Problem Set 6

Question 1:

Consider the following model. The individual chooses between two sectors ("0" or "1") according to the following choice model:

$$s_i = 1 \Leftrightarrow E\left[y_{i,1} - y_{i,0} - \gamma_0 - \gamma_2 z_i - \gamma_3 x_i - \alpha_c \theta_i - \epsilon_{i,C} \middle| \mathcal{F}_i\right] \geq 0.$$

where $\mathcal{F}_i$ is the individual's information set.

Assume that the outcomes $y_{i,0}$ and $y_{i,1}$ are determined according to the following equations:

$$y_{i,0} = \delta_0 + \beta_0 x_i + \theta_i + \epsilon_{i,0}$$

$$y_{i,1} = \delta_1 + \beta_1 x_i + \alpha_1 \theta_i + \epsilon_{i,1}$$

where x_i, z_i, and θ_i are observed and:

$$\left.\begin{pmatrix} \epsilon_{i,0} \\ \epsilon_{i,1} \\ \epsilon_{i,C} \end{pmatrix}\right| x_i, z_i, \theta_i \sim N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_0^2 & 0 & 0 \\ 0 & \sigma_1^2 & 0 \\ 0 & 0 & \sigma_C^2 \end{pmatrix}\right]$$

Assume that $\epsilon_{i,C} \in \mathcal{F}_i$, but $\epsilon_{i,s} \notin \mathcal{F}_i$ for $s = 0, 1$. Discuss the identification of this model.

Question 2:

Consider the following model. The individual chooses between two sectors ("0" or "1") according to the following choice model:

$$s_i = 1 \Leftrightarrow E\left[y_{i,1} - y_{i,0} - \gamma_0 - \gamma_2 z_i - \gamma_3 x_i - \alpha_c \theta_i - \epsilon_{i,C} \middle| \mathcal{F}_i\right] \geq 0.$$

Assume that the outcomes $y_{i,0}$ and $y_{i,1}$ are determined according to the following equations:

$$y_{i,0} = \delta_0 + \beta_0 x_i + \alpha_0 \theta_i + \epsilon_{i,0}$$

$$y_{i,1} = \delta_1 + \beta_1 x_i + \alpha_1 \theta_i + \epsilon_{i,1}$$

where x_i, z_i, are observed and

$$\left.\begin{pmatrix} \epsilon_{i,0} \\ \epsilon_{i,1} \\ \epsilon_{i,C} \end{pmatrix}\right| x_i, z_i \sim N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_0^2 & 0 & 0 \\ 0 & \sigma_1^2 & 0 \\ 0 & 0 & \sigma_C^2 \end{pmatrix}\right].$$

Although you don't observe θ_i, you know that $\theta_i \sim N\left(0, \sigma_\theta^2\right)$ and that $\theta_i \in \mathcal{F}_i$. Assume you observe measurements for θ_i for all individuals (so there is no selection problem for the observation of measurements):

$$M_{i,A} = x_i^M \beta_A^M + \theta_i + \epsilon_{i,A}^M$$

$$M_{i,B} = x_i^M \beta_B^M + \alpha_B \theta_i + \epsilon_{i,B}^M$$

where the $\epsilon_{i,A}^M$ and $\epsilon_{i,B}^M$ are normally distributed and independent random variables

Assume that $\epsilon_{i,C} \in \mathcal{F}_i$, but $\epsilon_{i,s} \notin \mathcal{F}_i$ for $s = 0, 1$. Discuss the identification of this model.

Question 3:

Use the data problem_set6.raw to estimate the identifiable parameters of the model in Question 2. Hint: Take a look at the EM algorithm.

Question 4:

This is the same model as in Question 2, but now you only observe the measurement for the individuals who choose sector 1. Discuss the identification of this model.