

A modelling manifesto

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2nd TIAS/SESYNCR/ SESMO Webcast: Exploring Uncertainty,
Transparency and Robustness in Socio-Environmental Systems
Modelling and Assessments – 28 April 2021



Where to find this talk: www.andreasaltelli.eu

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CAETERIS ARE
NEVER PARIBUS

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 **I-site ULNE**
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#statistiques #probabilités #modélisation
#prédiction Isabelle Bruno du #CERAPS
@univ_lille @CNRS_HdF @ScPoLille nous parle
des dérives de la #quantophrénie dans un article à
lire sur le media @FR_Conversation
https://twitter.com/FR_Conversation/status/1302651033164881920

♡ ↗

Sep 7, 2020

 **andrea saltelli**
@AndreaSaltelli

Pour mes amis francophones. Honoured to be co-author of a stactivist like Isabelle Bruno du #CERAPS @univ_lille @CNRS_HdF @ScPoLille @OpenEvidence @UOCNews
Statistiques et modèles mathématiques : doit-on

Embed

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Five ways to ensure that models serve society: a manifesto

Pandemic politics highlight how predictions need to be transparent and humble to invite insight, not blame.



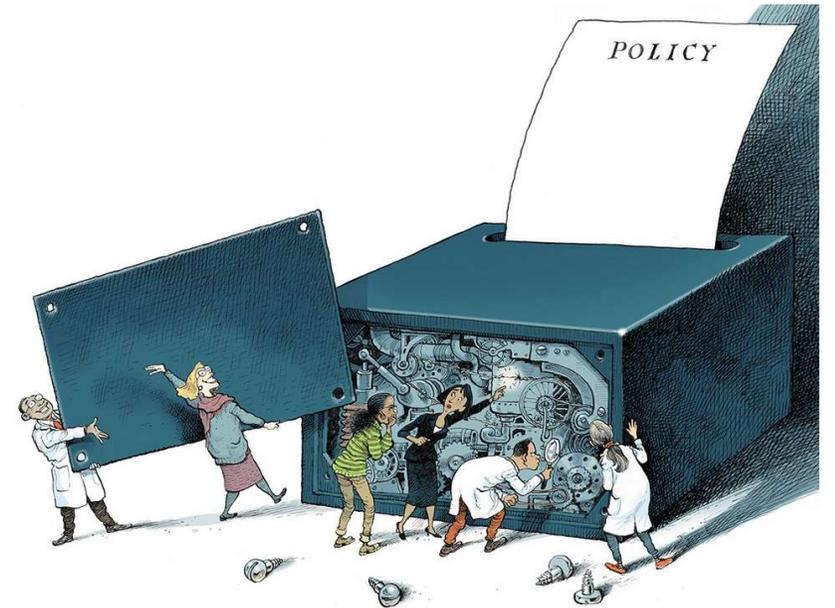
Illustration by David Parkins



Andrea Saltelli , Gabriele Bammer, Isabelle Bruno, Erica Charters, Monica Di Fiore, Emmanuel Didier, Wendy Nelson Espeland, John Kay, Samuele Lo Piano, Deborah Mayo, Roger Pielke Jr, Tommaso Portaluri, Theodore M. Porter, Arnald Puy, Ismael Rafols, Jerome R. Ravetz, Erik Reinert, Daniel Sarewitz, Philip B. Stark, Andrew Stirling, Jeroen van der Sluijs & Paolo Vineis

3 modellers
2 experts models and society
3 statisticians
2 *statactivistes*
2 economists
1 epidemiologist

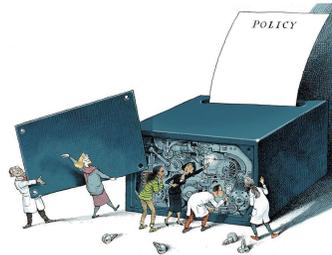
2 sociologists of quantification
3 STS scholars
1 philosopher
1 historian
1 political scientists
1 expert RRI - Open Science



COVID-19: models in the
limelight:
power and conflicts

Power: “the Virus Report That Jarred the U.S. and the U.K. to Action (NYT)”

Research code used as a policy tool (chameleon models)



Landler, Mark, and Stephen Castle. 2020. Behind the Virus Report That Jarred the U.S. and the U.K. to Action – The New York Times.

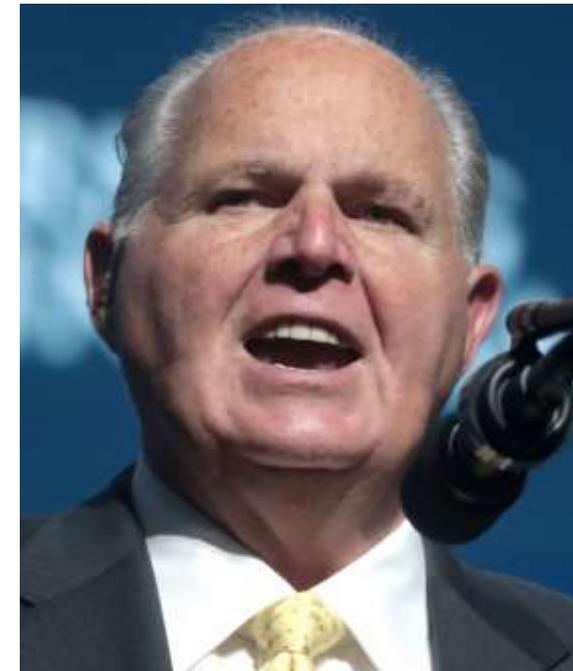
Pfleiderer, P. Chameleons: The Misuse of Theoretical Models in Finance and Economics. *Economica* 87, 81–107 (2020).

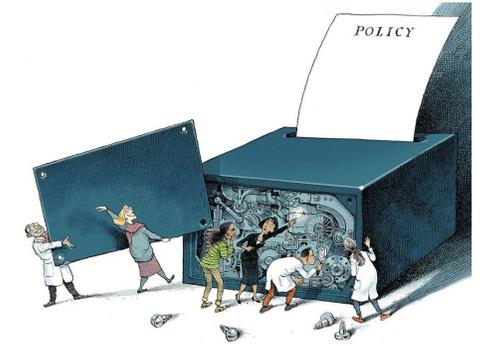
Conflicts, when questions of urgency, stakes, values and uncertainty collide

“Wild-Ass Covid numbers
... The minute I hear
anybody start talking about
models and modeling, I
blanch”

Rhodes, Tim, and Kari Lancaster. 2020. “Mathematical Models as Public Troubles in COVID-19 Infection Control: Following the Numbers.” *Health Sociology Review* 1-18.
doi: 10.1080/14461242.2020.1764376

Rush Limbaugh



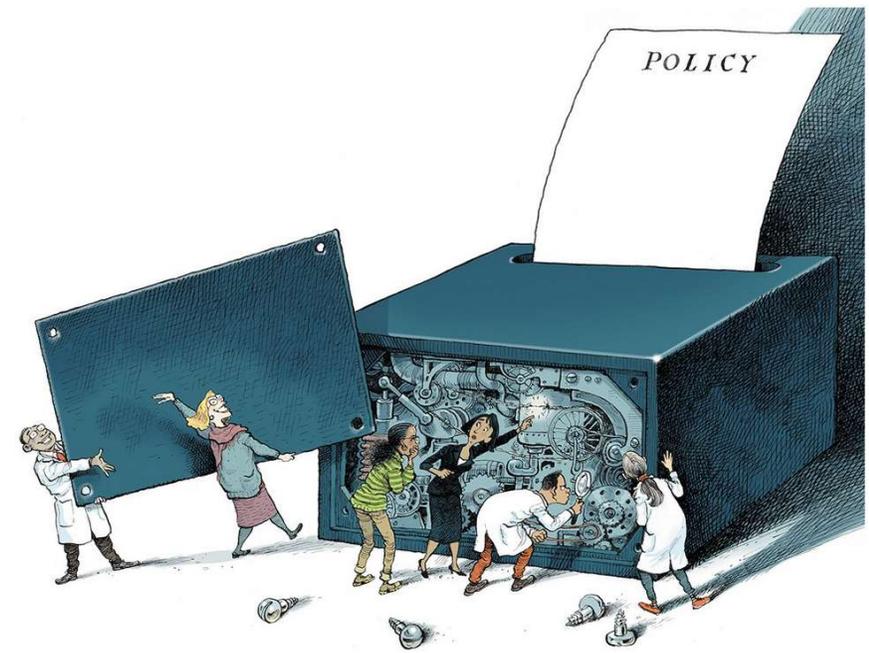


“Modellers must not be permitted to project more certainty than their models deserve;

and politicians must not be allowed to offload accountability to models of their choosing”

Mind the assumptions

Assess uncertainty and sensitivity



...global uncertainty and sensitivity analyses are often not done. Anyone turning to a model for insight should demand them ...

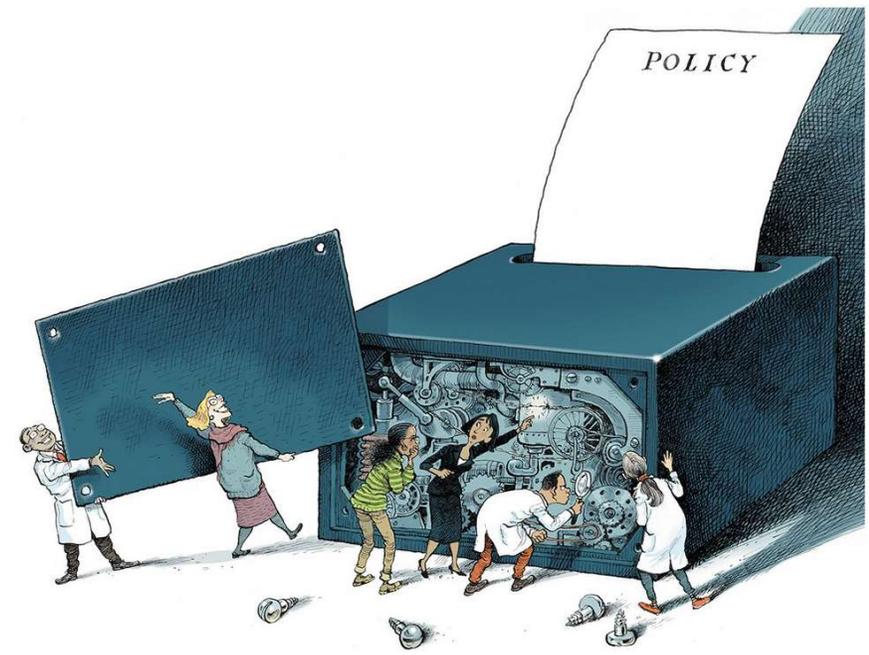
SUPPLEMENTARY INFORMATION

1. Additional information and references

>260 references

Mind the hubris

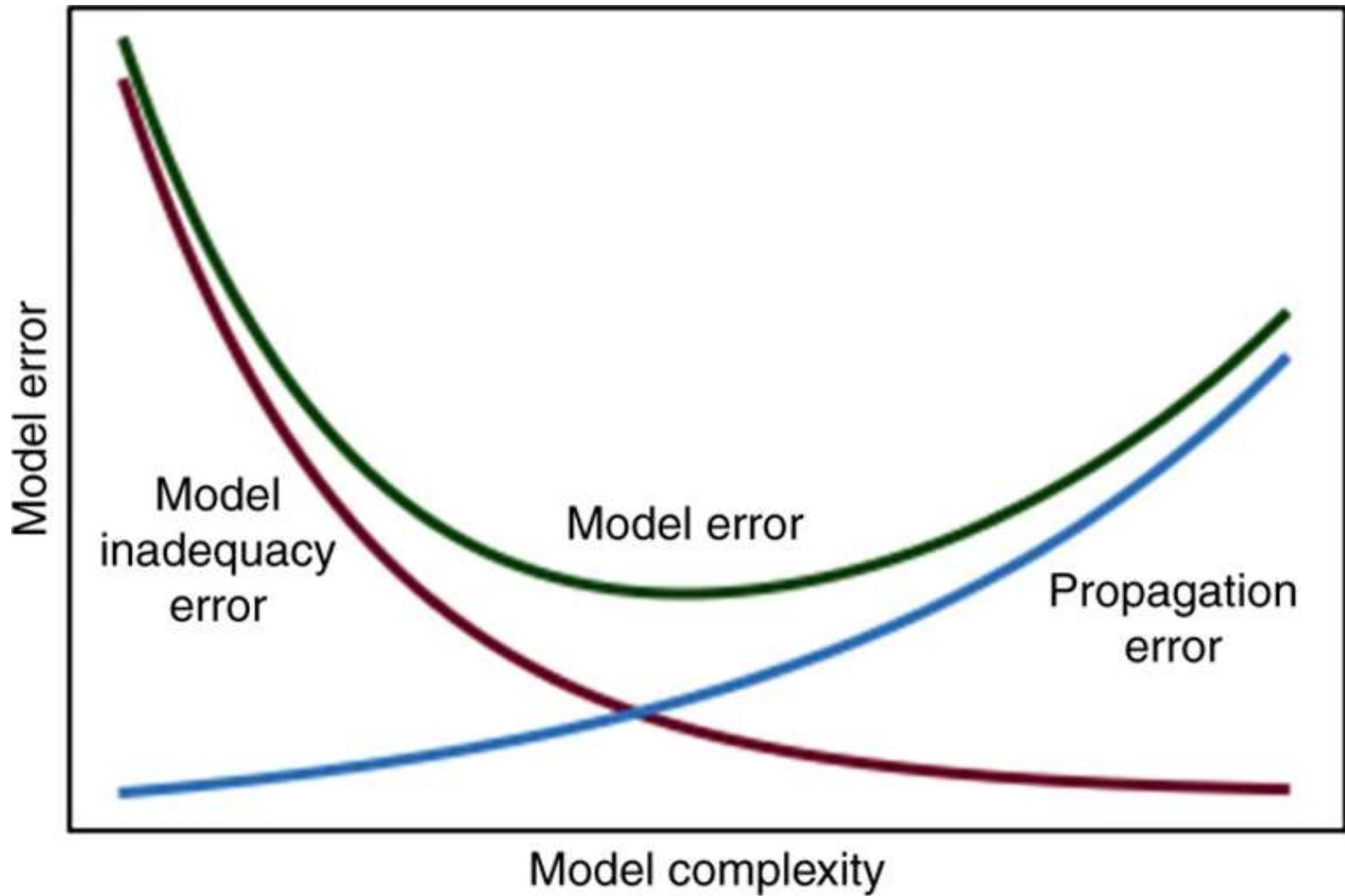
Complexity can be the enemy of relevance



... many are seduced by the idea of adding complexity in an attempt to capture reality more accurately...

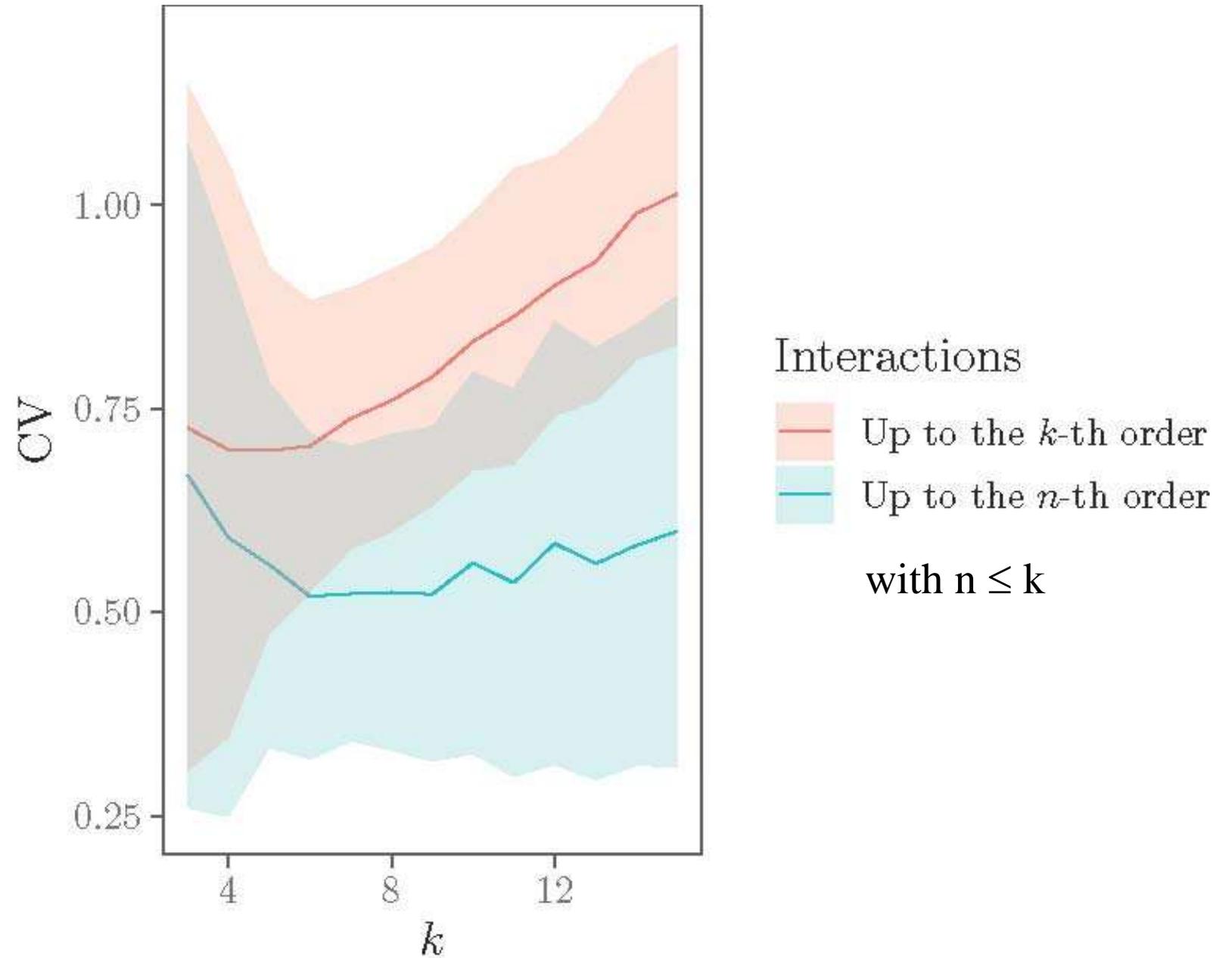
SUPPLEMENTARY INFORMATION

1. [Additional information and references](#) >260 references



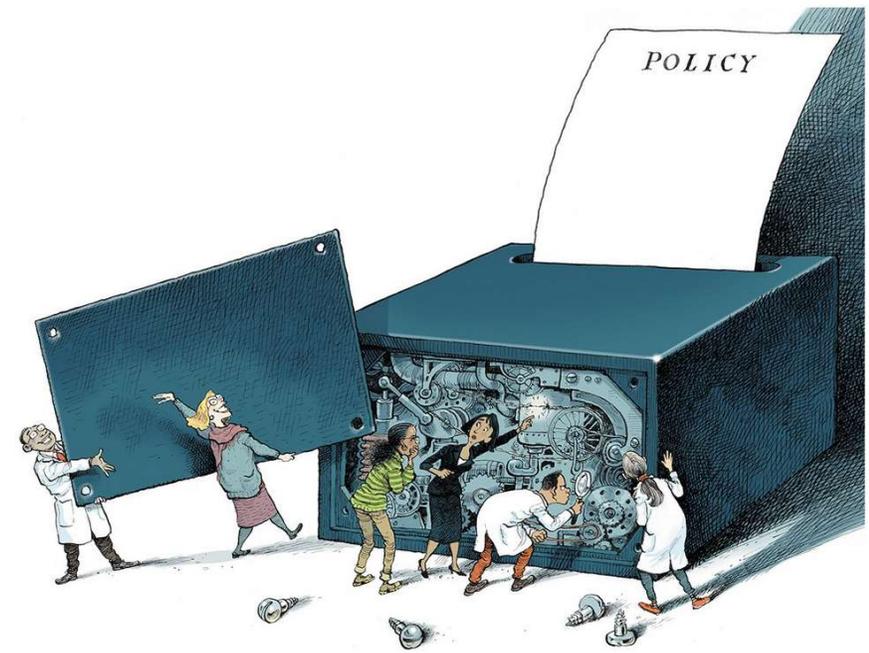
O’Neil
conjecture,
uncertainty
cascade ...
several names
in the literature

From A. Puy et al.,
“O’Neil conjecture
tested”, **paper in
progress**



Mind the framing

Match purpose and context



… models will reflect the interests, disciplinary orientations and biases of the developers…

SUPPLEMENTARY INFORMATION

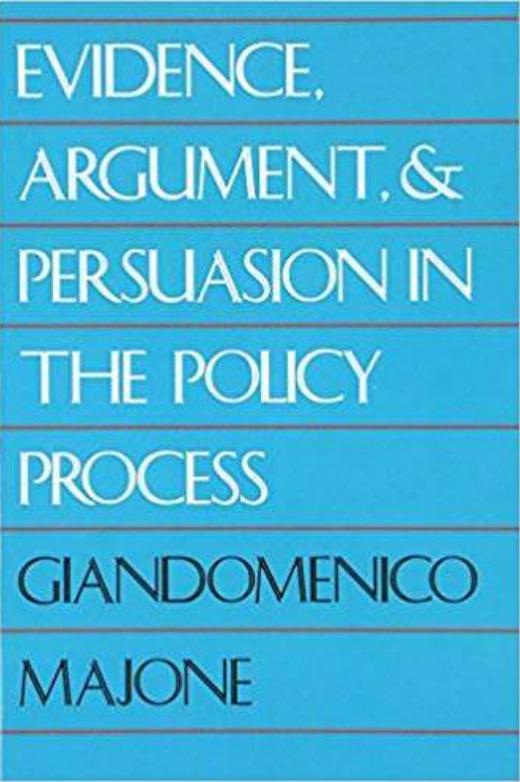
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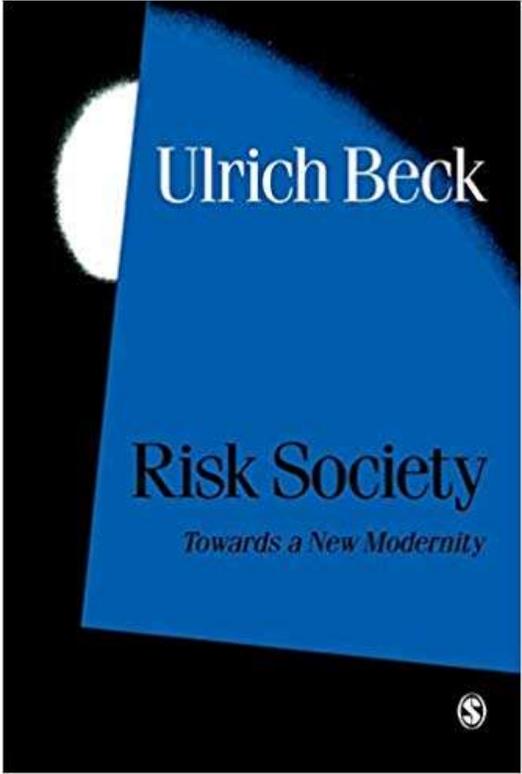
From Ulrich Beck to Giandomenico Majone: the technique is never neutral



Ulrich Beck
(1944 –2015)



1989



1992 (1986)



Environmental Science & Policy

Volume 106, April 2020, Pages 87-98

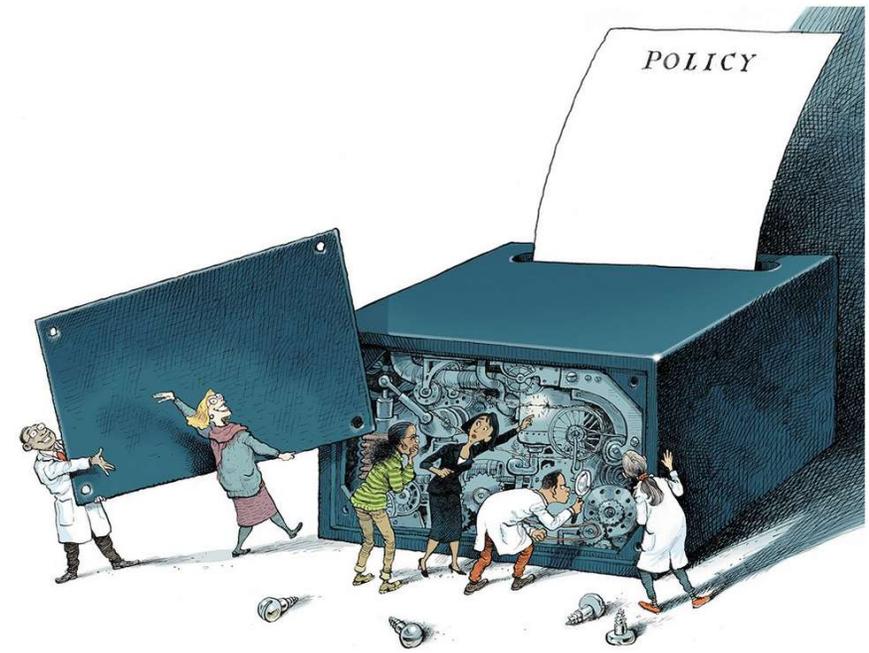


The technique is never neutral. How methodological choices condition the generation of narratives for sustainability

Andrea Saltelli ^{a, b} ✉, Lorenzo Benini ^c, Silvio Funtowicz ^a, Mario Giampietro ^{d, e}, Matthias Kaiser ^a, Erik Reinert ^{a, f}, Jeroen P. van der Sluijs ^{a, g, h}

Mind the consequences

Quantification can backfire.



Sociology of quantification: ... numbers are seductive, performative, confer legitimacy; trust is essential for numbers to be useful; opacity damages trust ...

SUPPLEMENTARY INFORMATION

1. Additional information and references

>260 references

Dangers of mathematization of economics



Wolfgang Drechsler



Erik S. Reinert



Paul Romer



Philip Mirowski

W. Drechsler, “On the possibility of quantitative-mathematical social science, chiefly economics,” *J. Econ. Stud.*, vol. 27, no. 4/5, pp. 246–259, 2000.

E. S. Reinert, “Full circle: economics from scholasticism through innovation and back into mathematical scholasticism,” *J. Econ. Stud.*, vol. 27, no. 4/5, pp. 364–376, Aug. 2000.

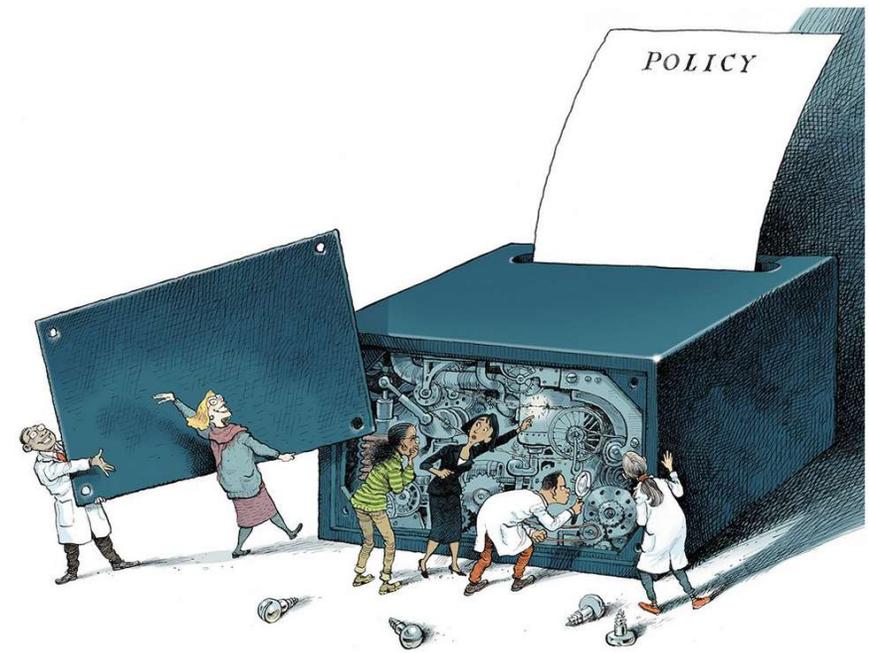
P. Romer, “Mathiness in the Theory of Economic Growth,” *Am. Econ. Rev.*, vol. 105, no. 5, pp. 89–93, May 2015.

Mirowski, Philip. 2013. *Never Let a Serious Crisis Go to Waste: How Neoliberalism Survived the Financial Meltdown*. Verso.

Mind the unknowns

Acknowledge ignorance

“there is no
number-answer to
your question”



SUPPLEMENTARY INFORMATION

1. Additional information and references

>260 references

Anthony Fauci



Eight grand challenges in socio-environmental systems modeling



- ➔ informed, equitable, and empowered decision making (eight challenges...)
- ➔ Responsible modelling ... domestication of models (five rules...)

**Why ethics of quantification
is needed now**

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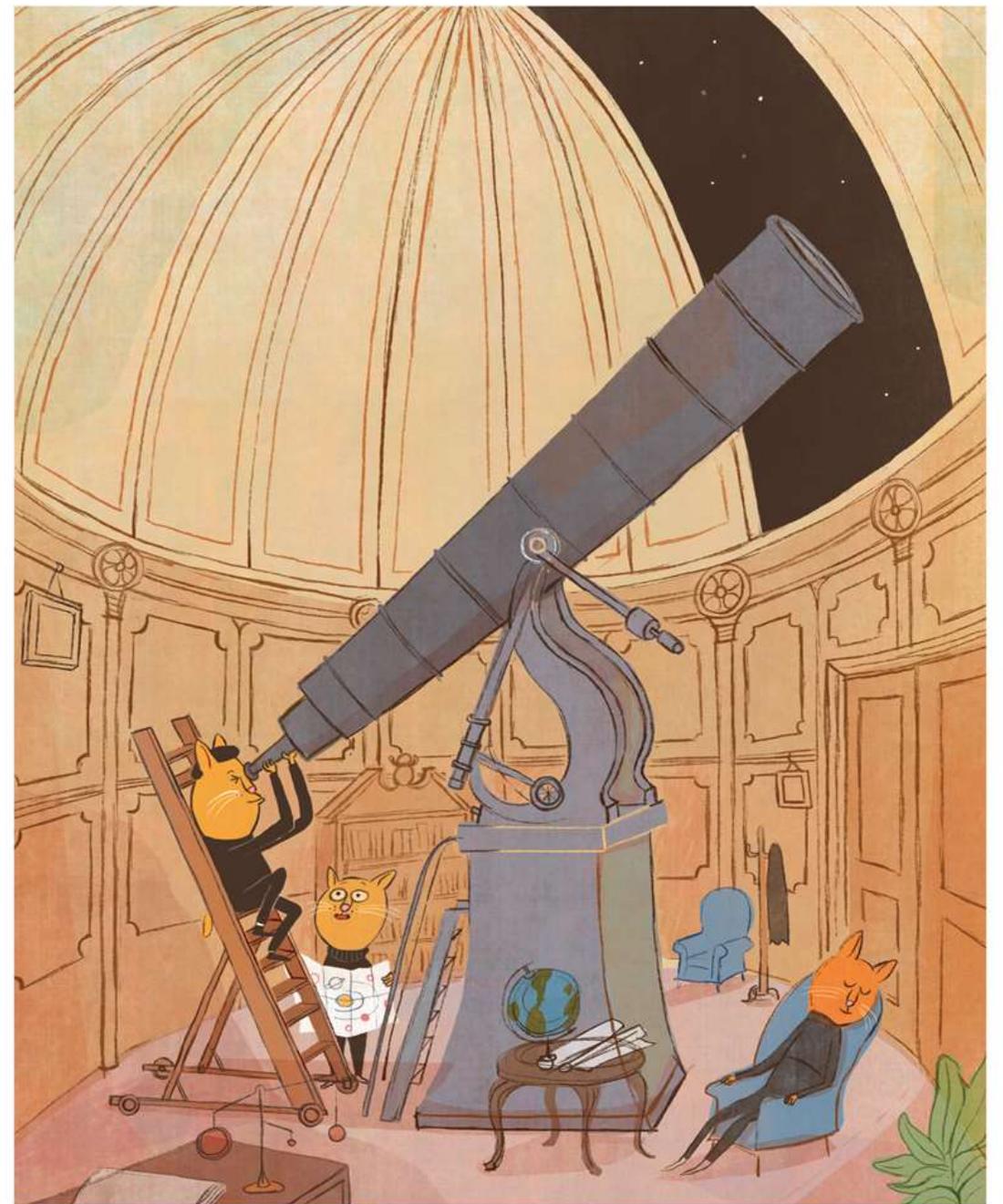


**UCL Institute for
Innovation and
Public Purpose**

WORKING PAPER
WP 2021/05



An observatory on
quantification?



Source: Tor Freeman, <http://tormalore.blogspot.com/>

The End



@andreasaltelli

Extra slides

$$y = \sum_{i=1}^k f^{u_i}(x_i)$$

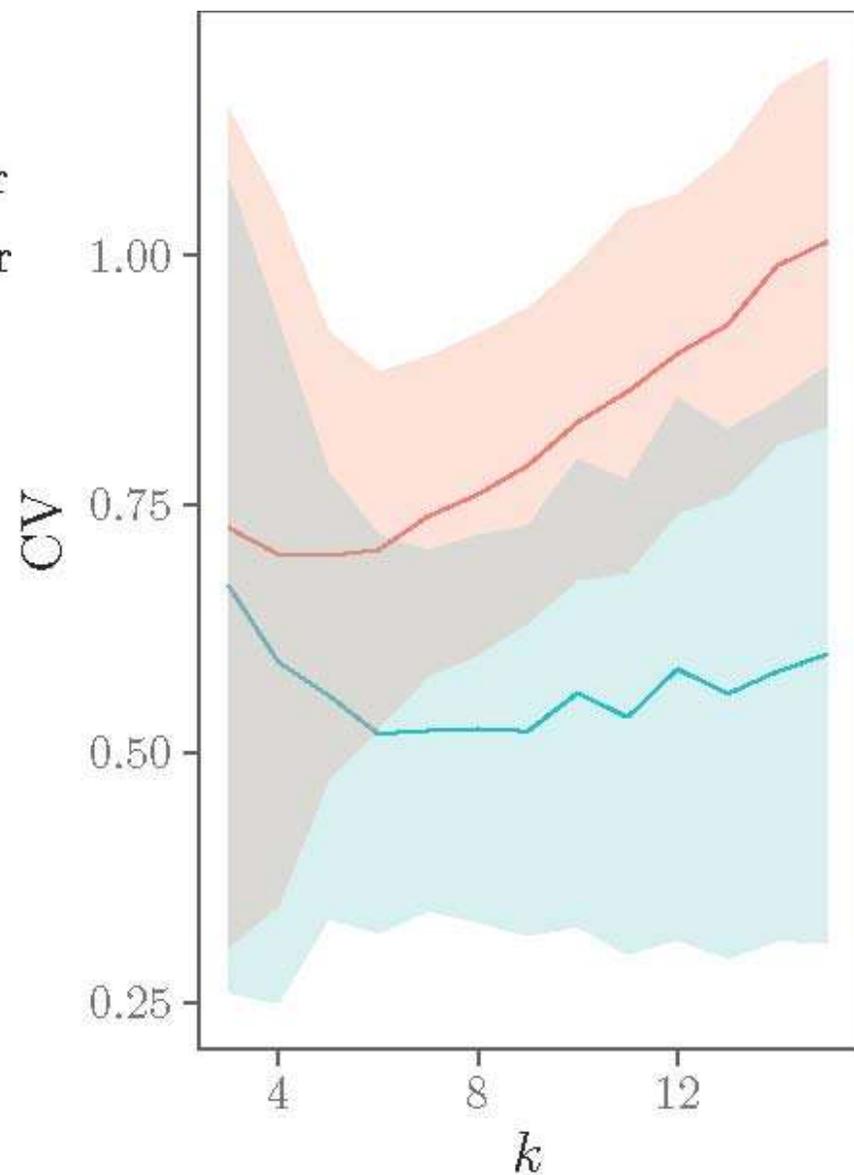
$$+ \sum_{i=1}^{k_2} f^{u_{V_{i,1}}}(x_{V_{i,1}}) f^{u_{V_{i,2}}}(x_{V_{i,2}})$$

+ ...

$$+ \sum_{i=1}^{k_n} f^{u_{W_{i,1}}}(x_{W_{i,1}}) \dots f^{u_{W_{i,n}}}(x_{W_{i,n}})$$

Interactions

- Up to the k -th order
 - Up to the n -th order
- with $n \leq k$





Comment

Open Access

Published: 27 August 2019

A short comment on statistical versus mathematical modelling

Andrea Saltelli 

Numbers and their ‘reactivity’
(Espeland and Sauder, 2016)

Incumbent numbers affect what society will
measure in the future (Merry 2016)

Numbers “create the environment that
justifies their assumptions”
(O’Neil, 2016)

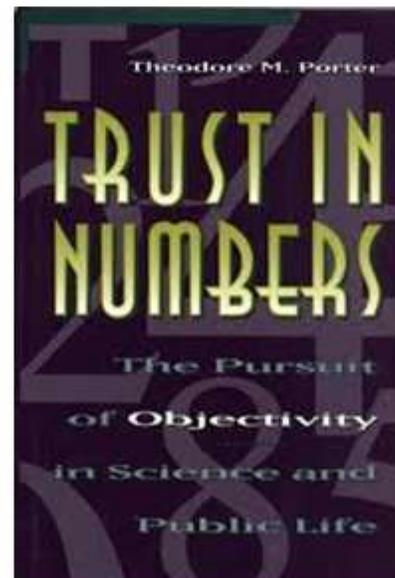
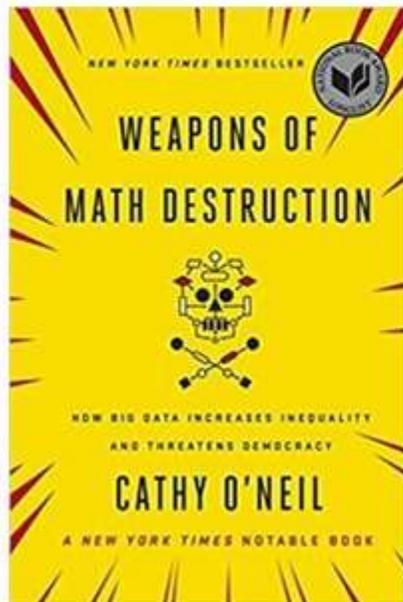
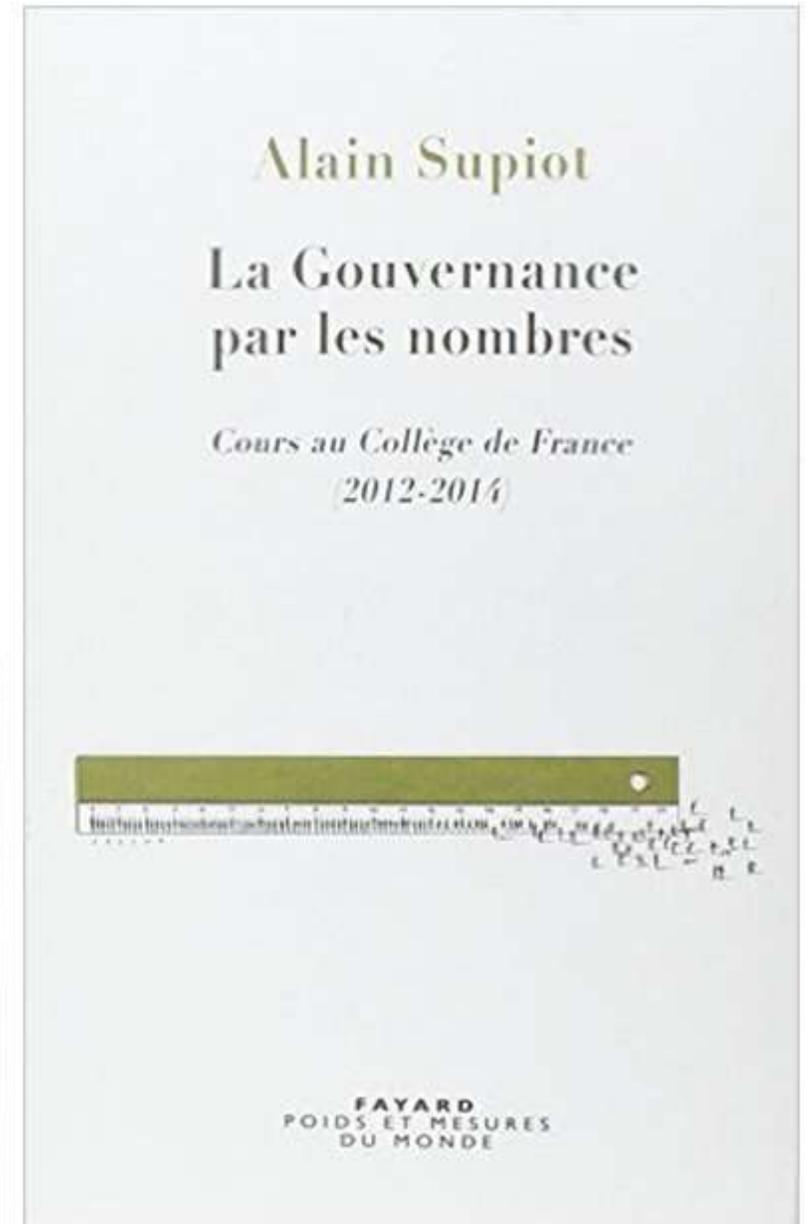
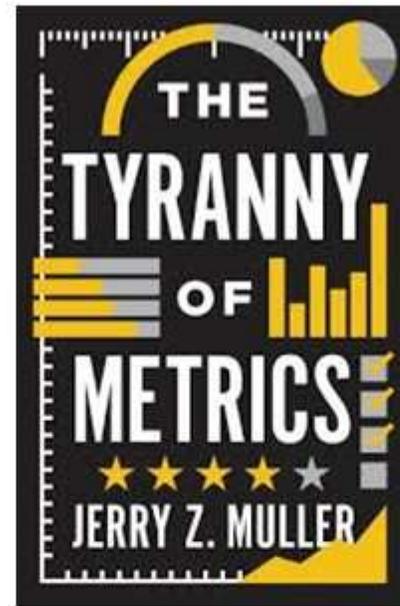
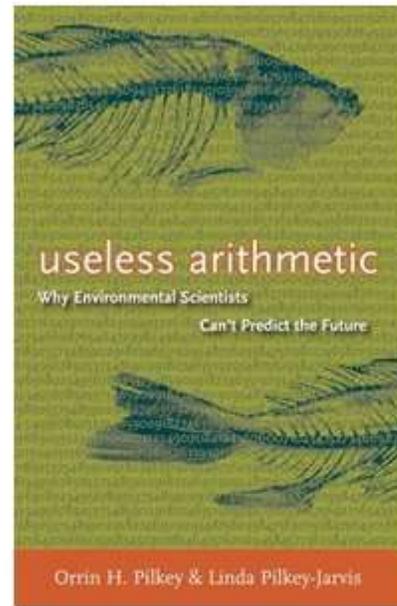
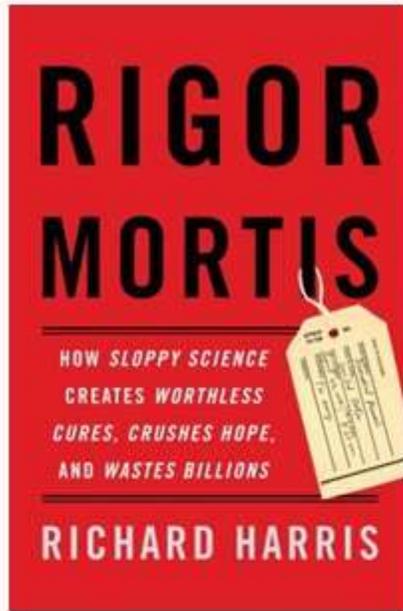
… our world is structured by numbers, visible and invisible, where truth is conveyed and reality constructed

Numbers are seductive, performative, confer to their masters' epistemic power and legitimacy

Governing the modern state, or even contesting it, without numbers is impossible

Numbers are the prevalent means to express value in our societies
… Access & production of numbers reflect and reinforce power imbalances

Algorithms, models, metrics, statistics...



Algorithms, models, metrics, statistics...

