COLORADO STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL & RESOURCE ECONOMICS

Exam 1 **Agricultural & Resource Economics / Economics 535** *S.R. Koontz*
Fall 2021 **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.) The following is an OLS regression of demand for further processed food as a function of a price index for processed food, a price index for unprocessed food, and income

$$\ln(Q_t) = \underset{(0.006)}{\underset{(0.005)}{0.015}} - \underset{(0.002)}{\underset{(0.150)}{0.525}} \ln(P_t) + \underset{(0.146)}{\underset{(0.050)}{0.075}} \ln(S_t) + \underset{(0.022)}{\underset{(0.025)}{0.610}} \ln(I_t) + e_t$$

$F = 11.41$ $R^2 = 0.550$ $T = 30$

where Q_t = Consumption of Processed Food (pounds per capita) in year t,
P_t = Price Index of Processed Food (real dollars per pound) in year t,
S_t = Price Index of Unprocessed Food (real dollars per pound) in year t,
I_t = Disposable Personal Income (dollars per capita) in year t.

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

a) Interpret the slope coefficient estimate on the own-price variable. Be precise.

b) Calculate a 95% confidence interval for the slope coefficient estimate on the own-price variable. Provide a precise interpretation.

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

d) Provide an exact interpretation of the model R^2. It seems rather small. What should you do about that?

e) If $\ln(P) = 1.25$, $\ln(S) = -0.69$, and $\ln(I) = 9.21$, what is the expected value of $\ln(Q)$?

f) "All point estimates need a confidence interval." Outline the needed measure for the predicted value.

2. (20 pts.) Hypothesis testing is a critical element of applied econometric work. Suppose you have the following general model

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + e_t \quad \text{where } t=1,...,T.$$

First, suppose a researcher is interested in whether x_2 or x_3 has a larger impact on y. Write this null hypothesis and the formula for the test statistic. Provide detail related to the components of the test statistic. Identify the distribution of this test statistic under the null hypothesis.

Second, suppose a researcher is interested in whether x_2, x_3, and x_4 contribute to the model. Write this null hypothesis and identify the test statistic. Identify the distribution of this test statistic under the null.

Third, instead of formal hypothesis testing researchers often present p-values. Suppose the p-value on the first test above is 0.061. Define a p-value such that your definition communicates well.

Fourth, suppose an alternative theory suggests x_5 and x_6 are important in the model and that x_4 is not. Discuss how you would test these alternative theories.

3. (15 pts.) Suppose you were interested in testing for the existence of seasonality in the general model question 2. First, discuss how seasonal dummy variables are constructed and interpreted. Second, suppose the RSS for the model in question 2 is 130 and that the sample has T = 31. Further, suppose the RSS for the model with dummy variables reduces the RSS by 40. Conduct the test.

4. (20 pts.) The following is an OLS regression equation

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + e_t$$

where y = is the dependent variable, x_1 through x_5 are independent variables and t denotes a sample over time. You are concerned about collinearity. The variation decomposition table is as follows.

Condition Index	Intercept	x_1	x_2	x_3	x_4	x_5
1.0	0.25	0.10	0.05	0.15	0.10	0.15
5.8	0.15	0.10	0.025	0.15	0.05	0.15
11.4	0.25	0.60	0.10	0.05	0.05	0.50
42.6	0.20	0.15	0.025	0.05	0.70	0.10
60.9	0.15	0.05	0.80	0.60	0.10	0.10

First, diagnose the model results for collinearity. Draw appropriate conclusions.

Second, discuss how this collinearity impacts this model. In other words,

how does it impact the results and their interpretation?

Third, discuss what you can do about it. What can you do to address this issue?

5. (20 pts.) So, you are presenting at your professional society meeting. You are presenting results from your thesis or dissertation and the audience is a bit challenging.

First, your work uses OLS and you know OLS is BLUE. Define the properties of a BLU Estimator.

Second, one commenter is concerned that the results of your work are biased. How can OLS results be biased?

Last, second commenter states the model may not be informative. Many of the independent variables in the original work are insignificant and the comment writer questions the efficiency of the unique results. How can OLS results be not be efficient?