Quality of indicators, an introduction

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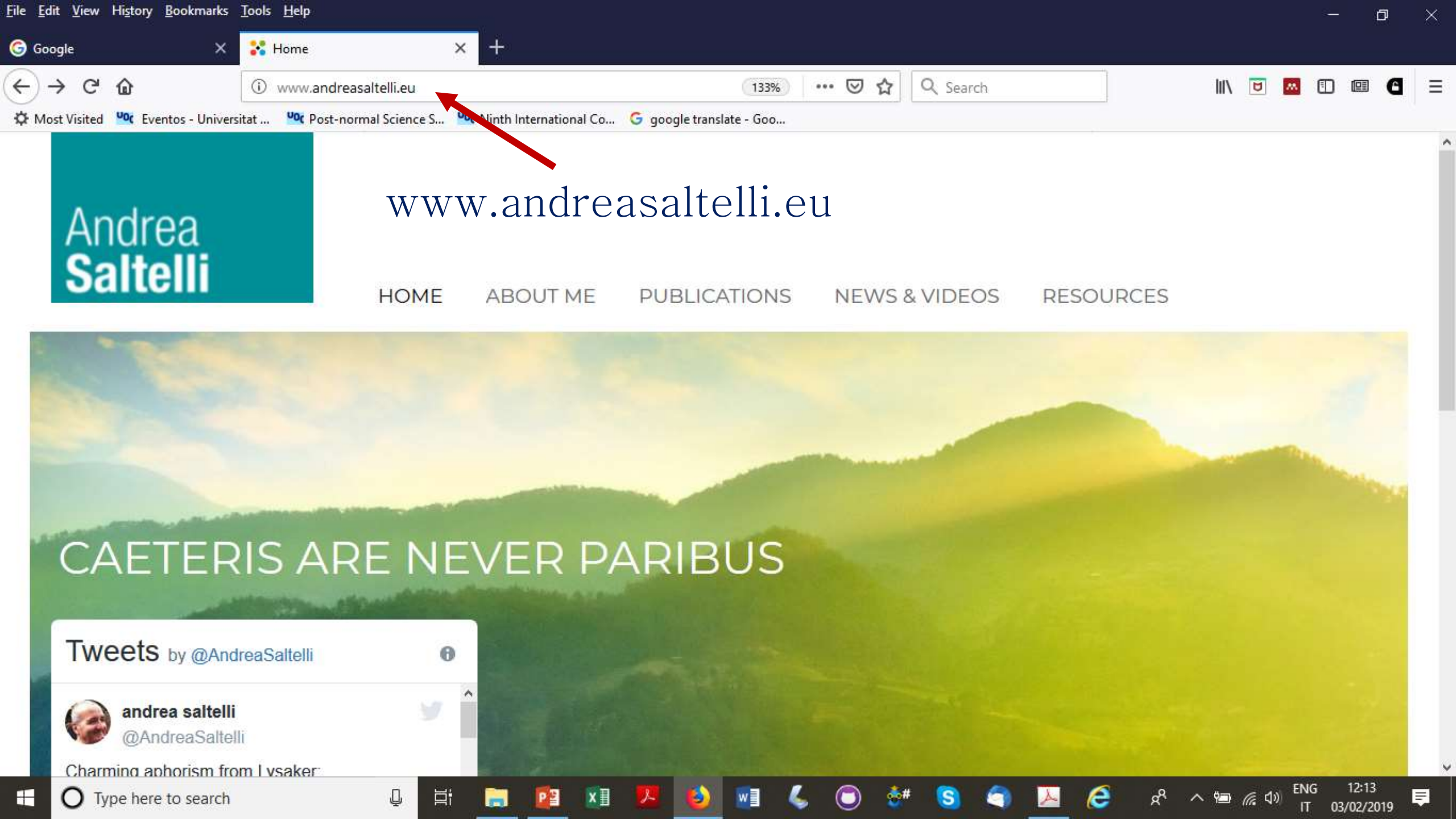
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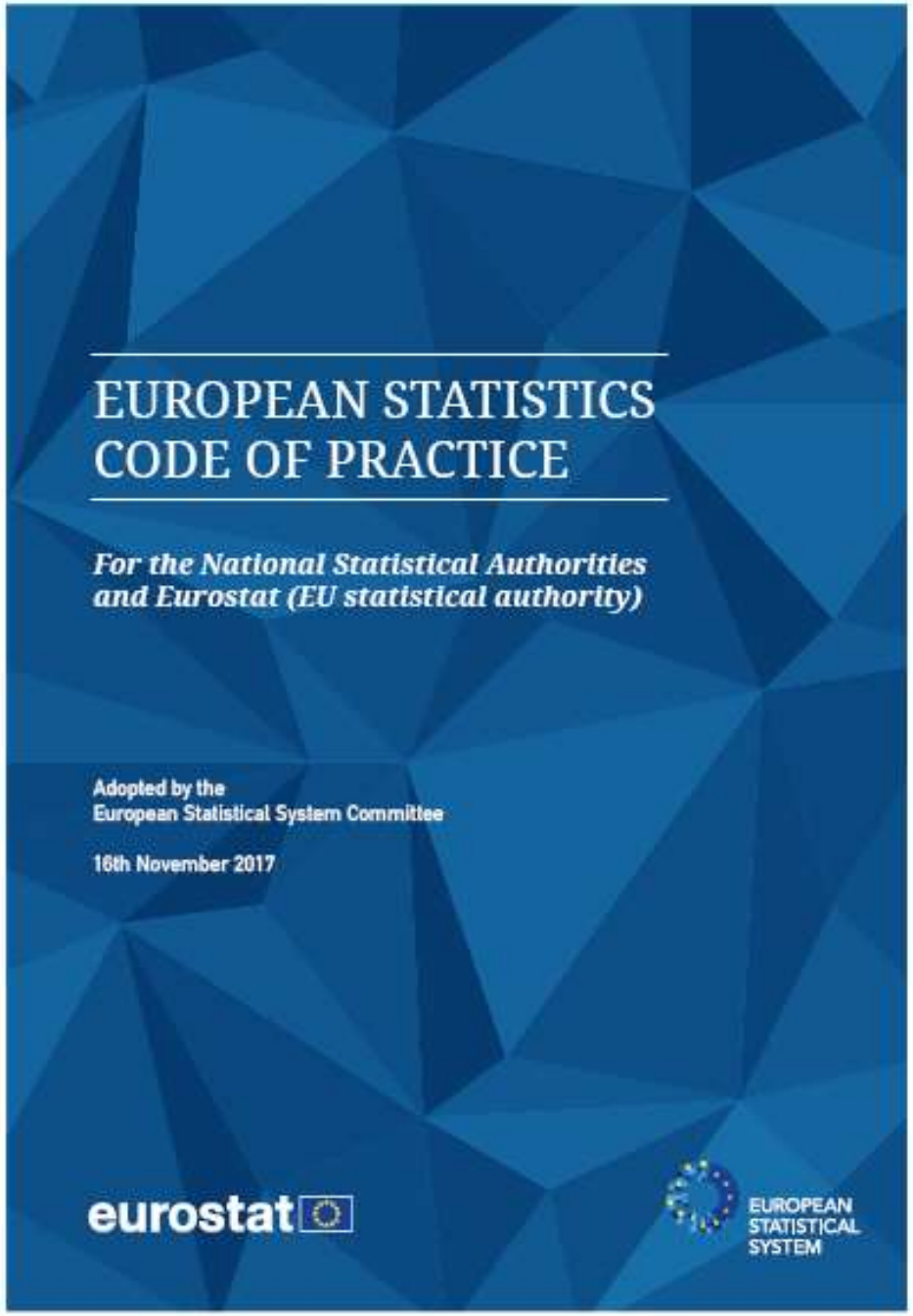
Quality in official statistics


EUROPEAN STATISTICS CODE OF PRACTICE
For the National Statistical Authorities and Eurostat (EU statistical authority)
Adopted by the European Statistical System Committee
16th November 2017
eurostat
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Data Quality Reference Site
Data Quality Assessment Framework
Five dimensions--assurances of integrity, methodological soundness, accuracy and reliability, serviceability, and accessibility--of data quality and a set of prerequisites for data quality are the center of the IMF Data Quality Assessment Framework (DQAF). The DQAF, which is used for comprehensive assessments of countries' data quality, covers institutional environments, statistical processes, and characteristics of the statistical products.
The generic DQAF May 2012 serves as an umbrella for seven dataset-specific frameworks. The current May 2012 version of the DQAF is an update of the July 2003 version of the DQAF to reflect experience and international statistical developments, particularly updated international methodological standards.

EUROPEAN STATISTICS CODE OF PRACTICE

For the National Statistical Authorities and Eurostat (EU statistical authority)

Institutional environment

Institutional and organisational factors have a significant influence on the effectiveness and credibility of a statistical authority developing, producing and disseminating European Statistics. The relevant Principles are professional independence, coordination and cooperation, mandate for data collection, adequacy of resources, quality commitment, statistical confidentiality, impartiality and objectivity.

Articulated as Professional Independence, Coordination and cooperation, Legal mandate, Adequacy of resources, Commitment to quality, Statistical Confidentiality and Data Protection

Statistical Processes

European and other international standards, guidelines and good practices are fully observed in the statistical processes used by the statistical authorities to develop, produce and disseminate European Statistics, while constantly striving for innovation. The credibility of the statistics is enhanced by a reputation for good management and efficiency. The relevant Principles are sound methodology, appropriate statistical procedures, non-excessive burden on respondents and cost effectiveness.

Articulated as Impartiality and Objectivity, Sound Methodology, Appropriate Statistical Procedures, Non-excessive Burden on Respondents, Cost Effectiveness

Statistical Output

Available statistics meet users' needs. Statistics comply with the European quality standards and serve the needs of European institutions, governments, research institutions, business concerns and the public generally. Output quality is measured by the extent to which the statistics are relevant, accurate and reliable, timely, coherent, comparable across regions and countries, and readily accessible by users, i.e. the Principles of Statistical Output.

Articulated as Relevance, Accuracy and reliability, Timeliness and Punctuality, Coherence and Comparability

Examples of how these principles are articulated

Professional independence from other policy, regulatory or administrative departments and bodies, as well as from private sector operators,

E.g. statistical releases are clearly distinguished and issued separately from political/policy statements

Sound methodology

E.g. statistical authorities maintain and develop cooperation with the scientific community to improve methodology, the effectiveness of the methods implemented and to promote better tools when feasible

Appropriate statistical procedure

E.g. in the case of statistical surveys, questionnaires are systematically tested prior to the data collection

Relevance

E.g. procedures are in place to consult users, to monitor the relevance and value of existing statistics in meeting their needs, and to consider and anticipate their emerging needs and priorities

Coherence and comparability

E.g. statistics are comparable over a reasonable period of time

Composite indicators

Specific elements of quality for composite indicators

OECD JRC

RELEVANCE

In the context of composite indicators, relevance has to be evaluated considering the overall purpose of the indicator. Careful evaluation and selection of basic data have to be carried out to ensure that the right range of domains is covered in a balanced way.

ACCURACY

The credibility of data products refers to confidence that users place in … the image of the data producer, i.e., the brand image … [crucial] that the data are perceived to be produced professionally and that practices are transparent (for example, data are not manipulated, nor their release timed in response to political pressure).

TIMELINESS

… special attention must be paid to the overall coherence of the vintages of data used to build composite indicators

ACCESSIBILITY

… the credibility of the composite indicator can be impaired if poor accessibility of basic data makes it difficult for third parties to replicate the results of the composite indicators

INTERPRETABILITY

The availability of definitions and classifications used to produce basic data is essential to assess the comparability … adequate metadata are important

COHERENCE

… ensure coherence over time and across countries … Coherence across countries implies that from country to country the data are based on common concepts, definitions, classifications and methodology, or that any differences can be justified

Is a theory for composite indicators possible?

“The role [of statistical indicators] has increased significantly over the last two decades. This reflects improvements in the level of education in the population, increases in the complexity of modern economies and the widespread use of information technology.”

Jean-Paul Fitoussi,
Amartya Sen, Joseph Stiglitz

CMEPSP (2009). Commission on the Measurement of Economic Performance and Social Progress, URL: http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+ Commission+ report, last accessed June 2017.

CI as boundary objects, between analysis and advocacy, as:

- instruments of democratization of expertise;
- instruments of social discovery
- semiotic objects

Paul-Marie Boulanger

Paul-Marie Boulanger, 2014, Elements for a comprehensive assessment of public indicators, Report EUR 26921 EN.
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92162/lbna26921enn.pdf

A triadic conception of the sign as structure connecting three elements: the sign properly said (S), an object (O) and an "interpretant"(I). But an example is needed …

Charles Sanders Peirce,
the father of semiotics
1839-1914

“This monkey possess a sophisticated repertory of vocal signs for signaling the presence of a predator [distinguishing a] terrestrial stalking one such as a leopard, an aerial raptor such as an eagle or a ground predator such as a snake.”

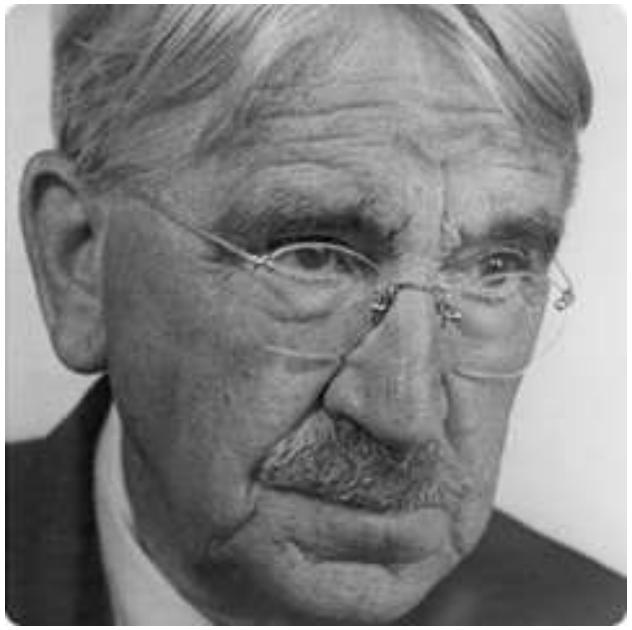
African vervet monkey
(Cercopithecus aethiops)

Sign ⟷ Cry

Object ⟷ Predator

Interpretant ⟷ Behaviour

CI as instrumental to the creation of a new public, through a process of social discovery (J. Dewey)



John Dewey
1859-1952

Dewey, J., 1938. The Public and its Problems, Read Book Ltd. Edition, 2013.

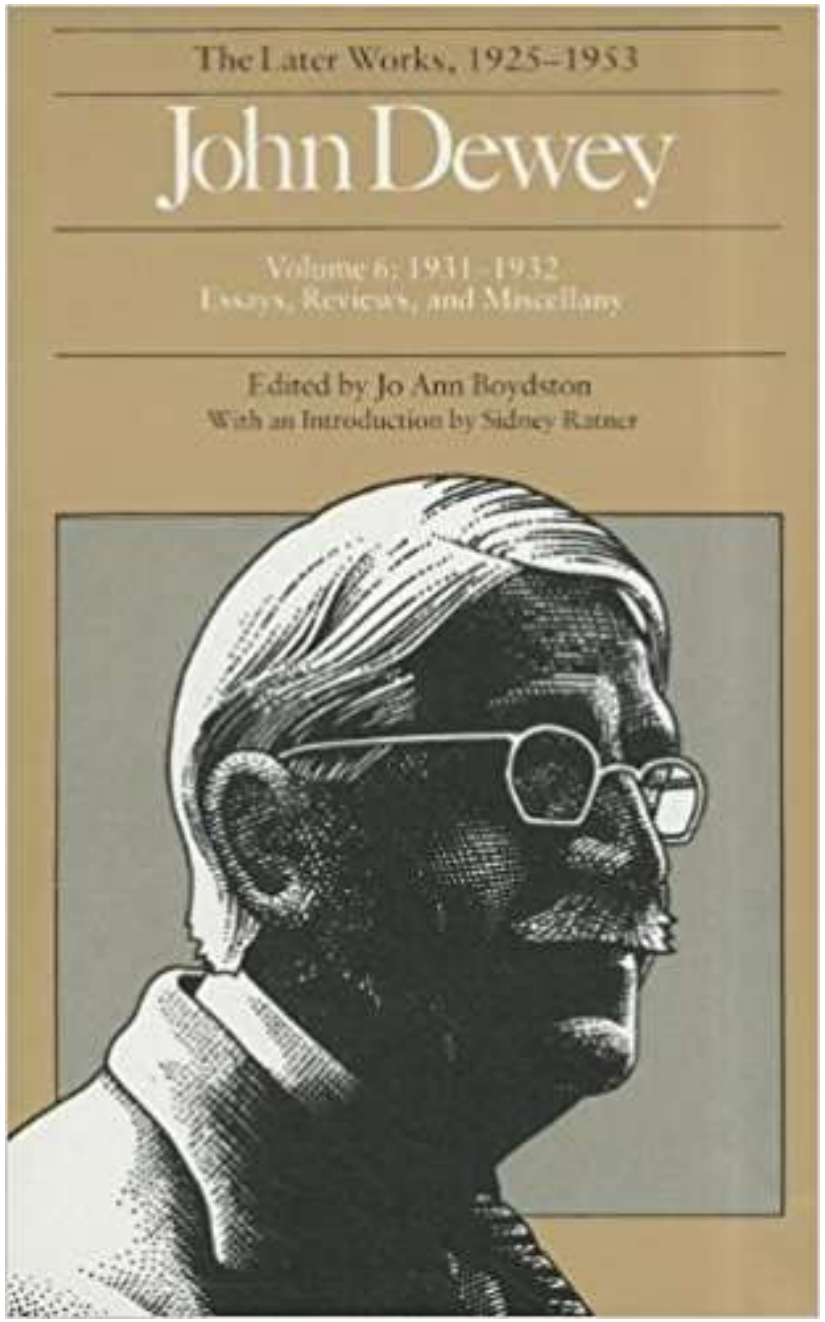
Why are ‘social discoveries’ needed?

Because there are ‘publics’ affected by transaction taking place somewhere else. “[…] machine age has so enormously expanded, multiplied, intensified and complicated the scope of the indirect consequences […] that the resultant public cannot identify and distinguish itself.”

Dewey, J., 1938. The Public and its Problems, Read Book Ltd. Edition, 2013.

Social facts – unlike physical facts, are only meaningful in a context of desired ends

From J. Dewey ‘Social Science and Social Control’ in John Dewey: The Later Works, 1925-1953: 1931-1932, Vol. 6-ExLibrary,

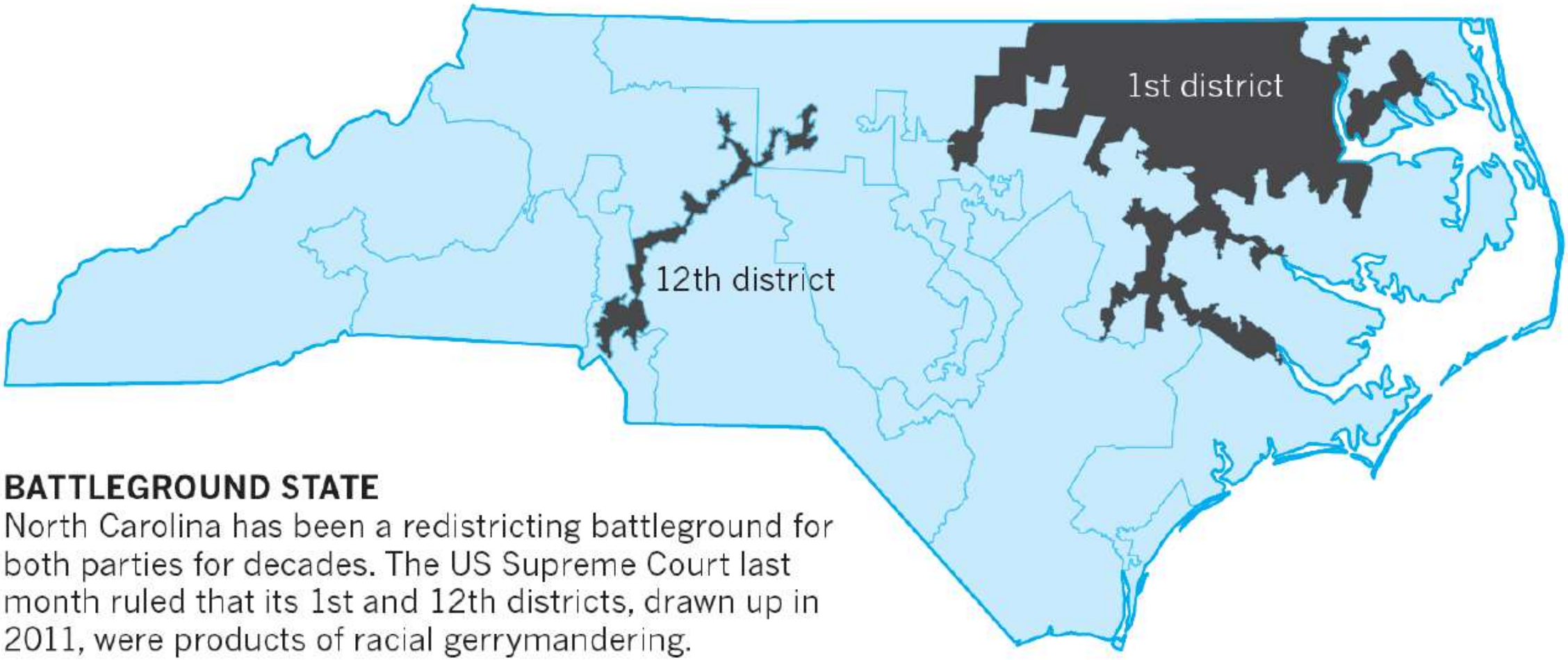


Building a composite indicator can be seen as a process of social discovery for which a model of extended participation comes natural.
Frames and indicators are co-produced in the process which must be designed as to have a meaningful ‘interpretant’, or ‘end-in-sight’

Paul-Marie Boulanger, 2014, Elements for a comprehensive assessment of public indicators, Report EUR 26921 EN. http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92162/lbna26921enn.pdf

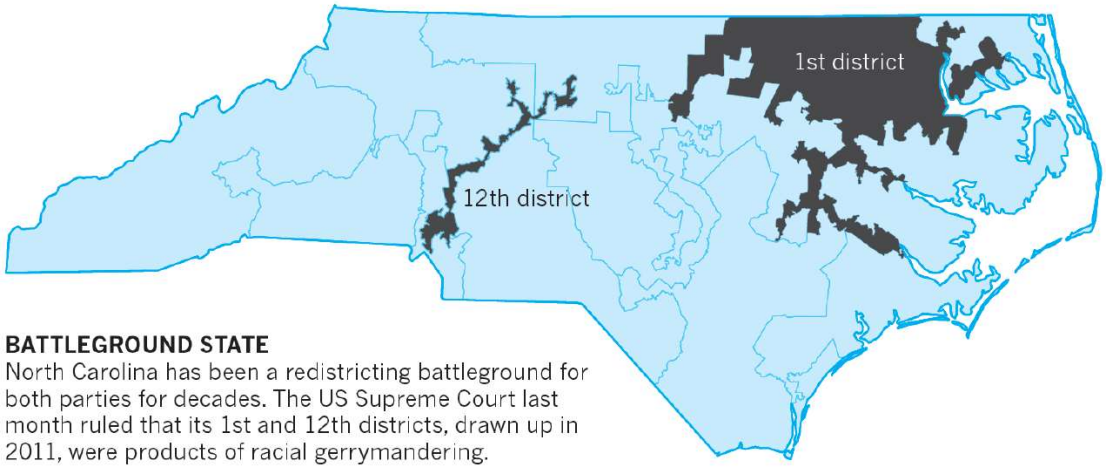
Ubiquity of composite indicators

Making the case for gerrymandering?



BATTLEGROUND STATE
North Carolina has been a redistricting battleground for both parties for decades. The US Supreme Court last month ruled that its 1st and 12th districts, drawn up in 2011, were products of racial gerrymandering.

Nature June 2017 article on the mathematics of ‘nailing’ gerrymandering



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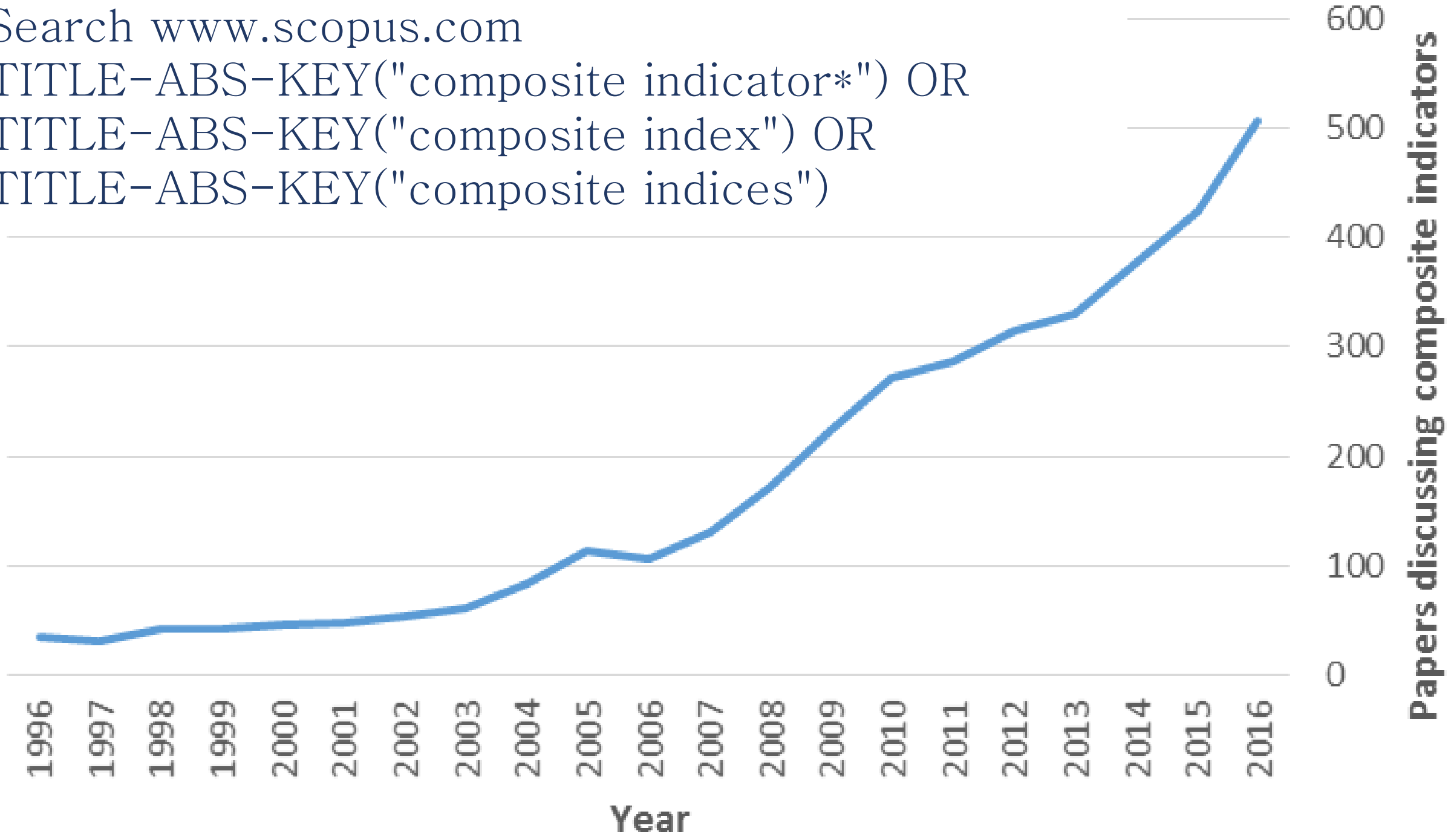
“[US] ranked 55th of 158 nations — last among Western democracies — in a 2017 index of voting fairness (Electoral Integrity Project)”

Carrie Arnold, 2017, The mathematicians who want to save democracy, 200, NATURE, VOL 546, 8 JUNE 2017.

Search www.scopus.com
TITLE-ABS-KEY("composite indicator*") OR
TITLE-ABS-KEY("composite index") OR
TITLE-ABS-KEY("composite indices")



Critique of composite indicators

“a general criticism … frequently addressed at composite indicators, i.e. the arbitrary character of the procedures used to weight their various components … an aggregation procedure always means putting relative values on the items that are introduced in the index …

Jean-Paul Fitoussi,
Amartya Sen, Joseph Stiglitz

CMEPSP (2009). Commission on the Measurement of Economic Performance and Social Progress, URL: http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+ Commission+ report, last accessed June 2017.

"The problem is not that these weighting procedures are hidden, non-transparent or non-replicable – they are often very explicitly presented by the authors of the indices, and this is one of the strengths of this literature. The problem is rather that their normative implications are seldom made explicit or justified.

Jean-Paul Fitoussi,
Amartya Sen, Joseph Stiglitz

CMEPSP (2009). Commission on the Measurement of Economic Performance and Social Progress, URL: http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+ Commission+ report, last accessed June 2017.

There are types two indices: those built on economic theory / monetary aggregates / shadow prices and all others (=mashup indices)

Martin Ravallion

+ existing measures of e.g. development or poverty (Human Development Index, HDI, the Multidimensional Poverty Index, MPI) are bad at coping with tradeoffs

Martin Ravallion, 2010, Mashup indices of development, Policy Research Working Paper 5432 , The World Bank Development Research Group, http://documents.worldbank.org/curated/en/454791468329342000/pdf/WPS5432.pdf

To illustrate the distinction, consider two stylized examples of composite indices, both formed from the data on household assets and consumer durables found in the Demographic and Health Surveys (DHS). For index A the variables and their weights are set by the analyst, who has some concept of ―economic welfare‖ in mind, and thinks this is related to certain variables in the DHS, which are aggregated based on the analyst‘s judgments. For index B, the variables and weights are instead based on a regression model calibrated to another survey data set for which a comprehensive measure of consumption (though still containing measurement errors) could be derived. The model is calibrated to common variables in the expenditure survey and the DHS, and the regression model is used to predict wealth in the DHS.

A is a mashup index, B is not.

Martin Ravallion

Since composite indicators are here to stay how can we make them defensible?

Tools for evidence appraisal such sensitivity analysis, sensitivity auditing, quantitative storytelling can be useful to gauge (and possibly deconstruct) measures

Sensitivity analysis

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Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators

M. Saisana, A. Saltelli, S. Tarantola

First published: 3 March 2005 Full publication history

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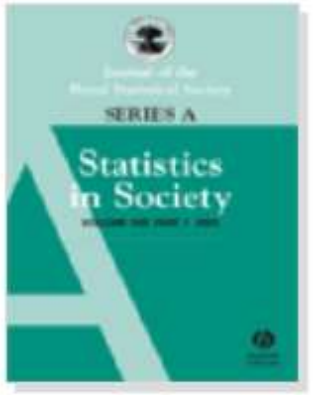

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Volume 168, Issue 2
March 2005
Pages 307–323

Using sensitivity analysis the volatility of country ranking can be exposed

Research Policy 40 (2011) 165–177

Contents lists available at ScienceDirect

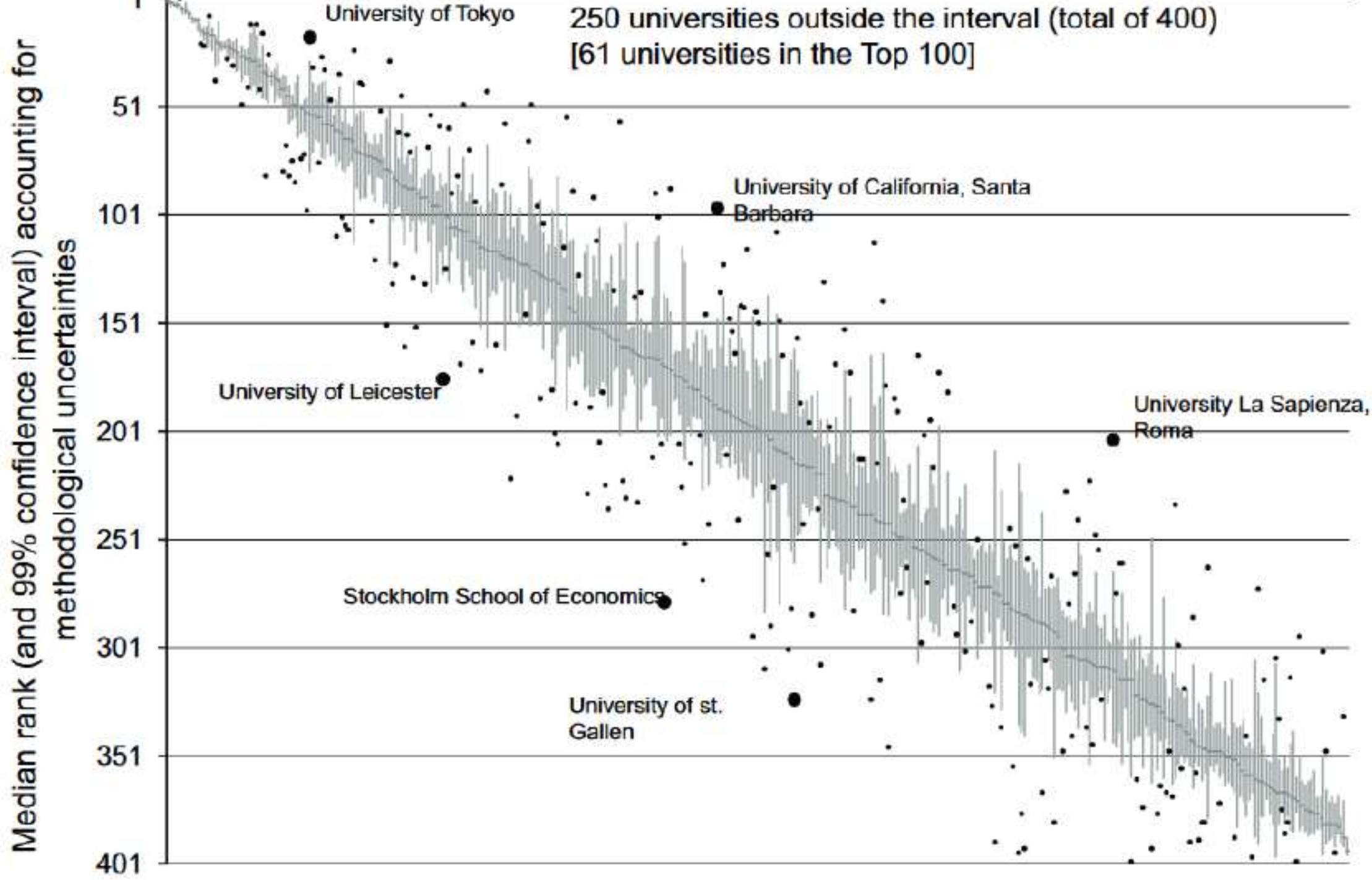
Research Policy

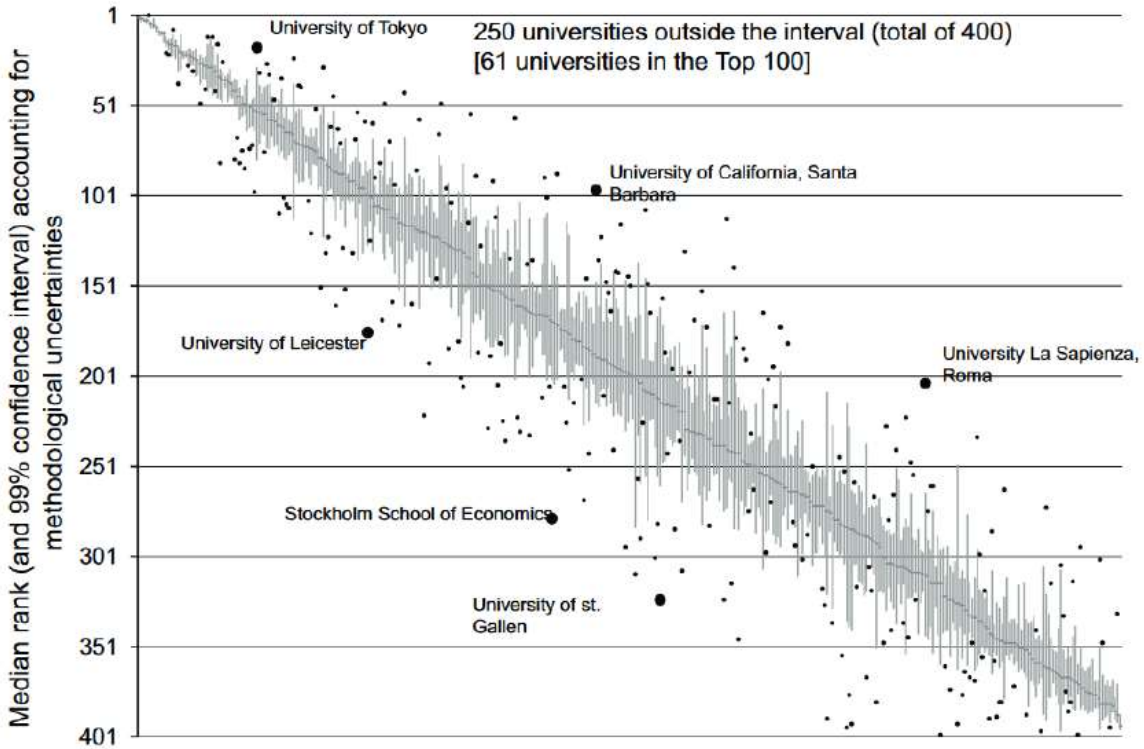
journal homepage: www.elsevier.com/locate/respol

Rickety numbers: Volatility of university rankings and policy implications

Michaela Saisana*, Béatrice d'Hombres, Andrea Saltelli

Econometrics and Applied Statistics, Joint Research Centre, European Commission, Enrico Fermi 2749, 21027 Ispra, Italy


250 universities outside the interval (total of 400)
[61 universities in the Top 100]
University of Tokyo
University of California, Santa Barbara
University of Leicester
University La Sapienza, Roma
Stockholm School of Economics
University of st. Gallen
Median rank (and 99% confidence interval) accounting for methodological uncertainties
1
51
101
151
201
251
301
351
401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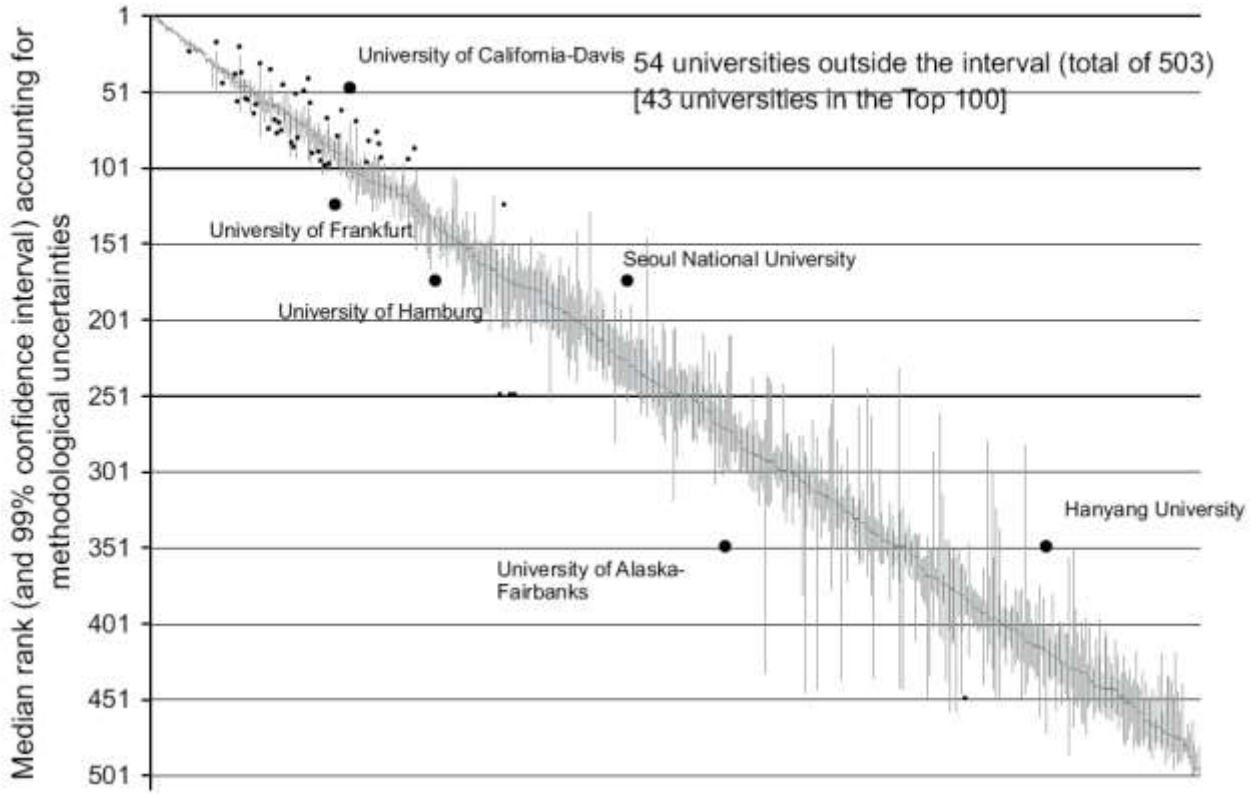

Median rank (and 99% confidence interval) accounting for methodological uncertainties
1
51
101
151
201
251
301
351
401
451
501
University of California-Davis
54 universities outside the interval (total of 503)
[43 universities in the Top 100]
University of Frankfurt
Seoul National University
University of Hamburg
Hanyang University
University of Alaska-Fairbanks

One can test whether assigned weights correspond to real importance

Journal of the Royal Statistical Society
SERIES A Statistics in Society

J. R. Statist. Soc. A (2013)
176, *Part* 3, *pp.* 609–634

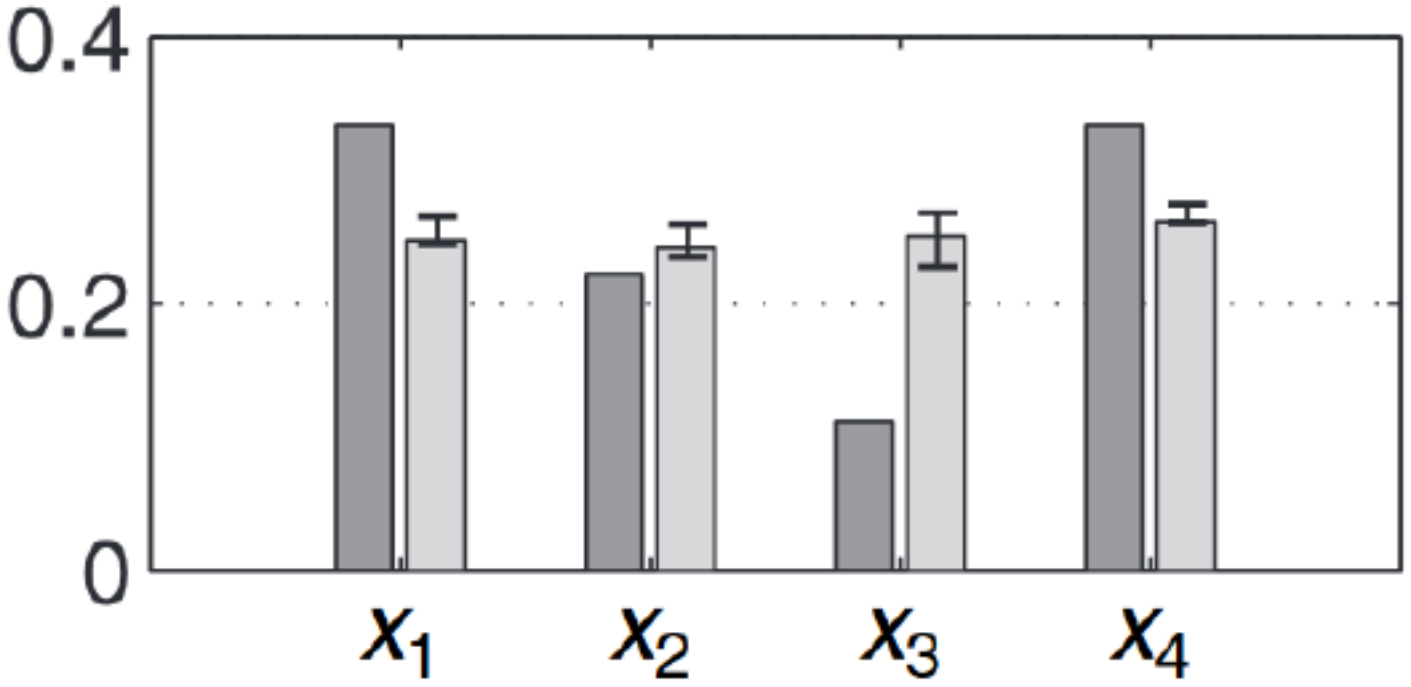
Ratings and rankings: voodoo or science?

Paolo Paruolo

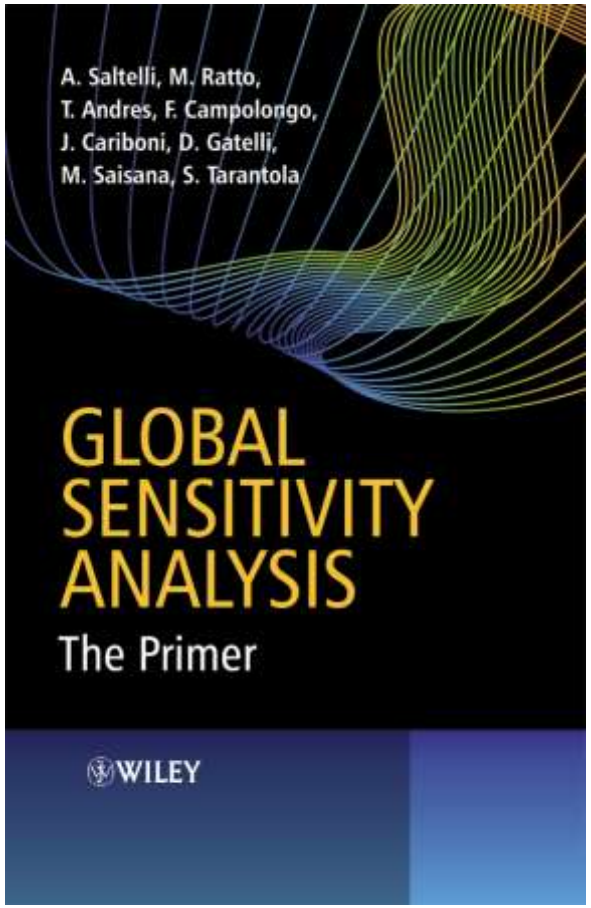
University of Insubria, Varese, Italy

and Michaela Saisana and Andrea Saltelli

European Commission, Ispra, Italy



Assigned weights (dark grey) versus measured importance for the 2010 HDI (Paruolo et al., 2011)



Sensitivity auditing

Int. J. Foresight and Innovation Policy, Vol. 9, Nos. 2/3/4, 2013 213

What do I make of your latinorum? Sensitivity auditing of mathematical modelling

Andrea Saltelli* and
Ângela Guimarães Pereira

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Futures xxx (2017) xxx–xxx

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Original research article

What is wrong with evidence based policy, and how can it be improved?

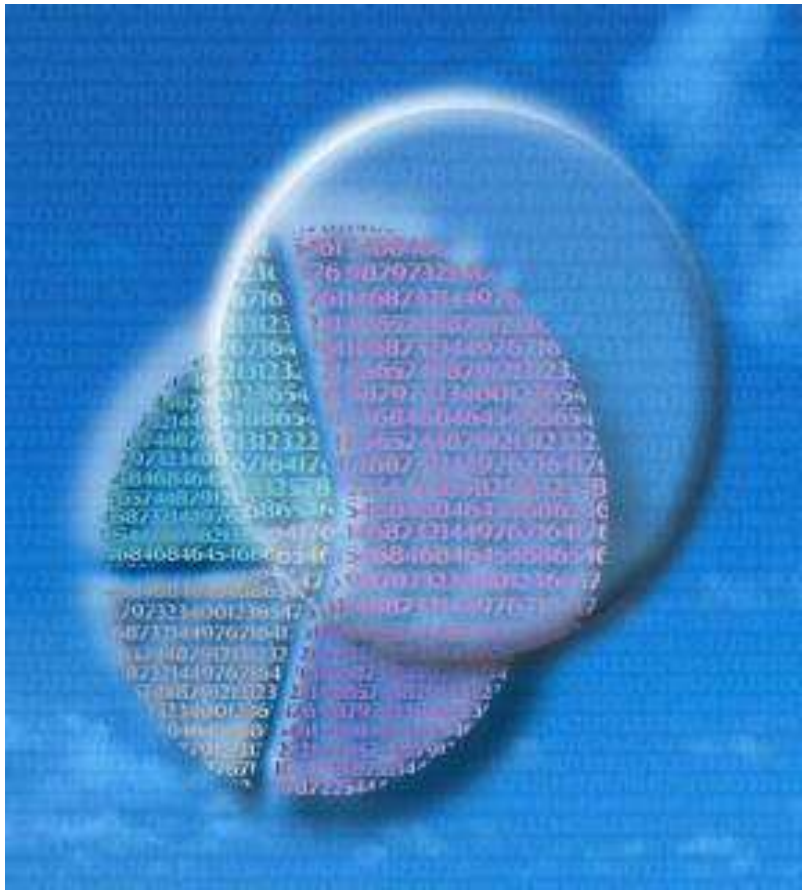
Andrea Saltelli[a,b,c,*], Mario Giampietro[a,c,d]

Conclusions: CI – instructions for use

Awareness of the imperfections and non-neutrality of measures

Investigate properties and assumptions (uncertainty and sensitivity analysis)

Use for social discovery, (deliberative) extended participation; quality as fitness for purpose (interpretant)



END of part one

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@andreasaltelli

Survey and Likert scales; desirable properties

Pointing to a single latent variable

Number of levels (5-7)

Symmetry

Balance

Equidistance

Orientation of items

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Likert scales; possible shortcomings:

Fake bad of fake good

Social desirability bias *

Acquiescence bias *

Central tendency

Readiness indicators (Governance and coordination) source: document Vanda Lima
Indicator GOVERNANCE_1;

Question: A integrated governance structure is in place to discuss and make decisions on SDI/INSPIRE, ICT, e-Government and Digital Transformation policy and initiatives

Possible answers:

Y= one single governance structure exists for discussing and deciding on all these aspects with all stakeholders involved

P = separate governance structures exist but joint meetings take place **OR** representatives from the SDI/INSPIRE participate in meetings of a eGovernment/DT body or structure (and vice versa)

N = two or more structures or bodies exist that work totally independently **OR** only exchange information

Baseline survey on the EIF implementation, in the context of the revised EIF;
source DG DIGIT Unit D2, document November 2018

Underlying principles of European public services, **Question Q1:**
Please state your level of agreement with the following statement: In my country, the current strategies or frameworks in place, or those in the process of being published, take the 47 EIF recommendations and its 12 principles into account. [Recommendation 1]

Possible answers:

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree
- ☐ Don't know

Possible answers:

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree/Don't know
- ☐ Agree
- ☐ Strongly agree

Baseline survey on the EIF implementation
(in the context of the revised EIF)

Underlying principles of European public services, **Question Q4:**
When developing new IT solutions, does your country actively consider the use of open source software, and account for it in the total cost of ownership of the solution? [Recommendation 3]

Possible answers:

- ☐ Yes
- ☐ No
- ☐ Don't know

Possible answers:

- ☐ Yes, procedure and costing underway
- ☐ Yes it is being considered
- ☐ Don't know
- ☐ Unlikely to be considered
- ☐ Very unlikely to be considered

Location Interoperability Framework Observatory, Survey on EULF implementation source ABC_IV_LIFO_survey-1.docx, Antonio Rotundo

Recommendation 1: Connect location information strategies and digital government strategies in all legal and policy instruments

[Q1.1].Are location-related information and technologies integrated and connected in the digital government and ICT strategies and in their development process?

[1]. YES, a broad national strategy on digital government and ICT is formally well-defined and includes a key role for location information to deliver innovative and high effective digital public services.

[2]. YES, BUT PARTIALLY, the digital government strategy only includes some references and actions for location information in the strategic approach.

[3]. NO, digital government and location information are addressed in separate strategies with no alignment in terms of architectures and technologies. A national strategy on digital government and ICT is defined for general purposes but without any specific provision for location information. Location information strategy is implemented in its restricted context, including INSPIRE implementation, and doesn't address the requirements of digital public services.

[4]. NO, the digital government strategy is not yet well-defined at national level and the alignment and integration are left to individual initiatives.

[5]. Other. Specify:_____

[Q1.1]. Are location-related information and technologies integrated and connected in the digital government and ICT strategies and in their development process?

[1]. YES
[2]. YES, PARTIALLY
[3]. NO, [but 1]
[4]. NO, [but 2]
[5]. Other. Specify:_____

One alternative:
[1]. Fully integrated
[2]. Partially, in progress
[3]. Do not know, not applicable
[4]. Few instances of integration
[5]. No integration

Another alternative: reformulating the question

[Q1.1] Please state your level of agreement with the following statement: Location-related information and technologies are integrated and connected with the digital government and ICT strategies in all legal and policy instruments.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Location Interoperability Framework Observatory, Survey on EULF implementation source ABC_IV_LIFO_survey-1.docx, Antonio Rotundo

4. Focus area: Return on investment

Recommendation 16: Facilitate the use of public administrations' location data by non-governmental actors to stimulate innovation in products and services and enable job creation and growth

[Q16.1]. Which of the following initiatives does the Member State implement to facilitate the use of public administrations' location data by non-governmental actors:

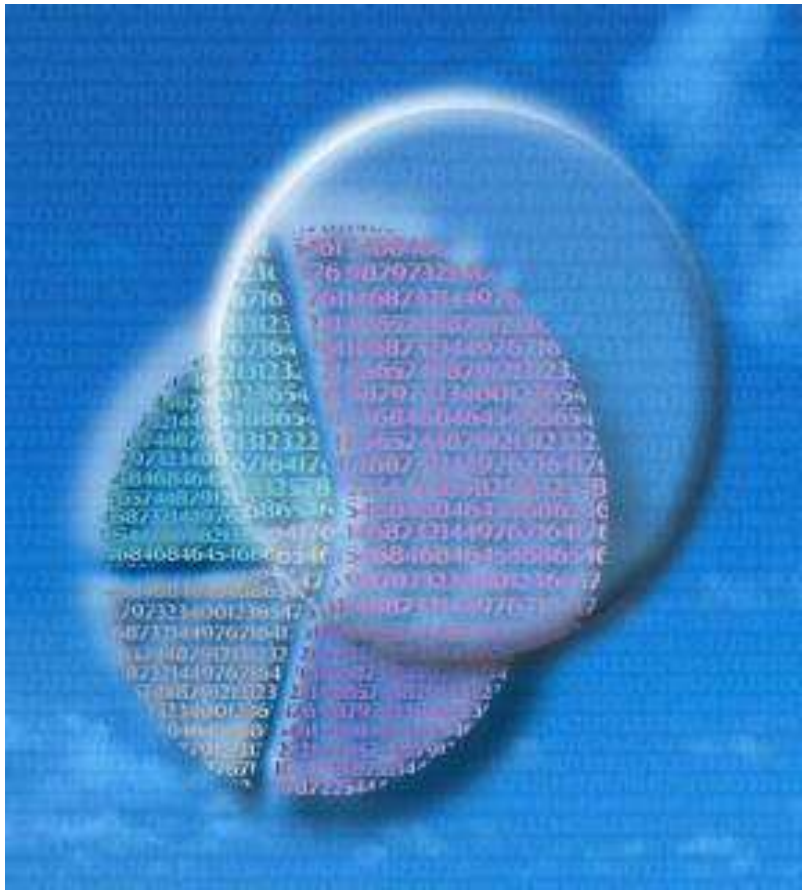
[1]. promotion of the availability of location data and web services to companies, research institutions, citizens and other interested parties;
[2]. take a strategic approach to funding public sector location reference data;
[3]. support to private, non-profit and academic actors in the development of new products and e-services;
[4]. facilitation of the companies from other countries wishing to establish operations or do business in their country;
[5]. other. Specify: _____
[6]. None

Assuming all point to the same latent dimension each question can be reformulated as

[1]. promotion of the availability of location data and web services to companies, research institutions, citizens and other interested parties;

➔

[1bis] Do you agree with the following statement: public administrations in my country actively promote of the availability of location data and web services to companies, research institutions, citizens and other interested parties



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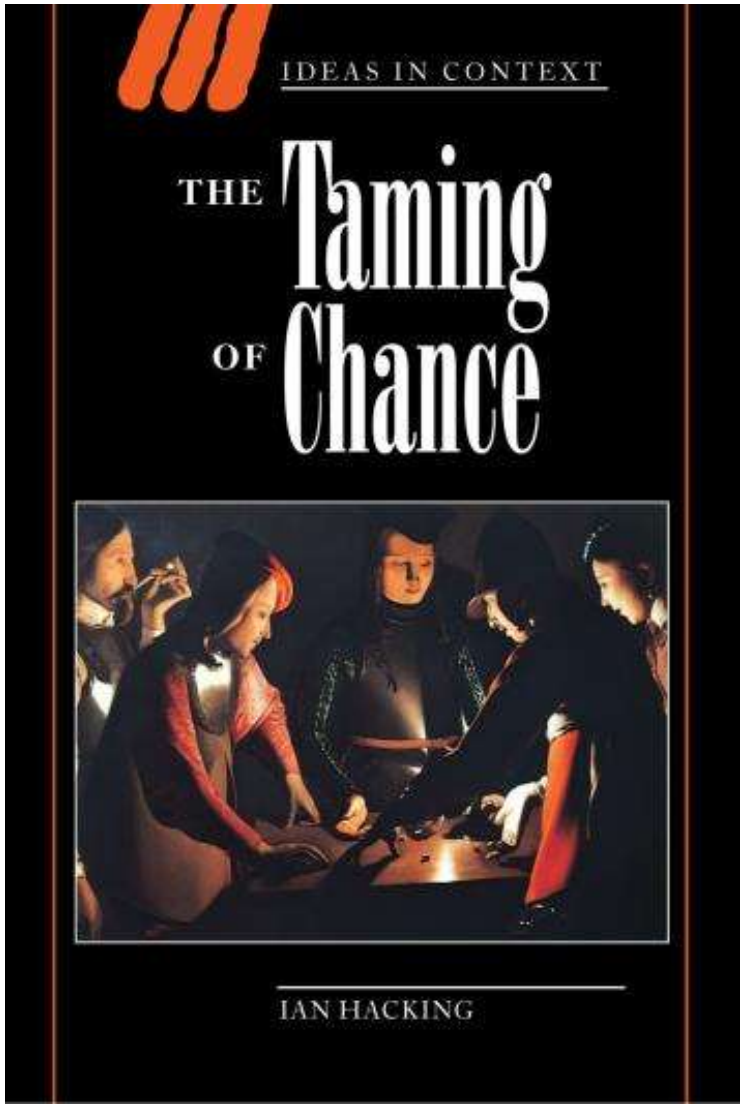
@andreasaltelli

Extra material

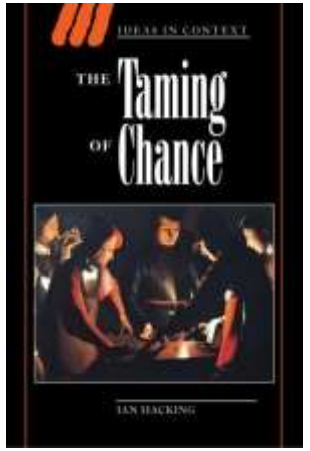
Some history

The first scoreboard and the imperialism of probabilities



Ian Hacking, 1990, The taming of chance, Cambridge University Press.

The victory of probability is metaphysical (quantum mechanics), epistemological (statistics as a way of knowing things), logical (statistical inference methods) and ethical (no decision taken without statistical evidence), leading to the ‘imperialism of probability’…

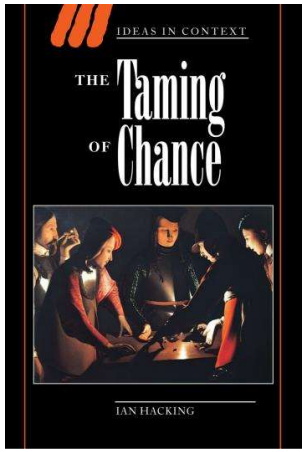


Statistics ⟷ nation state ⟷ Modernity

Leibnitz, ‘philosophical godfather of Prussian official statistics’.

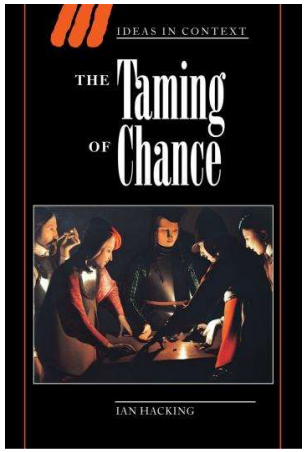
Gottfried Wilhelm Leibniz (1646-1716)

His proposal to the Prince Frederik of Prussia, 1700



56 categories to ‘measure the power of a state’, the first scoreboard;

- number of marriageable girls,
- able bodied capable to carry arms,
- diseases,
- child mortality,
- …
- number of Jews

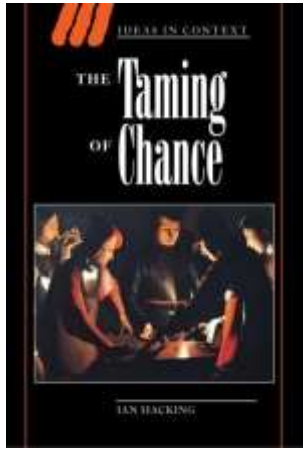


Gottfried Wilhelm Leibniz (1646-1716)

‘Probability’ won an epistemological war between the eighteen and the nineteen century.

‘Probability’ became king in adjudicating the credibility of evidence.

We look at facts mostly through the lenses of statistics – before the enlightenment chance was equated with superstition.



Example of sensitivity auditing applied to an indicator

Too much is being read in the OECD-PISA data

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19,1

20

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Do PISA data justify PISA-based education policy?

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2396-7404
DOI 10.1108/IJCED-12-2016-0023

THE CONVERSATION
Academic rigour, journalistic flair

International PISA tests show how evidence-based policy can go wrong

June 12, 2017 3.55pm AEST

Taking issue with:

"If every EU Member State achieved an improvement of 25 points in its PISA score [...] the GDP of the whole EU would increase by between 4% and 6% by 2090; such an 6% increase would correspond to 35 trillion Euro" (Woessmann, 2014)

Advocating for a more collegial construction of the measure

Woessmann, L. (2014), "The economic case for education", EENEE Analytical Report 20, European Expert Network on Economics of Education (EENEE), Institute and University of Munich, Munich

See also 'OECD and Pisa tests are damaging', The Guardian, 6 May 2014
https://www.theguardian.com/education/2014/may/06/oecd-pisa-tests-damaging-education-academics

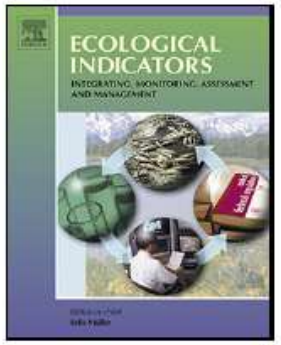
The Ecological Footprint; top in advocacy, bottom in quality

Ecological Indicators 46 (2014) 610–621

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind



Footprints to nowhere

Mario Giampietro [a,c], Andrea Saltelli [b,*]

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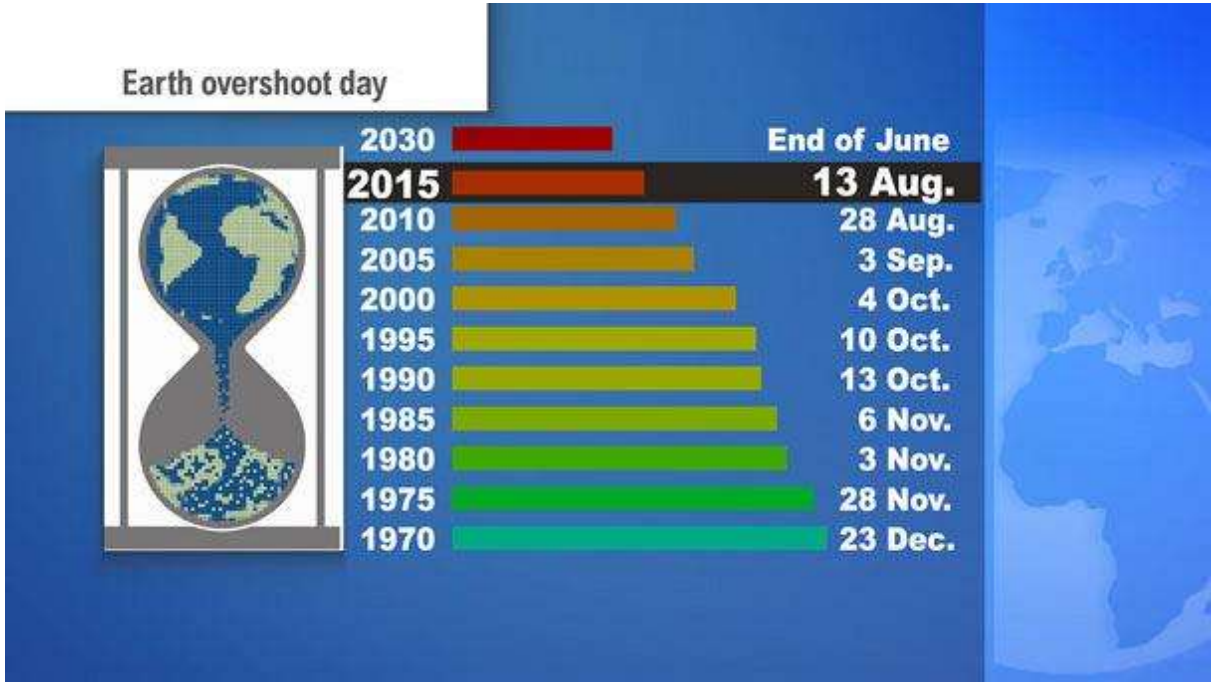
The Ecological Footprint suggests compressing sustainability to a single metric (acres of equivalent land). Volatile assumptions are taken, spurious precision is generated, and a meaningless ‘interpretant’ is proposed

Interpretant: Paradoxical policy implications – e.g. intensive non sustainable agricultural practices promoted



Alessandro Galli, Mario Giampietro , Steve Goldfinger , et al., 2016, Questioning the ecological footprint , Ecological Indicators, 69, 224–232.
Giampietro, M., and Saltelli, A., 2014, Footprints to nowhere, Ecological Indicators, 46, 610–621.
Goldfinger, S., Wackernagel, M., Galli, A., Lazarus, E., Lin, D., 2014, Footprint facts and fallacies: A response to Giampietro and Saltelli (2014) “Footprints to Nowhere”, 46, 622–632.
Giampietro, M., and Saltelli, A., 2014, Footworking in Circles, Ecological Indicators, 46 (2014) 260–263.

Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures

Original research article

What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli[a,b,c,*], Mario Giampietro[a,c,d]

Journal of Clinical Epidemiology 73 (2016) 82–86

Evidence-based medicine has been hijacked: a report to David Sackett

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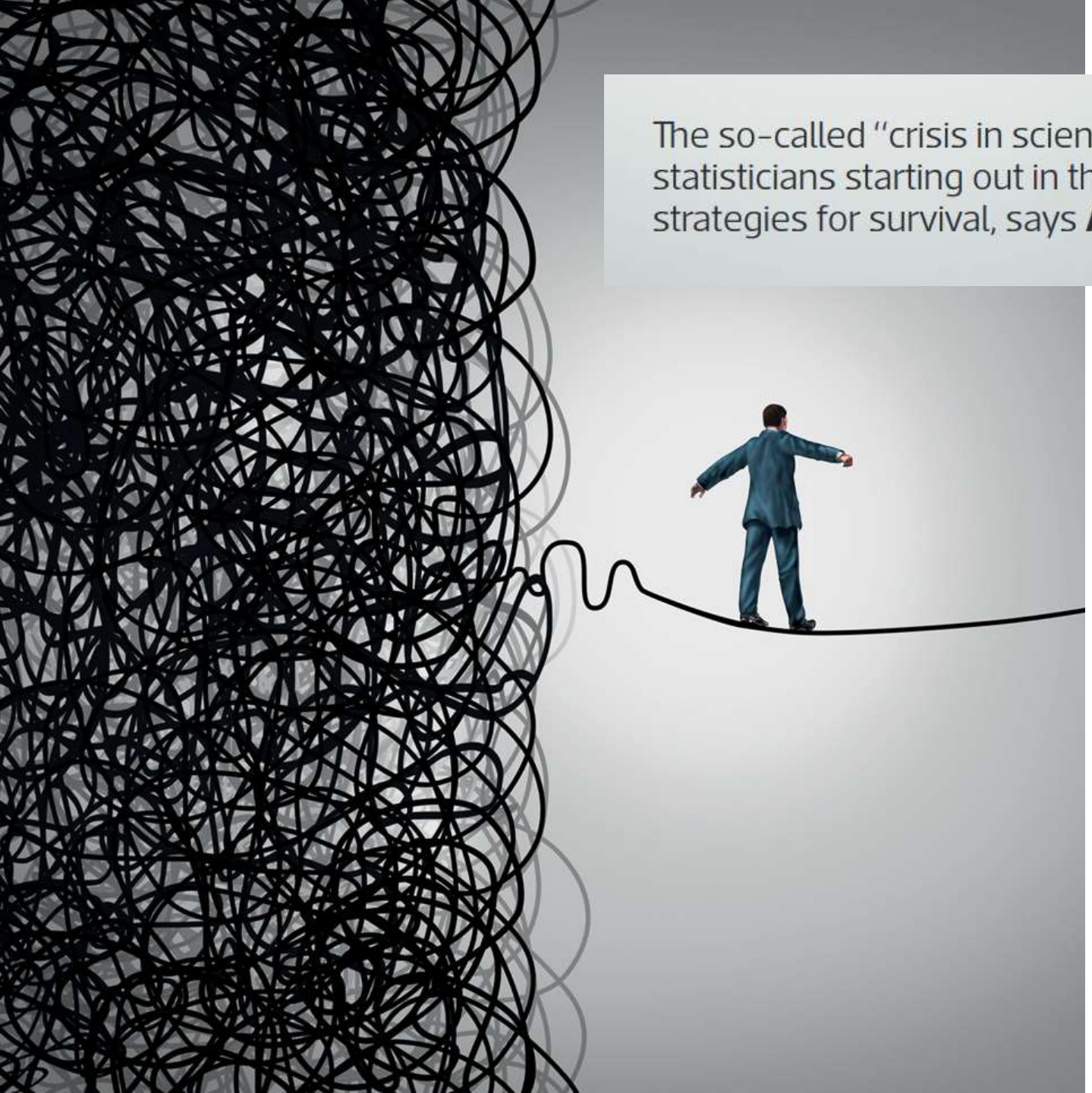
Accepted 18 February 2016; Published online 2 March 2016

Power asymmetries in the framing of issues: those who have the deepest pockets marshal the best evidence; Instrumental use of quantification to obfuscate; (Saltelli and Giampietro, 2017)

Evidence based medicine hijacked to serve corporate agendas. Meta-analyses and guidelines serving vested interests. “Under market pressure, clinical medicine has been transformed to finance-based medicine” (Ioannidis, 2016)

More reading on statistics, past and future



The so-called "crisis in science" presents challenges for statisticians starting out in their career. But there are strategies for survival, says **Andrea Saltelli**

Young Statistician, You shall live adventurous times, SIGNIFICANCE (The Royal Statistical Society), December 2016, Volume 13, Issue 6, (pages 38–41)