COLORADO STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL & RESOURCE ECONOMICS

Exam 1 **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. The best answers are correct and efficient.

1. (25 pts.) The following is an OLS regression of agricultural output for a small developed country where output is modeled as a function of capital, labor, and energy inputs

$$\ln(Y_t) = \underset{\substack{(0.020)\\(0.001)}}{0.150} + \underset{\substack{(0.120)\\(0.001)}}{0.675}\ln(C_t) + \underset{\substack{(0.062)\\(0.074)}}{0.115}\ln(L_t) + \underset{\substack{(0.110)\\(0.034)}}{0.245}\ln(E_t) + e_t$$

$F = 32.148$ $R^2 = 0.775$ $T = 32$

where Y_t = Real Gross Product (billion \$) in year t,
C_t = Real Capital Input (billion \$) in year t,
L_t = Labor Days (millions of days) in year t,
E_t = Real Energy Input (thousand BTUs) in year t.

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 the energy variable. Be precise.

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

c) Provide an exact interpretation of the model R^2. Does the value suggest the model is good?

d) Calculate a 95% confidence interval for the slope coefficient associated with the energy variable. Provide a precise interpretation.

f) If ln(C) = 1.25, ln(L) = 0.7, and ln(E) = 2.5, what is the expected value of ln(Y)? Be precise about the units.

g) Outline the calculation of the variance of the expected value dependent variable.

2. (20 pts.) Answer the following hypothesis testing questions making use the model in the first question.

a) Test the significance of the energy parameter.

b) Instead of formal hypothesis testing, p-values are often offered. Provide a ***useful*** interpretation of the p-valve reported for the energy parameter.

c) Suppose you are interested in whether energy or labor has a larger impact on output. Write this null hypothesis and the general formula for the test statistic. Provide detail related to the components of the test statistic – but do not calculate as you have incomplete information. Identify the distribution of this test statistic.

d) Suppose you want to test constant returns to scale in this production function. Write the null hypothesis. Write the complete formula for the test statistic – but do not calculate. What is the distribution of the test statistic?

3. (15 pts.) Applied econometric models can contain influential observations. These observations are also known as outliers.

First, how do influential observations impact modeling results and conclusions drawn? Second, what tools can you use to determine if you have influential observations? Last, comment on what tools can you not use.

4. (20 pts.) A sample (N = 28) of Colorado vegetable growing firms were surveyed about costs of production and total output. The following OLS regression was estimated

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + e_i$$

where

y_i = average total cost of firm ***i*** (cents per pound),
x_{1i} = logarithm of total output for firm ***i*** (million pounds),
x_{2i} = 1 if firm ***i*** was an organic vegetable producer,
0 otherwise, and
$x_{3i} = x_{1i} \times x_{2i}$.

Answer the following questions.

a) Interpret β_2 precisely.

b) Interpret β_3 precisely.

c) Suppose the residual sum of squares for the restricted model without x_2 and x_3 is 105 and suppose the RSS for the unrestricted model above is 80. State the null hypothesis, conduct the test, and drawn the conclusion.

d) Any cautions to offer for the above test?

5. (20 pts.) There are five desirable properties of estimators.

We have frequently called on unbiasedness, consistency, and efficiency. Please define and briefly discuss each. Specifically, offer interpretive discussion useful for the practitioner. (We defined but not much discussed asymptotic efficiency so please ignore.)

And we have also made substantial use of the mean square error. What is this fifth property and in what context have we most commonly used it?