

Climate numbers and climate wars. A fatal attraction?

Andrea Saltelli

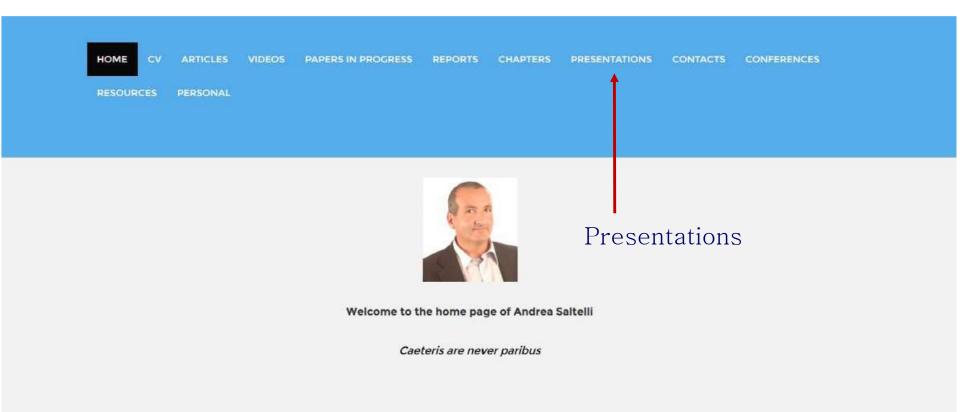
Centre for the Study of the Sciences and the Humanities (SVT) - University of Bergen (UIB)

Institut de Ciència i Tecnologia Ambientals (ICTA) -Universitat Autonoma de Barcelona (UAB)

> Presented in Bergen at: Klima: Hva vet vi? Hva bør vi gjøre? (VIT212) September 21, 2016

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Where to find this presentation

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

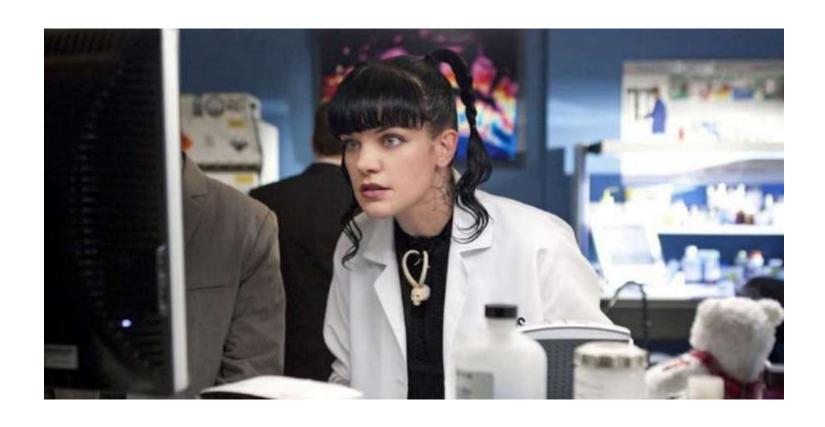
- Chapter 8, On Not Hitting the Tar-Baby, p. 138, of Winner, L., 1986.

 The Whale and the Reactor: a Search for Limits in an Age of High Technology. The University of Chicago Press.
- Funtowicz, S.O. and Ravetz, J.R. (1994). The worth of a songbird:

 <u>Ecological economics as a post-normal science. Ecological Economics</u>

 10(3), 197-207.
- Saltelli, A., D'Hombres, B., Sensitivity analysis didn't help. A practitioner's critique of the Stern review, 2010, Global Environmental Change, 20, 298-302.
- Saltelli, A., Stark, P.B., Becker, W., and Stano, P., 2015, Climate Models as Economic Guides. Scientific Challenge or Quixotic Quest? Issues in Science and Technology (IST), Volume XXXI Issue 3, Spring 2015.

What if even she is wrong?



On TV Series over series where lab-based forensics (science) adjudicates cases

Forensics, [medicine, biology, economics, health and nutrition] has produced serious misdiagnoses

How about climate's science modelling efforts and cost benefit analyses?









THE RIGHTFUL PLACE OF SCIENCE:

SCIENCE ON THE VERGE

CONTRIBUTORS

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lerome R. Ravetz Andrea Saltelli Roger Strand

The Rightful Place of Science: Science on the Verge

Paperback – 20 Feb 2016

by Andrea Saltelli (Author), Alice Benessia (Author), & 7 more



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£6.99



https://www.amazon.co.uk/Rightful-Place-Science-Vergeebook/dp/B01CJ0GLK6/ref=sr_1_1?ie=UTF8&qid=1473933311&sr=8-1&keywords=saltelli

http://www.andreasaltelli.eu/science-on-the-verge



Ecological Economics 10 (1994) 197-207

The worth of a songbird: ecological economics as a post-normal science

Silvio O. Funtowicz ^a, Jerome R. Ravetz ^{b,*}

^a CEC-Joint Research Centre, Institute for Systems Engineering and Informatics, 1-21020 Ispra (Va), Italy ^b The Research Methods Consultancy Ltd., Gresham House, 144 High Street, Edgware, Middx HA8 7EZ, UK

(Received 21 December 1992; accepted 30 July 1993)

An old paper, a PNS 'classic'

The worth of a songbird: ecological economics as a post-normal science

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^a CEC-Joint Research Centre, Institute for Systems Engineering and Informatics, 1-21020 Ispra (Va), Italy ^b The Research Methods Consultancy Ltd., Gresham House, 144 High Street, Edgware, Middx HA8 7EZ, UK

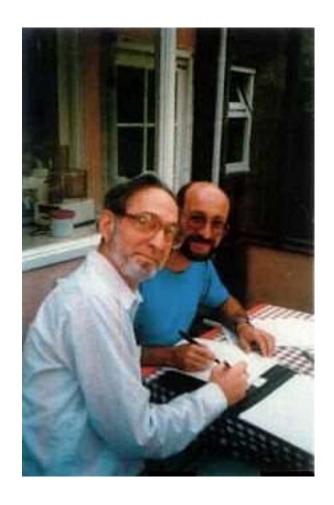
(Received 21 December 1992; accepted 30 July 1993)

Cited by 310 (Scopus) or by 715 (Google Scholar) September 2016

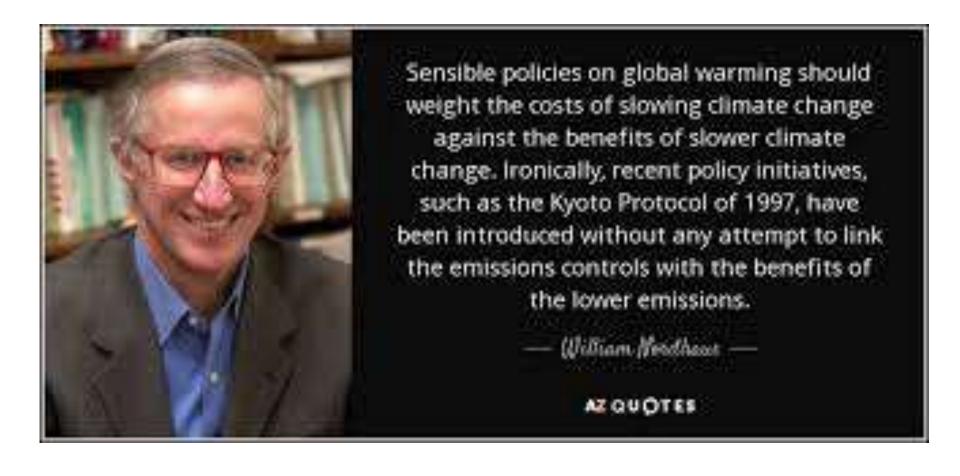
Funtowicz and Ravetz pick a paper on the economics of the greenhouse effect "since the paper displays considerable sophistication in the handling of uncertainties in data."

They note:

"the paper by Nordhaus is liberally sprinkled with caveats..."



One such caveat is – in the words of William Nordhaus – the difficulty to move from the "terra infirma of climate change to the terra incognita of the social and economic impacts of climate change" … but:



Having duly acknowledged Nordhaus' careful wording on uncertainty F&R proceed to deconstruct his work using the freshly minted NUSAP.



ECOLOGICAL ECONOMICS

Ecological Economics 10 (1994) 197-207

The worth of a songbird: ecological economics as a post-normal science

Silvio O. Funtowicz a, Jerome R. Ravetz b,*

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"[Although] in his rhetoric at least, the author shows a clear awareness of the presence of the various sorts of uncertainty, [...he] does not successfully manage the problems of uncertainty."

Table 1 Impact estimates for different sectors, for doubling of CO₂, U.S. (positive number indicates gain; negative number loss) (Nordhaus 1991 Table 6 p. 932)

Sectors	Billions (1981 \$)
Severely impacted sectors	
Farms	
Impact of greenhouse warming and CO ₂	-10.6 to $+9.7$
fertilisation	
Forestry, fisheries, other	Small + or
Moderately impacted sectors	
Construction	+
Water transportation	?
Energy and utilities	
Energy (electric, gas, oil)	
Energy demand	-1.65
Non-electric space heating	1.16
Water and sanitary	<u>-</u> ?
Real estate	
Land-rent component	
Estimate of damage from sea-level rise	
Loss of land	- 1.55
Protection of sheltered areas	-0.90
Protection of open coasts	- 2.84
Hotels, lodging, recreation	?
Total	
Central estimate	
Billions, 1981 level of national income	-6.23
Percentage of national income	-0.26

Sources for Table 6: Underlying data on impacts are summarised in EPA (1988). Translation into national-income accounts by author. Details are available on request.

"The hyper-precision in the expression of the key number - 0.26% [...] shows that this is one of those 'magic numbers' designed to produce confidence in the existence of a hard core of objective fact deep inside the mass of intuitive fuzz."

For Nordhaus - based on a 'hunch' this -0.26% could become -2% ...

Table 1
Impact estimates for different sectors, for doubling of CO₂, U.S. (positive number indicates gain; negative number loss) (Nordhaus, 1991, Table 6, p. 932)

Sectors	Billions (1981 \$)
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Contents lists available at ScienceDirect

Global Environmental Change





Sensitivity analysis didn't help. A practitioner's critique of the Stern review Andrea Saltelli*, Beatrice D'Hombres

Joint Research Centre, Institute for the Protection and Security of the Citizen, Ispra, Italy

A more recent paper ...

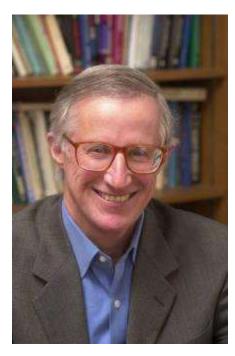
... but only 10 citations in Scopus & 28 in Google Scholar 😊



RULE FOUR of sensitivity auditing: Find sensitivities before sensitivities find you



The case of Stern's Review – Technical Annex to postscript



William Nordhaus, University of Yale



Nicholas Stern, London School of Economics

Stern, N., Stern Review on the Economics of Climate Change. UK Government Economic Service, London, www.sternreview.org.uk. Nordhaus W., Critical Assumptions in the Stern Review on Climate Change, SCIENCE, 317, 201-202, (2007).

RULE FOUR: find sensitivities before sensitivities find you; Stern is in violation of this rule as he did his sensitivity analysis <u>after</u> being criticized by Nordhaus





The terms of the dispute



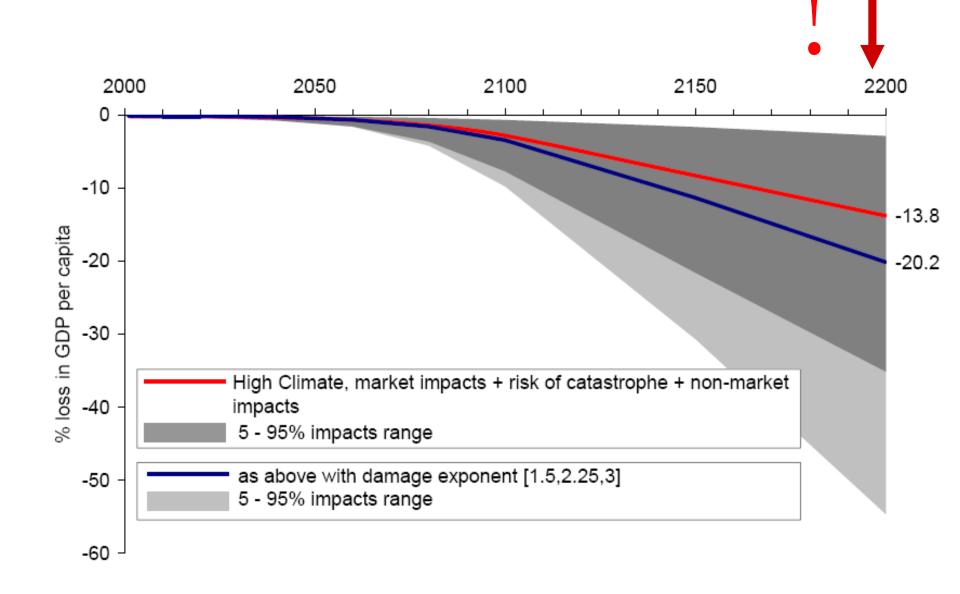
Falsifies Stern based on 'wrong' range of discount rate



Prepares a postscript to his eponymous review: a sensitivity analysis of his own cost benefit analysis and claims: 'my analysis shows robustness'



My problems with it:

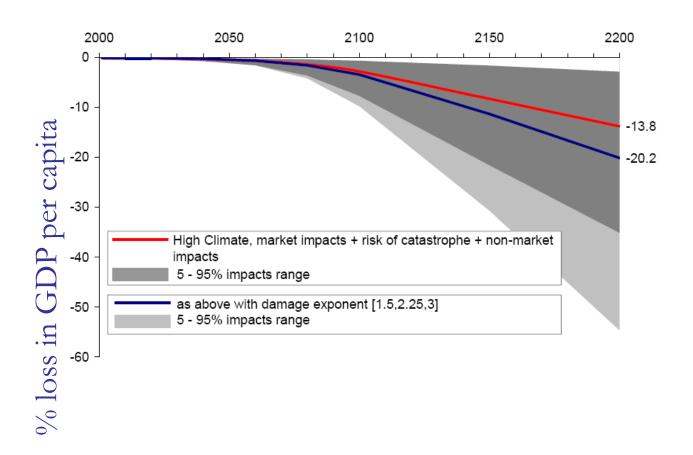


... but foremost Stern says:

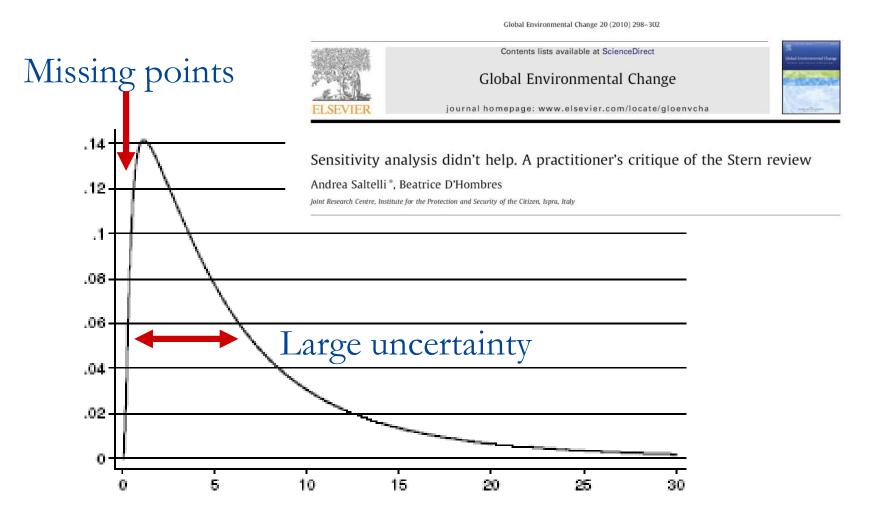
Even changing assumptions \rightarrow still important effect

when instead he should admit that:

Changing assumptions \rightarrow results change a lot

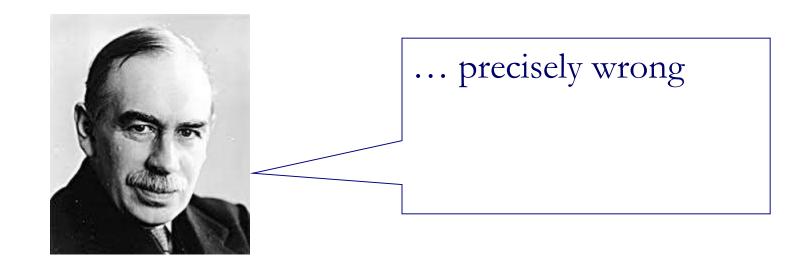


Why do we say so? A reverse engineering of Stern's analysis

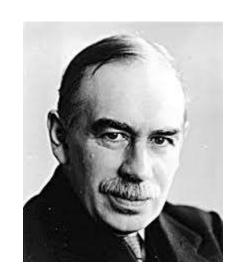


% loss in GDP per capita

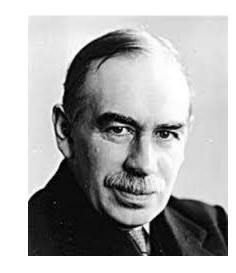
Not to say that Stern is wrong while Nordhaus is right, as both authors frame the debate around numbers which are ...



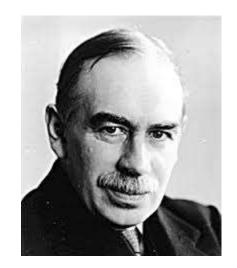
Since we are at John Maynard Keynes: what does he say of cost benefit analysis in his 1936 work 'The General Theory of Employment, Interest, and Money'?



"If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence..."



"... In fact, those who seriously attempt to make any such estimate are often so much in the minority that their behaviour does not govern the market."



ANDREA SALTELLI PHILIP B. STARK WILLIAM BECKER PAWEL STANO



NATIONAL ACADEMY OF SCIENCES
NATIONAL ACADEMY OF ENGINEERING
INSTITUTE OF MEDICINE
THE UNIVERSITY OF TEXAS AT DALLAS
ARIZONA STATE UNIVERSITY
SPRING 2015

A New
Model for the
American
Research
University

Clean Energy Diplomacy from Bush to Obama

Physics Envy: Get Over It

The Limitations of Climate Models as Guides for Policy

Welcome to the Anthropocene

Empowering Social Science

An Excess of Research Space?

First Science Fiction Contest Winner



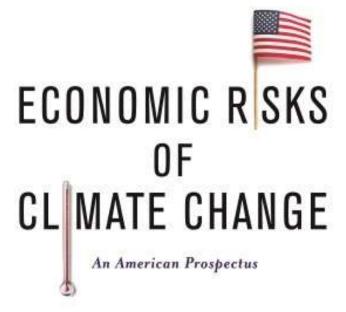
Climate Models as Economic Guides

Scientific Challenge or Quixotic Quest?

The uncertainties associated with mathematical models that assess the costs and benefits of climate change policy options are unknowable. Such models can be valuable guides to scientific inquiry, but they should not be used to guide climate policy decisions.

... targeting an audacious study:

Foreword by Michael R. Bloomberg, Henry M. Paulson, and Thomas F. Steyer



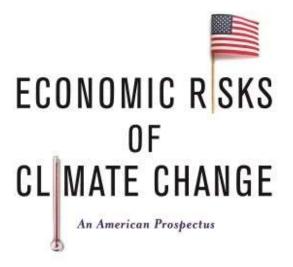
TREVOR HOUSER, SOLOMON HSIANG, ROBERT KOPP, AND KATE LARSEN

Contributions by Karen Fisher-Vanden, Michael Greenstone, Geoffrey Heal, Michael Oppenheimer, Nicholas Stern, and Bob Ward "[...] the report forecasts—at the level of individual counties in the U.S.—energy costs and demand, labor supply, mortality, violent crime rates, and real estate property prices up to

Climate Models as Economic Guides Scientific Challenge or Quixotic Quest?

the year 2100 [...]"

Foreword by Michael R. Bloomberg, Henry M. Paulson, and Thomas F. Stever



TREVOR HOUSER, SOLOMON HSIANG, ROBERT KOPP, AND KATE LARSEN

Contributions by Karen Fisher-Vanden, Michael Greenstone, Geoffrey Heal, Michael Oppenheimer, Nicholas Stern, and Bob Ward

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ECONOMIC R SKS

OF

CL MATE CHANGE

An American Prospectus

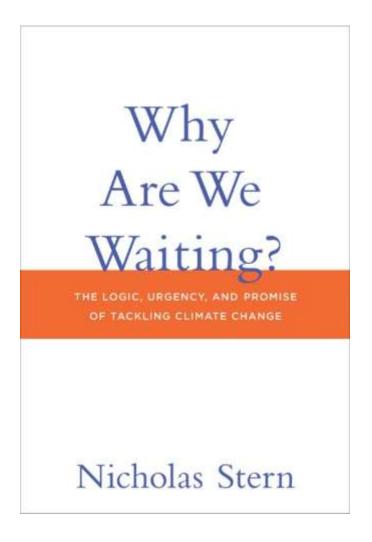
TREVOR HOUSER, SOLOMON HSIANG, ROBERT KOPP, AND KATE LARSEN

Contributions by Karen Fisher-Vanden, Michael Greenstone, Geoffrey Heal, Michael Oppenheimer, Nicholas Stern, and Bob Ward

"The report presents the amount of computer power and data generated as evidence of the scientific legitimacy of the enterprise. The authors note, however, that out of an abundance of caution they did not model deterioration in cognitive performance as temperatures rise"

Climate Models
as
Economic Guides
Scientific Challenge
or
Ouivotic Quest?

Next comes the latest (2015) book of Nicholas Stern ...



... advocating for better integrated assessment models (IAM)

THE LOGIC, URGENCY, AND PROMISE OF TACKLING CLIMATE CHANGE

Excerpts

"Integrated assessment models have produced valuable insights" p. 139

"In Chapter six of the Stern review we made use of the PAGE model" p. 345

THE LOGIC, URGENCY, AND PROMISE OF TACKLING CLIMATE CHANGE

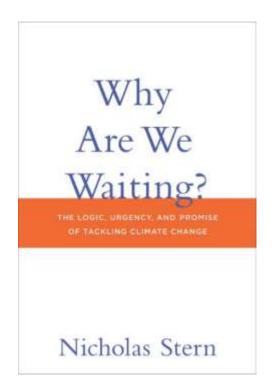
... After a list of criticism moved to the realism of Integrated Assessment Models:

"[...] the point is that estimates based on these models are very sensitive to assumptions and are likely to lead to gross underestimation" p.139

Things to be incorporated in 'formal modelling' [sic]

- "Damage to social, organizational or environmental capital [...]
 - Damage to stock of capitals and land [...]
 - Damage to overall factor productivity [...]
 - Damage to learning and endogenous growth", p. 145

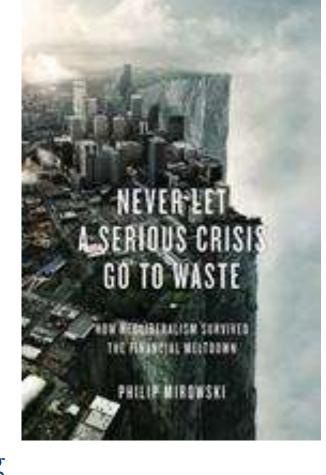
'formal modelling' as to produce 'numbers'?



The book of N. Stern suggests using different mathematical models, including dynamic stochastic general equilibrium models.



Philip Mirowski



See Philip Mirowski's book for a damaging critique of DSGE as used in economics ... inquiries by the US senate and the Queen of the England about their failure to predict the crisis ...

Everybody in the profession knows that DSGE work under the economists' standard 'caeteris paribus' hypothesis (=all the rest being equal)



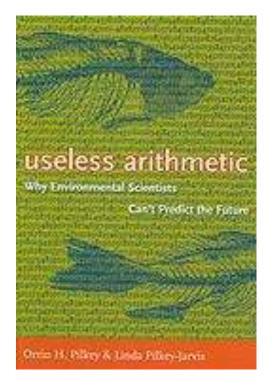
Caeteris are never paribus

Mathematical modelling of climatic change (terra infirma) and its cost to society (terra incognita):



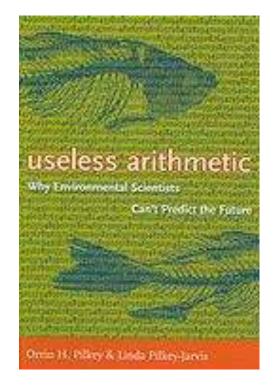
Pilkey and Pilkey-Jarvis (2007:86) climatesceptics' work would be harder if:

"[...] the global change modeling community would firmly and publicly recognize that its efforts to truly quantify the future are an academic exercise and that existing field data on atmospheric temperatures, melting glaciers, [...] and other evidence should be relied on to a much greater degree to convince politicians that we have a problem."

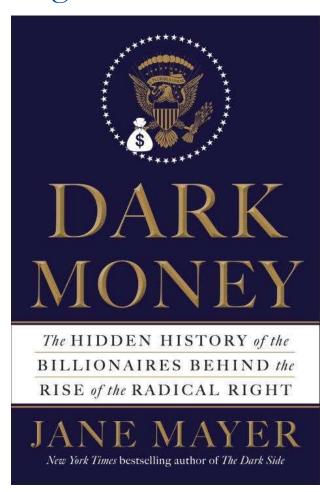


Pilkey, O.H. and Pilkey-Jarvis, L., 2007. Useless Arithmetic. Why Environmental Scientists Can't Predict the Future, Columbia University Press, New York.

"[...] A serious societal debate about 'solutions' can never occur as long as modellers hold out the probability, just around the corner, of accurate projections of future climates and seal-level position."



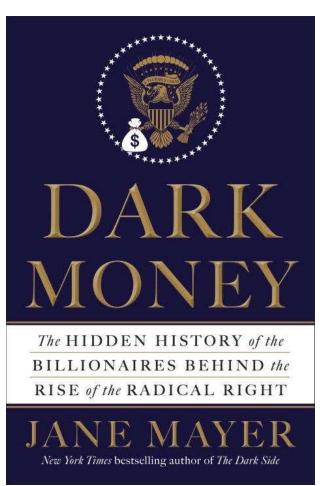
The skirmishes on misuse or abuse of modelling are likely to get lost in the all out war on climate



Some excerpts of chapter 8, The Fossils, here:

http://www.andreasaltelli.eu/file/repository/Chapter_8sr.pdf

"While Obama's health-care bill was useful in riling up Tea Party protesters, his environmental and energy policies were the real Target of Many of the multimillionaires and billionaires in the Koch circle."



THE HOUSE SCIENCE COMMITTEE'S ANTI-SCIENCE RAMPAGE

By Lawrence M. Krauss, SEPTEMBER 14, 2016



There has always been tension between scientists and Congress. But Lamar Smith, the chairman of the House Committee on Science, Space, and Technology, has escalated that tension into outright war.

The Next Genocide

By TIMOTHY SNYDER SEPT. 12, 2015

"New Haven — BEFORE he fired the shot, the Einsatzgruppe commander lifted the Jewish child in the air and said, "You must die so that we can live." As the killing proceeded, other Germans rationalized the murder of Jewish children in the same way: them or us."

The New York Times

The Next Genocide

By TIMOTHY SNYDER SEPT. 12, 2015

"Hitler spread ecological panic [...] the United States has done more than any other nation to bring about the next ecological panic [...] deniers [s...] intellectual stance that is uncomfortably close to Hitler's."

The New York Times

Climate change scepticism

World court should rule on climate science to quash sceptics, says Philippe Sands

International Court of Justice ruling would settle the scientific dispute and pave the way for future legal cases on climate change, says high-profile lawyer

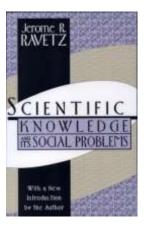




Philippe Sands QC says a court ruling would carry more weight with public opinion than science alone. Photograph: Antonio Zazueta Olmos/Antonio Olmos

Hold on a second!

p. 22-23: "Two separate factors are necessary for the achievement of worthwhile scientific results: a community of scholars with a shared knowledge of the standards of quality appropriate for their work and a shared commitment to enforce those standards by the informal sanctions the community possesses; and individuals whose personal integrity sets standards at least as high as those required by their community..."





Jerome R. Ravetz

Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.

Utopia or dystopia?

A community of scholars with shared commitment to enforce standards by informal sanctions (Ravetz 1971)

Versus

Warring parties where both scientists and/cum advocates throw at one another anti-racketeering legislation

Today's echoes of these discussions:

Using DSGE

Models of climate ...

Today: the 'Mathiness' discussion: blogs of Paul Romer, Judith Curry and Erik Reinert's 'scholasticism' paper.

See https://paulromer.net/mathiness/

https://judithcurry.com/2015/08/12/the-adversarial-method-versus-feynman-integrity-2/

http://www.andreasaltelli.eu/file/repository/Full_Circle_scholasticism_2.pdf



Paul Romer



Judith Curry



Erik Reinert

The Trouble With Macroeconomics

Paul Romer Stern School of Business New York University

September 14, 2016 Wednesday 14th September, 2016

https://paulromer.net/wp-content/uploads/2016/09/WP-Trouble.pdf



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



The Trouble With Macroeconomics

Paul Romer
Stern School of Business
New York University

Wednesday 14th September, 2016

2 Post-Real Models

5.4 Identification by Obfuscation

- 6 Questions About Economists, and Physicists
 - 7 Loyalty Can Corrode The Norms of Science
 - 9.1 The Norms of Science
 - 10 The Trouble Ahead For All of Economics

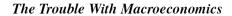


The Trouble With Macroeconomics

Paul Romer
Stern School of Business
New York University

Wednesday 14th September, 2016

"striking parallels between the characteristics of string-theorists in particle physics and postreal Macroeconomists"





PAUL ROMER Stern School of Business New York University

Wednesday 14th September, 2016

- 1. Tremendous self-confidence
- 2. An unusually monolithic community
- A sense of identification with the group akin to identification with a religious faith or political platform
- 4. A strong sense of the boundary between the group and other experts
- A disregard for and disinterest in ideas, opinions, and work of experts who are not part of the group
- A tendency to interpret evidence optimistically, to believe exaggerated or incomplete statements of results, and to disregard the possibility that the theory might be wrong
- A lack of appreciation for the extent to which a research program ought to involve risk

September 13, 2016

https://judithcurry.com/2016/09/13/global-climate-models-and-the-laws-of-physics/

Can one appeal to the Laws of Physics to justify the saliency of mathematical models for climate change?



Judith Curry

Something is not well in climate science

Math. models and stat. indicators is where the friction is highest

Another case in point: the Ecological Footprint

Ecological Indicators 69 (2016) 224-232



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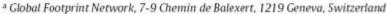
Ecological Indicators

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



Questioning the Ecological Footprint

Alessandro Galli^{a,1}, Mario Giampietro^{b,c}, Steve Goldfinger^d, Elias Lazarus^{d,2}, David Lin^{d,2}, Andrea Saltelli^{e,c}, Mathis Wackernagel^{d,2}, Felix Müller^{f,*}



b Institució Catalana de Recerca i Estudis Avançats (ICREA), Passeig Lluís Companys 23, 0801 0 Barcelona, Spain



c Institut de Ciència i Tecnologia Ambientals (ICTA), Universitat Autònoma de Barcelona (UAB), 08193 Bellaterra, Spain

d Global Footprint Network, 312 Clay Street, Suite 300, Oakland, CA 94607-3510, USA

e Centre for the Study of the Sciences and the Humanities (SVT) – University of Bergen (UIB) Norway

f Institute for Natural Resource Conservation, University of Kiel, Olshausenstrasse 75, D 24118 Kiel, Germany





Is saving the planet a sufficient justification to produce funny numbers?