

ECON 7920  
Econometrics II  
Philip Shaw  
Problem Set 5  
Due Date: April 19, 2022

Chapter 13 Problems:  
13.1, 13.2, 13.3

Problem 1

Using the data set `apple.csv`, create a variable  $ecobuy = I(ecolbs > 0)$ . Using as the explanatory variables  $regprc$ ,  $ecoprc$ , and  $age$  conduct the following analysis.<sup>1</sup>

- a. Under the assumption that the structural error term is independent of all  $x$ -variables and has a standard normal distribution derive the log-likelihood function.
- b. Using the log-likelihood function from above, modify the `qfunction.R` script file to estimate the parameters of interest via M-estimation.
- c. Compute the  $t$  statistics under the zero null for each of the  $x$ -variables on interest. Do you reject the zero null for all variables?
- d. Now using the `probit` command in R, compare your results to the ones under probit estimation. Do your conclusions change?<sup>2</sup>
- e. Now compute the likelihood ratio test under the null hypothesis that  $ecoprc$  and  $age$  are jointly insignificant in determining  $P(ecobuy = 1|x)$ . Do you reject the null hypothesis?<sup>3</sup>

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<sup>1</sup>For this problem you will need the script files `qfunction.R`, `qderivfun.R`, and `qderivfun2.R`.

<sup>2</sup>`probitout = glm(y~ x,family=binomial(link="probit"))`

<sup>3</sup>Recall the command in R for the Chi-squared distribution function is `dchisq(LR, Q)`.