

Econometrics I

Fall 2004

Assignment 4

Date: 10/5/2004

Due Date: 10/12/2004

Please show all of your work and clearly indicate your final response to each question.

The data to be used in performing these exercises are contained in the LAB_SUP data set, which can be found on my home page.

1. Select a subsample of currently unmarried women who are employed at the time of the survey (i.e., $m_{sp} = 0$ and $hours > 0$). You are to estimate the “deterministic” labor supply model

$$hours_i = \beta_0 + \beta_1 wage_i + \beta_2 grade_i, \text{ all } i,$$

after allowing for various forms of individual heterogeneity in the parameters.

- (a) Assume that β_0 is i.i.d. with mean $\bar{\beta}_0$ and variance $\sigma_{\beta_0}^2$. Obtain unbiased estimates of the parameters that characterize the model.
- (b) Assume that β_0 is normally distributed. Carry out an appropriate test of the null hypothesis that $\beta_2 = 0$ (two-sided test).
- (c) Assume that β_0 is fixed in the population, but that β_1 is an i.i.d. random variable with mean $\bar{\beta}_1$ and variance $\sigma_{\beta_1}^2$. Obtain estimates of all of the parameters that characterize the model.
- (d) Now allow both β_0 and β_1 to be random variables with distributions specified in parts (a) and (c). Under the assumption that β_0 and β_1 are independently distributed, are all parameters identified? Obtain consistent estimates of all identified parameters.
- (e) Say that $E(\beta_0 - \bar{\beta}_0)(\beta_1 - \bar{\beta}_1) \equiv \sigma_{0,1} \neq 0$. Determine whether this parameter is theoretically identified in this random coefficient model.

2. (You are to use the entire sample in answering this question.) Define the “desired hours of work” of individual i , h_i^* , as follows:

$$h_i^* = \delta_0 + \delta_1 \text{grade}_i + \delta_2 \text{age}_i + \delta_3 \text{south}_i + \delta_4 \text{msp}_i + \delta_5 \text{kids}_i + \delta_6 \text{kid_lt_5}_i + \varepsilon_i, \quad (1)$$

where the regressors on the right-hand side are defined in the attached codebook and ε_i is a disturbance term which is i.i.d. normal with mean 0 and variance σ_ε^2 .

- (a) Define the variable d_i to be equal to 1 if the woman was working and 0 if she was not. Estimate the linear probability model version of [1], that is, regress d on the right hand side variables. Obtain standard errors for the coefficient estimates, and describe any difficulties you encounter and choices you make along the way.
- (b) Assume that a woman will work whenever $h_i^* > 0$. Then

$$\begin{aligned} P(d_i = 1 | X_i) &= P(h_i^* > 0 | X_i) \\ &= P(X_i \beta + \varepsilon > 0) \\ &= P(\varepsilon > -X_i \beta) \\ &= 1 - \Phi\left(-\frac{X_i \beta}{\sigma_\varepsilon}\right) \\ &= \Phi\left(\frac{X_i \beta}{\sigma_\varepsilon}\right), \end{aligned}$$

where Φ is the standard normal c.d.f. and the last line follows from the symmetry of the normal c.d.f. around the mean. Estimate the index function model using Nonlinear Least Squares (NLLS), that is, estimate

$$d_i = \Phi\left(\frac{X_i \beta}{\sigma_\varepsilon}\right) + \xi_i.$$

Show that β and σ_ε are not separately identified in the model. Then normalize $\sigma_\varepsilon = 1$ and obtain a consistent estimate of β under this normalization.

- (c) Compute the elasticity of the probability of employment with respect to schooling [i.e., grade] using the linear probability model and the NLLS estimates. Defend your choices regarding the elasticity measures you compute.
- (d) Comment on the relationship between the LPM estimates and the NLLS estimates if [1] is the correct specification of the choice model.

Codebook for
LAB_SUP

This is a data set which is extracted from the NLSY and which contains observations on 14 variables for 2451 female respondents who were not enrolled in school at the time of the 1985 survey. Respondents are taken from the “random sample” component of the NSLY.

Column	Variable Name	Description
1	black	= 1 if R is black
2	Hispanic	= 1 if R is Hispanic
3	hours	hours worked during the week of the 1985 interview
4	wage	hourly wage rate if employed; if not = 0
5	north	= 1 if R lives in northeast U.S.
6	central	= 1 if R lives in north central U.S.
7	south	= 1 if R lives in southern U.S.
8	west	= 1 if R lives in western U.S.
9	msp	= 1 if R currently married living with spouse
10	nev_mar	= 1 if R never married
11	grade	highest grade of school completed
12	age	age at 1985 interview date
13	kids	number of children ever born
14	kid_lt_5	= 1 if R has child under 6 years of age