TSP Exercise Session - Problem Set 10

Tobit Model and Possion Regression

1) Tobit Model

(Based on Econometric Analysis by Green, Page 750)

The following 20 observations are drawn from a censored normal distribution:
3.8936 7.2040 0.0000 0.0000 4.4132 8.0230
5.7971 7.0828 0.0000 0.8026 4.3211 13.0670
0.0000 8.6801 5.4571 0.0000 8.1021 0.0000
1.2526 5.6016

The applicable model is \( y^*_i = \mu + \epsilon_i \) and \( y_i = y^*_i \) if \( \mu + \epsilon_i > 0 \), 0 otherwise. \( \epsilon_i \sim N[0, \sigma^2] \)

All exercise in this section are based on the preceding. The OLS estimator of \( \mu \) in the context of this Tobit model is simply the sample mean.

(a) Compute the mean of all 20 observations. Would you expect this estimator to over- or underestimate \( \mu \)?

(b) Formulate the log likelihood for the Tobit model.

(c) Reformulate the log likelihood in terms of \( \theta = \frac{1}{\sigma} \) and \( \gamma = \frac{\mu}{\sigma} \). Then derive the necessary conditions for maximizing the log likelihood with respect to \( \theta \) and \( \gamma \).

(d) Discuss how you would obtain the values of \( \theta \) and \( \gamma \) to solve the problem in part (b).

2) Problem 2

(Based on Introductory Econometrics by Wooldridge, 4th Edition, Page 615)

Consider a family saving function for the population of all families in the Unite States:
\[
\text{sav} = \beta_0 + \beta_1 \text{inc} + \beta_2 \text{hhsize} + \beta_3 \text{educ} + \beta_4 \text{age} + u
\]

where hhsize is household size, educ is years of education of the household head, and age is age of the household head. Assume that \( E(u|\text{inc}, \text{hhsize}, \text{educ}, \text{age}) = 0 \).

(a) Suppose that the sample includes only families whose head is over 25 years old. If we use OLS on such a sample, do we get unbiased estimators of the \( \beta_j \)? Explain.

(b) Now, suppose our sample includes only married couples without children. Can we estimate all of the parameters in the saving equation? Which ones can we estimate?

(c) Suppose we exclude from our sample families that save more than 25,000 dollars per year. Does OLS produce consistent estimators of the \( \beta_j \)?