

# Mashup or social discovery? Composite indicators in the fray

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Monitoring Convergence in the European Union  
Experts' workshop, Eurofound  
13 - 14 June 2017



CAETERIS ARE  
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24 (1)



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Lovely (also in the sense of 'of love') piece by an Italian scholar [@robertocalasso](https://twitter.com/robertocalasso):

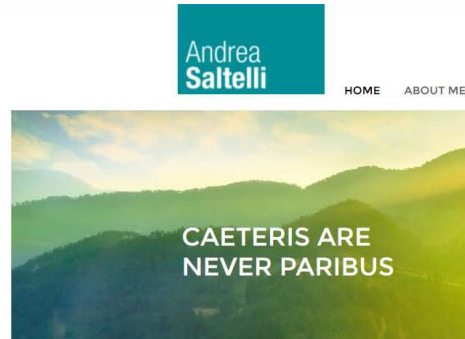
[nybooks.com/articles/2016/...](https://nybooks.com/articles/2016/)



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sensitivity analysis, sensitivity auditing, science for policy, impact assessment



= available on [andreasaltelli.eu](http://andreasaltelli.eu)

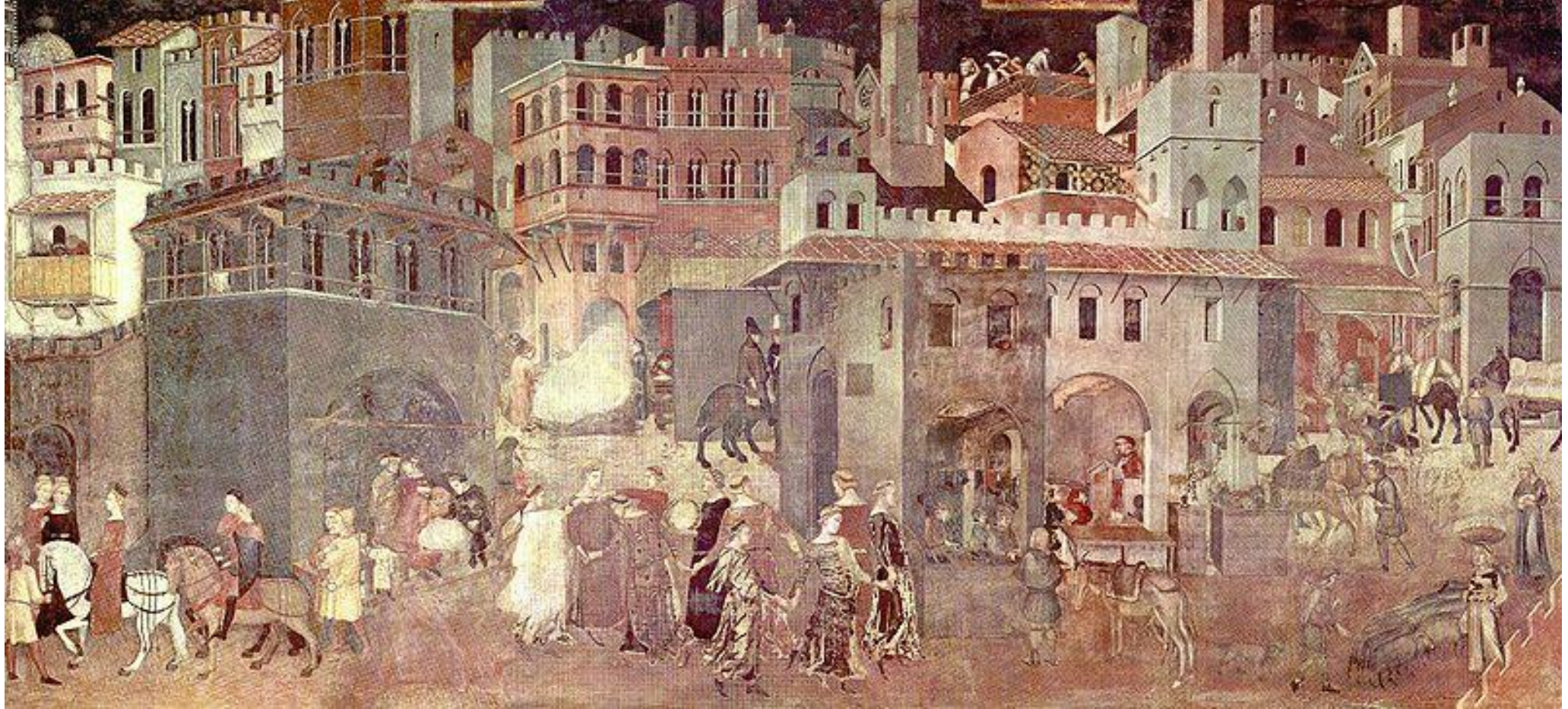
From images to numbers





Ambrogio Lorenzetti (c. 1290 – 1348), Allegory: Effects of good and bad government, Palazzo Pubblico di Siena, (detail: Safety)





Ambrogio Lorenzetti (c. 1290 – 1348), Allegory: Effects of good and bad government, Palazzo Pubblico di Siena, Effects of good government in the city





Ambrogio Lorenzetti (c. 1290 – 1348), Allegory: Effects of good and bad government, Palazzo Pubblico di Siena, Effects of the good government in the countryside





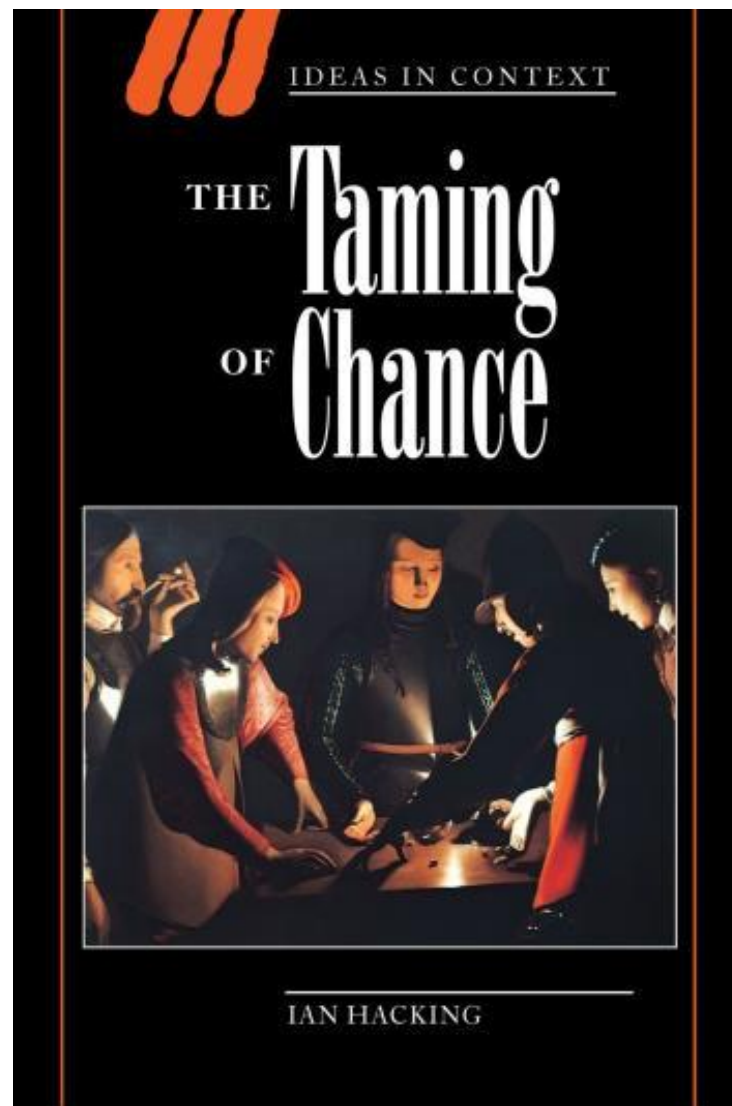
Ambrogio Lorenzetti (c. 1290 – 1348), Allegory: Effects of good and bad government, Palazzo Pubblico di Siena,  
Effects of the bad government in the countryside



“[...] Lorenzetti is modern because he invites the spectator of his frescoes, [...] to assess governments not so much on the political principles and values [...] than on the practical consequences of their decisions.

The paintings on the effects of good and bad governance show them were to look, what are the signs, or, in contemporary language, the indicators, to monitor in that respect.”

The emergence of statistics, the imperialism of probability, the first scoreboard ...

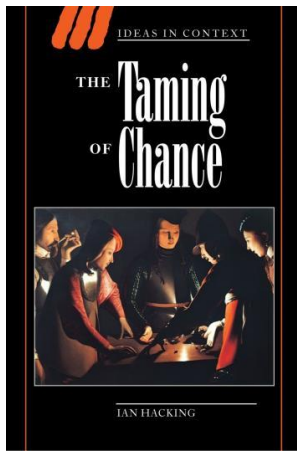


Ian Hacking

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



Leibnitz, 'philosophical godfather of Prussian official statistics' to the Prince Frederik of Prussia 1700



56 categories to 'measure the power of a state' (the first scoreboard; e.g. number of marriageable girls, able bodied capable to carry arms, diseases, child mortality)

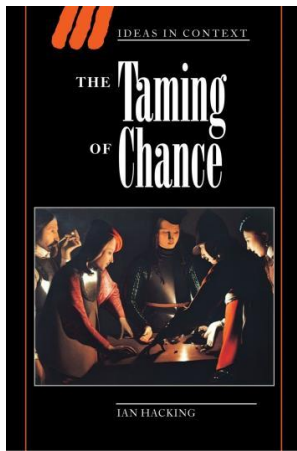
Leibnitz's first proposal for a statistical office

Already in 1745 Jews are being treated as a separate category and counted in Prussian statistics

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

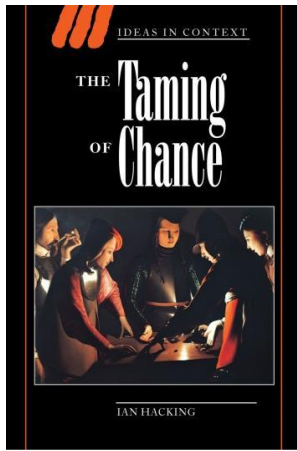
‘Probability’ became king in adjudicating the credibility of evidence.

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





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  $\leftrightarrow$  nation state  $\leftrightarrow$  Modernity

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](http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report), last accessed June 2017.

CI as boundary objects, between analysis and advocacy

CI as instruments in a changing styles of governance of knowledge for policy; of democratization of expertise; of social discovery (John Dewey); the semiotic of CI's (Charles Sanders Peirce)



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



“This monkey possess a sophisticated repertoire 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*)

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>

Sign  $\leftrightarrow$  Cry



Object  $\leftrightarrow$  Predator



Interpretant  $\leftrightarrow$  Behaviour



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

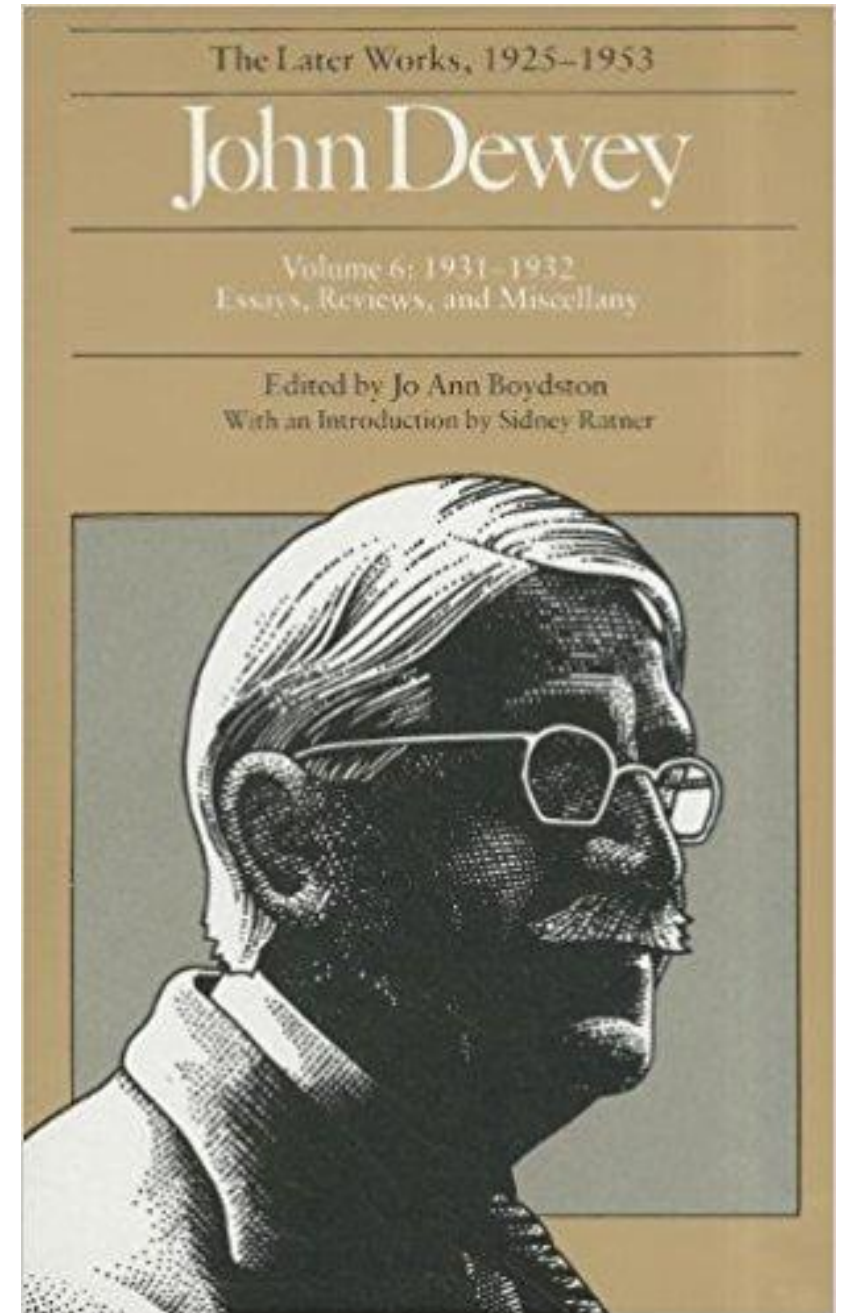
Why are ‘social discoveries’ needed?

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.”



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’

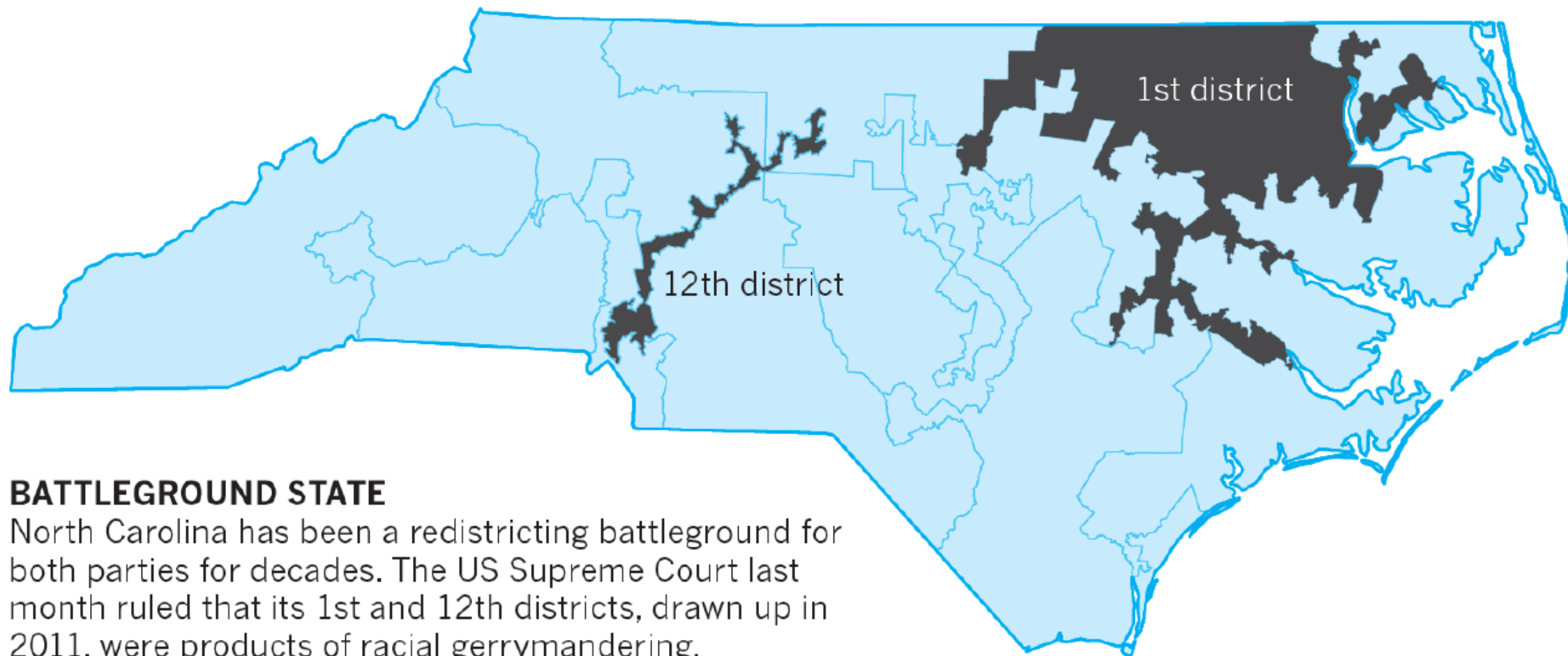


Paul-Marie Boulanger, 2014, Elements for a comprehensive assessment of public indicators, Report EUR 26921 EN. <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC92162/lbna26921enn.pdf>

Ubiquity of composite indicators



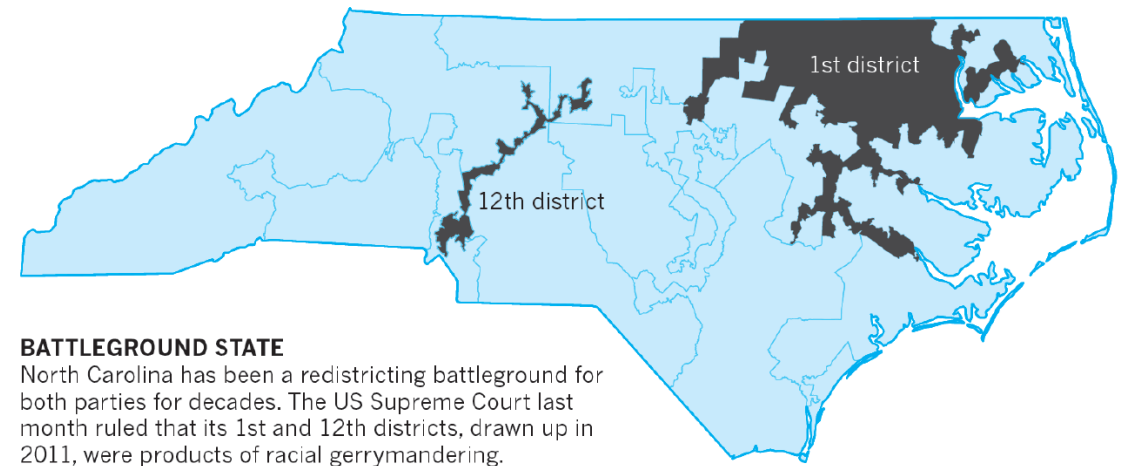
# Making the case for gerrymandering?



## **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



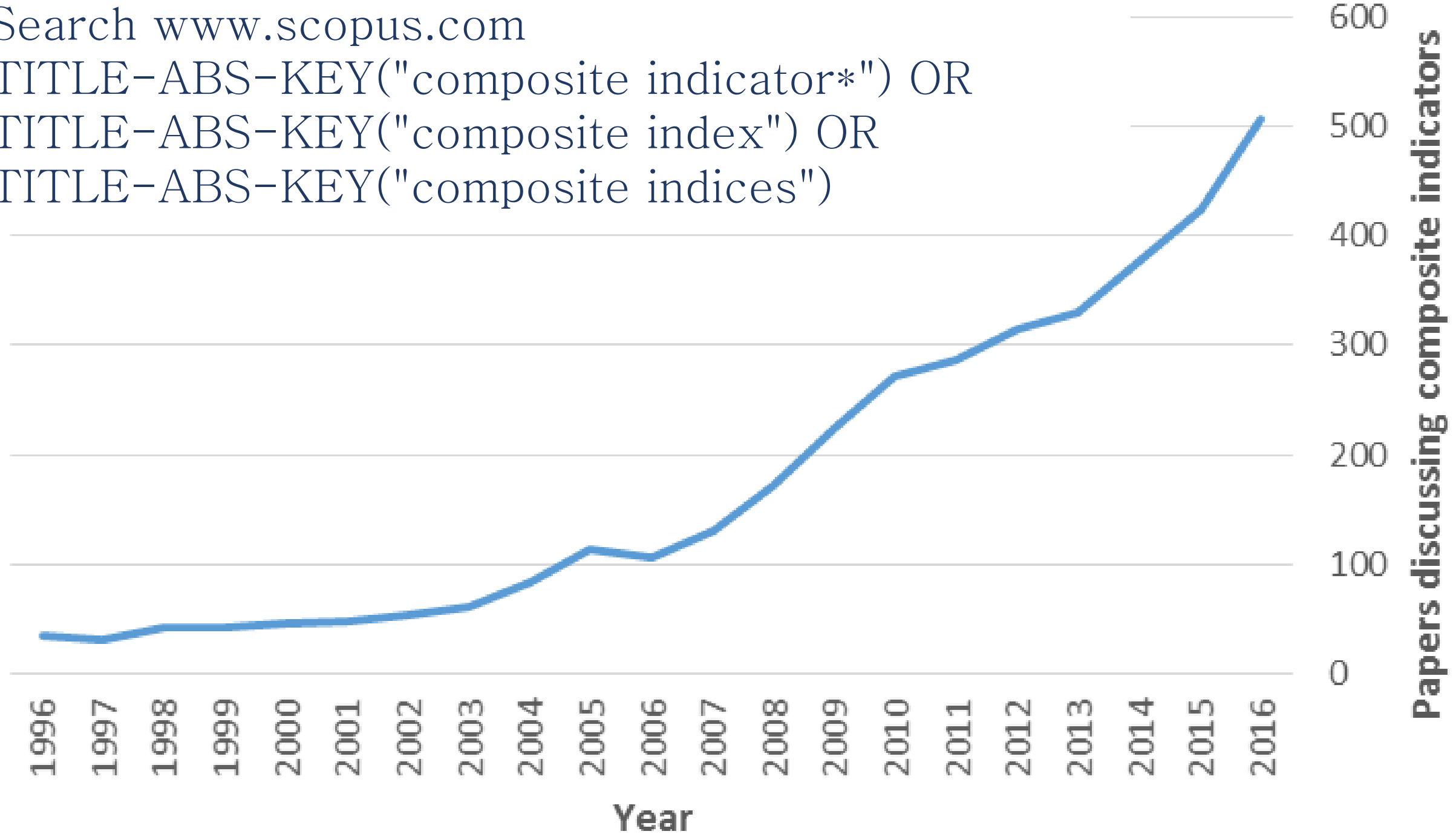
## **BATTLEGROUND STATE**

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.

“[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](http://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](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](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

Economics theory is not all  
that it's cracked up to be

Caution is needed with reliance on formal methods / models

From Carmen Reinhart and Kenneth Rogoff MS-Excel based theorem to the econometrics of Daron Acemoglu to the use of DSGE ...

John Cassidy, 2013, The Reinhart and Rogoff Controversy: A Summing Up, April 26, 2013

<http://www.newyorker.com/news/john-cassidy/the-reinhart-and-rogo-off-controversy-a-summing-up>

<http://www.bbc.com/news/magazine-22223190>

David Y. Albouy, American Economic Review, vol. 102, no. 6, October 2012 (pp. 3059–76) The Colonial Origins of Comparative Development: An Empirical Investigation: Comment,

<https://www.aeaweb.org/articles?id=10.1257/aer.102.6.3059>

Philip Mirowski, 2013, Never let a serious crisis go wasted, Verso Books.



Science appears to be in an existential crisis which has ethical, epistemological, methodological and even metaphysical dimensions



## THE RIGHTFUL PLACE OF SCIENCE: **SCIENCE ON THE VERGE**

### CONTRIBUTORS

Alice Benessia  
Silvio Funtowicz  
Mario Giampietro  
Ângela Guimarães Pereira  
Jerome R. Ravetz  
Andrea Saltelli  
Roger Strand  
Jeroen P. van der Sluijs



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## Futures

journal homepage: [www.elsevier.com/locate/futures](http://www.elsevier.com/locate/futures)

### What is science's crisis really about?

Andrea Saltelli<sup>a,b,\*</sup>, Silvio Funtowicz<sup>a</sup>

<sup>a</sup> Centre for the Study of the Sciences and the Humanities (SVT), University of Bergen, Norway

<sup>b</sup> Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, Spain



See an ongoing discussion here:

<https://theconversation.com/profiles/andrea-saltelli-299347/articles>



Since composite indicators are  
here to stay ...

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

# Sensitivity analysis



PDF



Info

## Series A Statistics in Society

[Explore this journal >](#)

### 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](#)

DOI: [10.1111/j.1467-985X.2005.00350.x](https://doi.org/10.1111/j.1467-985X.2005.00350.x) [View/save citation](#)

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Citation tools ▼



[View issue TOC](#)  
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



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Contents lists available at ScienceDirect

Research Policy

journal homepage: [www.elsevier.com/locate/respol](http://www.elsevier.com/locate/respol)

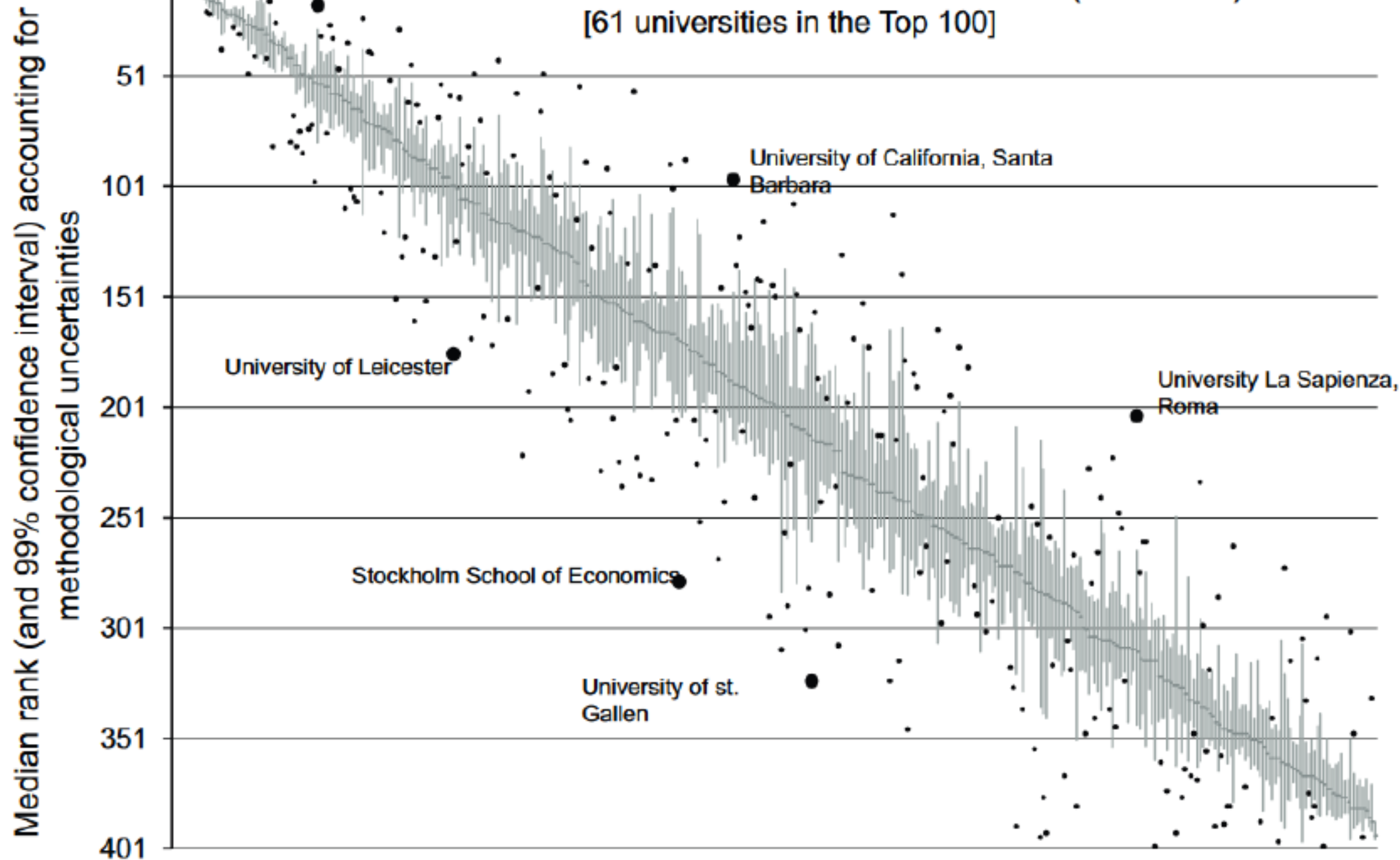


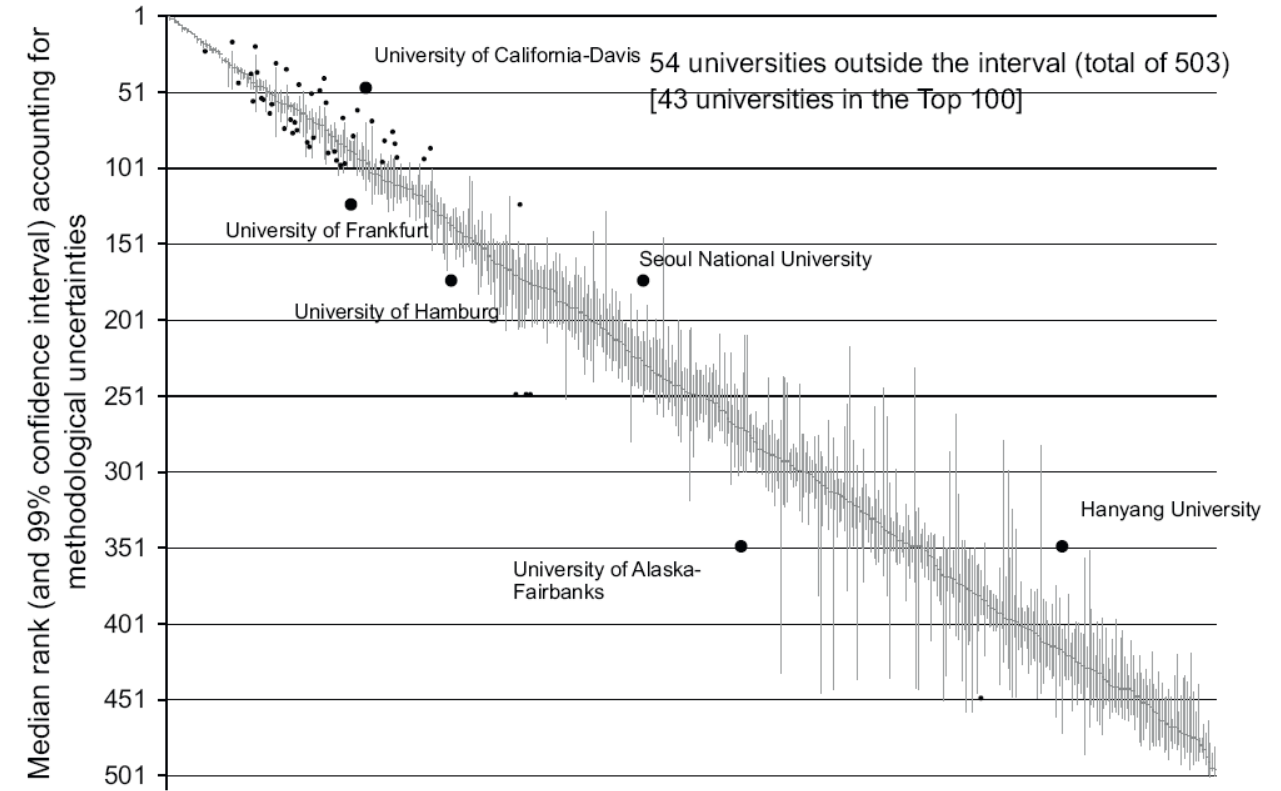
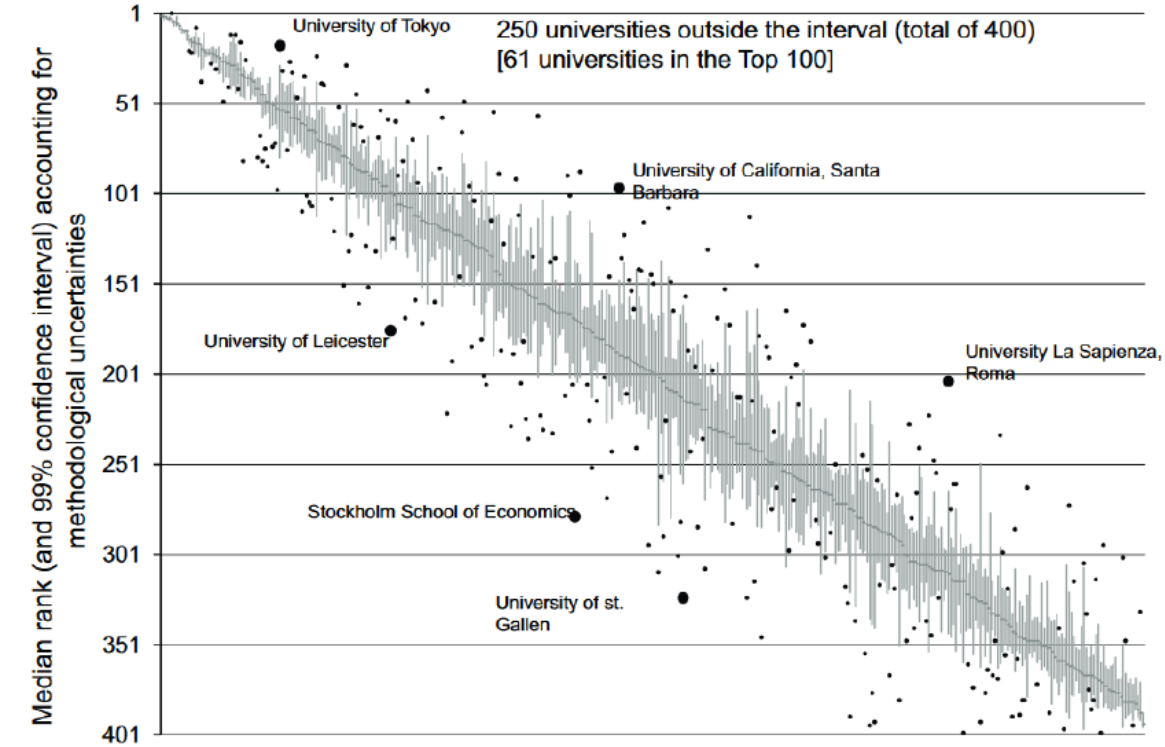
## Rickety numbers: Volatility of university rankings and policy implications

Michaela Saisana\*, Béatrice d'Hombres, Andrea Saltelli

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







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

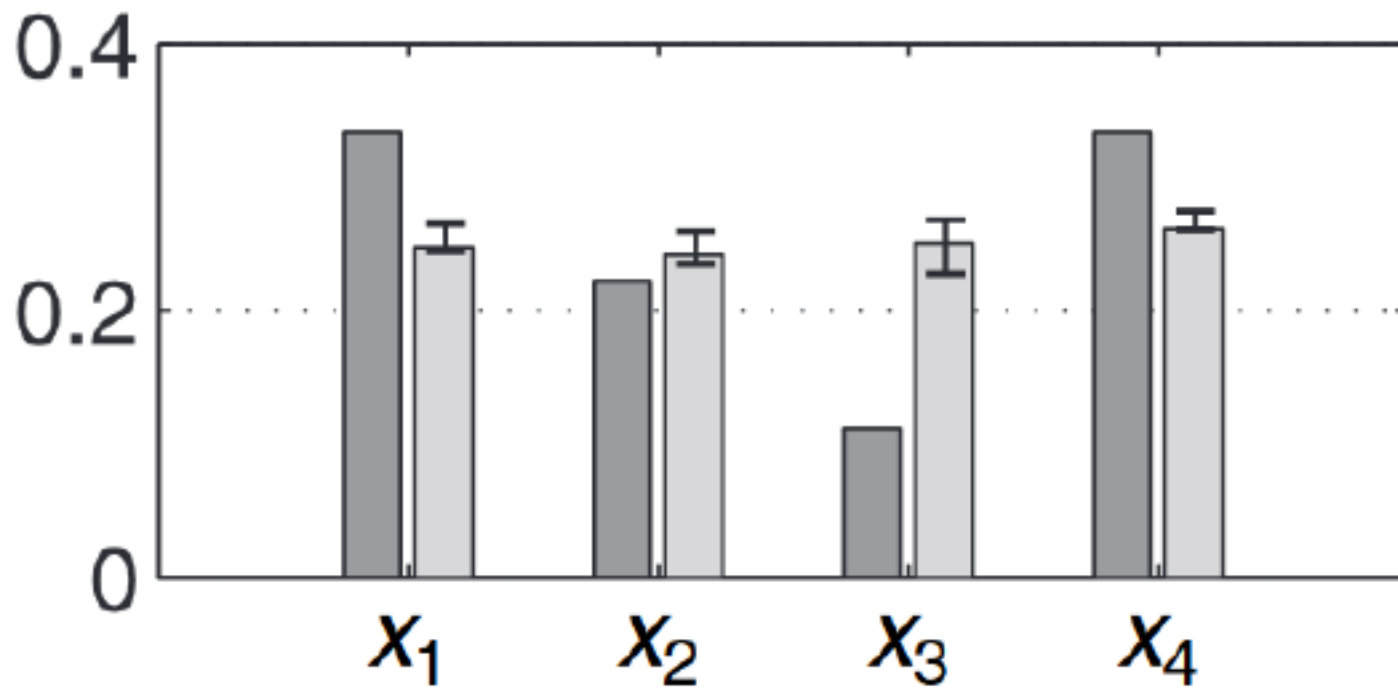
## **Ratings and rankings: voodoo or science?**

Paolo Paruolo

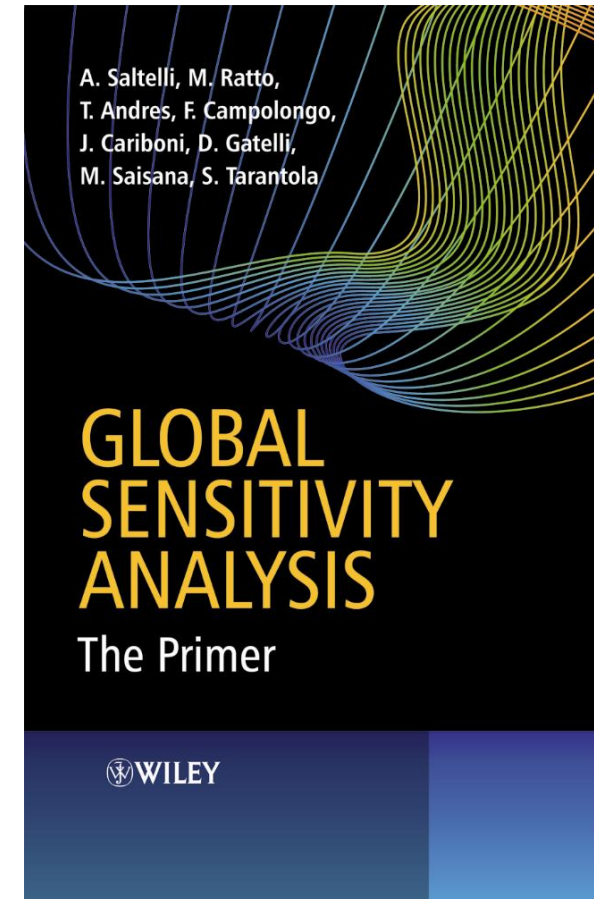
*University of Insubria, Varese, Italy*

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)





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

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Andrea Saltelli\* and  
Ângela Guimarães Pereira

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How about  
sensitivity  
auditing &  
quantitative  
story-telling

Futures xxx (2017) xxx–xxx



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journal homepage: [www.elsevier.com/locate/futures](http://www.elsevier.com/locate/futures)



Original research article

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

Andrea Saltelli<sup>a,b,c,\*</sup>, Mario Giampietro<sup>a,c,d</sup>

The issue of frames

# Why quantification / framing may obfuscate an issue:

## The example of GMO

Andrea Saltelli, Mario Giampietro, 2017, What is wrong with evidence based policy, and how can it be improved? Futures, DOI: <http://dx.doi.org/doi:10.1016/j.futures.2016.11.012>

Rayner, S., 2012, Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses, Economy and Society, 41:1, 107–125.





## GMO as a food scare

The Economist, Vermont v science, The little state that could kneecap the biotech industry, May 10th 2014



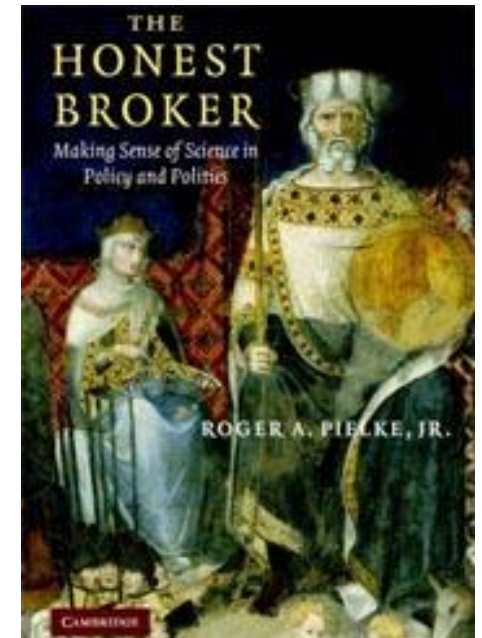
# Citizens' worries (Marris, 2001, excerpts)



- Who decided that they should be developed and how?
- Why are we not given an effective choice about whether or not to buy and consume these products?
- Do regulatory authorities have sufficient powers and resources to effectively counter-balance large companies who wish to develop these products?

Marris, C., Wynne, B., Simmons P., and Weldon, S. 2001. Final Report of the PABE research project funded by the Commission of European Communities, Contract number: FAIR CT98-3844 (DG12 – SSMI), December 2001.

The problem is not the non-neutrality of a measure but its purported neutrality (R. Pielke's Jr 'stealth advocacy')



Roger A. Pielke, Jr., 2007, The honest broker, Cambridge University Press

So what does quantitative story telling propose?

Instead of detailed quantification on a single frame a rough quantitative appraise of a richer set of frames

E.g. not just one convergence story

Test the various stories for:

- feasibility (compatibility with processes outside human control);
- viability (compatibility with processes under human control, in relation to both the economic and technical dimensions); and
- desirability (compatibility with a multitude of normative considerations relevant to a plurality of actors).

## Conclusions: CI – instructions for use

Awareness of the imperfections and non-neutrality of measures

Investigate properties and assumptions

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

Don't commit to a single view





# END

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# Outline

- Indicators from Lorenzetti to Leibnitz (Boulanger, Hacking)
- The fortune of composite indicators; How so? (CSMEP)
- CI as hybrid objects, here to stay: Gerrymandering and CI
- **The critique of CI**; CI hiding values (CSMEP)? CI as soft (mashup) versus strong monetary aggregates (Ravallion)
- Separating facts from values? Democratization of expertise.
- Evidence based policy and its nemesis (Saltelli and Giampietro, Ioannidis)
- The powerful methods of economics? Economics Blues (Rogoff and Reinhart, Acemoglu, Paul Romer, Mirowski on the virtues DSGE)
- Facts and norms cannot be separated; should they? Dewey on social discovery and the true nature of how social science works
- CI here to stay, let's do them properly

Extra material

More examples of deconstruction of dubious evidence

# Too much is being read in the OECD–PISA data

IJCED  
19,1

20

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Received 14 December 2016  
Revised 17 February 2017  
Accepted 24 February 2017

## Do PISA data justify PISA-based education policy?

Luisa Araujo

*Department of Human Capital and Employment,  
European Commission Joint Research Centre Ispra Sector, Ispra, Italy*

Andrea Saltelli

*University of Bergen, Bergen, Norway and  
Universitat Autònoma de Barcelona, Barcelona, Spain, and*

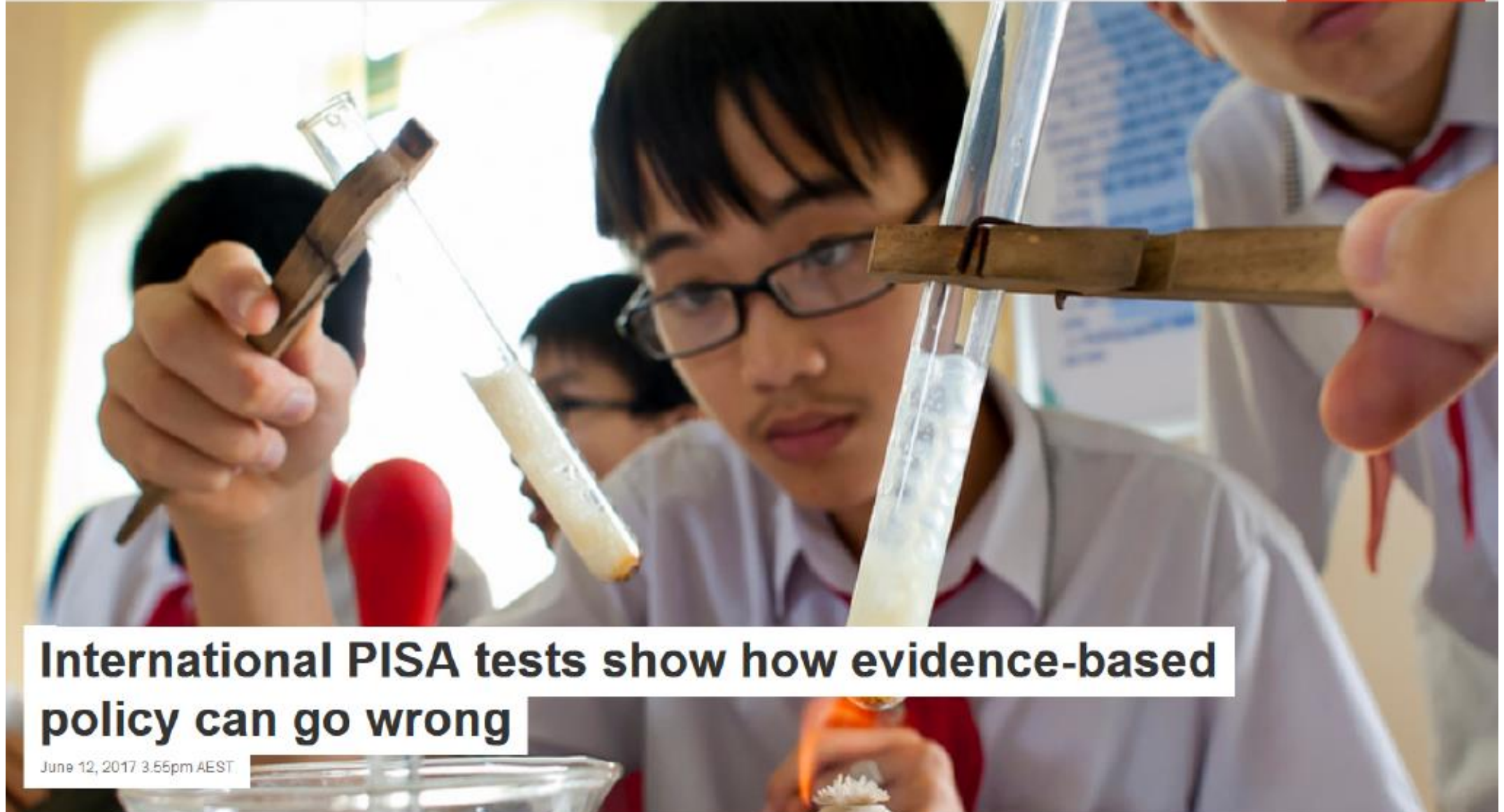
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pp. 20-34  
© Emerald Publishing Limited  
2396-7404  
DOI 10.1108/IJCED-12-2016-0023





## 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

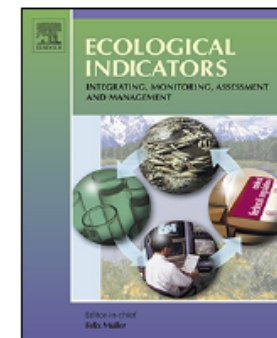
Ecological Indicators 46 (2014) 610–621



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## Ecological Indicators

journal homepage: [www.elsevier.com/locate/ecolind](http://www.elsevier.com/locate/ecolind)



## Footprints to nowhere

Mario Giampietro<sup>a,c</sup>, Andrea Saltelli<sup>b,\*</sup>

<sup>a</sup> Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain

<sup>b</sup> Institute for the Protection and Security of the Citizen (IPSC), The European Commission, Joint Research Centre, TP 361, 21027 Ispra, VA, Italy

<sup>c</sup> Catalan Institution for Research and Advanced Studies (ICREA), Passeig Lluís Companys, 23, 08010 Barcelona, Spain

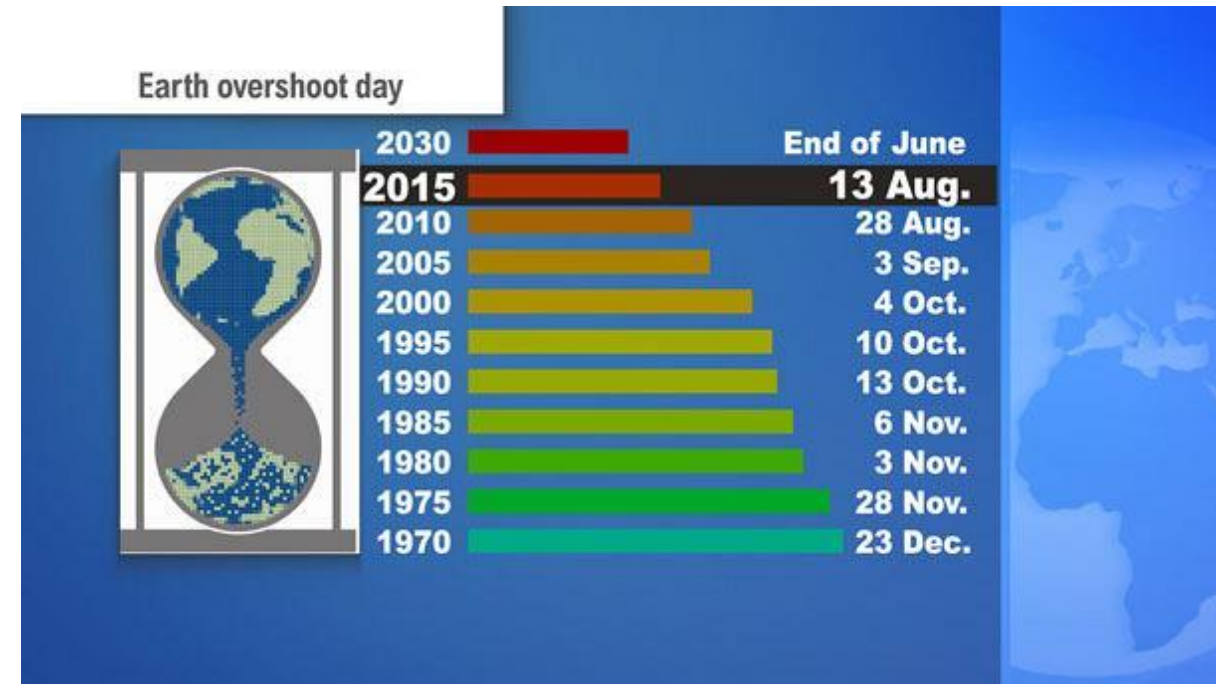




The Ecological Footprint suggests compressing sustainability to a single metric (acres of equivalent land). Volatile assumptions are taken, spurious precision is generated, and a meaningless 'interpretant' is proposed



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.



Economics as master discipline  
to adjudicate evidence for  
policy?

# The Mathiness discussion in Economics

“The style that I am calling mathiness lets academic politics masquerade as science”

The use of mathematics to veil a normative stance

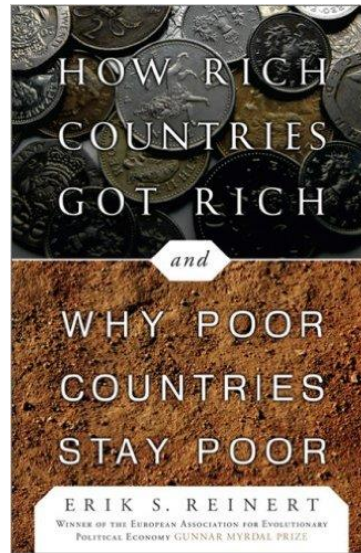
<https://paulromer.net/mathiness/>  
<https://paulromer.net/feynman-integrity/>



Paul Romer  
Since July 18  
2016 Chief  
Economist of the  
World Bank

For Erik Reinert economics has reverted to scholasticism forgetting an important continental tradition

... with important implications for developments



Erik Reinert

[http://www.andreasaltelli.eu/file/repository/Full\\_Circle\\_scholasticism\\_2.pdf](http://www.andreasaltelli.eu/file/repository/Full_Circle_scholasticism_2.pdf)



A crisis of economics? A crisis  
of science!

When entire branches of research become diseased the quality of any scientific artifact needs attention



## Reconstruction of a Train Wreck: How Priming Research Went off the Rails

<https://replicationindex.wordpress.com/2017/02/02/reconstruction-of-a-train-wreck-how-priming-research-went-of-the-rails/comment-page-1/>

🕒 February 2, 2017 📖 Kahneman, Priming, r-index, Statistical Power, Thinking Fast and Slow

**Authors: Ulrich Schimmack, Moritz Heene, and Kamini Kesavan**

**Replicability-Index**

*Improving the replicability of empirical research*



# Not even statisticians can stop the crisis in the misuse of fundamental statistical tools



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## **AMERICAN STATISTICAL ASSOCIATION RELEASES STATEMENT ON STATISTICAL SIGNIFICANCE AND P-VALUES**

*Provides Principles to Improve the Conduct and Interpretation of Quantitative  
Science*

March 7, 2016

Wasserstein, R.L. and Lazar, N.A., 2016. 'The ASA's statement on p-values: context, process, and purpose', *The American Statistician*, DOI:10.1080/00031305.2016.1154108.

See also Christie Aschwanden at <http://fivethirtyeight.com/features/not-even-scientists-can-easily-explain-p-values/>



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Original research article

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

Andrea Saltelli<sup>a,b,c,\*</sup>, Mario Giampietro<sup>a,c,d</sup>



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**Journal of  
Clinical  
Epidemiology**

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

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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)

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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

A man in a blue suit is walking a tightrope that extends from a large, dark, tangled mass of lines on the left side of the image. The man is facing away from the viewer, balancing on the rope. The background is a light gray gradient.

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)

Andrea  
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