

**Advanced Quantitative Methods in Marketing**  
**Coding Assignment #1: Multinomial Probit**

We assume there are  $i=1 \dots I$  consumers and  $j=0,1,2$  options. Consumer  $i$  choosing brand  $j$  gets utility

$$u_{ij} = \varepsilon_{ij}.$$

We assume

$$\begin{pmatrix} \varepsilon_{i1} - \varepsilon_{i0} \\ \varepsilon_{i2} - \varepsilon_{i0} \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, LL'\right)$$

where

$$L = \begin{bmatrix} 1 & 0 \\ \sigma_{21} & \sigma_{22} \end{bmatrix}.$$

(We normalize the upper-left hand element of  $L$  because otherwise the model is not identified.)

Utility maximization implies

$$y_{ij} = \begin{cases} j & \text{if } u_{ij} > u_{ik} \text{ for } k \neq j \\ 0 & \text{otherwise} \end{cases}.$$

Using these assumptions,

- 1) download simulated data from either <http://www-rcf.usc.edu/~kwilbur/mkt599/y.mat> (MATLAB format) or <http://www-rcf.usc.edu/~kwilbur/mkt599/y> (ASCII format).
- 2) Construct three vectors,  $y_{i0}$ ,  $y_{i1}$ , and  $y_{i2}$ .
- 3) Use simulation so that you can calculate predicted choices  $\hat{y}_{i0}$ ,  $\hat{y}_{i1}$ , and  $\hat{y}_{i2}$  given a guess of the parameters  $\sigma_{21}$  and  $\sigma_{22}$ .
- 4) Use the data and your predictions to recover  $\sigma_{21}$  and  $\sigma_{22}$ . Make sure you use a constant set of simulated draws while you optimize over  $\sigma_{21}$  and  $\sigma_{22}$ .