

Detecting Gender Effects in Risky Choice: A Machine Learning Approach

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Introduction: Gender differences in decision making under risk have broad implications for financial advising, pension policy, and insurance pricing. The standard approach detects gender effects via structural econometric modelling, usually assuming Expected Utility or Rank-Dependent Utility preferences, and testing whether a gender coefficient is significant. However, Alam, Georgalos and Rolls (2022) show this approach is sensitive to modelling assumptions: estimated gender effects can appear or disappear depending on the estimation method. Similarly, Thöni and Volk (2021) show that gender differences in risk preferences are primarily differences in variability rather than means: men are overrepresented at both extremes of the choice distribution. This raises a fundamental question: *is the gender effect genuine, or a statistical artefact of parametric modelling choices?*

Objective: This project reframes the question as a classification problem: rather than testing whether a gender coefficient is significant within a structural model, we ask whether gender is recoverable from raw incentivised lottery choices using model-free machine learning. The input is the vector of binary choices a subject makes across a battery of lottery tasks, along with features of each lottery (stakes, probabilities, expected value, variance); the output is a predicted gender label. Classification accuracy benchmarked against a permutation-based null distribution is then a direct test of whether gender differences in risk preferences are genuinely present in the choice data.

The internship: The intern will engineer distributional features (within-subject variance, extreme-choice propensity) and use SHAP values to map the gender signal onto specific lottery characteristics (stakes, probability levels, gain vs loss domain), connecting the ML result to the theoretical debate about the origins of gender differences in risk preferences (utility curvature, probability weighting, loss aversion). The project trains and tests classifiers as a proof of concept, contributing towards two deliverables: an open-source tool for researchers to screen datasets for gender effects, and an academic paper providing a meta-analysis of gender effect detection in risky choice. The student will contribute towards the framework for the former. Through this process, the student will gain experience in machine learning, reproducible research software development, and high-performance computing workflows.

Computational needs: The project uses multiple experimental datasets from the experimental economics literature, comprising thousands of subjects completing incentivised lottery tasks across multiple elicitation methods. Three computational demands motivate the use of high-performance computing infrastructure: (1) permutation testing requires classifiers to be retrained across 5,000+ label permutations per dataset to establish a valid null distribution; (2) hyperparameter search involves cross-validated tuning of gradient boosting and random forest classifiers across grids of 500+ configurations, requiring substantial parallel computation; and (3) cross-method validation repeats the full pipeline independently for each elicitation method (Multiple Price List, Binary Lottery Pairs, allocation tasks), multiplying the computational burden by the number of methods. The dRTP co-supervisor's expertise in Research Software Engineering will be invaluable in guiding best practices in code structure, documentation, and validation which will ensure that the pipeline is robust, reproducible, and fit for open-source release.

Tentative schedule: Weeks 1-2: Literature review & data preparation; Weeks 3-4: Baseline classifiers (logistic regression, random forest, gradient boosting) & cross-validation; Weeks 5-6: Feature engineering & SHAP value analysis; Weeks 7-8: Write-up of results & code documentation and repository deposit.

References: Alam, J., Georgalos, K., and Rolls, H. (2022): Risk Preferences, Gender Effects and Bayesian Econometrics, with Jess Alam and Harry Rolls, *Journal of Economic Behavior & Organization*, 202, 2022, 168-183.

Thöni, C. and Volk, S. (2021), Converging Evidence for Greater Male Variability in Time, Risk, and Social Preferences, *Proceedings of the National Academy of Sciences*, 118(23), e2026680118.