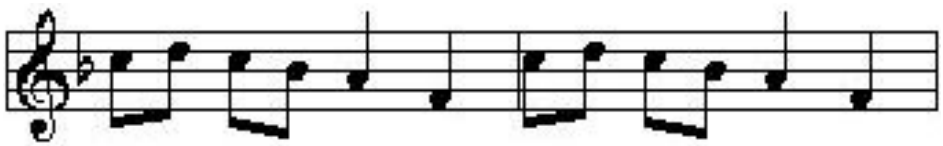
A Critique of Info-Gap Decision theory: from Voodoo Decision-Making to Voodoo Economics

Moshe Sniedovich

Department of Mathematics and Statistics
The University of Melbourne
www.moshe-online.com



ASOR Recent Advances in Operations Research
November 26, 2009
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Abstract

The title of this presentation is borrowed from a book that I am writing on my effort over the last six years to contain the spread of Info-Gap decision theory in Australia. However, the main question that I address in this presentation is not discussed in this book. Rather, it is one of the main questions addressed in my other book on this topic, which is tentatively entitled The Rise and Rise of Voodoo Decision-Making. The basic question is this: given the very harsh and detailed criticism of this theory that is freely available and easily accessible to the public and which shows that this theory is a classic example of a voodoo decision theory, how is it that this fundamentally flawed theory is still promoted from the pages of respectable refereed journals? I address this fascinating question from an Operational Research perspective.

Admin

This is a

Math Classification G

presentation.

Math Classification MA +18

versions can be found at

`decision-making.moshe-online.com`

$AU Perspective on Decision-Making Under Severe Uncertainty

bio-security homeland-security

Program

Breaking News

A new book from Palgrave is planned for 2010:
Info-Gap Economics: an Operational Introduction
by Yakov Ben-Haim

Official program for this presentation

- Part 1: Progress Report from Voodoostan
- Part 2: Progress Report from Academistan
- Part 3: Progress Report from Publicistan
- Part 4: Q/A

Program

Breaking News

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Breaking News

Info-Gap Economics: an Operational Introduction

From the information sheet

Description After every crisis economists and policy analysts ask: can better models help prevent or ameliorate such situations? This book is an answer. Yes, quantitative models can help if we remember that they are rough approximations to a vastly more complex reality. Models can help if we include realistic but simple representations of uncertainty among our models. Models can help if we retain the pre-eminence of human judgment over the churning of our computers.

Info-gap theory is a new method for modelling and managing severe uncertainty. The core of the book presents detailed examples of info-gap analysis of decisions in monetary policy, financial economics, environmental economics for pollution control and climate change, estimation and forecasting.

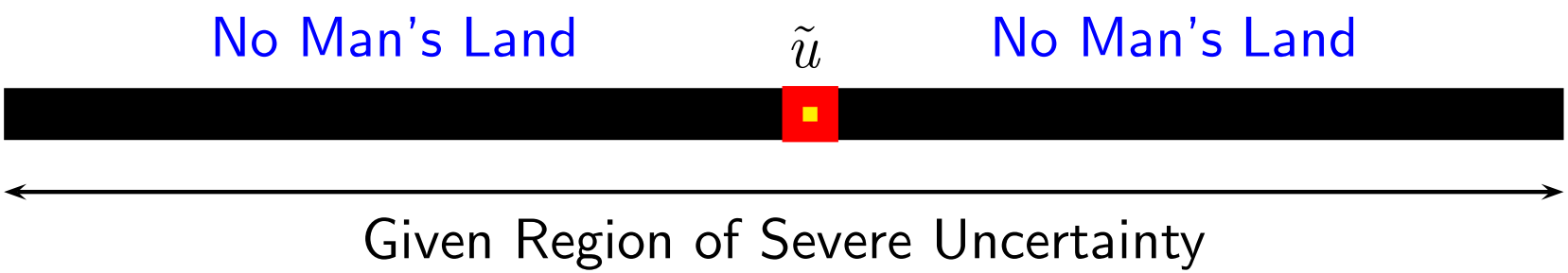
Gentle Reminder

Some of the "flaws" in Info-Gap Decision Theory

- Utter disrespect for the state of the art in Operations Research and Robust Optimization.
- Serious misconceptions about the modeling aspects of Optimization Theory.
- Complete disrespect for the *Garbage In / Garbage Out Maxim.*

$\tilde{u}$ = wild guess of the true value of the parameter of interest

■ = Domain of robustness analysis



Progress Report from Voodoostan

Encarta online Encyclopedia

Voodoo n

1. A religion practiced throughout Caribbean countries, especially Haiti, that is a combination of Roman Catholic rituals and animistic beliefs of Dahomean enslaved laborers, involving magic communication with ancestors.
2. Somebody who practices voodoo.
3. A charm, spell, or fetish regarded by those who practice voodoo as having magical powers.
4. A belief, theory, or method that lacks sufficient evidence or proof.

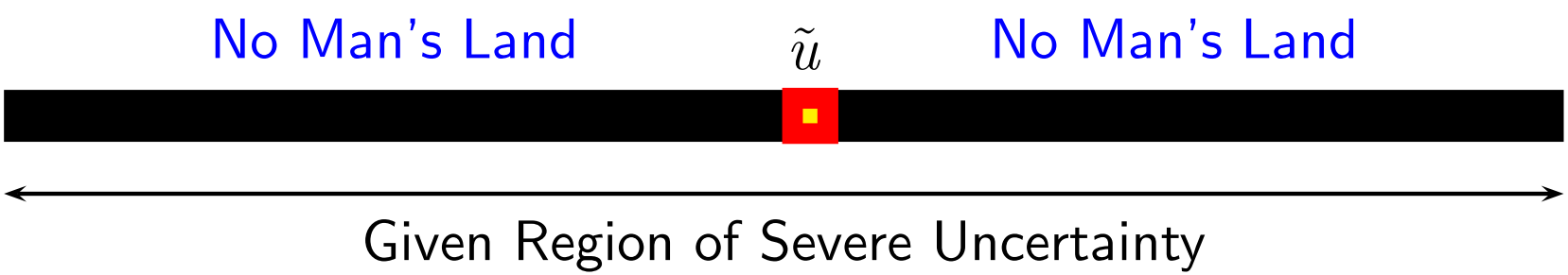
Progress Report from Voodoostan

Reminder

- Info-Gap decision theory is non-probabilistic.
- Info-Gap Decision theory is likelihood-free.

Eg. Ben-Haim (2001, p. 5)

In any case, an info-gap model of uncertainty is less informative than an probabilistic model (so its use is motivated by severe uncertainty) since it entails no information about likelihood or frequency of occurrence of u-vectors.



Progress Report from Voodoostan

2008 Quote of the year

Information-gap (henceforth termed 'info-gap') theory was invented to assist decision-making when there are substantial knowledge gaps and when probabilistic models of uncertainty are unreliable (Ben-Haim 2006). In general terms, info-gap theory seeks decisions that are most likely to achieve a minimally acceptable (satisfactory) outcome in the face of uncertainty, termed robust satisficing. It provides a platform for comprehensive sensitivity analysis relevant to a decision.

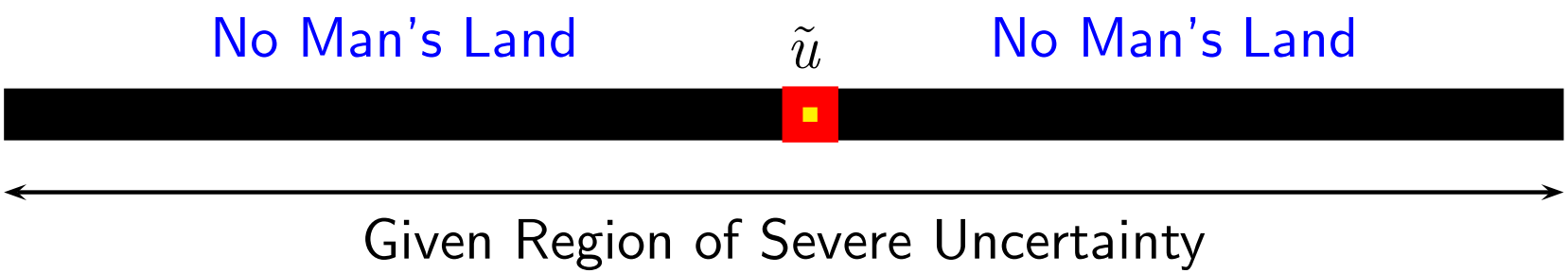
Burgman et al (2008, p. 8)

Progress Report from Voodoostan

2009 Quote of the year

An assumption remains that values of u become increasingly unlikely as they diverge from $\tilde{u}$.

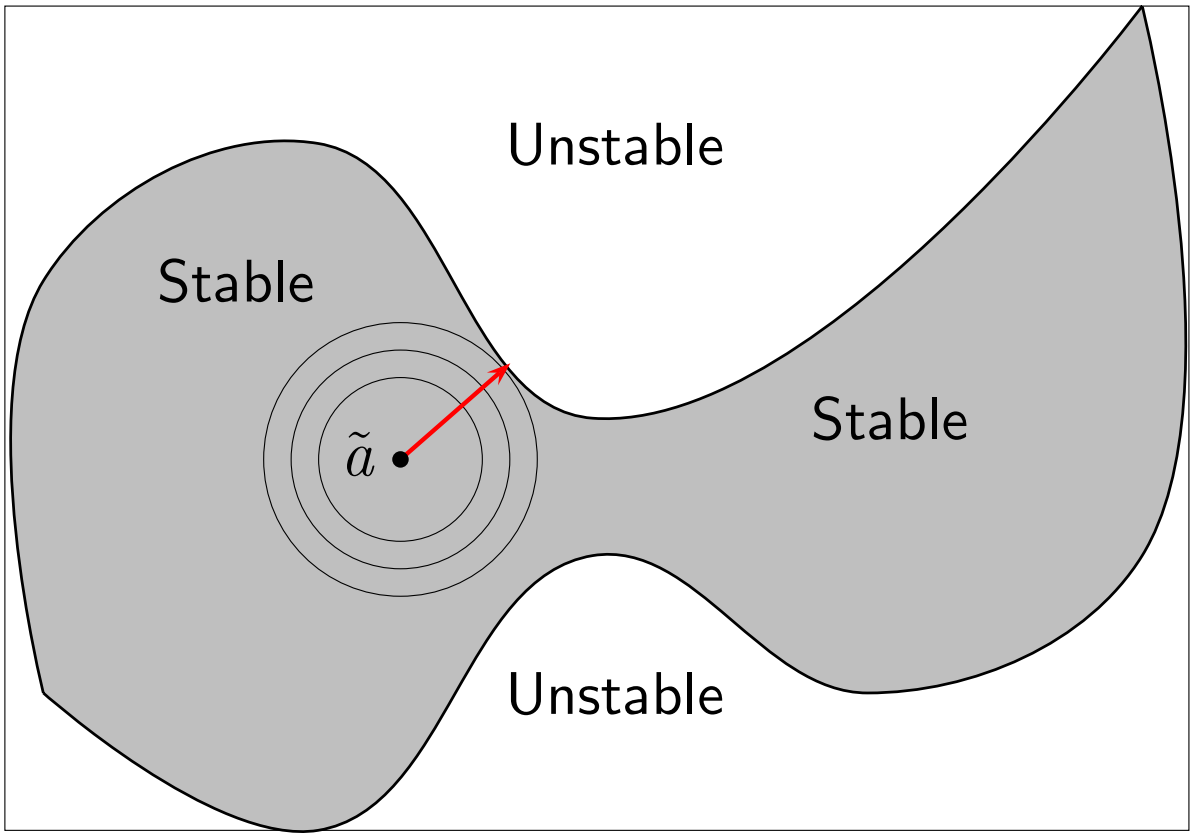
Hall and Harvey (2009, p. 2)



Progress Report from Academistan

Very established and fundamental concept

Radius of Stability

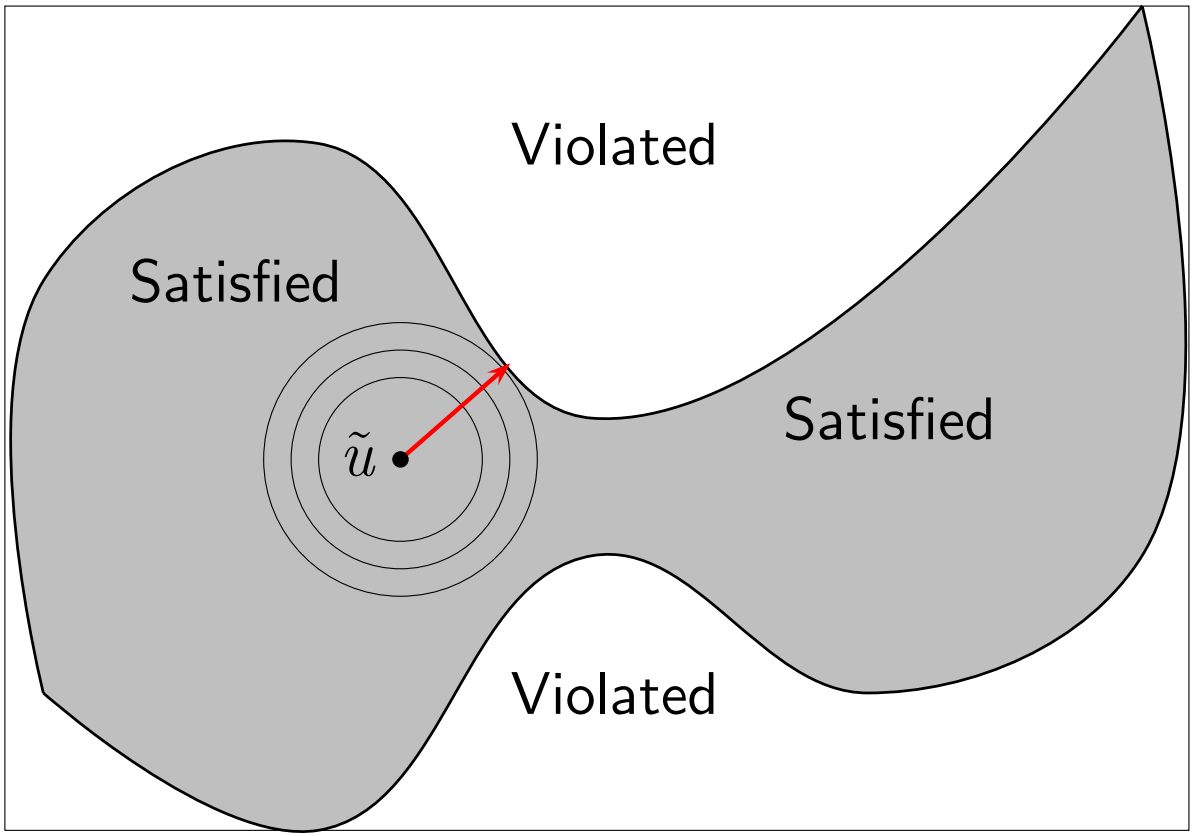


$\tilde{a}$ = reference value

Progress Report from Academistan

Brand new, revolutionary idea

Info-Gap Robustness Against Severe Uncertainty

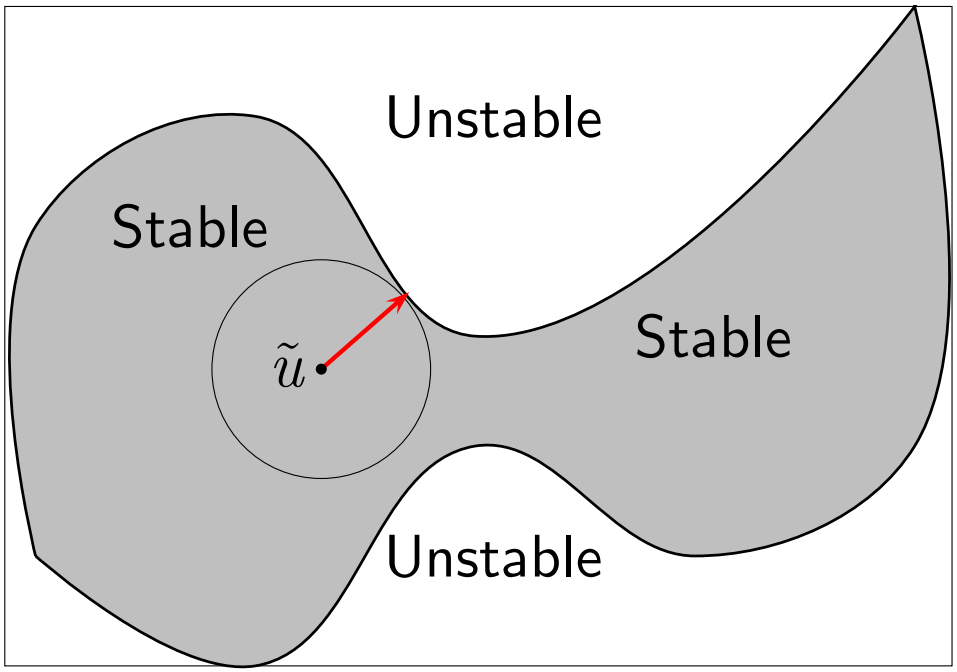


$\tilde{u}$ = wild guess of the true value of the parameter of interest

Reinvention of the Square Wheel

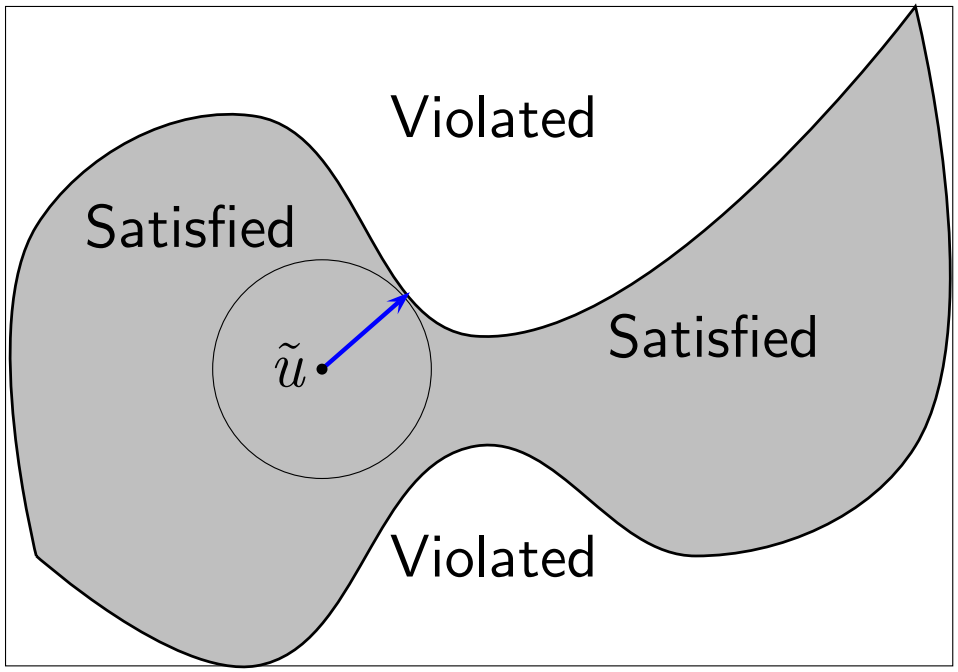
Find the differences

Radius of Stability
1980s



Small perturbation of a given point

Info-Gap Robustness
2010

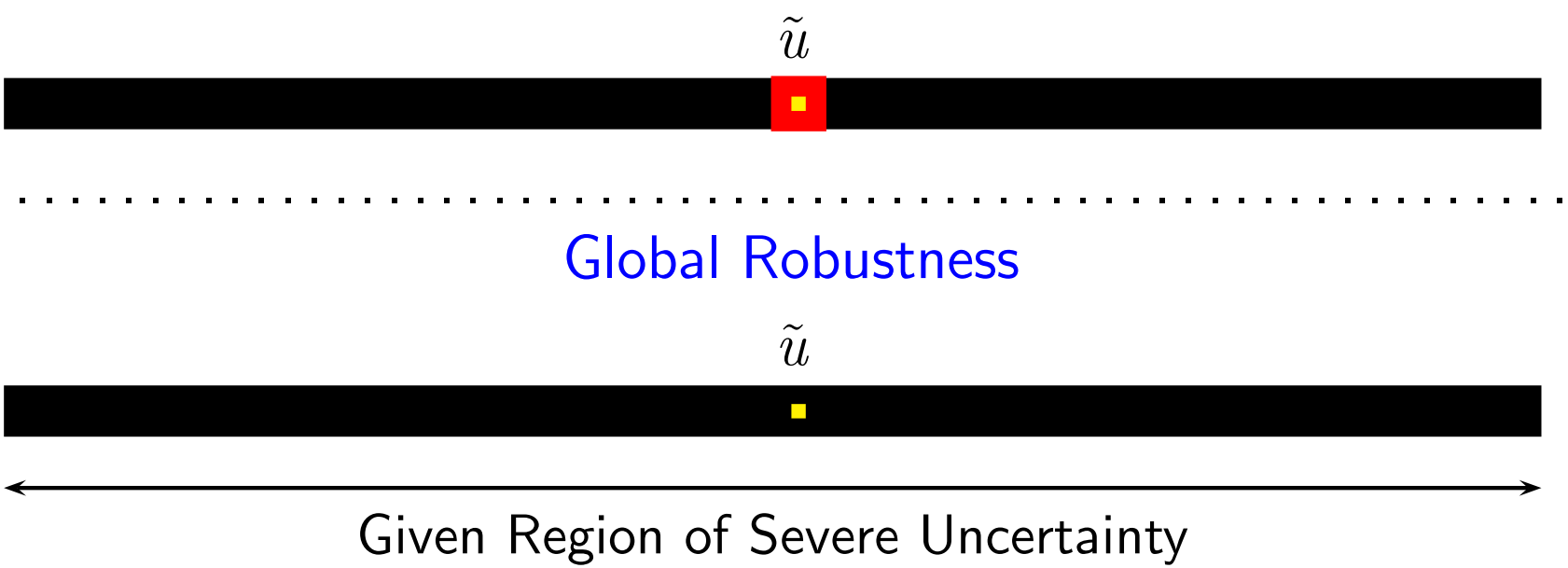


Modeling of severe uncertainty

Progress Report from Academistan

Confusion between

- Stability Radius represents local robustness.
- Treatment of severe uncertainty requires global robustness.



Progress Report from Academistan

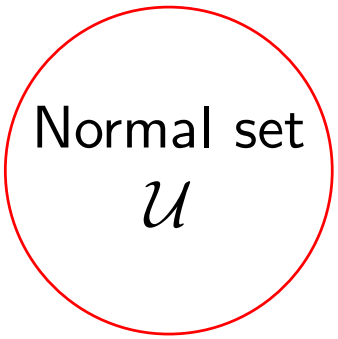
State of the Art in Robust Optimization

Guaranteeing feasibility of a constraint for all physically possible instances, even rare ones, may require a large uncertainty set, and as a result overly conservative decisions. The *Globalized Robust Counterpart* (GRC), developed by Ben-Tal et al. (2006), addresses this issue by requiring feasibility on a subset $\mathcal{U}$ of all physically possible instances, that includes the "normal range" of the uncertain parameters. For events outside $\mathcal{U}$, infeasibility is tolerated, but it is controlled.

Ben-Tal et al (2009. p. 926) EJOR

Progress Report from Academistan

Set of all physically possible instances of λ



$$c(x,\lambda) \leq b(\lambda) + \alpha\, dist(\lambda,\mathcal{U})$$

$$dist(\lambda,\mathcal{U}) := \inf_{u\in\mathcal{U}} ||\lambda - u||$$

$$dist(\lambda,\mathcal{U}) = 0 \quad \forall\lambda \in \mathcal{U}$$

$$\alpha \geq 0$$

State of the Art in Robust Optimization

On the extreme, $\alpha = \infty$ ... **nothing is required** from the decisions vector x when $\lambda \notin \mathcal{U}$; this choice of α then represents a somewhat "irresponsible" decision maker.

Ben-Tal et al (2009, p. 926) EJOR

Progress Report from Academistan

State of the Art in Robust Decision Making

But as we defined robustness to mean insensitivity with regard to small deviations from assumptions, any quantitative measure of robustness must somehow be concerned with the maximum degradation of performance possible for an ϵ-deviation from the assumptions. The optimally robust procedure minimizes this degradation and hence will be a **minimax** procedure of some kind.

Huber, P. J., *Robust Statistics,* 1981, p. 16-17

Indeed, Wald's Maximin model (1939) still dominates the scene in robust decision-making.

$$\max_{d \in D} \min_{s \in S(d)} f(d,s) \equiv \max_{\substack{d \in D \\ v \in \mathbb{R}}} \{v : v \leq f(d,s), \forall s \in S(d)\}$$

Progress Report from Publicistan

Breaking News

A new book from Palgrave is planned for 2010:
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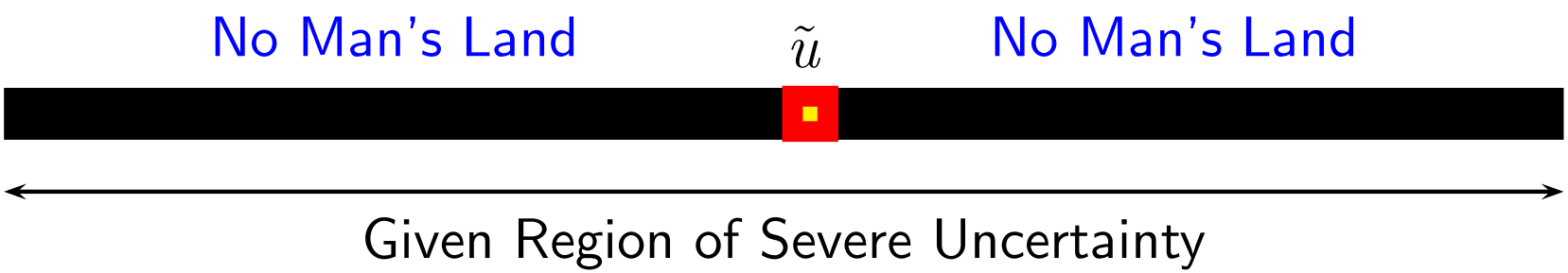
Major breakthrough in Economics

Apparently some senior economists accept the following magic recipe for the treatment of severe uncertainty

$$\sim \cdot \sim \cdot \sim \cdot \sim \cdot \sim$$

$\tilde{u}$ = wild guess of the true value of the parameter of interest

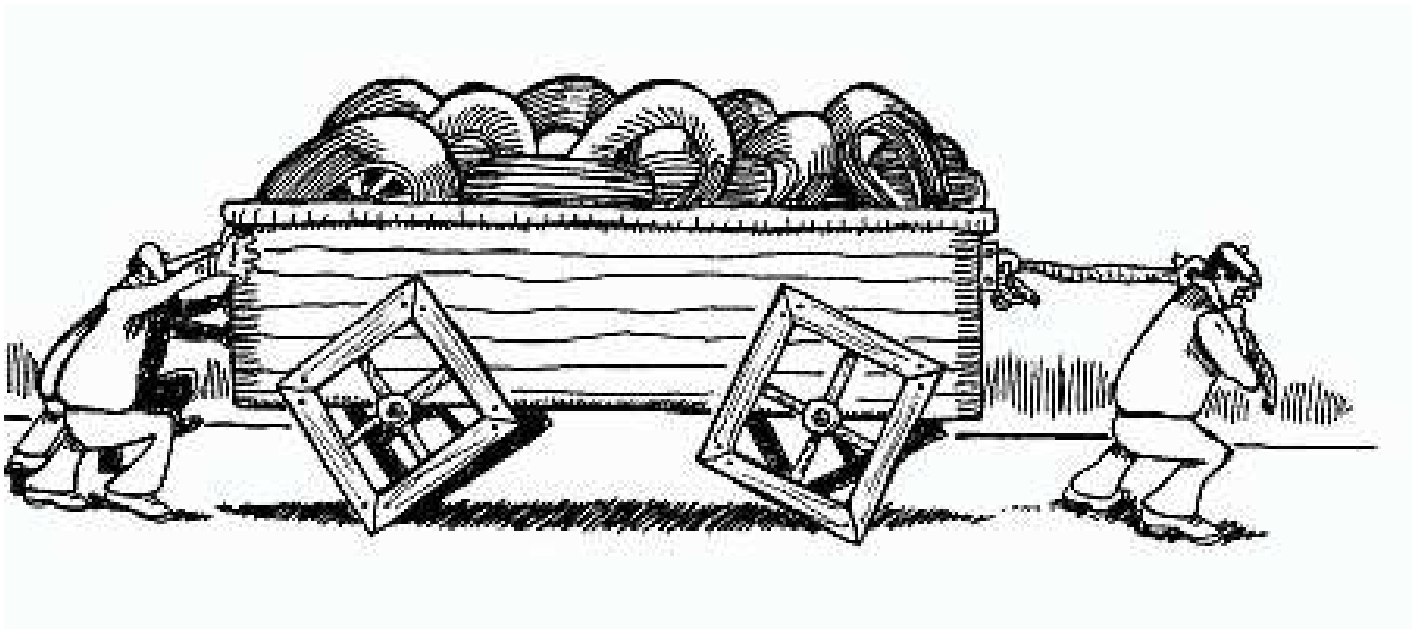
■ = Domain of robustness analysis



Progress Report from Publicistan

Key Question

Given the obvious, fundamental, well documented flaws in Info-Gap decision theory, how do you explain the fact that a reputable publisher such as Palgrave goes ahead with this project?



Progress Report from Publicistan

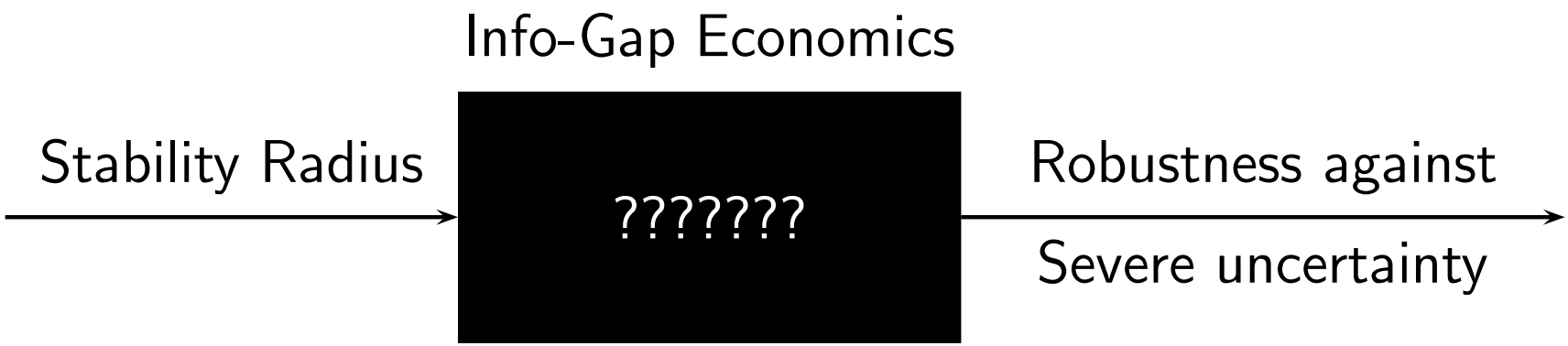
Suggestion

Perhaps Palgrave should consult its very own Dictionary of Economics (2008). The abstract of the entry **Robust Control** reads as follows:

Robust control is an approach for confronting model uncertainty in decision making, aiming at finding decision rules which perform well across a range of alternative models. This typically leads to a **minimax** approach, where the robust decision rule minimizes the worst-case outcome from the possible set. This article discusses the rationale for robust decisions, the background literature in control theory, and different approaches which have been used in economics, including **the most prominent approach due to Hansen and Sargent.**

Conclusions

- Info-Gap decision theory $\Longrightarrow$ Irresponsible Decisions.
- Info-Gap Economics $\Longrightarrow$ reinvention of a square wheel.
- Be careful with the articles/books you read!



?????? = fog, spin, rhetoric

Conclusions

http://www.stanwagon.com/

Question

What is the responsibility of a publisher for the validity, quality, correctness, etc of the content of a mathematically oriented book?

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