COLORADO STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL & RESOURCE ECONOMICS

Exam 1 **Agricultural & Resource Economics / Economics 535** *S.R. Koontz*
Fall 2022 **Applied Econometrics**

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

1. (25 pts.) The following is a general OLS regression. The model is a common functional form used in a variety of econometric models.

$$\ln(Y_t) = \underset{\substack{(0.020)\\(0.001)}}{0.150} + \underset{\substack{(0.175)\\(0.0012)}}{0.625}\ln(X_{1t}) - \underset{\substack{(0.075)\\(0.0194)}}{0.185}\ln(X_{2t}) + \underset{\substack{(0.055)\\(0.0301)}}{0.125}\ln(X_{3t}) + e_t$$

$F = 13.98$ $R^2 = 0.575$ $T = 34$.

Standard errors and p-values are reported under the coefficient estimates. The regression F-statistic, the model R^2, and sample size are also reported.

a) Interpret the slope coefficient estimate on X_3. Be complete and precise.

b) Calculate a 95% confidence interval for the slope coefficient associated with X_3. Provide a precise interpretation.

c) Calculate the t-statistic and formally test the significance of the slope coefficient estimate associated with the X_3 variable. Use $\alpha = 5\%$ and a two-tailed test.

d) Interpret the p-value associated with the slope coefficient estimate on X_3. (Do not say just the probability of Type I Error.)

e) Interpret the model F-Statistic. State the null hypothesis, identify the distribution under the null, and provide the critical value using $\alpha = 5\%$. Draw the conclusion.

f) Provide an exact interpretation of the model R^2. Is the one for this model good?

2. (20 pts.) The following production function is of interest to you

$$Y_t = A\, L_t^{\alpha}\, K_t^{\beta}$$

where Y = output, L = labor, K = capital, and t denotes the observation in a sample over time.

a) Transform the model so that it is linear in parameters.

b) The economic concept of constant returns to scale technology implies that $\alpha + \beta = 1$. Test that hypothesis with the following. The sample size is T = 28, estimates of $\alpha = 0.25$, $\beta = 0.65$, and variance-covariance matrix for the model is as follows

$$\begin{bmatrix} 6.000 & -1.000 & 1.000 \\ -1.000 & 0.025 & -0.050 \\ 1.000 & -0.050 & 0.100 \end{bmatrix}$$

Calculate the test statistic and test the null hypothesis at the 5% level.

c) Constant returns to scale technology implies that $\alpha + \beta = 1$. Test results suggest estimating the model enforcing the restriction. Derive the estimable restricted model that is linear in coefficients.

3. (20 pts.) Suppose you have the following three-variable model

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + e_t \quad \text{where } t=1,\ldots,T$$

and that you are concerned about structural change within your sample period. Outline and describe a Chow Test using dummy variables. To do this: Define the dummy variable. Write down the model used. State the null hypothesis and the distribution of the test under the null. Interpret the parameters of the model to be used. What are the two limitations of the test?

4. (15 pts.) Data are often assumed to be correct by econometricians. Real-world data often contain outliers. Why are outliers a problem when using Ordinary Least Squares? Briefly, how can you diagnose your data for outliers? And, very briefly, what do you do about outliers?

5. (20 pts.) There are two general approaches to model fitting: testing down and testing up. For example, models which are used to explain often follow testing down approach. In contrast, models which are used to forecast often follow the testing up approach. We have followed the testing down approach, in part because we have done little formal forecasting, but mainly because of the relative strengths and weaknesses of the two approaches. Demonstrate that you understand these strengths and weaknesses. Start with the definition of each approach. Then briefly discuss each approach's main strength and main weakness. And offer an overall assessment.

Suppose you discover the model presented in question 1 were the result of an iterative testing down process. There were eight candidate explanatory variables considered before the final specification was chosen. Comments on the significance of X_3?