ECON 5360 Problem Set #8

Due: Thursday, April 11, 2013

Chris Bastian, Ben Rashford and Muhammed Amin in UW's Department of Agricultural and Applied Economics are working on an interesting project related to land usage in Canada. The model explains land shares across 8 agricultural usages, 39 Census Agricultural Regions (CARs), and six time periods. The land shares are assumed to follow the logistic process:

$$s_{ijt} = \frac{\exp(\beta_i' x_{ijt} + \epsilon_{ijt})}{1 + \sum_{r=1}^{7} \exp(\beta_r' x_{rjt} + \epsilon_{rjt})}, \tag{1}$$

where $\beta_0 = 0$. The econometric framework is an SUR model with 7 share equations of the following form:

$$y_{ijt} = \ln\left(\frac{s_{ijt}}{s_{0jt}}\right) = \beta_i' x_{ijt} + \epsilon_{ijt} \tag{2}$$

where $i = 1, ..., 7$ indexes the land usage; $j = 1, ..., 39$ indexes CARs; and $t = 1981, 1986, ..., 2006$ indexes five-year intervals of time. The SUR model has seven equations indexed by i, with the eighth category $i = 0$ serving as the benchmark category because the shares must sum to one.

The authors are interested in using the model to predict land usage given various climate change scenarios. Changes in land usage from climate change can be captured through the following elasticities:

$$\delta_{ijtk} = \frac{\partial s_{ijt}}{\partial x_{ijtk}} \frac{x_{ijtk}}{s_{ijt}} = \left(\beta_{ik} - \sum_{r=1}^{7} s_{rjt}\beta_{rk}\right) x_{ijtk} \tag{3}$$

where $k = 1, ..., K$ indexes the explanatory variables in the vector x_{ijt}.

Your assignment is to find an approximate formula for the 95% confidence interval of $\hat{s}_{ijt}$ and $\hat{\delta}_{ijtk}$.