ECON 5350 Midterm Exam

Fall 2019

1. (70 pts) Consider the following model of housing prices:

$$P_i = \beta_1 + \beta_2 SQFT_i + \beta_3 AGE_i + \beta_4 AGE_i^2 + \varepsilon_i,$$

where $i = 1, \dots, N$ indexes each house, P_i is the price of house i in thousands of dollars, $SQFT_i$ is the square footage of the house, and AGE_i is the age of the house in years.

   a) What are the expected signs of the coefficients?

   b) Name two Classical assumptions that are likely to be violated and describe why.

   c) Write the regression model in matrix form. Make sure to define each matrix and specify its dimension.

   d) Assume there is a neighborhood effect, whereby all else equal, houses in the same geographical area have similar values. Develop a logical structure for the variance-covariance matrix of the errors that captures this effect, and explain how it will influence your OLS estimates.

   e) Using the general linear *F* and *t* tests developed in class, show how to test the hypothesis that the price of a house has a U-shaped relationship with AGE.

   f) Assume you have data on the assessed value of each house, $ASSESS_i$. Develop a bivariate regression model that can be used to test the hypothesis that real estate assessors produce unbiased property value forecasts. Describe how to perform such a test using the general linear *F* test.

   g) One possible omitted variable is lot size. How would the omission of lot size likely impact the OLS estimate of β_2?

2. (30 pts) Using matrix algebra, prove that OLS is indeed a minimum.