Supplementary Material to the Paper: The Statistical Power of Individual-Level Risk Preference Estimation

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1 Classification Using the Likelihood Ratio Test

Hey and Orme (1994) use the likelihood ratio (LR) test to classify subjects as EUT or not, and the AIC to classify non-EUT subjects. The RDU model with a Prelec (1998) PWF nests EUT as a special case when $\phi = \eta = 1$, and so the LR test can be applied to classify subjects as employing either EUT or RDU. The LR test to determine if the subject's observed choice data is statistically different from the null case of EUT is defined as:

$$LR = -2\left[\ln(L_{RDU}) - \ln(L_{EUT})\right] \tag{A.1}$$

where L_{RDU} and L_{EUT} are the likelihoods of the RDU and EUT models, respectively, estimated over the same data. In this Appendix, I repeat the analyses from Section 5 where the Wald test was used to classify subjects as either RDU or EUT, using the LR test with a 5% significance level. The parameter restrictions for the two models are the same as before. The EUT model is characterized by the parameter set $\{r, \lambda\}$ with $r \in [0, 1]$, and $\lambda \in [0.05, 0.3]$. The RDU model is characterized by the parameter set $\{r, \phi, \eta, \mu\}$ where $r = 0.5$ and $\lambda = 0.1$ for all simulations, and $\phi, \eta \in [0.5, 2.5]$.

The results of this new simulation analysis are presented for EUT subjects in Figure A.1 for the HO instrument, and Figure A.2 for the HN. As was observed with Figures 1 and 2 in the main text, we observe that the rate of type I errors is generally above 5% for both lottery batteries, and is often above 10% depending on the parameter values. As before, it appears that the HO battery has greater power to correctly classify EUT subjects than the HN battery.

The results RDU subjects are presented in Figure A.3 for the HO instrument,

and Figure A.4 for the HN instrument. Similar to Figures 3 and 4, we observe that the rate of type II errors is often very high for the parameter ranges considered here. The HO battery again generally outperforms the HN battery to correctly classify subjects as RDU, and for some parameter ranges roughly doubles the probability that an RDU subject is correctly classified.

The same patterns of type I and type II errors exist regardless of whether the Wald or LR test was used. Namely, as the λ parameter increases for EUT DGP, the rate of type I errors also increases, and type II errors are greatest for values near $\phi = \eta = 1$, the special case where RDU reduces to EUT. However, classification using the LR test generally outperforms classification using the Wald test in terms of rates of type I and type II errors.

Recall the probability of a type II error for a subject with $\phi = 1.58$ and $\eta = 1.36$, outlined in white in Figures A.3 and A.4, using the Wald test for classification is 92.95% for the HO battery, and 90.42% for the HN battery. Using the LR test, the probability of a type II error is is 30.42% for the HO battery, and 53.48% for the HN battery. Thus, the LR test performs markedly better than the Wald test for subjects with parameters in this range, but the rate of type II errors is still much higher than the 20% aimed for in economics.

References

Harrison, Glenn W. and Jia Min Ng (2016). "Evaluating the Expected Welfare Gain From Insurance." *Journal of Risk and Insurance* 83.1, pp. 91–120.

Hey, John D. and C. Orme (1994). "Investigating Generalizations of Expected Utility Theory using Experimental Data." *Econometrica* 62.6, pp. 1291–1326.

Prelec, Drazen (1998). "The Probability Weighting Function." *Econometrica* 66.3, pp. 497–527.

Figure A.1: Hey and Orme (1994)

Probability of Correct Classification using Likelihood Ratio Test, EUT DGP

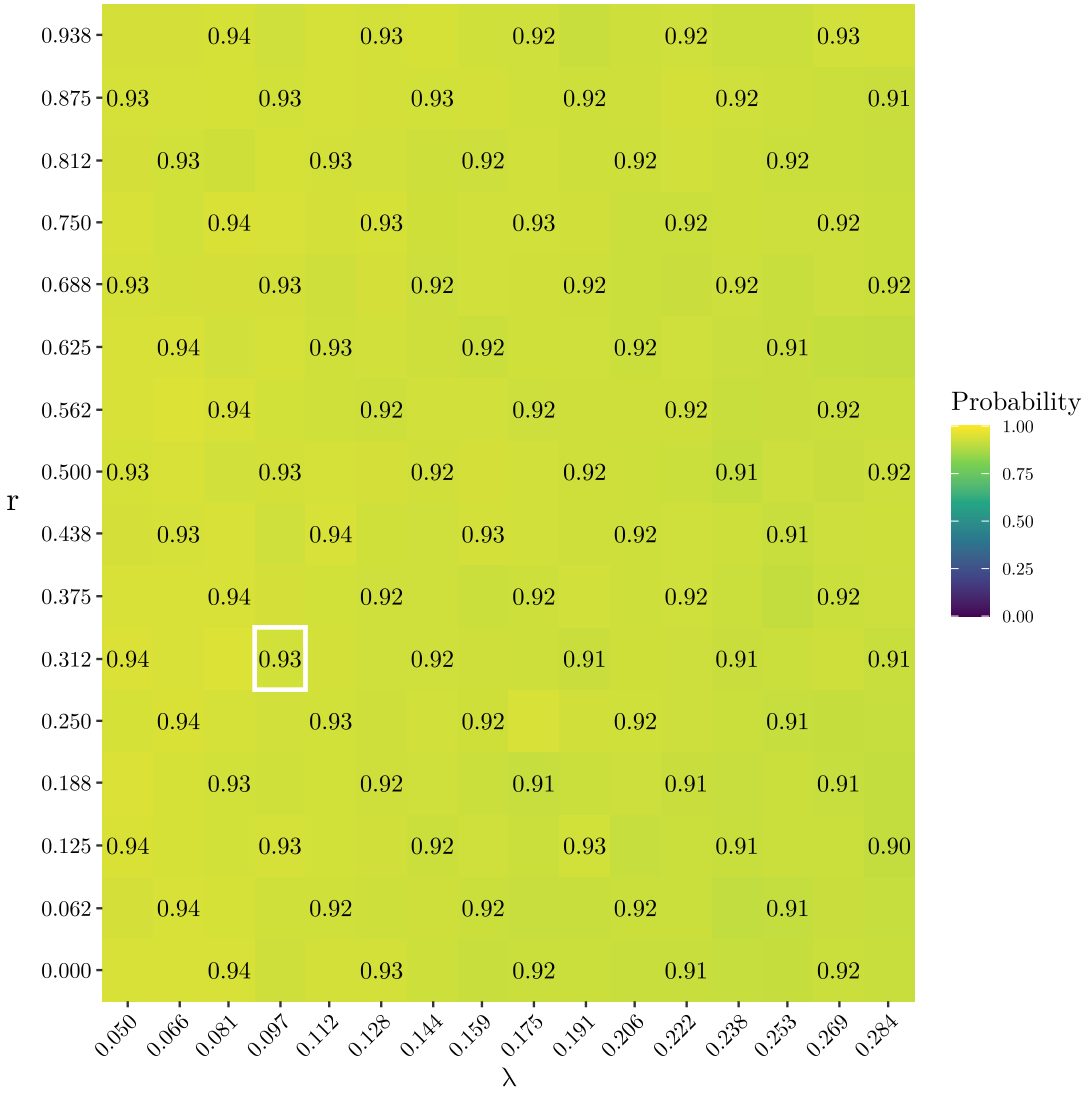

Figure A.2: Harrison and Ng (2016)

Probability of Correct Classification using Likelihood Ratio Test, EUT DGP

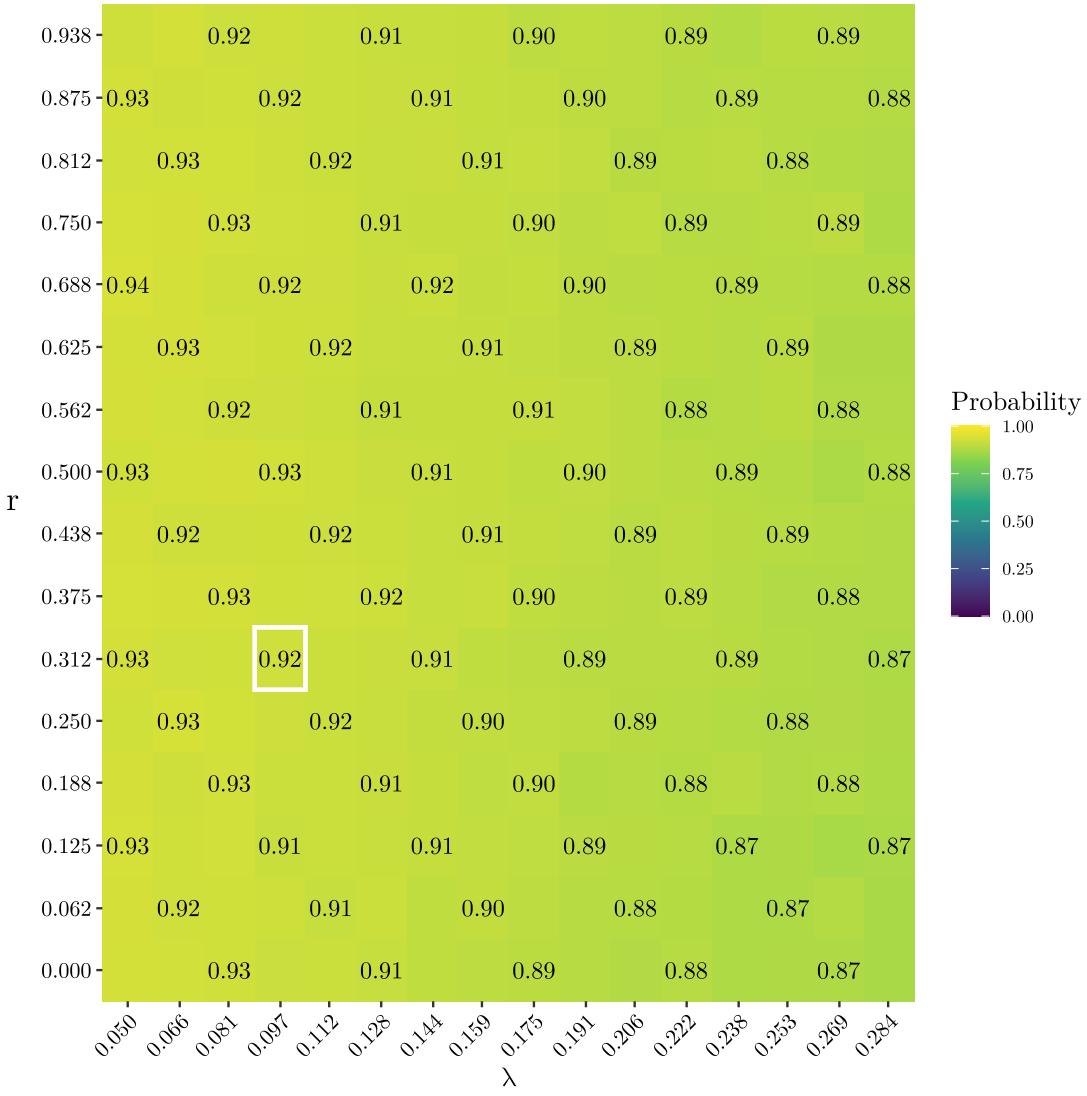

Figure A.3: Hey and Orme (1994)

Probability of Correct Classification using Likelihood Ratio Test, RDU DGP

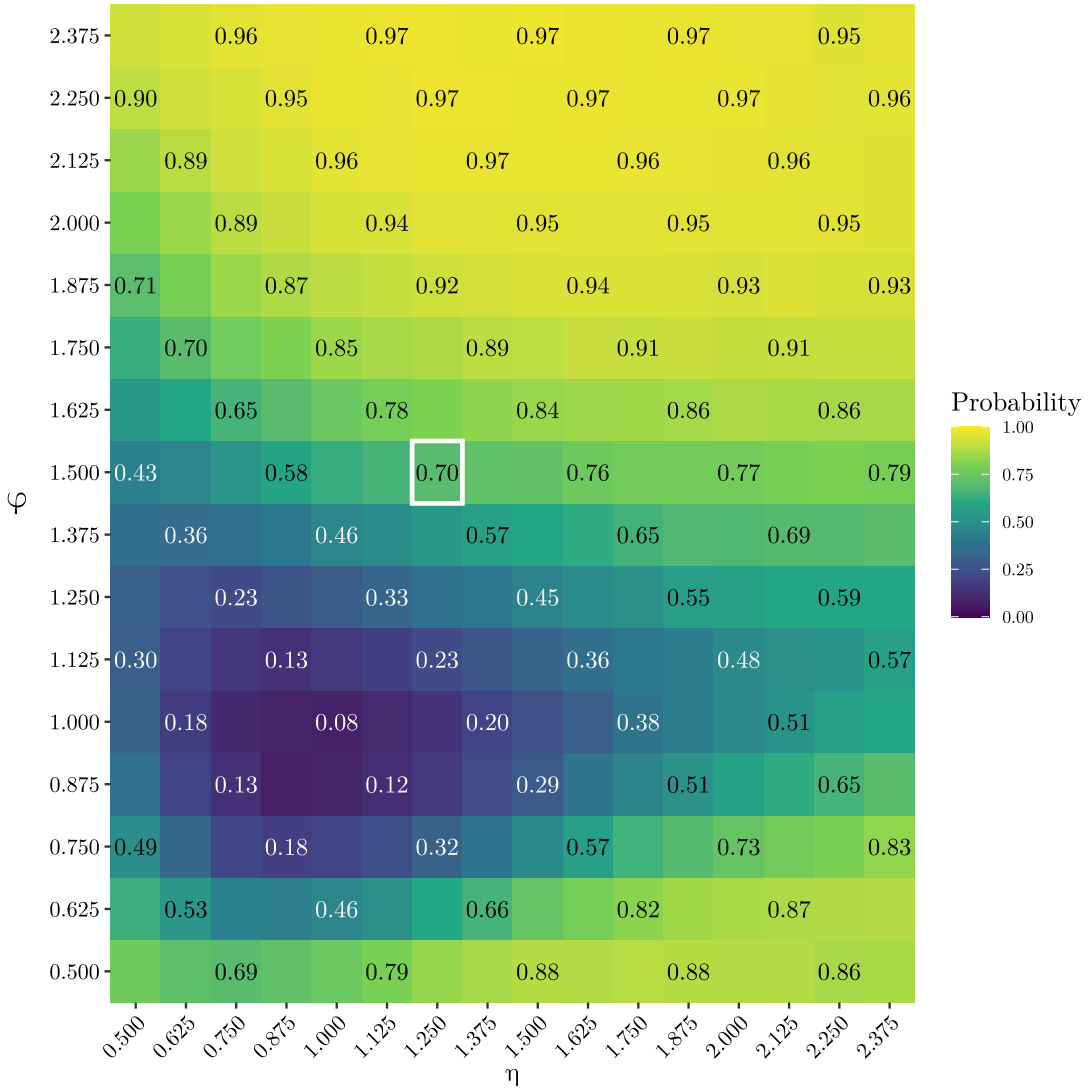

Figure A.4: Harrison and Ng (2016)

Probability of Correct Classification using Likelihood Ratio Test, RDU DGP