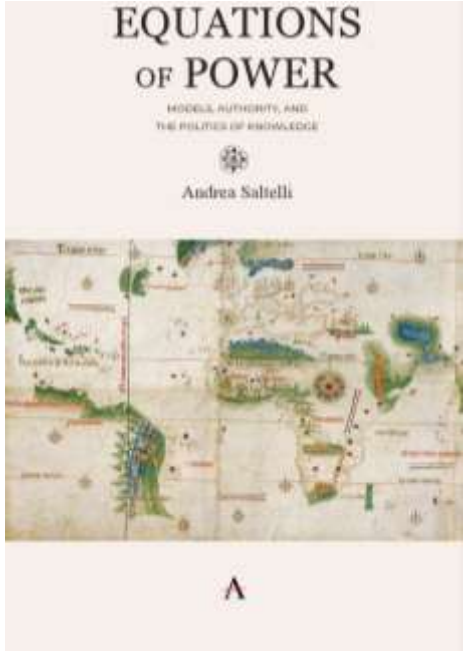
The culture of risk as a foundation of contemporary governance

Andrea Saltelli

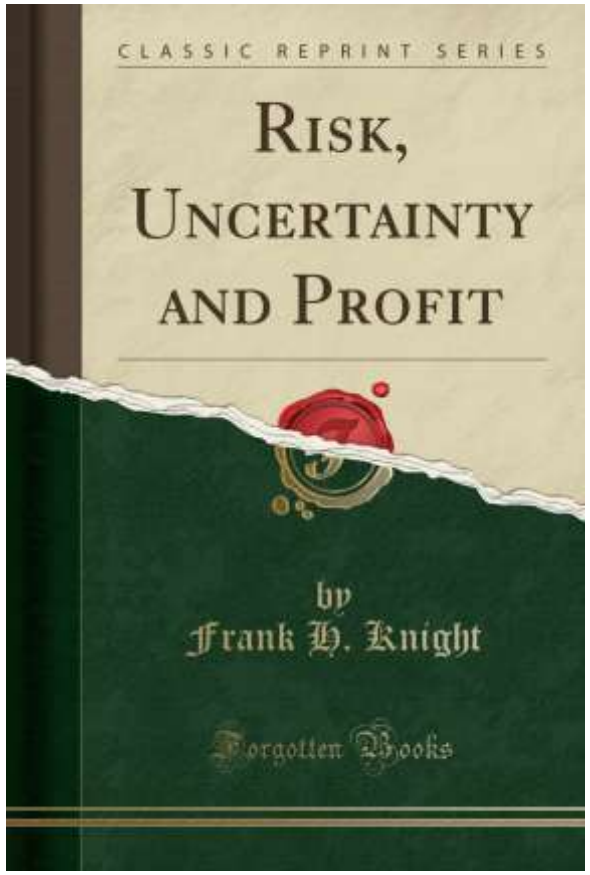
Seminario ANRA “Cultura e Comunicazione del Rischio per una Governance Efficace”, Milan, October 22, 2026

Based on Equations of Power: Models, Authority, and the Politics of Knowledge (Anthem Press, 2027)



«Viviamo in un mondo di contraddizioni e paradossi; un dato di fatto di cui forse l'esempio più fondamentale è questo: l'esistenza di un problema della conoscenza dipende dal fatto che il futuro sia diverso dal passato, mentre la possibilità di risolvere tale problema dipende dal fatto che il futuro sia simile al passato»

"We live in a world full of contradiction and paradox, a fact of which perhaps the most fundamental illustration is this: that the existence of a problem of knowledge depends on the future being different from the past, while the possibility of the solution of the problem depends on the future being like the past."



Frank H. Knight
1885-1972

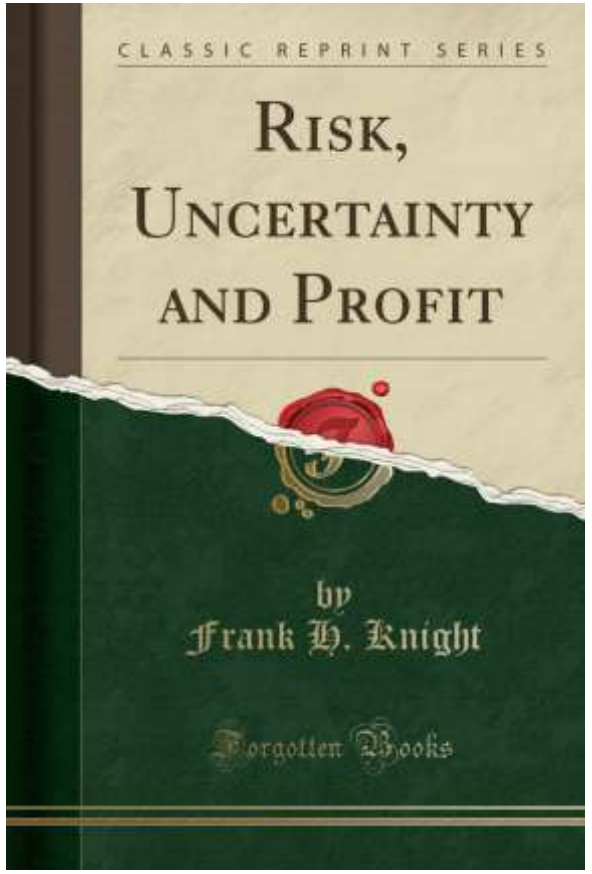
Risk and uncertainty are controversial both across and within professions

Frank Knight (1921) distinguished risk from uncertainty

Risk = know outcomes & probabilities; roulette game

Uncertainty = unsure about the probabilities; starting a business

➔ Profit arises from uncertainty, not from calculable risk



Frank H. Knight
1885-1972

But the story has many twists

The debate between Bruno De Finetti, Frank Ramsey and Jimmie Savage on one side and John Maynard Keynes and Frank Knight on the other: **a fundamental disagreement in decision theory**

Bruno De Finetti
(1906-1995)

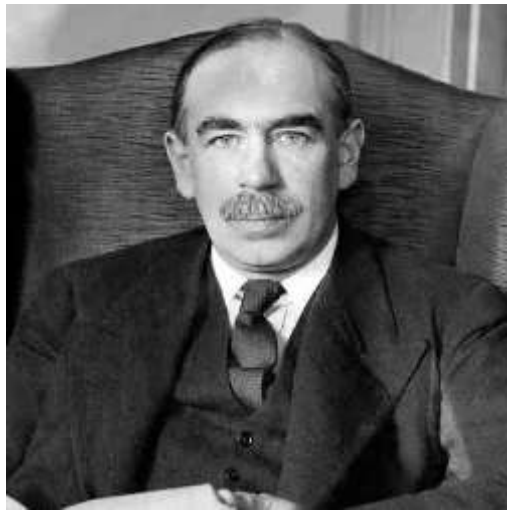
Leonard Jimmie Savage
(1917-1971)

Frank Ramsey
(1903-1930)

Twists and dissent

- Savage and Ramsey: pioneers of subjective probability theory for rational decision-making
- Keynes and Knight: sceptical that all uncertainties could be quantified probabilistically

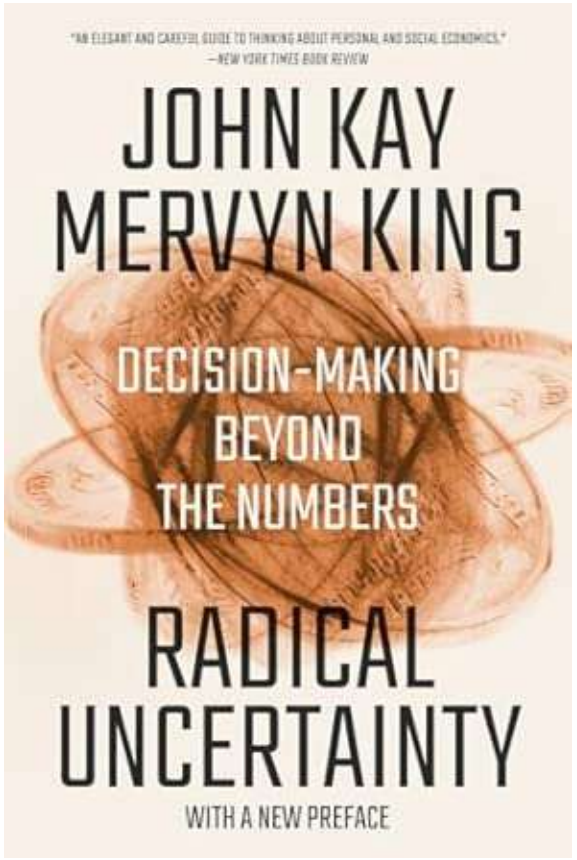
Frank H. Knight
1885-1972



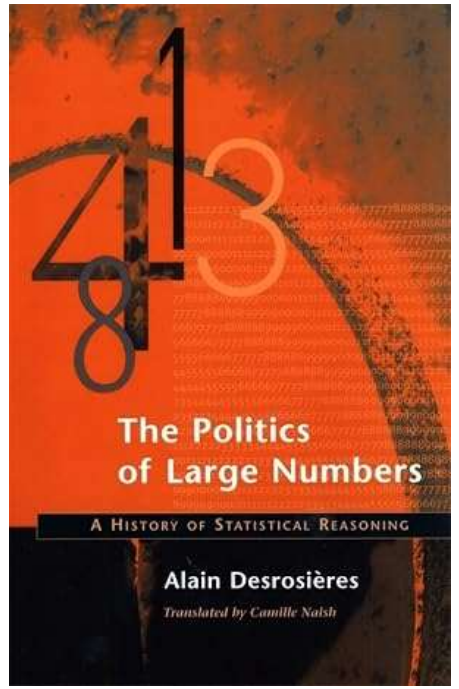
John Maynard Keynes
1883-1946

Twists and dissent

Some economists argue that Keynes was 'convinced' by the logic of Ramsey, while others disagree (Syll 2015) …

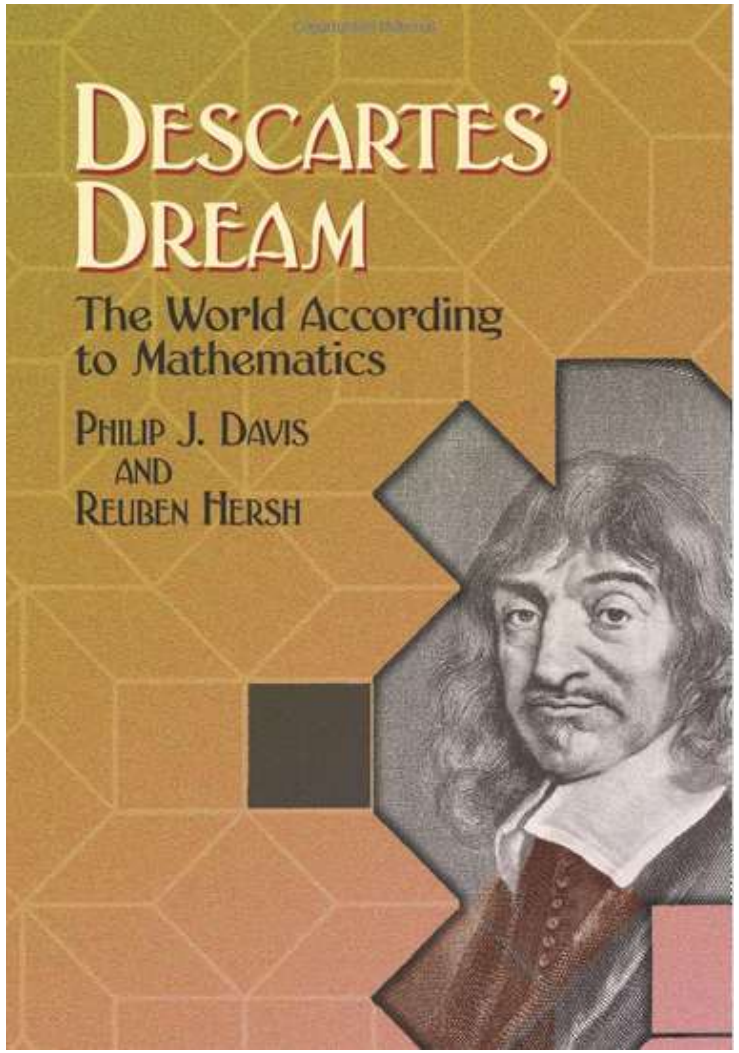


… yet quantification of uncertainty prevailed.



As noted by Kay & King (2020, p. 71),
"The pressure to apply these methods outside their context was irresistible"

Lars P. Syll, 2015, The Keynes-Ramsey-Savage debate on probability. Retrieved from https://larspsyll.wordpress.com/2015/07/22/the-keynes-ramsey-savage-debate-on-probability/



The victory of De Finetti, Ramsey and Savage ➔ make the incalculable calculable, extended from dice games to nuclear waste, from insurance tables to the fate of ecosystems

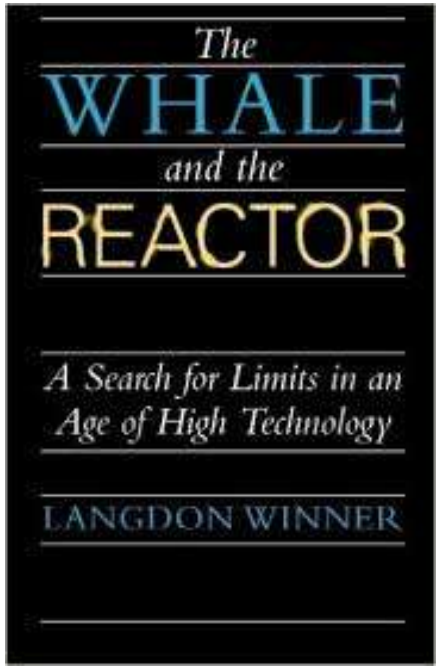
Historical dissenters from sociology and ecology

Most analyses offered as input to policy are framed as cost-benefit analysis or risk analyses, but some environmentalists disagree …

Langdon Winner

8

ON NOT HITTING
THE TAR-BABY



Winner, L., 1986. The Whale and the Reactor: a Search for Limits in an Age of High Technology. The University of Chicago Press, 1989 edition.

… and prefer to change the question from:

‘Is this [product/technology] safe?’

Claire Marris

to:

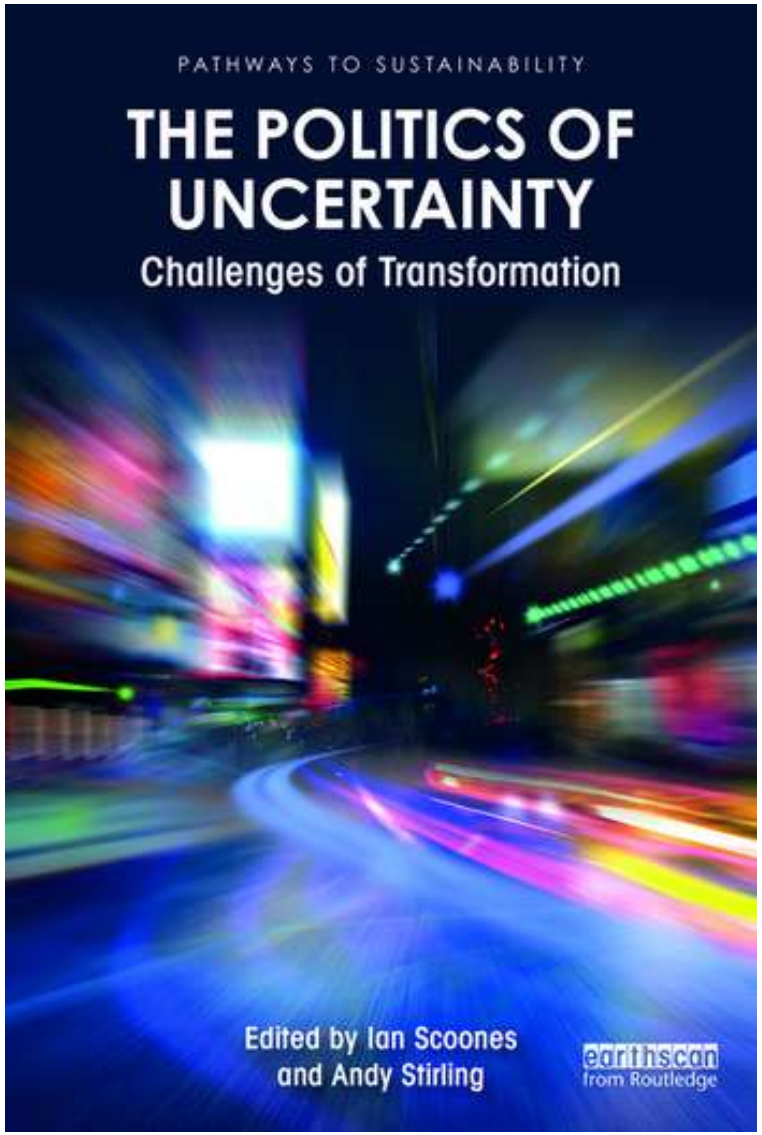
‘Why is it there in the first place?’

Langdon Winner

Claire Marris, Brian Wynne, Peter Simmons and Sue Weldon, 2001, Final Report of the PABE research project, funded by the Commission of European Communities, Contract number: FAIR CT98-3844 (DG12 - SSMI), December 2001

1. **Chi ne trarrà beneficio?**
   (Who will benefit from their use?)
2. **Chi ha deciso che andasse sviluppata, e come?**
   (Who decided that they should be developed and how?)
3. **Le autorità di controllo hanno poteri e risorse sufficienti per fare da contrappeso alle grandi imprese che intendono svilupparla?**
   (Do regulatory authorities have sufficient powers and resources to effectively counter-balance large companies that wish to develop these products?)
4. **Come si è tenuto conto, nelle decisioni, delle incertezze irriducibili e degli ambiti di ignoranza ineliminabili?**
   (How have irreducible uncertainties and unavoidable domains of ignorance been taken into account in decision-making?)
5. **Chi sarà responsabile in caso di danni imprevisti? Come ne risponderà?**
   (Who will be responsible in case of unforeseen harm? How will they be held to account?)

Claire Marris, Brian Wynne, Peter Simmons and Sue Weldon, 2001, Final Report of the PABE research project, funded by the Commission of European Communities, Contract number: FAIR CT98-3844 (DG12 - SSMI), December 2001



3

SHARING RISKS OR PROLIFERATING UNCERTAINTIES?

Insurance, disaster and development

Leigh Johnson

Model-based parametric insurance led to dramatic consequences for developing countries experiencing droughts or pandemies

Open access: https://www.taylorfrancis.com/books/politics-uncertainty-ian-scoones-andy-stirling/e/10.4324/9781003023845

Risk → uncertainty → ignorance → **indeterminacy**

Wynne's indeterminacy:

... will the high quality of maintenance, inspection, operation, etc, of a risky technology be sustained in future, multiplied over replications, possibly many over all the world?

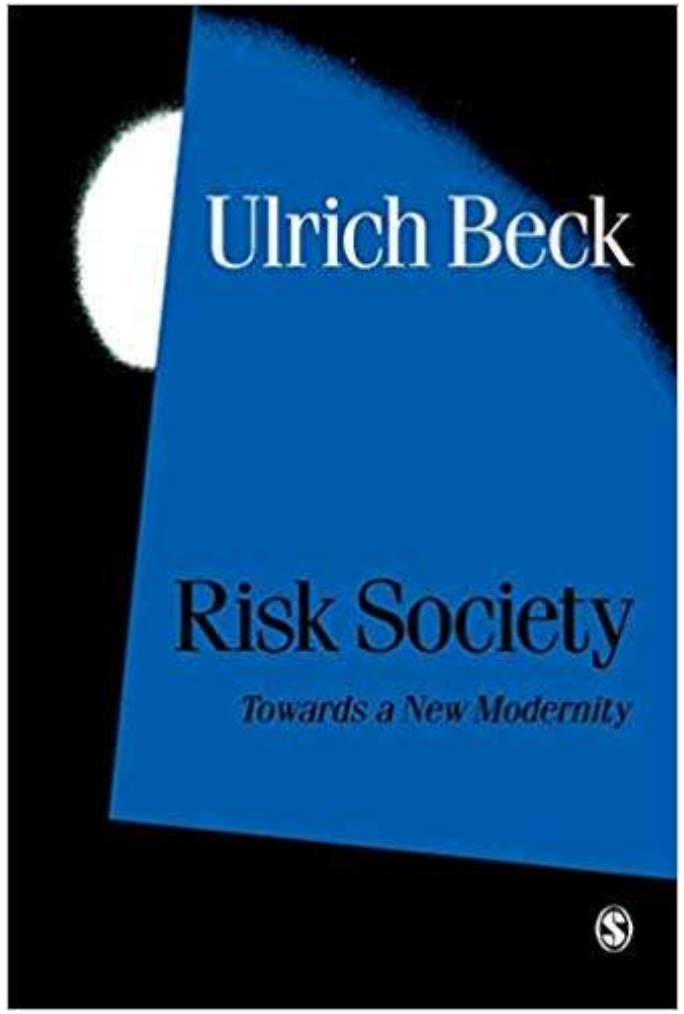
Brian Wynne

Wynne, B. (1992). Uncertainty and environmental learning, Global Environmental Change, 2(2), 111–127.

Ulrich Beck
(1944 –2015)

The Risk Society generates incalculable risks

"…the injured of Chernobyl are today, years after the catastrophe, not even all born yet" (Beck, 1996)



1992 (1986)

Beck, Ulrich. 1996. "Risk Society and the Provident State." In Risk, Environment and Modernity: Towards a New Ecology, eds. Scott Lash, Bronislaw Szerszynski, and Brian Wynne. London: SAGE Publications, 27–43.

Rayner's (2012) strategies to deal with "uncomfortable knowledge".

Denial, Dismissal, Diversion, Displacement

Steve Rayner
1953-2020

Model based

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

Displacement: “The model we have developed tells us that real progress is being achieved” (The focus is now the model not the problem)

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

Example of displacement: Chesapeake Bay Program (CBP) modelling work

"Bay models are used to track nutrient loads to ensure the cap is not exceeded"

➔The model results – rather than the actual measurements, become the substance of use

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

Mind the assumptions

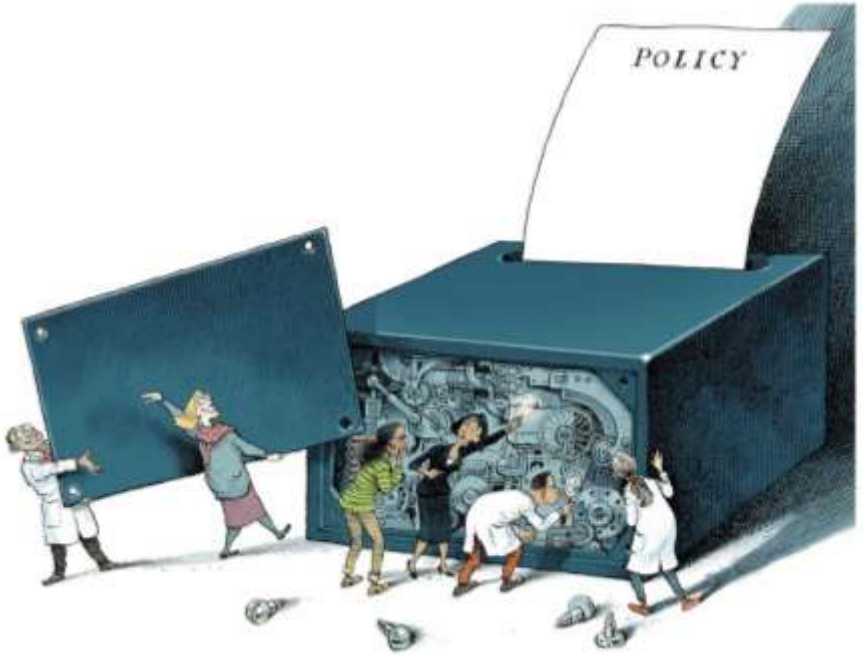
Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

Match purpose and context



Source: A. Saltelli, G. Bammer, I. Bruno, et al., Five ways to ensure that models serve society: a manifesto, Nature 582 (2020) 482–484.

Mind the consequences

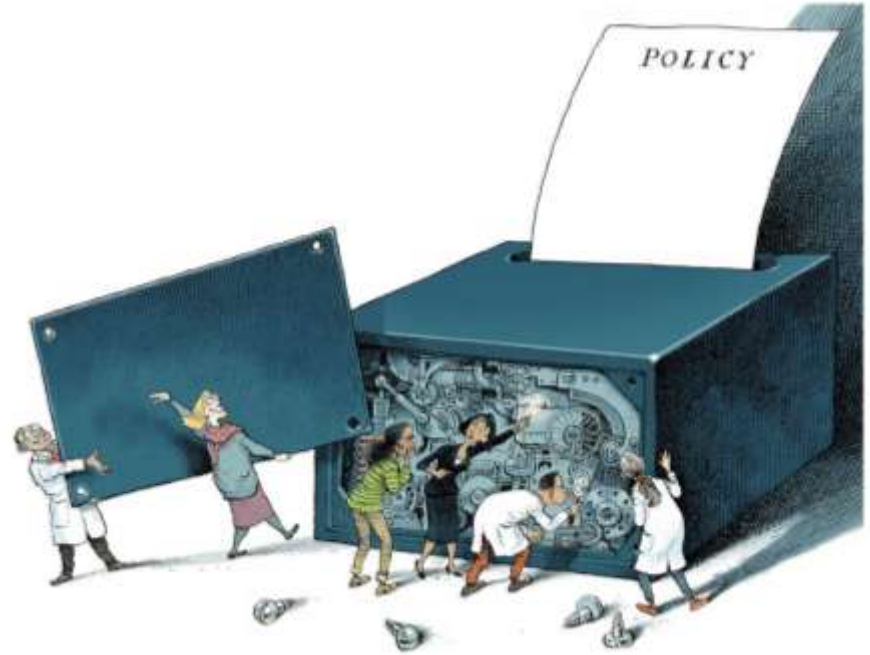
Quantification can backfire

Mind the unknowns

Acknowledge ignorance

Mind the consequences

Quantification can backfire.



« Back to Article

WIRED MAGAZINE: 17.03

Recipe for Disaster: The Formula That Killed Wall Street

By Felix Salmon 02.23.09

Here's what killed your 401(k) *David X. Li's Gaussian copula function as first published in 2000. Investors exploited it as a quick—and fatally flawed—way to assess risk. A shorter version appears on this month's cover of Wired.*

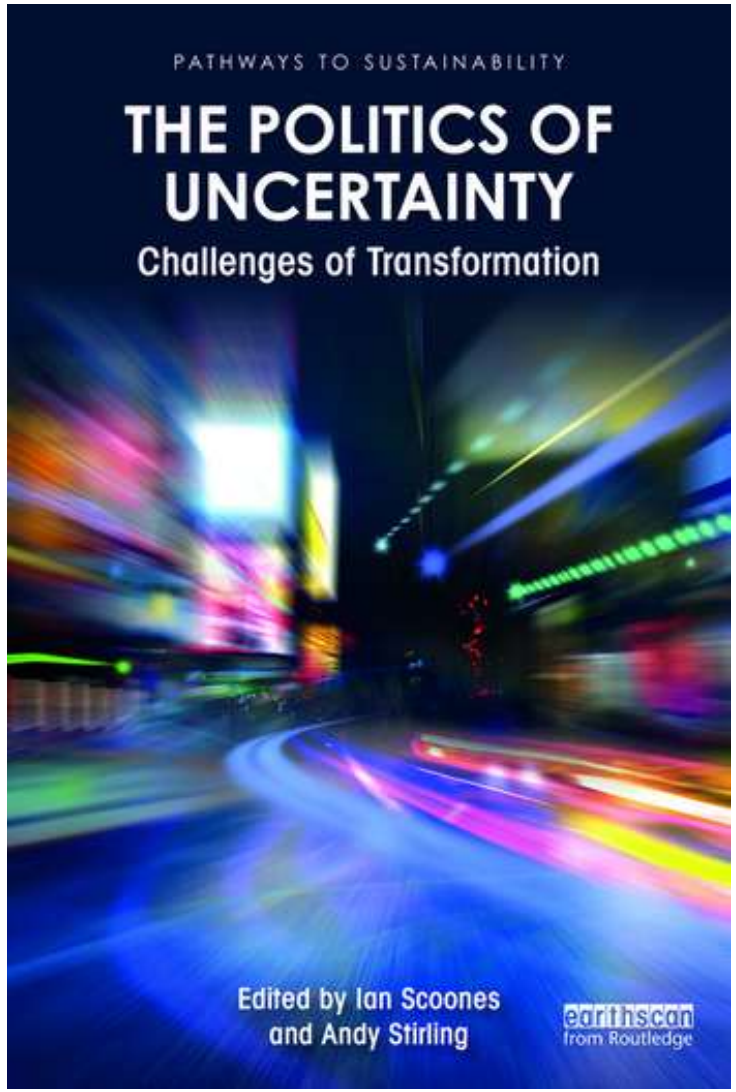
Knight's uncertainty (will homeowners default together?) was turned into a calculable risk, priced and sold

Nassim Nicholas Taleb, hedge fund manager and author of *The Black Swan*, is particularly harsh when it comes to the copula. "People got very excited about the Gaussian copula because of its mathematical elegance, but the thing never worked," he says. "Co-association between securities is not measurable using correlation," because past history can never prepare you for that one day when everything goes south. "Anything that relies on correlation is charlatanism."

Felix Salmon, Wired, February 2009

WIRED

Source: https://www.wired.com/2009/02/wp-quant/



The ergodic world of 'quantitative' finance

2

THE ASSAULT OF FINANCIAL FUTURES ON THE REST OF TIME

Timo Walter and Leon Wansleben

A profit-oriented colonisation of the future operated through financial instruments

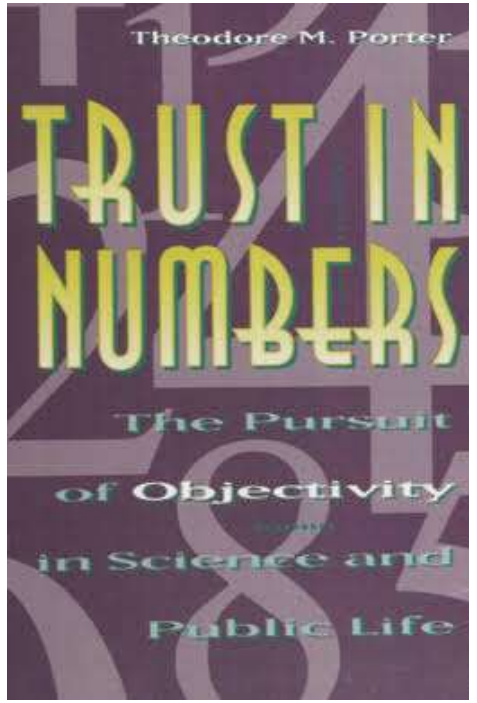
➔ the calculation lets operators control the "present future" while staying shielded from the "future present"

Theodore M. Porter

Culture Unbound
Journal of Current Cultural Research

Funny Numbers

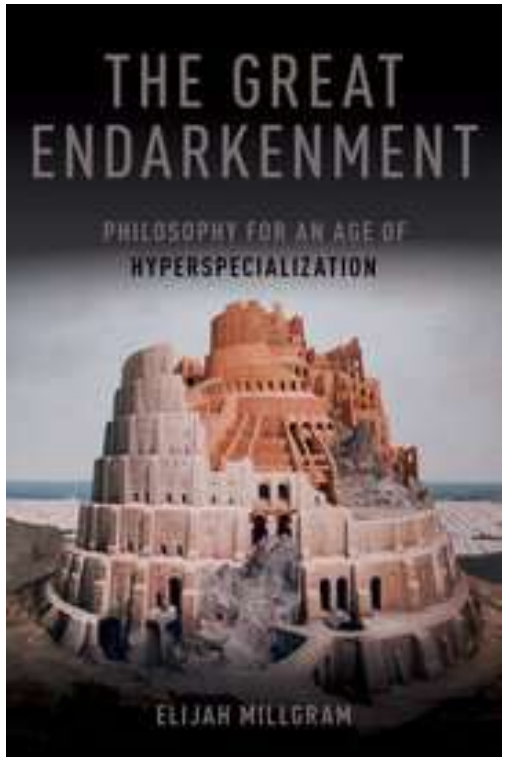
By Theodore M. Porter



"The evasion of goals and corruption of measures tends to make these numbers 'funny' … while the mismatch between boring, technical appearances and cunning backstage manipulations supplies dark humor" (Porter 2012, p. 585)

Porter, Theodore M. 2012. Funny Numbers. *Culture Unbound* 4: 585–98.
Porter, Theodore M. 1995. Trust in Numbers: *The Pursuit of Objectivity in Science and Public Life*. Princeton University Press.

Risk models' opacity



"The process of constructing and validating [value-at-risk] models is time-consuming and detail-oriented; normally, even the people who produced the model will not remember many of the assumptions incorporated into it, short of redoing their work, which means that the client cannot simply ask them what went into it."

Elijah Millgram

Millgram, Elijah. 2015. *The Great Endarkenment : Philosophy for an Age of Hyperspecialization*. Oxford University Press.

~ I will remember that I didn't make the world, and it doesn't satisfy my equations

...

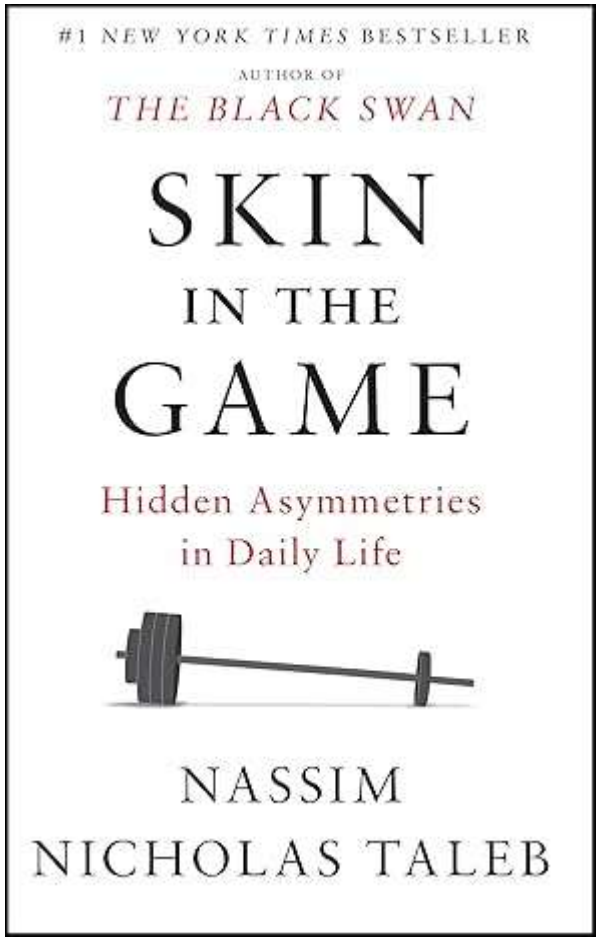
~ Though I will use models boldly to estimate value, I will not be overly impressed by mathematics.

~ Nor will I give the people who use my model false comfort about its accuracy. Instead, I will make explicit its assumptions and oversights.

~ I understand that my work may have enormous effects on society and the economy, many of them beyond my comprehension.

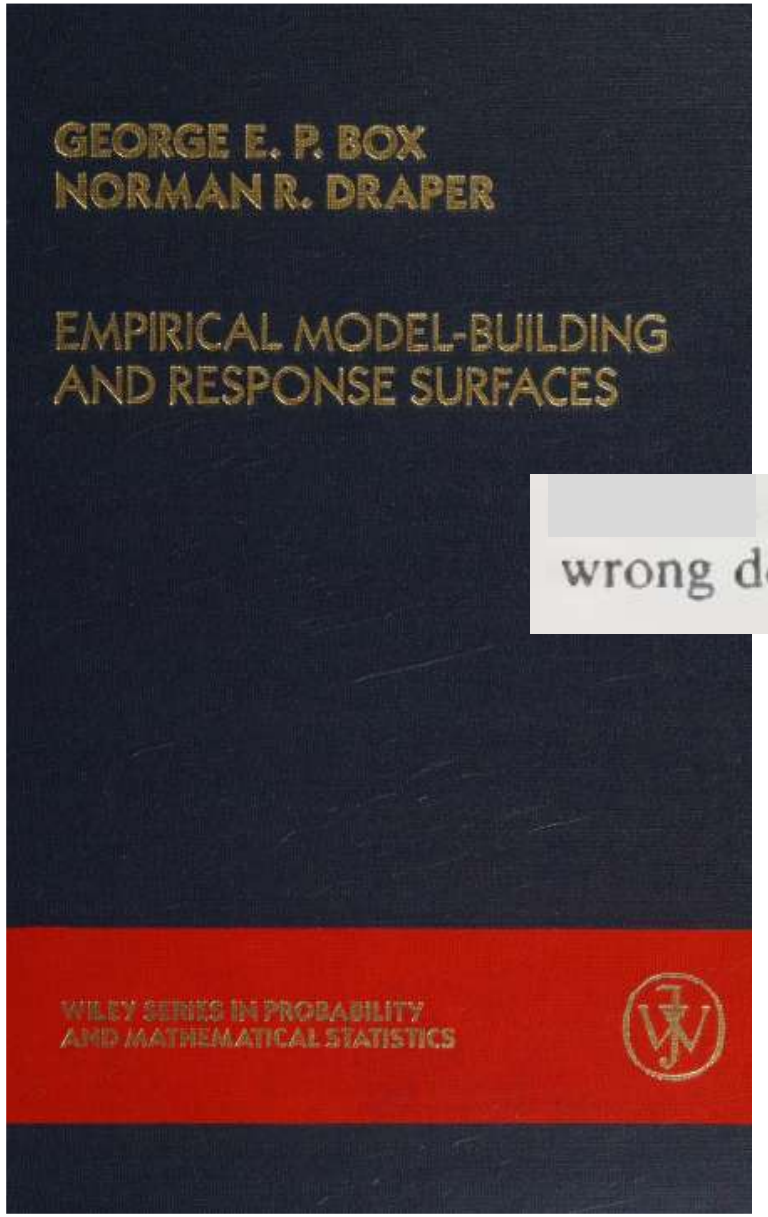
Emanuel Derman and Paul Wilmott January 7 2009

But the manifesto might collide with the political economy of modelling



Ignorantia and *via negativa*

"Via negativa: the principle that we know what is wrong with more clarity than what is right, and that knowledge grows by subtraction. Also, it is easier to know that something is wrong than to find the fix. Actions that remove are more robust than those that add because addition may have unseen, complicated feedback loops"



Ignorantia and *via negativa*

Box & Draper 1987, p. 74

(Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful.)

2.4 Worrying Selectively

Since all models are wrong the scientist must be alert to what is importantly wrong. It is inappropriate to be concerned about mice when there are tigers abroad.

Science and Statistics

George E. P. Box

Journal of the American Statistical Association, Vol. 71, No. 356. (Dec., 1976), pp. 791-799.

Stable URL:
http://links.jstor.org/sici?sici=0162-1459%28197612%2971%3A356%3C791%3ASAS%3E2.0.CO%3B2-W

Journal of the American Statistical Association is currently published by American Statistical Association.

Mind the assumptions

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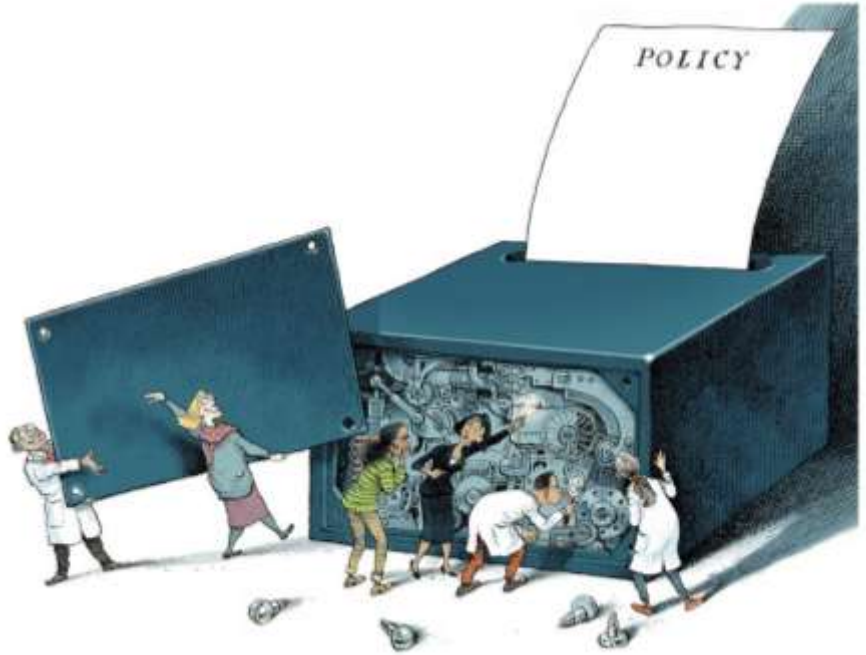
Mind the hubris

Complexity can be the enemy of relevance



Mind the framing

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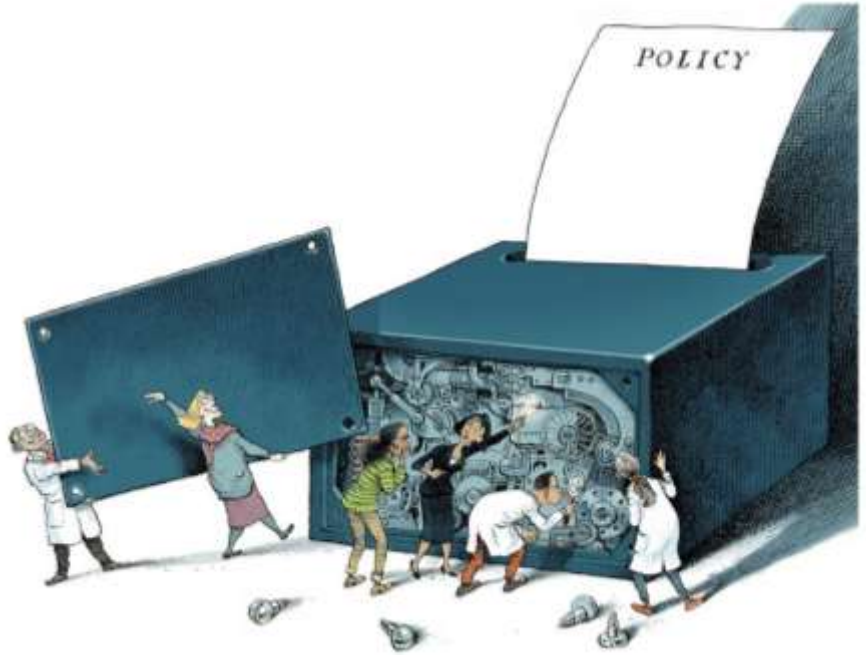


Source: A. Saltelli, G. Bammer, I. Bruno, et al., Five ways to ensure that models serve society: a manifesto, Nature 582 (2020) 482–484.

From Socrates's "knowing of not knowing" to Nicolaus Cusanus' *Docta Ignorantia*, ignorance was a virtue until Descartes

Un po’ di analisi di sensitività aiuterebbe

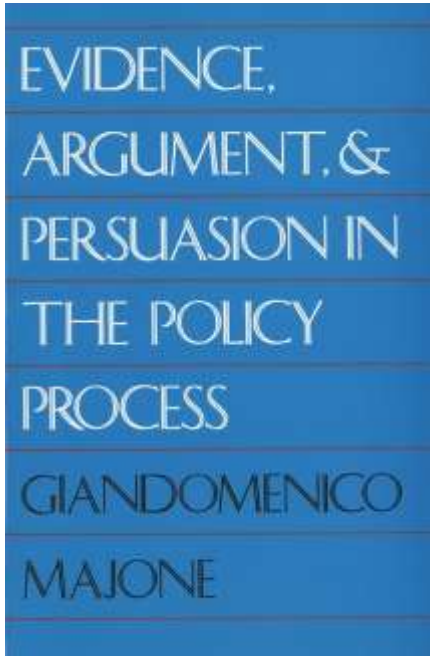
JOURNAL ARTICLE

Sensitivity Analyses Would Help

Edward E. Leamer

The American Economic Review
Vol. 75, No. 3 (Jun., 1985), pp. 308-313 (6 pages)
Published By: American Economic Association
https://www.jstor.org/stable/1814801

Giandomenico Majone

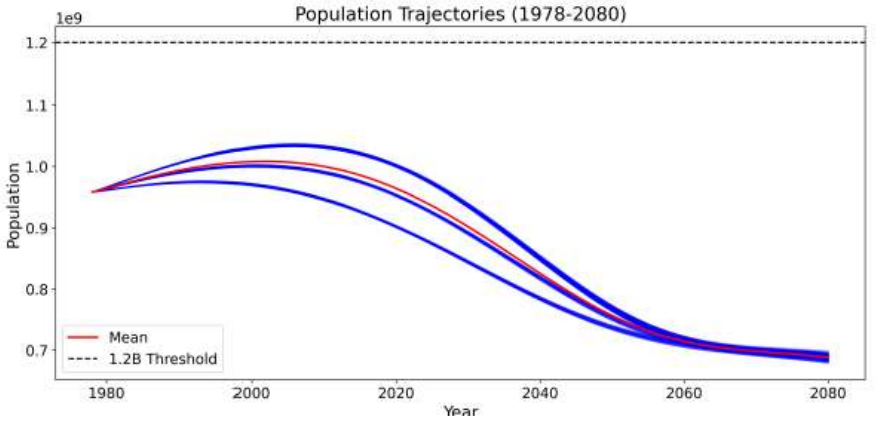


- Data
- Analyst
- Model
- Objective

"Are the results from a particular model more sensitive to changes in the model and the methods used to estimate its parameters, or to changes in the data?"

p. 62, Giandomenico Majone. *Evidence, argument, and persuasion in the policy process*. Yale University Press, 1989.

The Song Jian / one-child policy 1980's model was found to be near-insensitive to inputs …



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SSRN

What Demographic Prediction Can and Cannot Achieve

14 Pages • Posted: 19 May 2026

Samuele Lo Piano
Gdańsk University of Technology - Faculty of Management and Economics

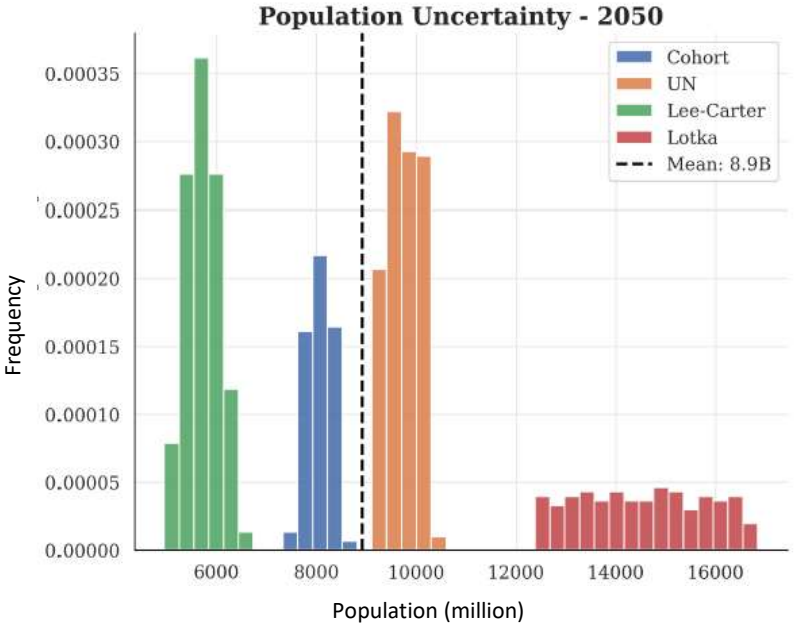
Marta Kuc Czarnecka
Gdańsk University of Technology

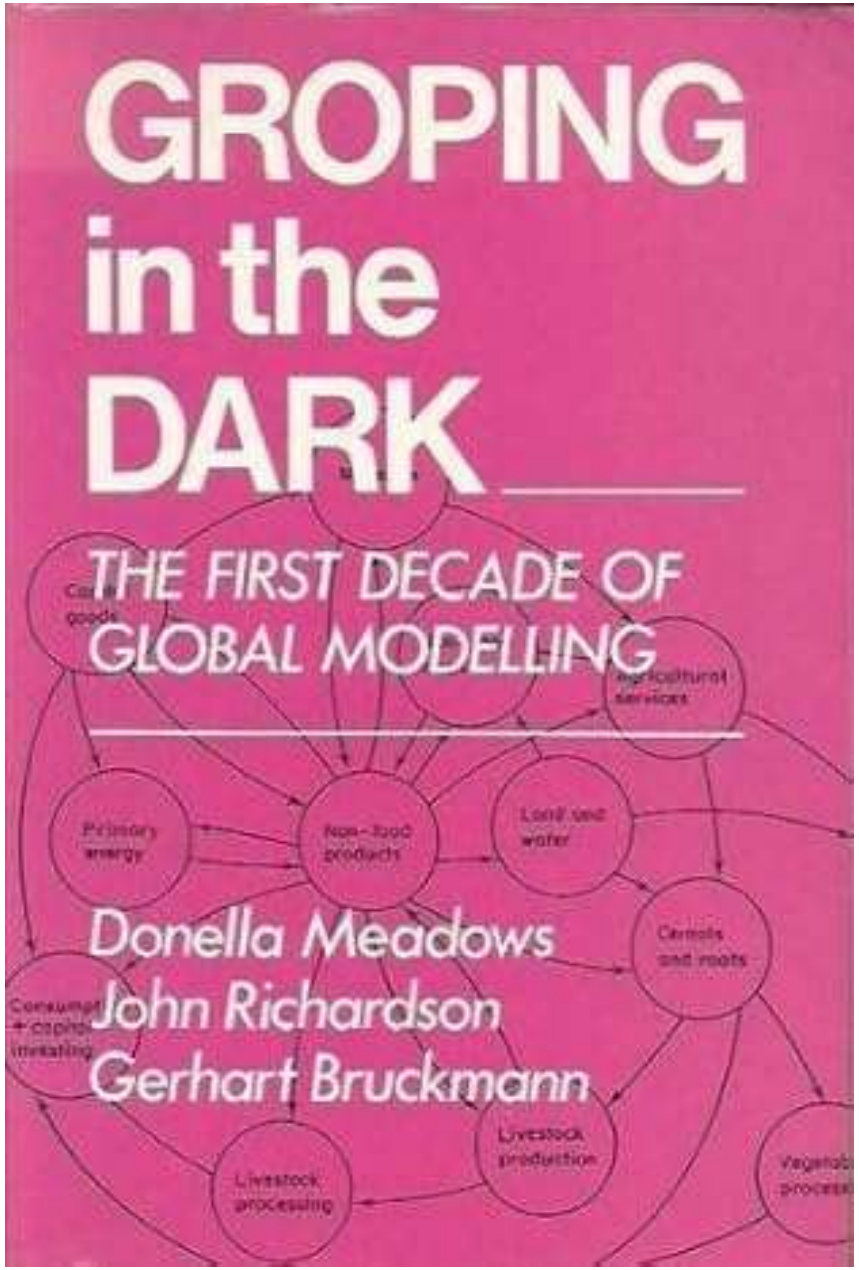
Roger Pielke
University of Colorado at Boulder

Andrea Saltelli
UPF Barcelona School of Management

Date Written: May 15, 2026

… and projections **today in use** are dramatically model-dependent





1982

"We call a parameter sensitive **not when a change in it changes the value of an output number but when it changes the policy conclusions** we would draw from the model" (p. 132)

1. Check against rhetorical use of mathematical modelling
2. Adopt an ‘assumption hunting’ attitude
3. Detect garbage in, garbage out (GIGO)
4. Find sensitive assumptions before they find you
5. Aim for transparency
6. Do the right sums
7. Focus the analysis on the key question answered by the model, exploring the entire space of the assumptions holistically

Verbatim from

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

What would help

A model should not be used for risk analysis unless:

- Its **sensitivity** to key assumptions has been explored — Global sensitivity analysis
- Its structural and **framing** choices have been made explicit and tested — Modelling of the modelling process
- **Affected parties** have had the opportunity to identify which assumptions matter to them — Sensitivity auditing

AI for this afternoon

Models → algorithms → AI: a continuum
Models that inform → algorithms that decide → systems that act (agentic AI)

In models and algorithms, someone made choices that can be recovered and challenged. In AI, we may lose that: "A mechanism, however, is not a reason." (*Equations of Power*, §4.8)

The problem is no longer opacity but unanswerability

In your organisation, who can answer for a decision made by AI?

Una cultura del rischio è, prima di tutto, una cultura dell’incertezza …

… che sa ascoltare il dissenso prima della crisi, non dopo, anche con l’AI

A culture of risk is, first and foremost, a culture of uncertainty … … one that knows how to listen to dissent before the crisis, not after, even with AI