Extended Abstract
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Paper/Poster Title	**Round effects in economic experiments – insights from a business simulation game with agricultural students**

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	***200 words max***

Round effects arise in stated preference elicitation methods with repeated choice tasks. They are associated with changes of preferences and patterns of response variance, they may counteract or distort experimental treatment effects and ultimately result in the biased estimation of the "true" underlying preferences. A precursor study, a business simulation game which tested, inter alia, the effect of hypothetical policy treatments on German farmers' smart weeding technology adoption, found evidence for a round effect. That is, despite not having received treatment, the behaviour of the control group in the treatment round changed in the same direction as in the treatment. We repeat and adapt the precursor study with German agricultural students to account for potential round effects. Specifically, we assess to which extent preference learning, institutional learning and fatigue influence the response behaviour and consequences thereof for the interpretation of treatment effects. Preliminary results from a reduced form model yield evidence for fatigue effects and institutional learning but not for preference learning. Thus, our findings are relevant for experimental agricultural economists and policy developers who interpret and apply findings from business simulation games and similar multi-period experimental studies.

Keywords	Economic experiment, business simulation game, round effects, Bayesian Probabilistic Programming
JEL Code	D91, B41, Q16, C11

Introduction	***100 – 250 words***

Observations of round effects arising during experimental elicitation of human preferences via repeated choice tasks have received notable scholarly attention, predominantly focused on consumer research. While the term subsumes different and by definition sometimes overlapping phenomena of systematic preference changes in stated preference methods, the general concern is that the identification of "true" preferences may be hampered due to bias or (and) error variance.

Our study is based on a precursor study from our research group in which a two-round business simulation game was conducted to assess the effect of hypothetical policy scenarios on German farmers' smart weeding technology adoption intention (see OSF). While all treatment groups showed higher technology adoption intention in the sense of the hypothesized treatments, the control group, despite not being treated, showed similar behaviour changes in the treatment round rendering the hypothesized treatment effects undetectable.

In the present study, we rerun the precursory study with agricultural students in a modified experimental design. Specifically, we assess to which extent results of multi-period business simulation games in experimental agricultural economics contexts may be affected by the outlined phenomenon of round effects. This enables a better understanding of potential consequences of round effects for conclusions drawn from respective experiments with the goal to inform policy.

To the best of our knowledge, we are the first to define and assess round effects in this context. Our findings are therefore relevant for both, (agricultural) economist and policy makers, who apply and interpret results from similar business simulation games.

Methodology | *100 – 250 words*

The online survey was addressed to students from German technical colleges and universities with an agricultural background and was distributed via email through multiple channels.

We adapted the precursory experimental design to enable a more versatile quantification of potential round effects. Specifically, in addition to a control and treatment group, which played two rounds (one baseline and one treatment round) we added a control and treatment group which played four rounds (baseline and three treatment rounds).

Based on previous experimental research and theoretical literature, we focus on three clearly defined types of phenomena: Institutional learning, i.e., preference changes between game rounds as a result of participants' familiarisation with the experimental setting. Preference learning, i.e., respondents developing their initially weak or unknown preferences during the study due to receiving feedback based on their choices, which is associated with a decrease in response variance. Lastly, fatigue effects, which are caused by respondents becoming increasingly overwhelmed or tired by the cognitive load and responding more randomly, i.e., with increased response variance, as the study progresses.

In order to allow for precise analysis of treatment and round effects, we used a Bayesian Probabilistic Programming approach, where the changes and the variance of changes in respondents' behaviour could explicitly be modelled and both, treatment and round effects, could be captured.

Data collection took place in December 2022. After cleaning, the final data set consisted of 230 complete observations. The analysis was conducted in Python, mainly using the NumPyro package.
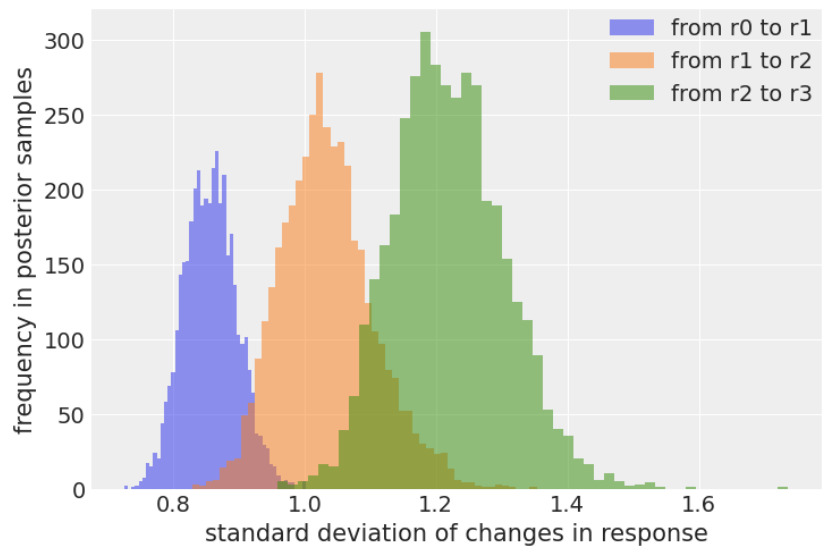
Results | *100 – 250 words*

Our preliminary findings are based on a reduced form model which includes only one of the three output variables we have asked respondents to evaluate, and yields the following results:

Firstly, we find evidence for an institutional learning effect when moving from round 1 to round 2, but not when moving from the baseline round (0) to the first round. Notably, half of the group is being treated in round 1 and thus might need more time to learn about the (new) institutional setting and thereby cause the learning effect to only appear after two game rounds. Closer analysis and comparison between treatment groups will yield more insights here.

Secondly, we find no evidence for preference learning in our study data, since the response variance continuously increases over the rounds.

Thirdly, we hence find evidence for fatigue effects. Our model revealed a progressive increase in participants' response variance across game rounds, suggesting a continuous surge of fatigue in participants. This can be illustrated by plotting the posterior distributions of the estimated standard deviation (sigma) of respondents' behaviour changes:

Lastly, our results confirm that controlling for round effects has influence on the estimation of the treatment effect, which will be further examined in the next analysis steps.

Discussion and Conclusion	*100 – 250 words*

Our preliminary results suggest evidence for institutional learning and fatigue effects, which affect the response behaviour of students in our multi-round business simulation game. Additionally, we found that inclusion of round effects in the analysis influenced the magnitude of the estimated treatment effect.

These findings confirm that mindful analysis and strategic planning of repeated choice studies and multiple-round business simulation games is crucial to the validity of acquired results and their relevance to policy makers. Further, the results show that the Bayesian Statistical approach used here is able to capture and quantify round effects by explicitly modelling the variance of respondent behaviour changes and disentangle them from changes caused by potential treatments.

The presented approach helps to quantify and identify three kinds of round effects, but further theoretical research as well as experimental testing is needed to identify and differentiate (other) round effects.

Our study respondents mainly consisted of young students of the agricultural sector, which likely have higher than average digital competence. Hence, the implications of this study might be of limited transferability to other respondent pools typically used in agricultural economic research and testing similar study settings with different respondent pools will be of interest to generate deeper understanding of the magnitude of different round effects and the study and respondent characteristics which cause them.