Uncertainty and Economics

A paradigmatic perspective

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Riga, 8 November 2019

ORDER WITH PUBLISHER: www.cmueller.ch/8897x8.php

Outline

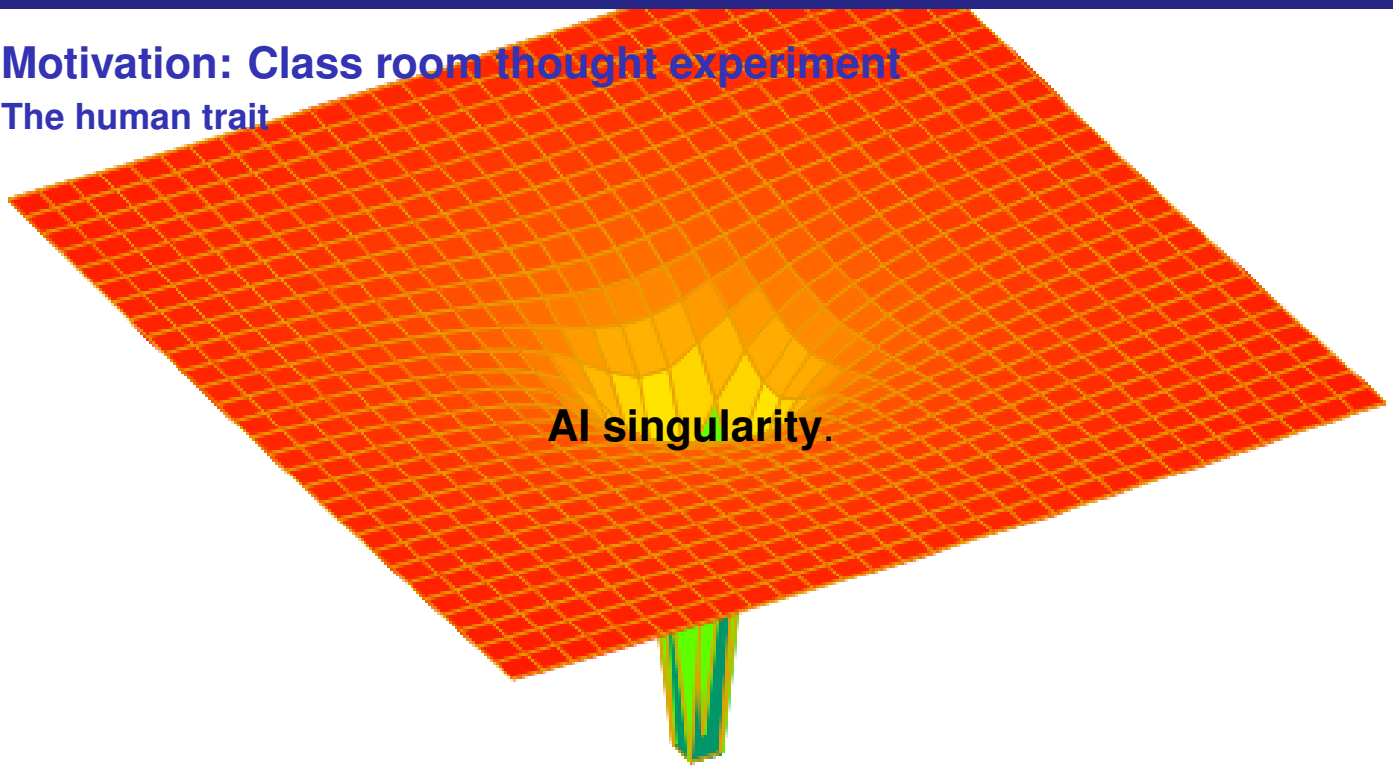
Motivation: Class room thought experiment
The human trait

Imagine the moment when you (can) . . .

- create an artificial copy of a human,
- in its entirety,
- with understanding all its internal (causal) dependencies.

Call this moment . . .

Motivation: Class room thought experiment
The human trait



Motivation: Class room thought experiment

The human trait

However, AI singularity either

- does not exist, or
- does not matter.

Motivation: Class room thought experiment

The human trait

- (i) **does not** exist
  - humans are genuinely individual
  - human action is genuinely unpredictable
  - methodological individualism justified
- (ii) **does** exist
  - humans are replicable
  - human action is genuinely predictable
  - AI singularity may have occurred in the past
    - we are are replica!
    - **AI singularity does not matter!**

Motivation: Class room thought experiment

The human trait

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  - AI singularity may have occurred in the past
    - we are are replica!
    - **AI singularity does not matter!**

Therefore, let's assume:

Humans cannot be emulated by humans or by non-humans.

(AI does not exist, thank you!)

A taxonomy of uncertainty

Problem statement

- AI non-singularity gives rise to "uncertainty": human action is unpredictable.
- Q: What is uncertainty?
- A: It is popular.
- `repec.org` search for "uncertainty":
  - 2003 – 12 / 2006: 1'348 (28 per month)
  - 2007 – 06 / 2010: 1'526 (37 per month)
  - **+32 percent**

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Ruffino (2014, p. 3) notes “Google searches for the phrase economic ’uncertainty’, for example, rose to an all-time high in February 2009. The second-highest level was reached in May 2010, as the euro-zone crisis intensified.”

A taxonomy of uncertainty
Problem statement

What is uncertainty?

- quantity of usage at odds with quality (and quantity) of definition.
- most common usage: variance (of something)
- usage driven by
  - longing for empirical results,
  - marketing of publications (financial crisis)
  - and similar

Proper definitions for scientific use still needed.

A taxonomy of uncertainty
Problem statement

Famous definitions of “uncertainty”.

- Knight (1921)
- Keynes (1924)
- Keynes (1936)
- Ellsberg (1961)

Insightful applications.

- Keynes (1936)
- Savage (1951)
- Muth (1961)
- Shackle (1972)
- Minsky (1986)

A taxonomy of uncertainty
Problem statement

Making “uncertainty” operational: taxonomy of “uncertainty”

1. determinism
2. randomness
3. ambiguity
4. uncertainty

Principle approach: inference between states of the world.

A taxonomy of uncertainty
Definitions

Determinism.

- Determinism is a process that deduces the properties of a final state from the properties of an initial state. The final state is unique.

A taxonomy of uncertainty
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Examples.

- Water wets a floor
- dropping a pen
- roulette
- complex systems (*inter alia* Sonnenschein 1973, Cass& Shell 1983, Ormerod 1999)

A taxonomy of uncertainty
Definitions

Risk.

- Risk is a process that deduces the properties of a final state from the properties of an initial state. The final state is not unique. Each possible final state has a known (simple risk) or knowable (common risk) probability of occurrence.

Introduction Taxonomy Puzzles Applications Summary
Definitions

A taxonomy of uncertainty
Definitions

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Examples.

- quantum leap
- complex systems when ignoring the inherent determinism
- . . . ?

A taxonomy of uncertainty
Definitions

What if probabilities remain unknown?

> *The practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience), while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique.*
>
> *Knight (1921, p. 233)*

A taxonomy of uncertainty
Definitions

Ambiguity.

- Ambiguity is a process that deduces the properties of a final state from the properties of an initial state. The final state is not unique. Each final state has a probability of occurrence. At least one final state has an unknown probability of occurrence.

Example.

- Ellsberg's urn experiment

A taxonomy of uncertainty
Definitions

Determinism, risk and ambiguity: resting on objective laws.
What if there are now laws?

> *By "uncertain" knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth-owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know.* *Keynes (1937, pp. 213f)*

A taxonomy of uncertainty
Definitions

Uncertainty.

- Uncertainty is a process that deduces the properties of a set of final states from the properties of an initial state. The final state is not unique. One or more final states are not known altogether.

Examples.

- the prospect of a European war
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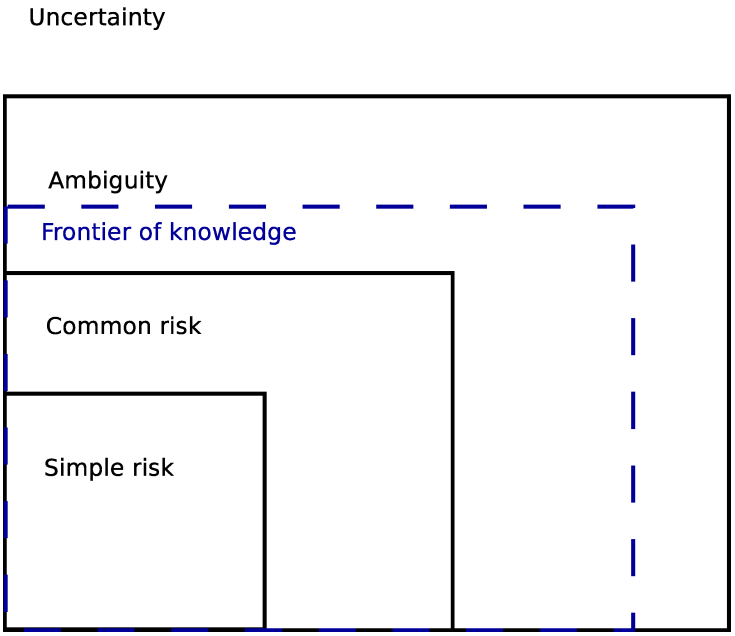
There is no AI singularity.

A taxonomy of uncertainty



Uncertainty and rationality

Rationality

- There is no AI singularity ✓
- There is a limit to knowledge ✓
- **So what??**

Uncertainty and rationality
Rationality

Uncertainty affects several key economic concepts

- decision making
- economic policy
- economics' ontology
- methodology
- rationality

Uncertainty and rationality
Rationality

Are people "rational"?

> *Rational people systematically and purposefully do the best they can to achieve their objectives, given the available opportunities.*
>
> *Mankiw: Principles of Macroeconomics 6th ed.*

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Rationality

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... a “useless” definition unless ...

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... one knows “the best”.

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Are people “rational”?

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Rationality tests cannot be applied to uncertainty!

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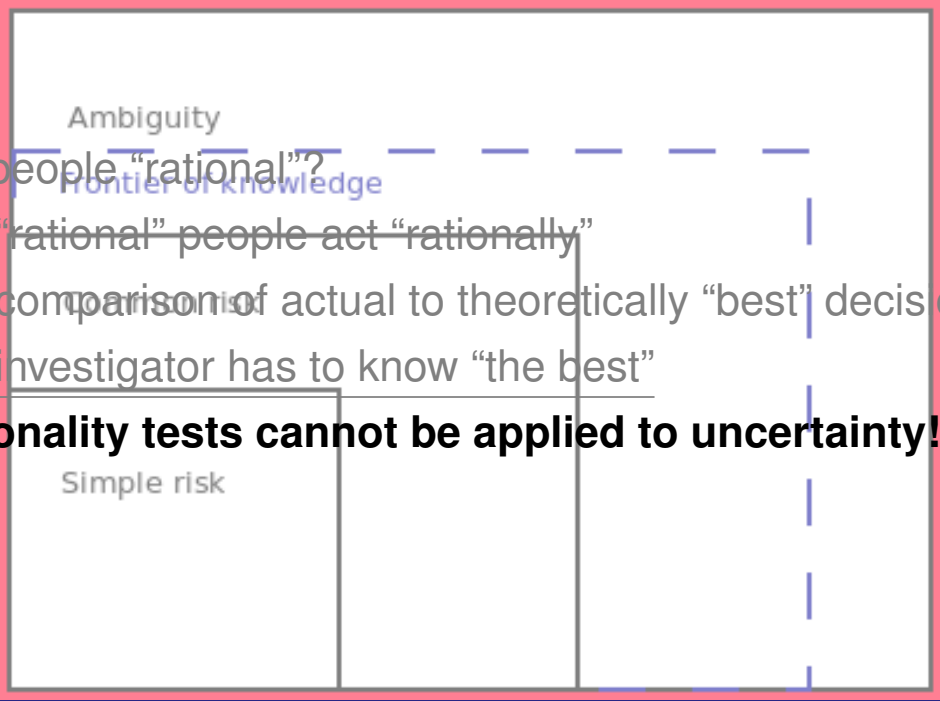

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- ~~"rational" people act "rationally"~~
- ~~comparison of actual to theoretically "best" decision~~
- ~~investigator has to know "the best"~~

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Uncertainty and puzzles
Puzzles

Puzzles arise when rationality tests fail.

Examples

- uncovered interest parity puzzles
- forward rate puzzle
- (exchange rate) volatility puzzle
- gone–fishing–effect
- . . . (e.g. Meese & Rogoff, 1983; Obstfeld & Rogoff, 2000)

Uncertainty and puzzles

Puzzles

Puzzles demand “explain(away)tions” (Thaler).

- sample effects: wrong country, wrong period, wrong assets, wrong...
- too small confident bands, woodoo statistics
- *[...] Lothian (2016) [...] recently wrote a paper [...] using 100 to 200 years [...] for about 20 rich countries, he found good but still noisy evidence that UIP held. [...] Lothian notes that 2/3 of the beta coefficients (which should equal exactly 1 in theory) have values of between 0.75 and 1.25. But since we can still “fail to reject” the hypothesis that beta equals 1, Lothian treats this as* `pro-UIP long run evidence`*. [...]*
  I think Lothian’s approach is the right one, and [...] most readers would come to Lothian’s conclusion: That it’s nice that “in the extremely long run” UIP holds on average, but it’s still a puzzle why it often fails to hold in the short run.

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Uncertainty and puzzles
Puzzles

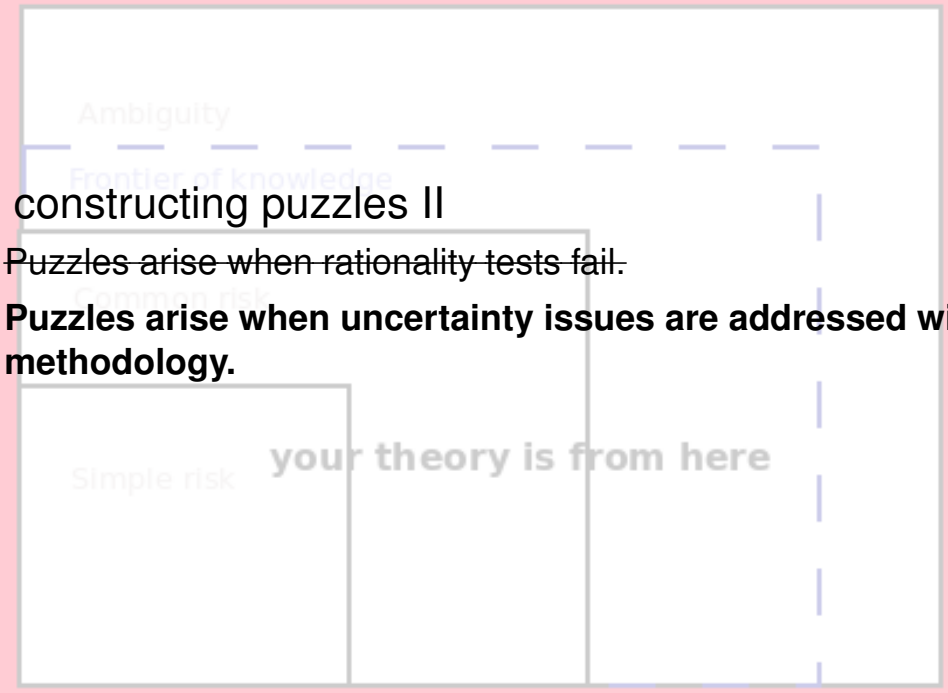
(De) constructing puzzles I

1. have a theory (ideally from “first principles”)
2. ignore uncertainty
3. turn your theory into an objective truth (Savage + Muth)
4. take your theory to the data
5. reject your theory
6. **declare the rejection a “puzzle”** ✓
7. “explainaway” the rejection and maintain your theory
8. take more / other data, go to 4 (and continue publishing about puzzles)

Uncertainty and puzzles
Puzzles

(De) constructing puzzles II

Uncertainty and puzzles
Puzzles



(De) constructing puzzles II

- ~~Puzzles arise when rationality tests fail.~~
- **Puzzles arise when uncertainty issues are addressed with risk methodology.**

Uncertainty and puzzles
Irrationality

But people do behave irrational!

- irrational exuberance
- anchor effect
- status quo bias
- endowment effect
- etc.

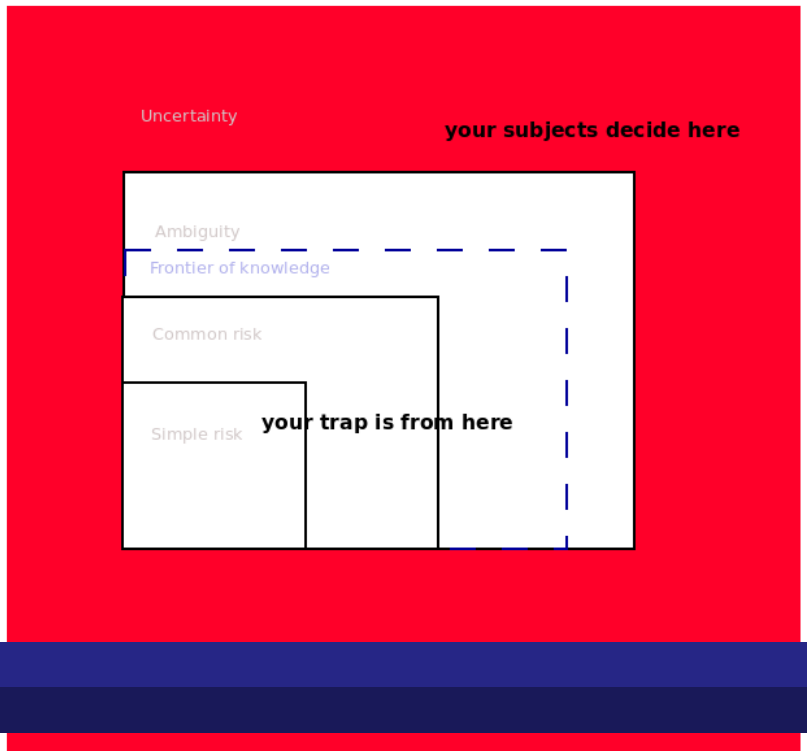
Uncertainty and puzzles
Irrationality

But people do behave irrational!

> *when I see experimental evidence such as that underlying the Allais paradox, I find it very unproductive to marvel at the stupidity or irrationality of the human mind (this reaction may be attributed to the fact that I almost invariably fall into **the traps built by the experimenters**!).*
>
> *Tirole, 2002, p. 640, emphasis added*

Uncertainty and puzzles
Irrationality

But people do behave irrational!



Uncertainty and puzzles

Puzzles and irrationality

Empirical uncertainty decision rules

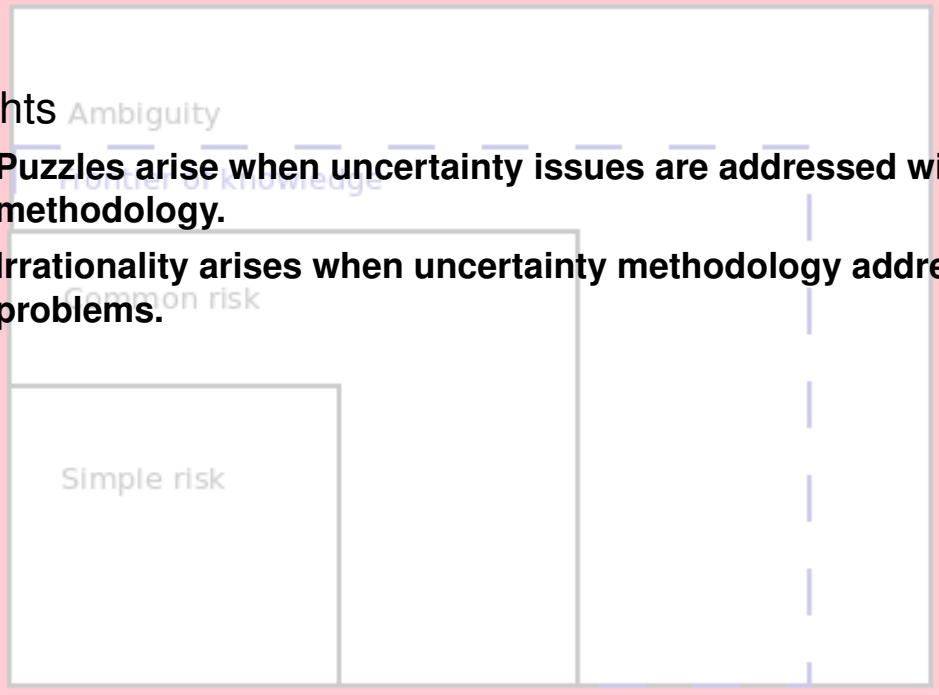
- emotions (Damasio, 1995; 2012)
- anchor values (Kahneman, Schkade and Sunstein, 1998)
- endowment (Tversky and Griffin, 1991)
- institutions
- belief / religions
- credible information (Druckman, 2001)
- status quo (Samuelson and Zeckhauser, 1988)
- heuristics (Goldstein and Gigerenzer, 2002)
- inattention (Bacchetta and van Wincoop, 2005)
- deliberate ignorance / pretence of knowledge / DSGE
- science
- whim (Keynes, 1936, pp. 162â163)
- sentiment (Keynes, 1936, pp. 162â163)
- prejudice

Uncertainty and puzzles

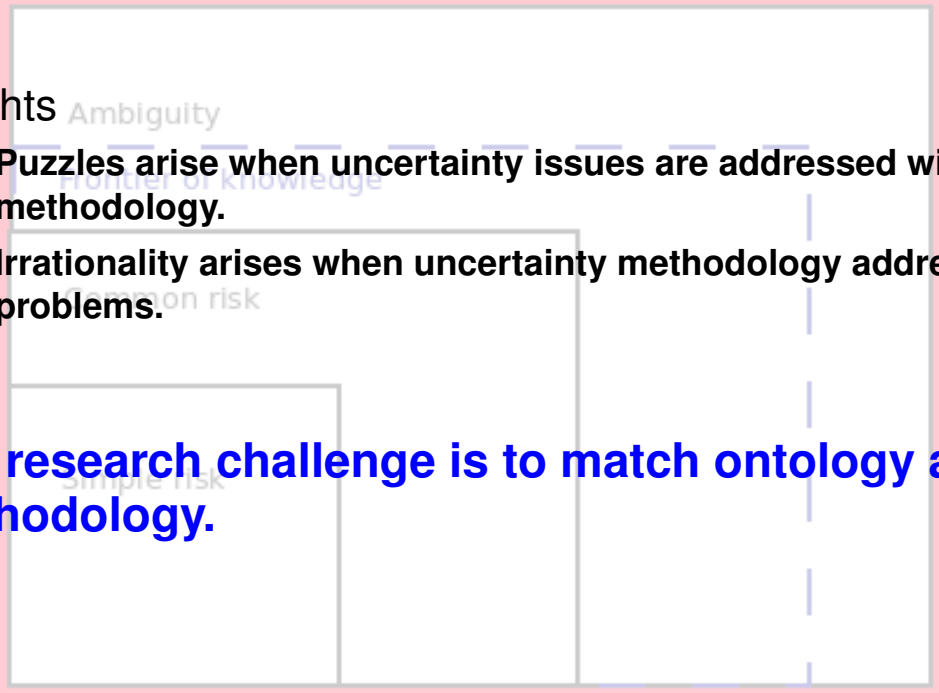
Puzzles and irrationality

Insights

1. **Puzzles arise when uncertainty issues are addressed with risk methodology.**
2. **Irrationality arises when uncertainty methodology address risk problems.**



Uncertainty and puzzles
Puzzles and irrationality



Insights

1. **Puzzles arise when uncertainty issues are addressed with risk methodology.**
2. **Irrationality arises when uncertainty methodology address risk problems.**

The research challenge is to match ontology and methodology.

Outlook

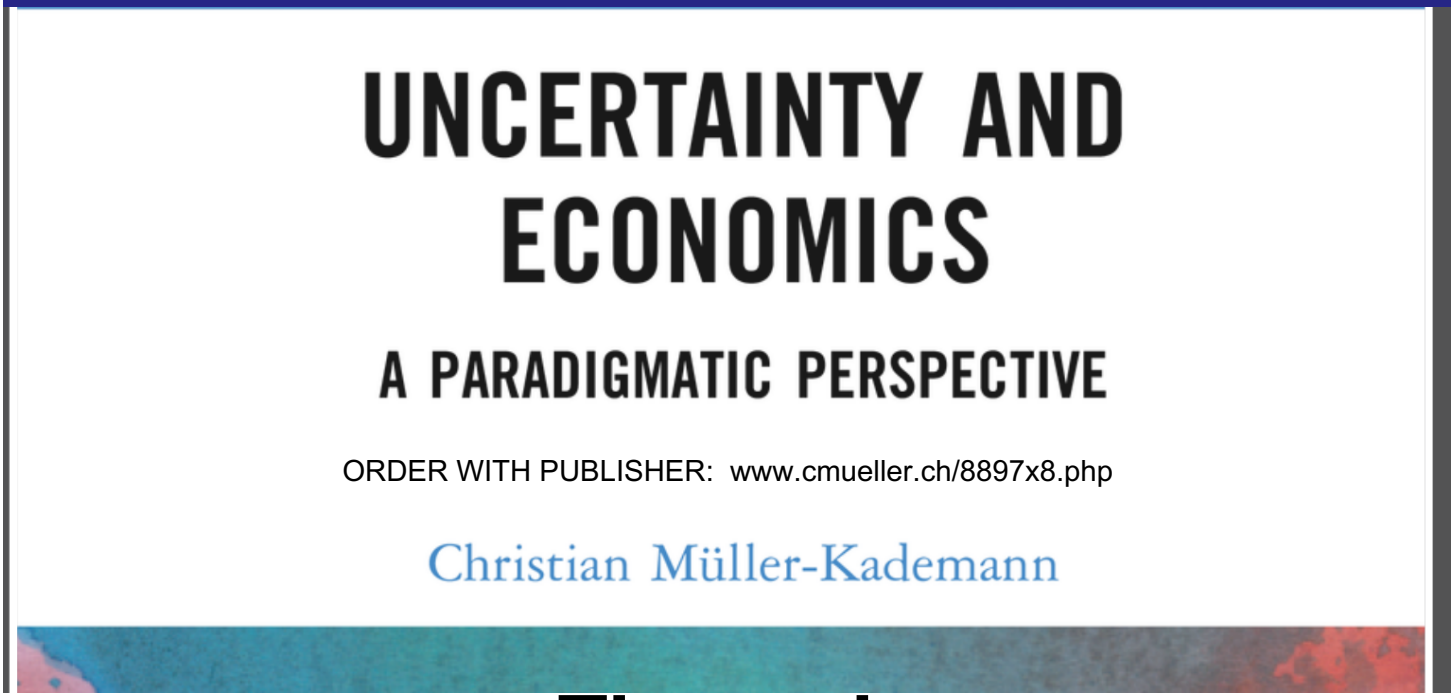
Uncertainty and Economics

- role of institutions: taming uncertainty
- fiscal stimulus: potentially self-defeating
- money + inflation: trust determines price stability
- finance: “proof” of uncertainty

Summary

Uncertainty and Economics

- uncertainty is a human trait
- uncertainty is due to individualism
- uncertainty implies incomplete knowledge
- rationality is not testable under uncertainty
- research to focus on matching economic ontology and method
- research into efficient decision rules under uncertainty needed
- uncertainty commands re-interpretation of standard concepts



The end.