COLORADO STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL & RESOURCE ECONOMICS

Exam 2 **Agricultural & Resource Economics / Economics 535** *S.R. Koontz*
Fall 2020 **Applied Econometrics**

This exam is worth 100 points. The points allocated to each question are listed with the question number. Use your time appropriately. Show the work necessary to communicate clear answers each question. Good answers always communicate.

1. (25 pts.) Serial correlation is a common problem in econometric models that use time series data.

a. What is serial correlation and how does it impact OLS estimates?

b. Suppose you have 50 observations of quarterly data, that your model has four explanatory variables, and the DW-d for your model is DW-d = 2.925. Briefly, interpret the statistic and draw any conclusion.

c. Suppose the artificial regression results from the Breusch-Godfrey test is as follows

$$e_t = 0.0 - \underset{(0.001)}{0.750\, e_{t-1}} + \underset{(0.450)}{0.015\, e_{t-2}} - \underset{(0.675)}{0.050\, e_{t-3}} + \underset{(0.025)}{0.300\, e_{t-4}} + x_t\varphi + v_t$$

where p-values are reported, the last term are the variables from the original model, and the $R^2 = 0.475$. Conduct the test and draw the conclusion.

d. The Cochrane-Orcutt procedure is an empirical implementation of Generalized Differencing and is programmed into most econometric software. Describe and discuss important concepts implemented in the context of the model needed based on the testing results above.

2. (25 pts.) You are interested in estimating a model with cross sectional data. The general model is

$$y_i = \beta_0 + \beta_1 x_{1i} + \ldots + \beta_k x_{ki} + e_i \qquad i = 1,\ldots,N.$$

You think that heteroscedasticity is likely to be a problem.

a. Briefly, outline the White test for heteroscedasticity. Discuss what the test is examining for.

b. Briefly, outline the White correction for heteroscedasticity. Discuss what this tool is useful for.

c. Assume you find heteroscedasticity and your software will not do White's correction. Suppose the heteroscedasticity is related to a single variable – income – how can you address the problem directly?

d. Assume you find heteroscedasticity and your software will not do White's correction. Suppose the heteroscedasticity is clearly related to multiple variables then how do you address the problem directly?

3. (15 pts.) Dynamic empirical supply models with lagged dependent variables are common. A version of the basic model is below

$$y_t = \beta_0 + \delta\, y_{t-1} + x_t' \beta + e_t \qquad t = 1,\ldots,T$$

where production is denoted as y_t and the tth row of the data matrix is x_t'.

a. Interpret δ.

b. Suppose there is a change in an exogenous variable x_{it}. What is the impact on the dependent variable in time period t? What is the impact in time period t+1? What is the impact in t+2? What is the long run impact?

c. These models are common within larger sets of models because of strengths. Please outline. These models are not commonly used on their own – without the larger set of models – because of weaknesses. Please outline.

4. (15 pts.) Below is a simplified Probit model of an economic choice

$$z_i = \underset{(0.4)}{-2.8} + \underset{(0.10)}{0.375}\, x_i$$

where y_i = 1 if individual makes the choice and 0 otherwise, and x is the main conditioning characteristic. The sample average of y = 0.35 and x = 10. The normal probability density function is $f(z) = \exp(-(z)^2/2))/\sqrt{(2\pi)}$

a. Calculate the change in probability of observing the choice given a change in x. Interpret the measure precisely.

b. What is the level of x where the individual is more likely to make the choice than not?

5. (20 pts.) The Tobit model is an example of a model which can be used to describe data which are truncated or are a censored response.

a. Why does this data require a unique model that is not estimated using OLS?

b. The regression coefficients, like qualitative choice models, cannot be interpreted directly. Instead, the equation below has been derived. Explain the measure and its four pieces. (Be sure to read the next 2 parts.)

$$\partial E(y^*)/\partial x_j = F(z)[\partial E(y)/\partial x_j] + [\partial F(z)/\partial x_j]E(y)$$

c. Further, define F(z) =

d. And, interpret the following being sure to explain what the f/F term measures

$$E(y) = x_i\, \beta + \sigma\, f(z)/F(z)$$

e. Finally, the Tobit model imposes an important and limiting restriction on the parameters. What is it? Is it testable?