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Report on PhD Dissertation by Sasha Prokosheva (Cerge-EI, Prague): *Essays on decision making under uncertainty*

The current thesis deals with aspects of uncertainty that go beyond well defined, probabilistic risks, sometimes called deep uncertainty. In particular, the candidate investigates how decision makers evaluate financial prospects in situations of uncertainty. The topic is timely and important. Deep uncertainty is essential to virtually all economic, financial, or political decisions, and we need to understand how decision makers approach these situations and what problems they may confront. Indeed, there is a lot a research in this area going on. While the research frontier is moving quickly, few researchers take the time to stand still and assess the methodological pitfalls by which we may be caught. The current thesis does both: On the one hand, new empirical insights are provided that will shift our knowledge frontier. On the other hand, some of the potential insights of past research are re-assessed, and shown to require reinterpretation. The thesis consists of three substantial essays, on which I will comment in the following.

The first chapter deals with the widely discussed "uncertainty effect." It makes an important methodological contribution, showing how experimental design and instructions may affect empirical results, and how these findings may subsequently mistakenly be interpreted as substantial insights into decision-making. The study is a clear case of an important robustness test of a published influential study. Rejecting to take the results of the original study at face value, the candidate instead set out to take a closer look. Arguing that the experimental design of the Gneezy et al. study has many problems, the candidate demonstrates the sensitivity of the Gneezy et al. findings to minor changes in design and instructions by running a set of experiments that approach exactly these problems heads-on. It is shown that the original finding may not be robust.

Non-replications are insightful, but also pose new problems interpreting why two experiments provide different findings. The candidate carefully discusses both substantial

aspects (whether participants properly perceive of and understand the decision problem) and statistical aspects. Clearly, the reader of the chapter benefits by understanding what the drivers and boundaries of the uncertainty effect are. Indeed, in many situations agents may employ simple heuristics to stay away from uncertainty propositions, not getting involved in careful evaluations of these propositions at all. This will not be the typical behavior in many important financial decisions, however, except if there is a lot of ambiguity about the proposed prospects.

There is no doubt the paper has been very influential already. As of September 2015, the paper has already been cited twelve times in the web of science citation index. A remarkable impact for a paper in an ongoing PhD thesis.

The second and third substantial chapters deal with the concept of ambiguity, i.e., settings in which probabilities are unknown. Ambiguity attracted a lot of attention in theoretical decision modelling and in applied modeling of financial market behavior. Various well-known behavioral puzzles have been explained by ambiguity aversion, including the widely discussed equity premium puzzle, the stock market participation puzzle and the home bias. Unfortunately, we still have only a weak understanding of the phenomenon of (non-neutral) ambiguity attitude. This is a serious problem for applications. If we do not understand the phenomenon, we may model it in an inappropriate way, and may thus draw wrong conclusions in applied work.

To deepen our understanding of the concept of ambiguity, Chapter 2 of the thesis looks into its relation to violations in the reduction of compound lotteries. An important set of papers has proposed and tested the proposition that violation in the reduction of compound risk leads to ambiguity aversion. The current paper studies the link experimentally, and looks at the role of cognitive ability. The study is carefully executed. It suggests that reduction and ambiguity may be different concepts, after all. It also suggests that cognitive ability may be an important moderator. Because the chapter is not yet published, I give some more detailed comments in the appendix (such that they can be forwarded to the candidate). These may be useful to the candidate in the future publication process of the papers. The comments are <u>not</u> meant as requests to rewrite or reorganize the papers of the thesis.

Chapter 3 studies the demographic (broadly defined) foundations of ambiguity attitudes. In our recent review chapter on ambiguity attitude, Gijs van de Kuilen and I concluded that there is little clear evidence yet, and that the evidence is scattered among many papers. The literature has already moved on since then. The current chapter makes an attempt to organize the findings in the literature along many potential dimensions. It provides a very complete

overview of the literature (including very recent publications) and of the important effects found so far. Given the complexity and the detail of the analyses, I would suggest that the candidate adds (in the style of the very useful "directions" on page 99ff) maybe a short list of those findings that seem to be established or robust, given our current knowledge (as we have seem in Chapter 1, even established results can be challenged; see also Füllbrunn et al.'s paper in ambiguity in market experiments). This would be of tremendous help for the non-expert reader trying to identify which results are robust enough to build on in future work. I am confident that the paper will be an important resource for researchers inside and outside the field who want to get an idea where the literature currently stands. I give some more comments on Chapter 3 in the appendix. Again, the comments are not meant as requests to rewrite or reorganize the papers of the thesis.

Overall thus, this is a very well-written thesis containing reports of three carefully conducted studies. Some of the work has already had significant impact in the field, collecting a large number of published citations. The other studies are bound to have significant future impact as well, providing important insights for the modelling of decision making under uncertainty and its empirical applications. The thesis in its current form clearly meets the international standards and requirement for a doctoral dissertation in economics, and I recommend that the candidate should be accepted to defend her work.

Heidelberg, September 23rd, 2015

Appendix A: Further comments on Chapter 2

1) Here and elsewhere, the candidate tries to justify why MPL may be preferable to BDM etc. In general I think that often there is no clear ordering of different, mostly equivalent methods. I do not think researchers need to *over*-justify these choices.

2) The description on page 47 suggests that risk and ambiguity is implemented using bags with containers with differently colored insides. However, in the instructions on page 76, the candidate writes "draw a ball." This inconsistency would deserve some clarification.

3) Discussion of multiple switching on page 47: Bettinger and Slonim (2007, JPubEcon) discuss the demographic antecedents of multiple switching behavior in much detail. This might be a useful resource for the current paper.

4) Last sentence on page 47 claiming similarity of ambiguity with compound in the current design: indeed, we may argue that ambiguity is clearly compound risk here. The different, potentially equally-probable states of the world seem to have been discussed publicly with the subjects (previous three lines). Given that no strong link is found between compound and ambiguity, this problem may even make the result stronger. Still, there will be people who would not accept the current way of modelling ambiguity. In Trautmann-Zeckhauser (2013), we used a similar way to create ambiguous prospects, and had to remove any claims from the paper that these prospects were ambiguous. A possible extension of the current design would be to add one treatment where indeed no information is given; thus, true ambiguity.

5) The paper by Olivier Armantier and Nicolas Treich in Management Science (2014) on complex risky lotteries and ambiguity may be of interest here as well.

Appendix B: Further comments on Chapter 3

6) Some of the references need updates. Would be desirable to have everything up to date in the printed version.

7) De Lara Resende, J. and G. Wu (2010): the proper second name of first author is "de Lara Resende"; see reference list

8) Interestingly Dimmock et al. (2014) {published now JFE} does not find effects of gender on ambiguity. The same authors use the same data in another paper (in JRU), changing the model framework a bit, and then do find gender effects. This tells us something about the sensitivity of results to (hidden?) model assumptions.