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Efficiency in Education Workshop
Politecnico di Milano
October 20th and 21st 2016

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PERFORMANCE INDICATORS AND RANKINGS IN HIGHER EDUCATION

Jill Johnes
University of Huddersfield

Outline of talk

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- Introduction
- Composite indicators (CIs) and university rankings
- Producing a performance indicator (PI)
- Comparing CIs and PIs
- From point estimates to groupings
- Conclusions

Introduction

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Why do we need performance indicators (PIs)?

- Principal-agent problem:
  the objectives of the principal and the agent may not be aligned
- In a publicly-funded HE sector, the government (principal) can only imperfectly observe the actions of those running the HEIs (agents)
- Link funding to performance?
- Customers (prospective students) want to know about performance in order to make informed decisions about university choice

Introduction

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Awarding funding based on performance

- UK – Research Assessment Exercises, Research Excellence Framework
- Australia – performance-based schemes for allocating funding for research and research training
- Other countries have also used performance-based research funding systems eg: Spain, Hong Kong, Poland, Portugal, Italy, New Zealand, Norway, Sweden, Denmark, Finland (Hicks, 2012)

Introduction

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From PIs to university rankings and league tables

- PIs are quantitative data on the performance of HEIs typically used by policy-makers for resource allocation.
- Rankings are lists of HEIs ranked according to a set of quantitative data (much like the PIs) combined into a composite index (CI) and presented in the format of a league table.
- Rankings draw attention to relative performance between HEIs
- Rankings are often aimed at the general public but are increasingly used by managers and policy-makers

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- ‘In league tables and ranking systems, ranks are often presented as if they had been calculated under conditions of certainty. Media and stakeholders take these measures at face value, as if they were unequivocal, all-purpose yardsticks of quality. To the consumers of composite indiators, the numbers seem crisp and convincing’ (Saisana *et al* 2011)

Some questions:

- Can a composite index of performance adequately reflect university performance for the stakeholders?
- Can we find an alternative methodology?

Composite indicators (CIs) and university rankings

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- We identify various indicators of interest and combine them into a CI for eg funding or student choice

Points to address

- Level of analysis: what are the entities being measured?
- Dimensions: what are the dimensions along which performance should be measured?
- In producing a CI what weights should be used?

Composite indicators (CIs) and university rankings

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Historical development of rankings

- Unregulated and highly-competitive higher education market in USA has led to it pioneering the production of rankings (Dill, 2009).
- Bibliographical dictionary of American academics (Cattell 1910). Used to rank US universities and departments.
- Graduate programs in the USA based on a survey of faculty (Hughes 1925). Also used to rank universities.
- The first media rankings of universities and colleges (at the institution level) are attributed to *US News and World Report* in 1983 (Dill, 2009).

Composite indicators (CIs) and university rankings

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What dimensions are used?

- Research – Assessment exercises, Publications, Citations
- Teaching
  - Good honours degrees
  - non-continuation rates
  - module completion rates
  - employment of graduates
  - widening participation rates
  - student feedback

The Campus Squirrel Listings

Reports, Rankings and Fascinating Lore From Colleges Far and Near

The quality of an institution of higher learning can often be determined by the size, health and behavior of the squirrel population on campus. This site documents the critter quality at schools throughout the United States and beyond!

- Environmental impact ('green' credentials)
- Squirrels (!!)

Composite indicators (CIs) and university rankings

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From individual dimensions to a CI: Weights

- Equal weights?
- *Complete University Guide* weights range from 0.5-1.5
- Why these weightings?
- Ideally weightings should reflect the preferences of the target audience

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Weights

- Deriving preferences for a group from the preferences of the individuals within that group is notoriously difficult. 'Indeed, once one realizes that different students may value the characteristics of universities differently, the notion that one can come up with a single number that summarizes the overall ranking of an academic institution seems quite silly.' (Ehrenberg, 2000, p53)

Composite indicators (CIs) and university rankings

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The Complete University Guide: Weights and correlation with ranking

1. Entry standards
2. Student satisfaction
3. Research assessment
4. Research intensity
5. Graduate prospects
6. Staff-student ratio
7. Academic services spend
8. Facilities spend
9. Good honours
10. Degree completion

Composite indicators (CIs) and university rankings

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Principal components (PC) analysis: results

- The first two PCs account for nearly 70% of the variation (information) in the data set

	Principal components	
The Complete University Guide dimensions	PC1	PC2
1. Entry standards	0.39	-0.05
2. Student satisfaction	0.13	0.65
3. Research assessment	0.35	-0.09
4. Research intensity	0.36	0.07
5. Graduate prospects	0.36	0.06
6. Staff-student ratio	0.35	-0.21
7. Academic services spend	0.27	-0.35
8. Facilities spend	0.07	0.61
9. Good honours	0.38	-0.02
10. Degree completion	0.34	0.16

Composite indicators (CIs) and university rankings

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Good performance on 8 dimensions, poor performance on student satisfaction and facility spend.

Good performance along all 10 dimensions

Poor performance along all 10 dimensions

Poor performance on 8 dimensions, good performance on student satisfaction and facility spend.

Composite indicators (CIs) and university rankings

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An alternative weights system: The BOD approach to creating a CI from Cherchye *et al* 2007

- The weighting method is data-orientated and can be justified in the CI-context of uncertainty about, and lack of consensus on, an appropriate weighting scheme.
- Good relative performance of a HEI in one dimension (indicator) signals that this HEI considers that dimension relatively important.
- Calculated as input oriented DEA model of Charnes *et al* (1978), with all sub-indicators considered as outputs and a 'dummy input' equal to one for all HEIs

Composite indicators (CIs) and university rankings

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Advantages of a CI

- Summarises information across dimensions
- Easy to interpret (Saltelli *et al.*, 2005)
- Everyone can use the indicators, from policy-makers to the general public, promoting accountability
- Can make comparisons across HEIs and over time

Shortcomings of a CI

- It may not adequately represent all dimensions
- Inappropriate weightings may be used
- The result might be eg. inappropriate policy development or unsuitable choice of university by potential students

Producing a performance indicator

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- Efficiency of resource use requires a knowledge of both outputs and inputs
- A PI should take the multi-dimensional production context into account
- Distance functions
- Frontier estimation methods:
  - DEA
  - SFA

Producing a performance indicator

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Advantages of rankings based on distance function approach

- Evaluates the efficiency with which resources are converted into outputs
- Can take into account all dimensions
- Can make comparisons across HEIs and over time

Shortcomings of rankings based on distance function approach

- The approach is not easily understood by stakeholders

A comparison of PIs and CIs

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Transparency

- A CI is transparent in terms of the method and the data used.
- A HEI can see its strengths and weaknesses and alter behaviour accordingly
- The more complex distance function approach is not transparent

A comparison of PIs and CIs

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Gaming

- BUT greater transparency can lead to 'gaming'
- CI rankings are potentially open to manipulation
- Many performance measures underpinning CIs are under HEI control
- Changing behaviour is a desirable consequence of performance measurement *only* if the changed behaviour genuinely improves *performance* rather than simply *rank*.
- Gaming behaviour by universities is unlikely to achieve the efficiency objective of performance assessment.

A comparison of PIs and CIs

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Homogenisation

- By focusing on improvement of the components of CI rankings, HEIs can become homogeneous.
- Eg, the underlying components of the rankings are often biased towards research activity; HEIs might alter mission to scientific research activity.
- Highly-ranked elite universities become benchmarks for lower-ranked HEIs to mimic, ensuring reduction in diversity between universities .

A comparison of PIs and CIs

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Precision

- CIs: Large differences in rankings, may be based on only small differences in underlying scores
- PIs: 95% confidence indicators around DEA and SFA rankings reveal large overlap

A comparison of PIs and CIs

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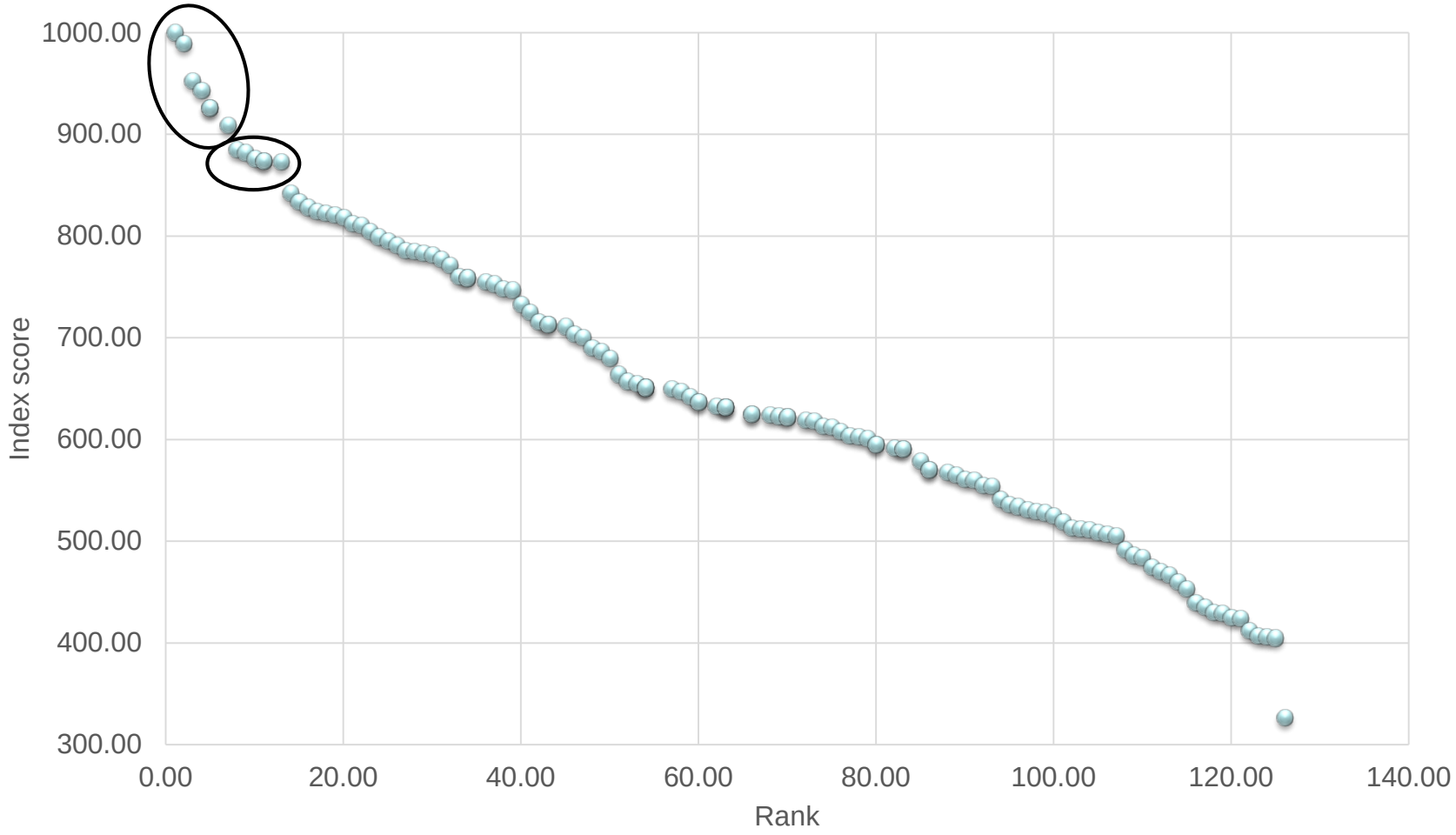

A comparison of PIs and CIs

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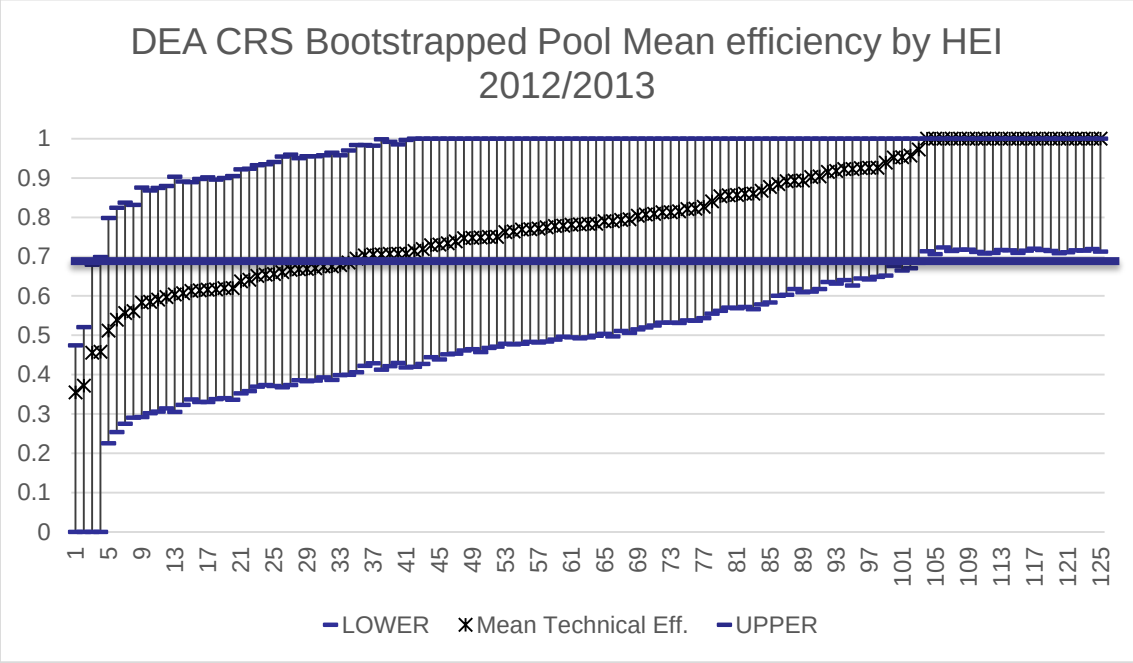
Rankings: DEA estimation



Source: Papadimmitriou and Johnes 2016

From point estimates to groupings

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Produce groups rather than individual rankings. How?

- A possibility: peeling the onion (Barr, Durchholz and Seiford 2000)
- Use DEA to produce tiers of universities (known as 'peeling the DEA onion'): the first application produces a set of efficient universities which are removed to form the top tier. DEA is then applied to the truncated data set, and the efficient universities removed to form the second DEA. This 'peeling' continues until all HEIs have been assigned to a tier.
- Can be used to form tiers on the basis of CI (BOD approach) or distance function (DEA) approach

From point estimates to groupings

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Application of BOD to the data from *The Complete University Guide* reveals 4 basic groups

Tier	Number of HEIs	Mean rank from *The Complete University Guide*
1	26	42.15
2	41	54.85
3	40	69.53
4	17	98.71

Conclusions

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- CIs commonly used by the media to produce rankings can misrepresent the data and are open to gaming
- The BOD approach can address the issues of choice of weights and reduce the opportunity for gaming.
- But differences between HEIs based on point estimates are often not significant.
- A tiered approach might be more satisfactory. But opportunities for gaming at the margins?
- Different approaches deliver different conclusions and the user of PIs and rankings should beware: university rankings should come with a serious health warning and be handled with care.