

Review of the manuscript MS 1656
“THE COMING BREAKTHROUGH IN RISK RESEARCH”

The topic of the paper is very relevant to today’s policy debate on global risks management and in particular to climate change risks. I recommend publication conditional to addressing the points below (I do not need to see the paper a second time).

In summary:

First, I think the paper discusses in a novel way the relation between decision theory and uncertainty in the context of policy design, but I am not sure this objective comes clear to the reader from the beginning. The authors should better clarify in the introduction and conclusions what are the contributions of the paper: should the reader expect a review or a novel conceptual framework?

Second, the analogy to quantum logic should be explained better, in particular the fundamental reasons why it is so difficult not only to observe but even to estimate what would happen along those trajectories that we do not choose. See my detailed comments.

DETAILED COMMENTS

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“The two cases yield not only the same expected utility, “ : Shouldn’t one add “under the assumption that the second urn is unbiased” ?

“Consider the case of picking a ball twice with replacement” : please explain in one more sentence how the replacement works.

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“If a society or social network is unable to maintain such equilibria for sufficient amounts of time, it is bound to disintegrate, as patterns of communication and interaction will break down” : please rephrase, I suppose this means to maintain at least one those equilibria. Also maybe the subsequent sentence “Metastable equilibria offer a possible representation of social conventions, rules, norms and the like.” seems to be the assumption under which the previous sentence holds true.

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“And fourth, it is crucial to distinguish between marginal measures that work under the assumption that the system one is part of remains in the same basin of attraction and inframarginal measures where transition from one such basin to another one are essential.” : please explain, at least in a footnote what is meant by marginal and inframarginal measures. Does this mean here statistics over a subset of variables in the system or over the time periods when the system visit a metastable equilibrium?

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“All four implications can be spelled out with the specific format of transition functions considered in (3). This format, however, presupposes that for each agent the decision problem (2) has a unique solution, that action spaces and utility functions don’t change and that the overall network changes only in a random way.” : This statement is not obvious to me. If it has been proven in previous work, it would help to cite those works and say in one sentence the intuition why it holds.

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“Moreover, it leads to an additional, critical insight for risk management and governance. This is the acknowledgement that in order to become practically useful, (4) needs to be specified with the help of major additional assumptions about the particular problem at hand.” : what are the characteristics of Eq. 4 that lead to such an insight?

Page 15. “They proved a famous theorem about quantum mechanics, here we are interested in the generalization of classical logic that they introduced, because it is relevant for tackling uncertainty and ambiguity in decision-making.”:

I suggest to add a note or more precise reference to the specific result the author wants to refer to here, so that the interested reader can look at it.

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“What they cannot do is to show the one best strategy for tackling climate change.”: I think one-two more sentences could help the reader in this logical step that is very crucial for the paper. If I understand right the argument: first, we are not able to assign ex ante probability distributions to the outcomes of two given different future actions; second once we have chosen one of the two actions, we are excluding from observation the other one and we will not be able to know more, even ex post, about the probability distributions for the action we did not take. So we will never know for sure which one was better. I am trying to understand what is the fundamental hypothesis that makes this statement true. Is it simply that we are not able to assign ex ante probability distributions to the outcomes of actions? But this is the case for basically all policy contexts? DO I understand right?

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“The first practical implication then is that German climate policy cannot and need not be justified by a cost-benefit calculus based on a comparison between short term losses in GDP from climate policy and long-term damages to GDP from climate change. It cannot be so justified because the only way to find out actual GDP in, say, 2100 without climate policy, would be by not implementing climate policy and seeing what would happen. And the only way to find out GDP in 2100 under conditions of stringent climate policy would be to realize such a policy. These two possibilities correspond to incompatible propositions, they cannot be known together.”

I would suggest to (re)explain why estimating the GDP value in 2100 under the two scenarios cannot be done today in a meaningful sense. I am trying to understand what is the precise argument made by the authors here.

Consider the following example. In principle, if we know enough of the dynamics of a system and the uncertainty associated to the factors that we do not control is small enough, then we can reasonably predict the trajectories resulting from two initial conditions that are sufficiently different. This holds both if we simulate a system with a computer and if we devise a physical experiment. Now, suppose we would be allowed to run only one trajectory in a given scenario. We could still reasonably predict what would have happened in another scenario and thus decide the scenario that is best according to some criterion. So what is the fundamental difference, between the above experimental set up and the GDP of Germany under different climate policies?

For instance, in the example above the prediction is not possible anymore if the system exhibits deterministic chaos, i.e. if the dynamics, even in the absence of stochasticity, is such that differences in initial conditions are amplified exponentially during the evolution. It would also not be possible if there is an unknown feedback between the position of the system in the trajectory and the future trend in the trajectory, or if the expectations of the agents on the future of the trajectory make unknown contributions to the dynamics of the trajectory today.

In the examples I made, it is a matter of either unknown dynamics or chaotic dynamics (in the technical meaning) or both, that makes impossible to predict the outcome of the trajectory we do not choose to run.

I would suggest the authors to better explain if the reason why “These two possibilities correspond to incompatible propositions, they cannot be known together.” Comes from the uncertainty I mentioned or from something else.

My concern here is the following. The analogy to quantum logic and the notion of complementary variables that is suggested by the authors is very interesting. However, one could argue that quantum logic is a way to extend classic logic in a way to encompass the facts of quantum mechanics, and in particular the constraints of complementarity among certain variables such as position and momentum of a particle. However, we cannot really say that we fully understand why we do not know what we don't know. Quantum mechanics is very counterintuitive and challenges our cognitive abilities, maybe because our brain has evolved dealing with phenomenon at the scale of meters, while the physics at the scale of atoms is different. If we tell policy makers that the future impact of climate policies is like quantum mechanics and we cannot even know why we do not know, I am not sure how this will make the debate evolve.

TYPOS

- “Finally, from the point of view of the focal actor, a whole set of actors can be grouped as the environment (the word environment here becomes a technical term, to be distinguished from everyday notions of environment). These are the actors that are relevant for the problem at hand and somehow affect the focal agent, while the focal agent has no significant effect on them.”

Enviroment → environment

- “The set of relevant conditions then corresponds to the functional forms and parameter values that one considers possible for this concatenation of functions.”

concatentation → concatenation

- “The fundamental difficulty with this attempt to analyse the climate challenge is the one highlighted by complementarity logic: our actions enable us to know certain things, actual or possible, while making others unknowable, not because of our cognitive limitations, but because they simply are not there to be found.”

and

- “How then can an analysis of the climate challenge taking into account the insights of complementarity logic proceed?”

complementarity → complementary (adj.)

- “Once a focal agent has been chosen, it can be situated in the broad setting of iterated games outlined above.”

beein → been

- “They are linked by a more pragmatic understanding of rationality than the one that has shaped the present world economy and the mechanisms of risk governance on which it relies.”

understanding → understanding

- “Not surprisingly, research can only contribute to such a pragmatic view of rationality by engaging with actual practitioners.”

surprisingly → surprisingly