New ranking: Same approach, same problems

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The latest rankings of universities, released by the Center for World University Ranking in Saudi Arabia is a new comer to the marketplace, joining the ARWU, QWUR, THEWUR and many others, new and old.

The CWUR also adopts the weight-and-sum approach of most world university ranking systems but with a more sophisticated approach to the indicators presented in econometric formulation. It ranks the top 100 universities in the world.

CWUR 2013 has seven indicators. The first four are research-based and each is given a weight of unity (1) and the remaining three each has a weight of four (4). The reason for the weighting scheme is not explicitly articulated, presumably because the first four indicators are research-based and to equalise the remaining three with them.

Trends of indicator scores

Table 1 shows the means and standard deviations for the indicators. Note that there are obvious differences among the standard deviations and these suggest the indicator scores may *not* follow the nominal weights as assigned by the ranker when these are summed to form the Overall for ranking the universities.

Table 1. Descriptive Statistics

	Nominal weight	Mean	SD
Publication	1	72.83	20.08
Influence	1	65.86	20.66
Citations	1	69.00	20.68
Patents	1	62.84	25.59
Faculty	4	59.99	21.40
Employment	4	50.06	15.58
Education	4	50.62	16.28
Overall	-	55.27	13.52

Inter-indicator correlations

Table 2 shows the correlations among the indicators and with the Overall. All correlations are statistically significant, particularly high for publication, influence, and citations. As these are all research-based, their high correlations suggest giving additional information about research performance is unnecessary. For example, citation depends on publication and influential articles are more likely to be cited; hence, citations would be sufficient as an indicator and the other two may be redundant.

Table 2. Correlations of Indicators (N=100)

	PUB	INF	CIT	PAT	FAC	EMP	EDU	Overll
PUB	1.00							
INF	.81	1.00						
CIT	.89	.87	1.00					
PAT	.50	.41	.50	1.00				
FAC	.33	.53	.42	.28	1.00			

EMP	21	.30	.26	.37	.33	1.00		
EDU	.26	.43	.34	.24	.68	.46	1.00	
Overall	.58	.71	.65	.53	.83	.66	.82	1.00

Note: All coefficients are statistically significant (p<.05, tow-tailed)

Prediction of indicators

Table 3 show both the unstandardised and standardised b-coefficients and the standardised beta coefficients. The two sets of coefficients re not consistent in their ratios of 1:1 and 1:4, depending on the indicators considered together. (This is the same issue found in the three ranking systems listed above.)

When the indictor scores were first standardised to the same standard deviation and then weighted and summed, as shown in Table 4, the two sets of regression coefficients became consistent (allowing for marginal errors). This, again, is the same as found for the other three systems.

Table 3. Multiple Regression for Original Raw Scores

	Nominal weight	b-coefficient	beta-coefficient
Adjusted R^2	-	.993	
Intercept	-	-1.123	-
Publication	1	.086	.128
Influence	1	.043	.065
Citations	1	.055	.084
Patents	1	.056	.106
Faculty	4	.243	.384
Employment	4	.241	.278
Education	4	.264	.318

Note: All coefficients are statistically significant (p<.05).

Table 4. Multiple Regression for T-scores

	Nominal weight	b-coefficient	beta-coefficient
Adjusted R^2	-	1.000	
Intercept	-	.000	.000
Publication	1	.085	.084
Influence	1	.085	.084
Citations	1	.085	.084
Patents	1	.085	.084
Faculty	4	.340	.337
Employment	4	.340	.337
Education	4	.340	.337

Note: All coefficients are statistically significant (p<.05).

Standardisation

The beneficial effect of first standardising the indicator scores before weight-and-sum is evident in Table 5. For example, the first four indicators are equally weighted as ‘1’, but the ratios of their beta coefficients do not maintain those intended by the ranker. Likewise, the other three indicators also do not follow the nominal weights when the raw scores are not standardized before weight-and-sum.

Table 5. Actual and Expected Ratios of Predictor Beta-weights

	PUB	INF	CIT	PAT	FAC	EMP	EDU
PUB	1.0 (1)						

INF	0.5 (1)	1.0 (1)					
CIT	0.7 (1)	1.3 (1)	1.0 (1)				
PAT	0.8 (1)	1.6 (1)	1.3(1)	1.0 (1)			
FAC	3.0 (4)	5.9 (4)	4.6 (4)	3.6 (4)	1.0 (1)		
EMP	2.2 (4)	4.3 (4)	3.3 (4)	2.6 (4)	0.7 (1)	1.0 (1)	
EDU	2.5 (4)	4.9 (4)	3.8 (4)	3.0 *4)	0.8 (1)	1.1 (1)	1.0 (1)

Note: Figures outside parentheses are inter-indicator ratios obtained for original raw scores, and those within parentheses are expected ratios based on nominal scores.

Factor Structure

In view of the high correlations (Table 2), a factor analysis was performed to simplify the ranking scheme for greater parsimony so the same ranking outcome can be interpreted with broader dimension but fewer indicators. Two oblique (correlated) factors were obtained: the first is formed by the four research-based indicators and explained 43% of the Overall result.

The second factor is made up of the remaining three indicators and explained 30% of the Overall variance. The results indicate that the 100 universities could be more simply evaluated on two dimensions: research and instruction, the basic functions of a university.

Table 6. Factor Structure

	Factor 1	Factor 2
Publication	**.949**	.089
Influence	**.859**	.324
Citations	**.941**	.188
Patents	**.584**	.261
Faculty	.293	**.776**
Employment	.142	**.700**
Education	.159	**.879**
Total variance explained	42.79%	29.70%
Correlation	-.442	

KMO statistic=0.786

Comparisons with other systems

How does the CWUR ranking compare with that of the other three systems? When the four lists of top 100 universities are merged, only 34 universities appear in all four. This shows the degree of inconsistency between the systems, partly due to some universities participating in one but not the other ranking exercises, and partly to the varied indicator configurations.

However, for the 34 universities common to all four lists, the correlations of their Overall (and hence ranking) are substantial. This suggests the different ranking systems are to some extent redundant, since they give more or less the same information about these universities.

It is particularly of note that the correlation r=.93 between CWUR 2013 and ARWU is extremely high, most probably due to both emphasising research outputs.

Table 7. Correlations for Overalls of four Ranking Systems (N=34)

	CWUR	ARWU	QSWUR	THEWUR
CWUR	1.00			
ARWU	.93	1.00		

QSWUR	.78	.68	1.00	
THEWUR	.86	.84	.81	1.00

Note: All coefficients are statistically significant (p<.05, two-tailed)

Table 8 list the top 10 universities in the original CWUR 2013 ranking and their rankings for ARWU, QSWUR, and THEWUR for 2012. With some exceptional cases such as Oxford, Stanford, California-Berkeley, and Columbia, the rankings are reasonably consistent across the four systems for these top universities.

Table 8. Top Ten Universities in CWUR 2013 and Three Other Rankings

	CWUR	**ARWU**	**QSWUR**	**THEWUR**
Harvard University	1	1	3	4
Stanford University	2	2	12	2.5
University of Oxford	3	10	4	2.5
Massachusetts Institute of Technology	4	3	1	5
University of Cambridge	5	5	2	7
Columbia University	6	8	9	11
University of California, Berkeley	7	4	16	8
Princeton University	8	7	7	6
University of Chicago	9	9	6	9
Yale University	10	11	5	10

Re-ranking of the universities

While the original ranking based on unstandardised indicators shows inconsistencies between nominal and attained weights (Tables 3, 4, and 5), the problem is solved by scaling the scores to the same mean and standard deviation prior to weighing and summing. The standardised scores are therefore, by definition, accurate in reflecting the ranker-assigned or nominal weights (while the rationale for the differentiate weights awaits explanation).

The 100 universities were then compared on the original and the new ranking based on the scaled scores. As shown in Table 9, although the mean change is a negligible 0.01, the standard deviation of 8.45 indicates marked variation in the differences between the two rankings for the individual universities and hence cannot be dismissed as unimportant in view of the premium place on ranking by them.

Table 9. Original and New Rankings

Institution	Original Rank	New Rank	Gain
Harvard University	1	1	0
Stanford University	2	2	0
University of Oxford	3	3	0
Massachusetts Institute of Technology	4	4	0
University of Cambridge	5	5	0
Columbia University	6	6	0
University of California Berkeley	7	7	0
Princeton University	8	8	0
University of Chicago	9	9	0
Yale University	10	12	-2
California Institute of Technology	11	10	1
University of Pennsylvania	12	11	1
Cornell University	13	14	-1
University of Tokyo	14	13	1
Kyoto University	15	15	0
University of California Los Angeles	16	16	0
Johns Hopkins University	17	17	0
Swiss Federal Institute of Technology Zurich	18	18	0
New York University	19	19	0
University of California San Diego	20	20	0

Hebrew University of Jerusalem	21	21	0
University of California San Francisco	22	22	0
University of Wisconsin Madison	23	23	0
University of Illinois Urbana Champaign	24	24	0
Duke University	25	25	0
University of Texas Austin	26	28	-2
Imperial College London	27	30	-3
Northwestern University	28	26	2
University of Toronto	29	29	0
University College London	30	31	-1
University of Washington Seattle	31	32	-1
University of Michigan	32	27	**5**
Weizmann Institute of Science	33	34	-1
University of North Carolina Chapel Hill	34	38	-4
Osaka University	35	41	**-6**
University of Paris Sud Paris Xi	36	40	-4
University of California Santa Barbara	37	43	**-6**
Purdue University	38	45	**-7**
University of Southern California	39	44	**-5**
Seoul National University	40	33	**7**
University of Colorado Boulder	41	50	**-9**
University of Utah	42	53	**-11**
Rutgers State University	43	51	**-8**
University of Minnesota Twin Cities	44	42	2
University of Edinburgh	45	49	-4
University of Texas Southwestern Medical Center Dallas	46	46	0
McGill University	47	47	0
Pierre Marie Curie University	48	48	0
Rockefeller University	49	39	**10**
Penn State University	50	52	-2
Carnegie Mellon University	51	54	-3
Ohio State University	52	56	-4
University of California Davis	53	55	-2
Boston University	54	60	**-6**
University of Florida	55	57	-2
University of Geneva	56	58	-2
Tel Aviv University	57	68	**-11**
University of British Columbia	58	61	-3
University of Maryland College Park	59	65	**-6**
Karolinska Institute	60	64	-4
Vanderbilt University	61	70	**-9**
Sapienza University Rome	62	69	**-7**
Washington University	63	59	4
Ecole Normale Superieure Ens Paris	64	37	**27**
University of California Irvine	65	67	-2
Technion Israel Institute of Technology	66	73	**-7**
University of Munich	67	74	**-7**
University of Copenhagen	68	71	-3
University of Pittsburgh	69	63	**6**
Keio University	70	35	**35**
University of Virginia	71	66	**5**
University of Manchester	72	76	-4
Arizona State University	73	84	**-11**
University of Zurich	74	78	-4
Kings College London	75	75	0
University of Rochester	76	80	-4
Brown University	77	82	**-5**
University of Arizona	78	77	1
Ruprecht Karl University Heidelberg	79	83	-4
Texas A M University College Station	80	85	**-5**
University of Oslo	81	87	**-6**
Dartmouth College	82	62	**20**
Swiss Federal Institute of Technology Lausanne	83	91	**-8**
University of Utrecht	84	79	**5**
Indiana University	85	81	4
Ecole Polytechnique	86	36	**50**
National University of Singapore	87	86	1
Utmd Anderson Cancer Center	88	88	0
State University of New York Suny Stony Brook	89	99	**-10**
Lomonosov Moscow State University	90	72	**18**
Nagoya University	91	100	**-9**

University Of Sydney	92	94	-2
Emory University	93	90	3
Rice University	94	98	-4
Tohoku University	95	89	**6**
Australian National University	96	96	0
University of Alberta	97	97	0
University of Helsinki	98	93	**5**
University of Paris Diderot Paris Vii	99	95	4
Georgia Institute of Technology	100	93	**7**

Notes: (1) Correlation between original and new rankings is r=.96. (2) Gain mean=-0.01 with SD=8.45.

The effect of standardising the indicator scores is summarised in Table 10. The six universities which gain positions when the new rankings are used are Ecole Polytechnique (50), Keio University (35), Ecole Normale Superieure Ens Paris (27), Dartmouth College (20), Lomonosov Moscow State University (18), and Rockefeller University (10). Note that the change (gain) is as much as 50 positions!

At the other end, four universities lost 10 or more positions: State University of New York Sunny Stony Brook (10), University of Utah (11), Tel Aviv University (11), and Arizona State University (11).

The issue here is not which universities gained or lost but how accurate is the presentation of their academic excellence as ranked by the CWUR 2013 data.

Table 10. Summary of Changes in Rankings

Change ranking (Gain)	No. of universities
Gain 10 or more	6
Gain 5 to 9	8
Gain 1 to 4	11
No change	28
Lost 1 to 4	26
Lost 5 to 9	17
Lost 10 or more	4

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