U Leeds, UK	59.70%
Karolinska Inst., SE	59.60%
University C, London, UK	58.60%
EU Rotterdam, NL	57.80%
U Nottingham, UK	57.50%
U Helsinki, FI	57.30%
U Sheffield, UK	57.20%
RU Nijmegen, NL	57.00%
U Groningen, NL	56.90%
Queen Mary, U London, UK	55.80%
U Oxford, UK	55.60%
U Col, Dublin, IR	55.50%
U Southampton, UK	54.50%

(Table 2 to be continued)

U Utrecht, NL	53.10%
U Lund, SE	51.90%
U Glasgow, UK	51.90%
U Uppsala, SE	51.80%
U Bonn, DE	51.70%
King's C, London, UK	51.50%
U Newcastle, UK	51.30%
U Liverpool, UK	50.90%
RWTH Aachen, DE	50.80%
KTH Royal Inst. of Techn., SE	50.40%
TU Delft, NL	50.10%
U Leicester, UK	48.50%
U Geneva, CH	48.20%
U Manchester, UK	46.30%
U Edinburgh, UK	46.00%
ETH Lausanne, CH	46.00%
U Bern, CH	39.10%
ETH Zürich, CH	37.50%
U Wageningen, NL	37.50%
U Zürich, CH	31.30%
TU München, DE	29.10%

### DEA Results in Details

Figures 1-5 outline the detailed dual combinations of two output or performance measures in order to compare them graphically as follows:

1. The first combination of the outputs of THE scores and ARWU scores (per input budget) analyzes the University of Sussex (UK) to be the most efficient one in this regard, followed by the German universities of Heidelberg and Freiburg. For all the three cases, it can be stated that the institutions are mid-sized (see Figure 1);

2. Figure 2 depicts the output combination of ARWU and Leiden Ranking scores. In this comparison, Sussex, St. Andrews, and Heidelberg universities are the most efficient in a DEA model as described—with St. Andrews being a very small but prestigious university;

3. Figure 3 uses the outputs of THE ranking scores and Ph.D. graduates (according to the EUMIDA dataset) with the most efficient universities in Heidelberg and Sussex again, followed by St. Andrews and Freiburg. In Figure 3, it is obvious that there is a distinctive German-UK profile characteristics as most UK universities are very productive regarding the output measure THE ranking scores (lower half of the grouped institutions), whereas the German universities are populating the upper half of the figure, representing a relatively productive characteristic in terms of Ph.D. graduates;

4. Figure 4 featuring the frontier comparison of university efficiency according to DEA describes the combined outputs of B.A. graduates (EUMIDA) and THE ranking scores, with the universities of Vienna (B.A. graduates) and Sussex (THE ranking scores) being the most efficient;

5. Figure 5 outlines the output combination of Leiden Ranking scores with Ph.D. graduates—therein, the University of Heidelberg is the efficiency leader, followed by Ghent, Freiburg, and Munich.

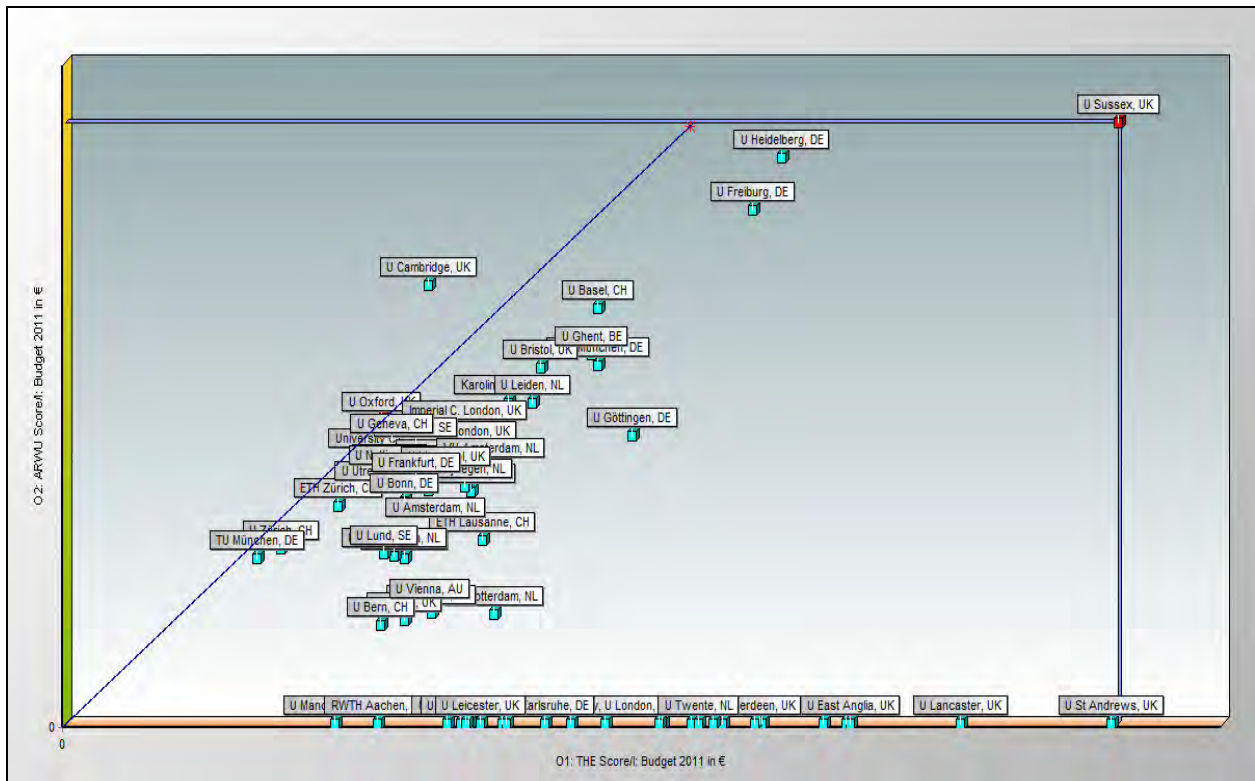


Figure 1. Frontier plot for university efficiency—Outputs of THE (X) and ARWU scores (Y).

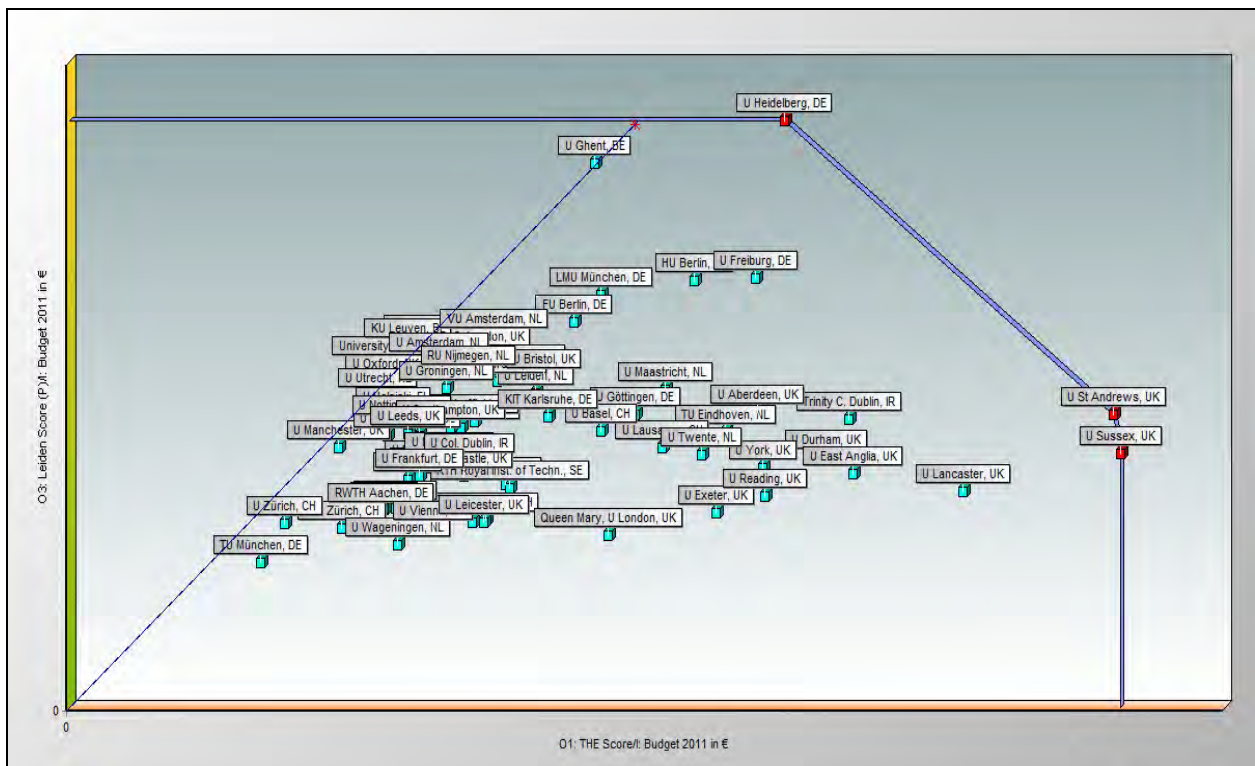


Figure 2. Frontier plot for university efficiency—Outputs of THE (X) and Leiden scores (Y).

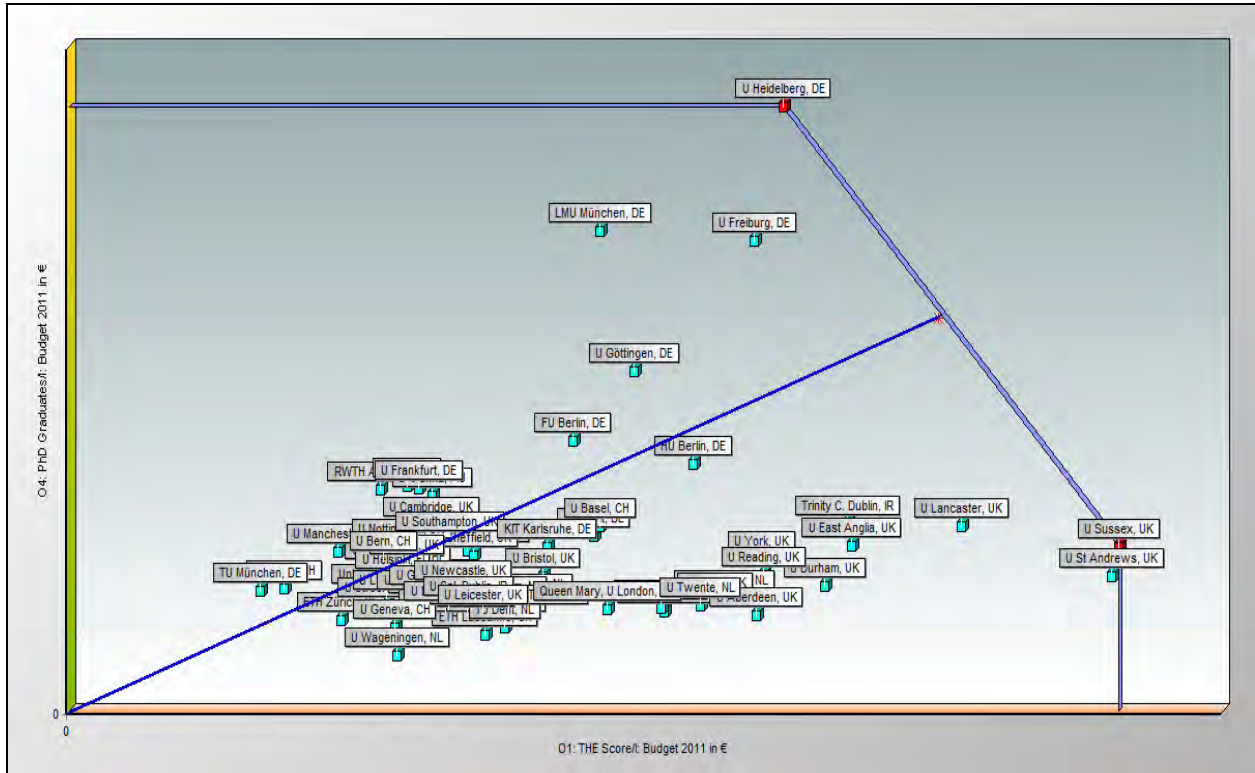


Figure 3. Frontier plot for university efficiency—Outputs of THE (X) and Ph.D. graduates EUMIDA (Y).

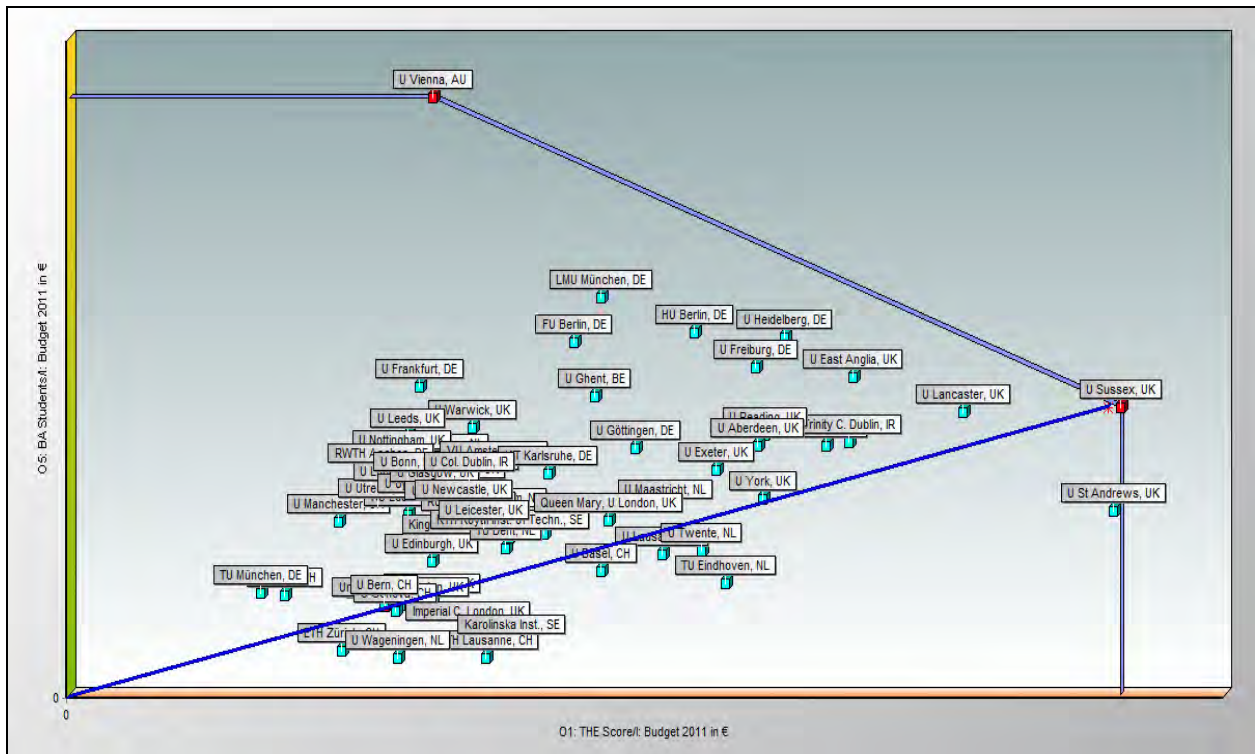


Figure 4. Frontier plot for university efficiency—Outputs of THE (X) and B.A. students EUMIDA (Y).

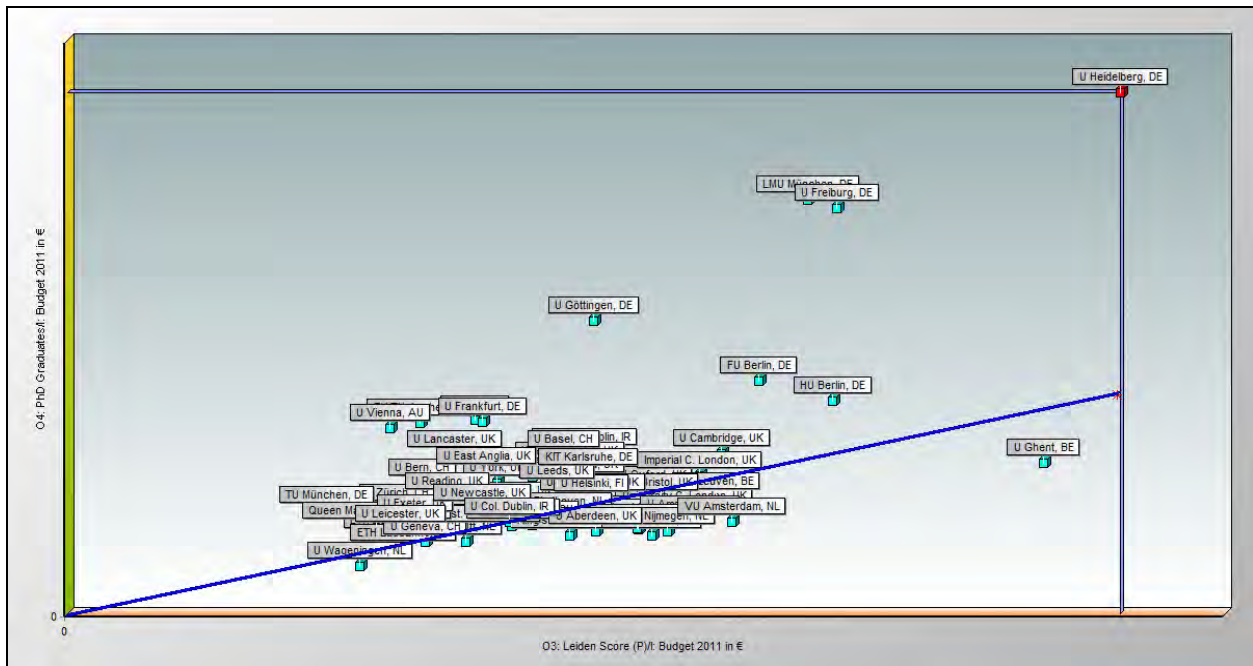


Figure 5. Frontier plot for university efficiency—Outputs of Leiden scores (X) and Ph.D. graduates (Y).

### Conclusions

The different perspectives of different ranking endeavours provide for a much differentiated view towards university efficiency. Interestingly, the budget size-efficiency correlation over all those output perspectives is negative ( $r = -0.65$ ), indicating that smaller universities are more efficient in the light of several different performance disciplines and areas (see Figure 6).

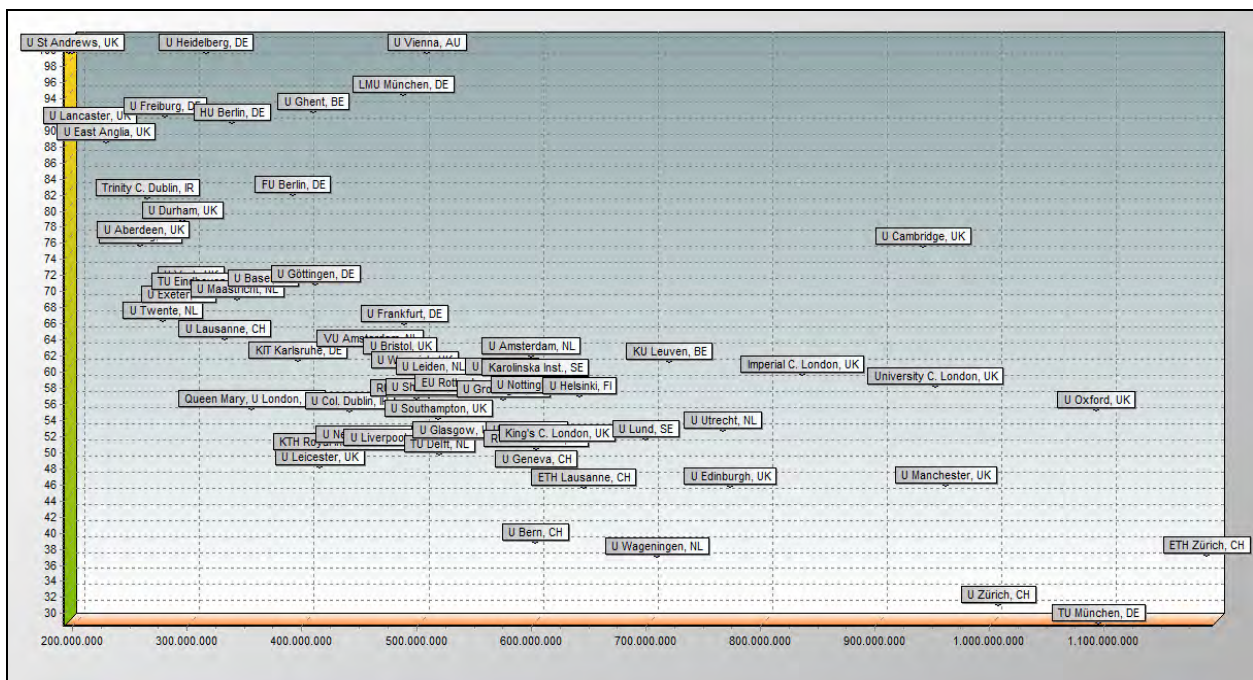


Figure 6. The correlation between budget size (X) and efficiency (Y) ( $N = 67$ ).

On the other hand, different ranking scores also feature a very high correlation regarding the compared university dataset—the highest one for the THE World University Rankings, with the Leiden Ranking ( $r = 0.80$ ) as depicted below (see Figure 7). This indicates that ranking results are largely comparable and stable across different measurements and indicator concepts—though not including the selection bias question, as the institutions compared here are all included in the rankings compared.

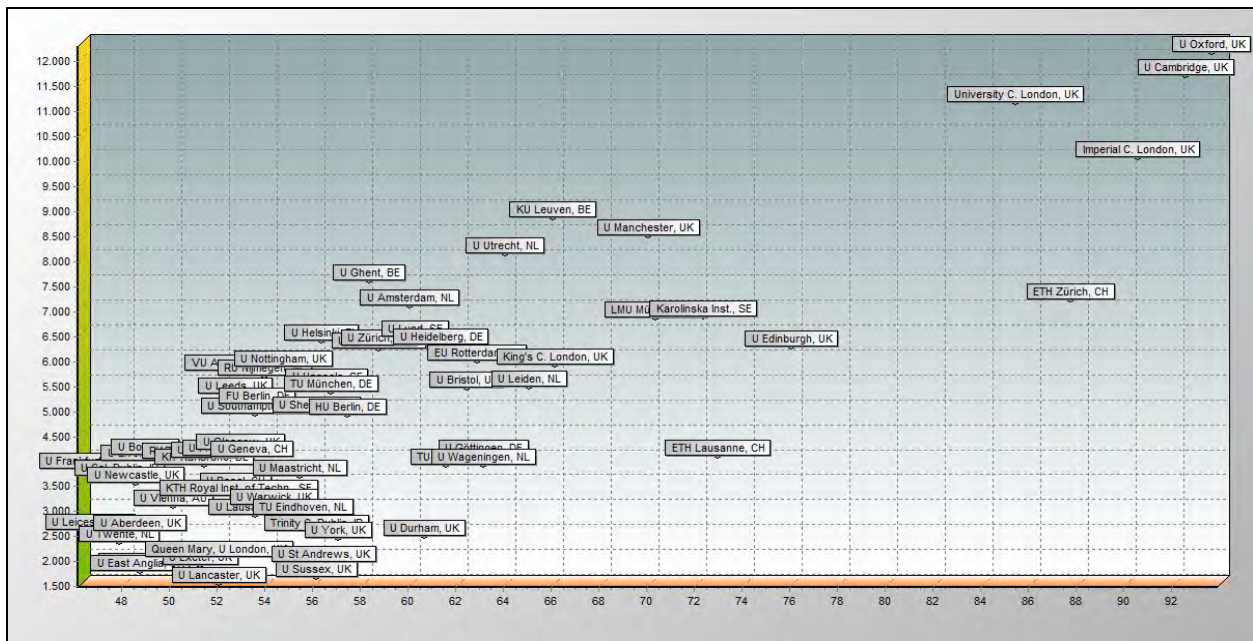


Figure 7. The correlation between Leiden scores (Y) and THE scores (X) ( $N = 67$ ;  $r = 0.80$ ).

## References

- Beasley, J. E. (1995). Determining teaching and research efficiencies. *Journal of the Operational Research Society*, 46, 441-452.
- Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2, 429-444.
- Cohn, E., Rhine, S. L. W., & Santos, M. C. (1989). Institutions of higher education as multi-product firms: Economies of scale and scope. *Review of Economics and Statistics*, 71, 284-290.
- Cooper, W. W., Seiford, L. M., & Tone, K. (2000). *Data envelopment analysis: A comprehensive text with models, applications, references and DEA-solver software*. Boston, MA: Kluwer Academic Publishers.
- Dundar, H., & Lewis, D. R. (1995). Departmental productivity in American universities: Economies of scale and scope. *Economics of Education Review*, 14, 199-244.
- Glass, J. C., Mckillop, D. G., & O'Rourke, G. (1998). A cost indirect evaluation of productivity change in UK universities. *Journal of Productivity Analysis*, 10, 153-175.
- Kao, C., & Hung, H. T. (2008). Efficiency analysis of university departments: An empirical study. *Omega*, 36(4), 653-664.
- Kocher, G. M., Luptacik, M., & Sutter, M. (2006). Measuring productivity of research in economics: A cross-country study using DEA. *Socio-economic Planning Sciences*, 40, 314-332.
- Korhonen, P., Tainio, R., & Wallenius, J. (2001). Value efficiency analysis of academic research. *European Journal of Operational Research*, 130, 121-132.
- Ng, Y. C., & Li, S. K. (2000). Measuring the research performance of Chinese higher education institutions: An application of data envelopment analysis. *Education Economics*, 8, 139-156.
- Ramsden, P. (1994). Describing and explaining research productivity. *Higher Education*, 28(2), 207-226.
- Sarrico, C. S., & Dyson, R. G. (2004). Restricting virtual weights in data envelopment analysis. *European Journal of Operational Research*, 159(1), 17-34.

- Sarrico, C. S. (2010). On performance in higher education—Towards performance government. *Tertiary Education and Management*, 16(2), 145-158.
- Sarrico, C. S., Hogan, S. M., Dyson, R. G., & Athanassopoulos, A. D. (1997). Data envelopment analysis and university selection. *The Journal of the Operational Research Society*, 48(12), 1163-1177.
- Sarrico, C. S., Teixeira, P., Rosa, M. J., & Cardoso, M. F. (2009). Subject mix and productivity in Portuguese universities. *European Journal of Operational Research*, 197(2), 287-295.
- Shin, J. C., & Totkoushian, R. K. (2012). The past, present, and future of university rankings. In J. C. Shin, R. K. Totkoushian, & U. Teichler (Eds.), *University rankings—Theoretical basis, methodology and impact on global higher education* (pp. 1-18). Dordrecht, N.L.: Springer.
- Stahl, M. J., Leap, S. L., & Wei, Z. Z. (1998). Publication in leading management journals as a measure of institutional research productivity. *Academy of Management Journal*, 31(3), 707-720.
- Taylor, B., & Harris, G. (2004). Relative efficiency among South African universities: A data envelopment analysis. *Higher Education*, 47(1), 73-89.
- Worthington, A. C., & Higgs, H. (2011). Economies of scale and scope in Australian higher education. *Higher Education*, 61, 387-414.
- Worthington, A. C., & Lee, B. L. (2008). Efficiency, technology and productivity change in Australian universities, 1998-2003. *Economics of Education Review*, 27, 285-298.
- Zangouinezhad, A., & Moshabaki, A. (2011). Measuring university performance using a knowledge-based balanced scorecard. *Journal of Productivity and Performance Management*, 60(8), 824-843.



US-China Education Review B  
Volume 4, Number 3, March 2014

David Publishing Company  
240 Nagle Avenue #15C, New York, NY 10034, USA  
Tel: 1-323-984-7526, 323-410-1082; Fax: 1-323-984-7374, 323-908-0457  
<http://www.davidpublishing.org>, [www.davidpublishing.com](http://www.davidpublishing.com)  
[teacher@davidpublishing.org](mailto:teacher@davidpublishing.org), [teacher@davidpublishing.com](mailto:teacher@davidpublishing.com)

