Professor R.L. Oaxaca — Assignment #5
Econ 522a — Spring 2015

Due Wednesday, May 6
(40 points)

This assignment is on seemingly unrelated regressions, simultaneous equations, and non-linear least squares. The necessary data come from the Excel file credit.xls and capital_intensity.xlsx. Be sure to use matrix commands and attach the supporting computer print out to the completed assignment and make clear where your answers are shown.

The definitions of the variables in questions 1 and 2 are as follows. *majordrg* is the number of derogatory credit reports, *age* is the applicant's age, *age*2 is age squared, *cur_add* is months living at current address, *ownrent* is a dummy variable that takes on the value 1 if the applicant owns his or her home, and 0 otherwise, *avgexp* is average monthly credit card expenditure, *income* is yearly income/10,000, *depndt* is the number of dependents, and *active* is the number of active credit accounts. The definitions of the variables in question 3 are as follows. Y is a measure of capital intensity (relative to labor) in production, and X is the ratio of the hourly cost of labor to the user cost of capital.

1. Consider the following model for a random sample of 1,319 credit card applicants:

$$majordrg_t = \beta_{10} + \beta_{11} age_t + \beta_{12} age2_t + \beta_{13} cur\_add_t + \beta_{14} ownrent_t + \varepsilon_{1t}$$

$$avgexp_t = \beta_{20} + \beta_{21}\, cur\_add_t + \beta_{22}\, income_t + \beta_{23} depndt_t + \beta_{24} ownrent_t + \varepsilon_{2t}$$

$$active_t = \beta_{30} + \beta_{31}\, age_t + \beta_{32}\, age2_t + \beta_{34} income_t + \beta_{34} ownrent + \varepsilon_{3t},$$

   a. Estimate the above equations by OLS and SUR (seemingly unrelated regressions). You may use either two-step or iterated SUR.
   b. Test H_0: Σ is diagonal, H_1: $\sim H_0$ at the 5% level. Use the tests given below.
      (1) the Breusch-Pagan Lagrange Multiplier test.
      (2) the likelihood ratio test.
   c. What can you conclude about the use of OLS vs SUR? Explain.

2. A simultaneous equations model of credit card applications is specified as

$$majordrg_t = \gamma_{10} + \gamma_{11} age_t + \gamma_{12} age2_t + \gamma_{13} cur\_add_t + \beta_{13} active_t + u_{1t}$$

$$avgexp_t = \gamma_{20} + \gamma_{21} age_t + \gamma_{22} age2_t + \gamma_{24}\, income_t + \gamma_{25} depndt_t + \beta_{21} majordrg_t + u_{2t}$$

$$active_t = \gamma_{30} + \gamma_{31}\, age_t + \gamma_{32}\, age2_t + \gamma_{36} ownrent + \beta_{32} avgexp_t + u_{3t}$$

   a. Determine the identification status of each structural equation according to the order conditions.

b. Estimate the model by OLS, $2SLS$, and $3SLS$.

(1) Solve for the *derived* reduced form parameters from the $3SLS$ estimated structural parameters.

(2) Estimate the *unrestricted* reduced form equations by OLS (first-stage regressions).

(3) Treat your *derived* reduced form parameters as given restrictions on the reduced form parameters, and conduct F tests of these restrictions for each reduced form (at the 5% level). Although these tests are only approximate, what do they suggest about the validity of the specifications of the structural equations? Explain.

3. Use the Gauss-Newton method to estimate the parameters and standard errors of the non-linear model $Y_t = \beta_0 + \ln(X_t + \beta_1) + u_t, \;\; t = 1, ..., 100$, where $u_t \sim N(0, \sigma_u^2)$ and satisfies all of the classical assumptions.

Use as your convergence criteria $\left| \dfrac{\beta_k^{(j)} - \beta_k^{(j-1)}}{\beta_k^{(j-1)}} \right| < 0.5\text{x}10^{-4}$, $j > 1$ and $k = 0, 1$.