COLORADO STATE UNIVERSITY

Assignment 3 **Agricultural & Resource Economics / Economics 535** *S.R. Koontz*
Fall 2023 **Applied Econometrics**

This problem set is worth 25 points. Please show your work. A hand-written document is sufficient for many questions. Spreadsheet figures would also be sufficient. Correct answers with little supporting discussion are worth little. Communication is important. And so is efficiency.

1. Consider the following model

$$y_t = \alpha + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \beta_3 x_{t-3} + \beta_4 x_{t-4} + \beta_5 x_{t-5} + \varepsilon_t$$

Show how to derive the estimable model using the polynomial distributed lag model and a second-degree polynomial if (a) there are no end point restrictions and (b) there is a back endpoint restriction ($\beta_6 = 0$). Write the polynomial restrictions where each β_i is a function of ωs. Substitute the functions into the model above for the β's and express the model as linear in the ω_i coefficients. Rename the combinations of the x's as z's. You are deriving an estimable model.

2. Below are the results from your estimable model (a) above.

Variables	Coefficient Estimates	Standard Errors	P-Values
Z_1	0.575	0.095	0.0001
Z_2	1.250	0.300	0.0002
Z_3	-0.250	0.195	0.2072

The R^2 for the model was 0.85, the F-Statistic was 47.5, and there was no autocorrelation.

Construct the β's. How do you construct standard errors for each β_i? (You do not have sufficient information to do this but you need to communicate the process.) Test if the data finds that your second order polynomial restriction too binding. Interpret the marginal impacts through time and construct the cumulative impacts. Graph them through five periods. How do you construct standard errors for the cumulative impact measures?

3. Consider the following partial adjustment model

$$y_t^* = \alpha + \beta x_t + \varepsilon_t$$

where $y_t - y_{t-1} = \delta(y_t^* - y_{t-1})$ and $0 < \delta \leq 1$.

Derive the estimable model.

Suppose you estimate the following model

$$y_t = \underset{(0.475)}{1.100} + \underset{(0.125)}{0.625}\, x_t + \underset{(0.075)}{0.725}\, y_{t-1}$$

where standard errors are in parenthesis. The R^2 for the model was 0.945, the F-Statistic was 53.5, and there was no autocorrelation. Construct estimates of the parameters of the original structural model and interpret the parameters. What about standard errors on the structural parameters? (This is a trick question.) Interpret the marginal impacts through time and construct the cumulative impacts. Graph them through 10 periods.

4. Consider the following Logit model with a single explanatory variable

$$z_i = \alpha + \beta\, x_i$$

Assume x ranges from -40 to +40. Draw a graph of F(z) for the four pairs of α and β: (0, 0.045), (0, 0.1125), (-1.25, 0.1125), and (0, -0.045). Increment x by 1 in your figure.

5. Consider the following Probit model of market choice

$$z_i = 1.25 + 0.325\, x_{1i} - 0.115\, x_{2i}$$

where x_1 is the percent of household income from farming and x_2 is household income. The dependent variable is whether the farm household markets a farm product through a nontraditional market. The average of $x_1 = 5$ and ranges from 1 to 15. The average of $x_2 = 50$ and ranges from 10 to 80. (The first units are percentages and the second are thousands of dollars. Use these units.)

Educators would like to target outreach efforts at producers with a 50% chance or greater of using nontraditional markets. Can you comment on the attributes that this group of farm households would have?

6. Consider the following Tobit model

$$y_i = -0.175 + 0.375\, x_i$$

where y_i is the dependent variable whereby a large portion of the responses are zero and x_i is the independent variable with mean 0.75. The estimate of $\sigma = 0.185$. (Remember that the betas for the yes/no decision equal β/σ or $z = x\beta/\sigma$ because σ was restricted to equal one in the qualitative choice model.) Calculate and interpret E(y), F(z), and E(y*). Calculate and interpret $\partial E(y)/\partial x$, $\partial F(z)/\partial x$, and $\partial E(y^*)/\partial x$.