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Annex No. 11 to the MU Directive on Habilitation Procedures and Professor Appointment Procedures

HABILITATION THESIS REVIEWER'S REPORT

Masaryk University	
Faculty	Faculty of Economics and Administration
Procedure field	Economics
Applicant	Ing. Marek Hudík, Ph.D.
Applicant's home unit, institution	University of Economics, Faculty of Business Administration, Prague
Habilitation thesis	Games and Goal-oriented Behavior
Reviewer	doc. PhDr. Martin Gregor, Ph.D.
Reviewer's home unit, institution	Institute of Economic Studies, Faculty of Social Sciences, Charles University

The thesis makes a bold attempt to introduce procedural decision-making in a strategic (game-theoretic) context. The thesis can be seen as one of the attempts to analyze strategic decision-making that accounts for „motives"; in a word, the thesis belongs into a recent literature that attempts to marry norms, procedures, motives, and outcomes.

I applaud the attempt to incorporate procedural rationality into games, but many questions remain regarding the specific framework proposed in this work. In particular, many formal parts are effectively missing, and given these omissions, it is impossible to assess fully the merit of the approach, address conceptual questions, discuss empirical implications, and especially make a clear comparison with the classic game theory.

Formally, there are three main differences: (i) a richer set of strategies, (ii) preferences over goals and not concepts, and (iii) a new solution concept. The first two differences are not properly explained, and hence it is difficult to understand how the framework exactly maps into the classic game theory.

To see in detail, consider the following:

- "*Define for each player a set of goal-oriented strategies (or plans)… In words, each action is associated with one (possibly different) goal.*" (p. 14) The constraint that each action is associated with one goal is not imposed anywhere in the text. Basically, we lack understanding of how the set of feasible plans is constructed.
- "*Recall that conventional strategic game (Definition 2.1) is defined as a triple… This means that we have introduced three new elements: goals, plans, and probabilities of success.*" (p. 15) This is not correct. One of the main changes is to replace preferences over the outcomes by preferences over the goals. Unfortunately, what this change means is not clarified anywhere in the thesis.

We can look more into point (i), i.e., the introduction of richer strategies. In the games of the normal form, a strategy is an (objective) prescription of the agent's actions and an outcome is an (objective) description of a situation resulting from the actions. Agents then have preferences over the outcomes. Here, it is proposed that agents select between "goal-oriented

strategies". In other words, when selecting an action, they have also a specific outcome in mind.
In my view, before we proceed to a new solution concept, the first and foremost question is what this extension of dimensionality of strategy implies for the structure of the modified game and for Nash equilibria in the modified game. It depends on points (i) and (ii) discussed above.

1. Suppose this extension doesn't change feasibility of the pairs (action profile, outcome) and the agent's preferences over goals are preferences over the outcomes. Then, this extension is irrelevant for Nash equilibrium in the modified game. To demonstrate, consider Trade as a Prisoners' Dilemma on p. 4. The set of goals is the set of outcomes (HH, HC, CH and CC), and the set of goal-oriented strategies for the row player is thus a set of all pairs (Honest-HH, Honest-HC, Cheat-CH, Cheat-CC); the set is similarly constructed for the column player. Then, an extended game in the plans is just a strategically equivalent refinement of the original game, as any outcome in the modified game eventually depends *only* on the actions.

2. Suppose now this extension *reduces* feasibility of some pairs (action profile, outcome) and the agent's preferences over goals are still preferences over the outcomes. Then, any reduction basically serves as a *commitment to not use an action* if it is associated with a particular outcome (e.g., only a victory achieved by fair play matters). These restrictions generate differences between the extended game and the original game; but these restrictions are simply equivalent to having prohibitive preferences over a particular pairs (action profile, outcome). (More formally, we have lexicographically imposed external norms onto the optimizing behavior; the primary criterion is to comply with the norms, and the secondary criterion is to optimize.) In a word, this captures relatively standard norm-oriented preferences.

3. Suppose now this extension doesn't change feasibility of some pairs (action profile, outcome) but the agent's preferences over goals are now preferences over *both actions and outcomes*. Now, this obviously directly represents norm-oriented preferences; it is similar to the previous case, only we have introduced norm-oriented preferences directly.

All in all, extending the set of strategies into goal-oriented strategies basically preserves the Nash equilibria if the agents' preferences are not over the actions and if the restrictions on the set of goal-oriented strategies are not stringent enough. Only if the agents' preferences are over the actions or some of goal-oriented strategies are infeasible - which is equivalent to prohibitive preferences over certain pairs (action profile, outcome) - then this extension modifies the original game into a new game with possibly different Nash equilibria.

Then, in this extended game, the primary question to me seems to be how the set of Nash equilibria has been affected. Also, since all these extended games can be translated into norm-oriented preferences, I cannot exactly see why Nash equilibrium is not a reasonable solution concept here.

To summarize differently – to understand what exactly "goal-oriented strategies" bring to the original game, we have to disentangle two effects: (i) the effect on the set of Nash equilibria, and (ii) the role of the OCP solution concept.

Moreover, a "plan" normally invokes that an agent forms beliefs about fundamental and strategic uncertainty; in this interpretation, a plan involve beliefs over the action of strategic players (agents) and non-strategic players (Nature). In a traditional understanding, the failure to achieve a plan is misunderstanding of the environment (both given strategic and non-strategic uncertainty) and a penalty is paid in the form of a reduced payoff resulting from not

playing a best-response strategy and a player revises his or her plan. This is not the definition adopted in this framework; a plan involves links between actions and outcomes but these links are exogenously predetermined and hence cannot be subject to revisions.

Then, I cannot avoid the impression that a theory of plans (which involves links between actions and outcomes, where the link depends on the behavior of the opponents) should explicitly introduce how beliefs over the behavior of the opponents evolve and hence how plans that address strategic and non-strategic uncertainty tend to evolve.

To conclude, at my university, a habilitation thesis in Economics is a collection of published articles; we make assessment based on the journals in which the articles have been published. Here, the thesis is argued to be based on an unpublished manuscript; but, as I have noticed, the core of the thesis has been published in *Theory and Decision* in early 2020: https://link.springer.com/article/10.1007/s11238-020-09753-5 This is a respectable journal in decision theory. On the other hand, it is a bit hard to judge a thesis by a single article.

To give a broader perspective, at my university, we expect at least 3 solo-authored articles in Economics at this level, plus 2 extra solo-authored articles in (possibly interdisciplinary) journals at this or higher level; more articles are required if the work is co-authored. To the best of my knowledge, this habilitation thesis and the previous work of the author are not formally meeting our standards. However, in a nationwide comparison, the thesis in my opinion qualifies for promotion in the field of Economics as the author is able to publish in recognized (yet lower-ranked) journals in behavioral economics and also in interdisciplinary journals.

Reviewer's questions for the habilitation thesis defence

1. Please briefly review why Nash equilibrium is criticized in games with complete information. Explain how you address these critiques through OCP, using examples of games that address important economic problems.
2. Explain exactly what OCP brings relative to NE when the goals are characterized by the outcomes and thus the payoff from goal is the payoff from the outcome in the original game. Give interpretation of this difference for a game that contain some important economic problem (e.g., production, trade, or distribution). In plain words, can you explain why agents should make economic decisions that are not payoff-maximizing?
3. Please clarify whether the goals are characterized by the outcomes or not. If not, what exactly is the additional component that is inserted into the preferences over the goals?
4. Can we introduce procedural rationality (goal-oriented behavior) simply as preferences over both actions and outcomes? How exactly does that differ from your framework? In this extended game, are there other solution concepts that are close to OCP that would serve as an alternative to Nash equilibrium?

Conclusion

The habilitation thesis entitled Games and Goal-oriented Behavior by Marek Hudík **fulfils** requirements expected of a habilitation thesis in the field of Economics.

Date: June 24, 2020 Signature: