Topics in Labor and Demographic Economics
Midterm Problem Set

INSTRUCTIONS

Please submit all of the files related to your solution to this problem set via email to me (andrea.flores@fgv.br) by **SUNDAY, FEBRUARY 19TH at 23:59h**.

Your solution to this problem set should consist of (1) a pdf with your responses to the items in each of the questions as if it was a report (for items that just require coding with no discussion, include a reference to a particular part of your code), and (2) the files containing the code used in each question that requires estimation.

Even if you don't manage to complete all items in a question, partial credit will be applied generously if you clearly describe the issues you faced in implementing the estimation method and intuitively explain how you think these issues could be addressed.

Good Luck!

Question 1: Data Preparation and Analysis

(a) Use the ACS data set that you have downloaded and cleaned up from IPUMS and plot the yearly mean wages, mean hours worked (unconditional and conditional) and mean employment rates of women aged 15-65 in the downloaded sample

(b) Replicate Table 2 in Mincer (1962). *Note: Make sure to impose comparable sample restrictions.*

Question 2: Semi-Parametric, Structural Estimation

Suppose that the utility of the wife over participation and consumption follows the functional form:

$$U(C, P; \epsilon) = C + x'\alpha(1 - P) + \beta(1 - P)C + \epsilon(1 - P)$$

and the wage equation is

$$w(z, \xi) = z'\gamma + \xi$$

As shown in class, the observed wage equation can be written as

$$w(z, \xi) = z'\gamma + M(\Pr(P = 1|y, z, x)) + u$$

Using the sub-sample of married women between the ages of 25 and 55, implement the following estimation steps

(a) Non-parametrically estimate $\Pr(P = 1|y, z, x)$ using a kernel regression where z includes completed education and age and x includes a constant, age and current number of children

(b) Take your predicted working probabilities estimated in part (a) – $\widehat{\Pr}(P = 1|y, z, x)$ in the sample over which you implemented the non-parametric regression in part (a). Use Robinson's partial regression model to estimate γ and M. See pg. 62 in the Nonparametrics6.pdf file located in the Readings subfolder of the shared Dropbox folder.

(c) Use your estimates for γ obtained in part (b) to estimate α and β using the Klein and Spady single index estimator. Be careful to adjust the estimator to account for the fact that $\Pr(P = 1|y, z, x) = 1 - F(x'\alpha + \beta y - \widehat{\gamma}'z)$.

(d) Do you fail to reject the theoretical implications of the model? Discuss.

Question 3: (Fully) Parametric, Structural Estimation

Under the assumption that ϵ and ξ follow a bivariate normal distribution

$$\begin{pmatrix} \epsilon \\ \xi \end{pmatrix} \sim \mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_\epsilon^2 & \rho\sigma_\epsilon\sigma_\xi \\ \rho\sigma_\epsilon\sigma_\xi & \sigma_\xi^2 \end{bmatrix} \right)$$

(a) Estimate the model using full information maximum likelihood (that is, deriving a likelihood function in which we are estimating the utility function and the wage equation jointly).

(b) Compare your results with those obtained in Question 2. Discuss.

Question 4: Marshallian Labor Supply

Take the model we considered in the Estimation Lecture of the Static Intensive Labor Supply:
Let the direct utility follow a Stone-Geary form

$$U = B_0 \ln(L - \gamma_L) + B_1 \ln(C - \gamma_C)$$

where

$$\begin{aligned} B_0 + B_1 &= 1 \\ C_i - \gamma_C > 0; \quad L - \gamma_L &> 0 \\ B_0 &= x'\tilde{B}_0 + \epsilon \end{aligned}$$

(a) Suppose that the price of consumption is 1. What are the Marshallian demand functions for consumption and leisure?

(b) Under what conditions does the following condition hold?

$$\mathbb{E}[x'(\gamma_L w + x'\tilde{B}_0(wT + y - \gamma_C - \gamma_L w) - wL)] = 0$$

Hint: We already know this would require an interior solution, but what else should we be willing to assume regarding tastes for this moment condition to hold?

(c) Derive a similar moment using the Marshallian demand for the consumption of C. Combine this moment with the moment in part (b) to estimate the parameters of the model using GMM with data from the data set used in Question 1 but restrict your sample in the following way:

- Keep only the observations of married men who are between 25 and 55 years old at the time of the survey
- Keep only observations for 2015

(d) Calculate S_{00}. Do you fail to reject the theoretical implications of the model? Discuss

Bonus Question: Intertemporal Model of Labor Supply

Consider a simple 3-period model of consumption and labor supply with $T = 3$ denoting the retirement stage. That is, $L_3 = L_0$ where L_0 denotes total time endowment. Preferences are temporally separable so that at age 1, the agent solves the following life-cycle maximization problem:

$$\max \sum_{t=1}^{3} \beta^{t-1}[\alpha \ln C_t + (1-\alpha) \ln L_t]$$

subject to

$$\begin{aligned} \sum_{t=1}^{3} \frac{1}{(1+r)^{t-1}} C_t &\leq A_1 + \sum_{t=1}^{2} \frac{1}{(1+r)^{t-1}} w_t (L_0 - L_t) \\ L - L_1 &\geq 0 \\ L - L_2 &\geq 0 \end{aligned}$$

(a) Derive the Marshallian and Frischian labor supply functions. Consider cases with both interior and corner solutions for different periods.

(b) Within each case, characterize λ and derive expressions for changes in λ in response to changes in (w_1, w_2) and A_1 (initial wealth). *Note that in this case, λ is time-invariant as it would be the Lagrange multiplier associated with the lifetime budget constraint.*

(c) Describe how you would solve the model (describe the optimal policy functions) if you observe (w_1, w_2, A_1) and knew that

$$\begin{bmatrix} \alpha \\ \beta \\ r \\ L_0 \end{bmatrix} = \begin{bmatrix} 0.4 \\ 0.9 \\ 0.08 \\ 8700 \end{bmatrix}$$