Q1 Introduction: Farm Production

0 Points

In this homework assignment, you will use farm-level production data from maize farms in the Mexican state of Michoacán to estimate output elasticities of land and labor. The dataset contains 86 observations on output, land, and labor for each of two years (1983 and 1989).

Download the data set `ARE106_HW3_maize.Rdata` from Canvas and load it (and attach it) in RStudio using the following commands (make sure the data are in the working directory, or provide a path to the directory in which the data are stored):

```
load("ARE106_HW3_maize.Rdata")
attach(D)
```

The variables in the dataset are:

1. `year`: Year (1983 or 1989)
2. `Q`: Maize production (Q) in metric tons
3. `K`: Land (K) Input in Hectares
4. `L`: Labor Input in Person-Days

For this homework assignment, you will need to load (and install if you haven't already) the following packages:

```
library(car)      # Companion to Applied Regression
library(lmtest)   # Testing Linear Regression Models
```

Q2 Model 1

1.5 Points

Consider the following population regression model:

- Model 1: $Q_i = \beta_0 + \beta_1 K_i + \beta_2 L_i + \varepsilon_i$

where each observation i represents a farm.

Q2.1

1 Point

Estimate the population regression model above using ordinary least squares.

What is your estimate of β_1?

Enter your answer here

What is your estimate of β_2?

Enter your answer here

Interpret your estimates.

Enter your answer here

Do land and labor affect farm output? Explain.

Enter your answer here

Save Answer

Q2.2

0.5 Points

Compute an estimate of the elasticity of output with respect to land using the following formula:
$\eta_K = \frac{\partial Q}{\partial K}\frac{\bar{K}}{\bar{Q}}$,
where $\bar{Q}$ and $\bar{K}$ are the sample mean of Q and K, respectively.

Enter your answer here

Compute an estimate of the elasticity of output with respect to labor using the following formula:
$\eta_L = \frac{\partial Q}{\partial L}\frac{\bar{L}}{\bar{Q}}$,
where $\bar{L}$ is the sample mean of L.

Enter your answer here

Q3 Model 2

1 Point

Now consider the following, alternative specification for your population regression model

- Model 2: $Q_i = K_i^{\beta_1} L_i^{\beta_2} e^{\beta_0 + \varepsilon_i}$

where each observation i represents a farm.

Q3.1

0.5 Points

Estimate the population regression model above using ordinary least squares.

What is your estimate of the output elasticity of land?

Enter your answer here

What is your estimate of the output elasticity of labor?

Enter your answer here

Save Answer

Q3.2

0.5 Points

Suppose we want to test the null hypothesis that there are constant returns to scale in maize production amongst the population of farmers from which this sample was drawn.

Explain how you can write down a model that tests this hypothesis.

Enter your answer here

Test the null hypothesis. What do you find? Explain how you found your answer.

Enter your answer here

Q4 Difference in Production Technologies

0.75 Points

Consider whether the output elasticity of land and labor parameters are different in 1983 than in 1989.

Q4.1

0.5 Points

Write down a formulation of Model 2 that you could use to test for different elasticities in the two years.

Enter your answer here

Save Answer

Q4.2

0.25 Points

Test the null hypothesis that the output elasticities of land and labor are the same in 1983 as they are in 1989.

What do you find? Explain how you found your answer.

Q5.1

0.5 Points

Plot the sample regression residuals from Model 1 against the right-hand-side variables K and L (use two separate scatterplots).

Do the errors in Model 1 appear heteroskedastic? Explain.

Enter your answer here

Upload images of figures here.

Please select file(s) Select file(s)

Save Answer

Q5.2

0.25 Points

Test for heterskedasticity in Model 1 (using White's test).

What do you find? Is this consistent with your answer above? Explain.

Enter your answer here

Q5.3

0.5 Points

Plot the sample regression residuals from Model 2 against the right-hand-side variables K and L (use two separate scatterplots).

Do the errors in Model 2 appear heteroskedastic? Explain.

Enter your answer here

Upload images of figures here.

Please select file(s) Select file(s)

Save Answer

Q5.4

0.25 Points

Test for heterskedasticity in Model 2 (using White's test).

What do you find? Is this consistent with your answer above? Explain.

Enter your answer here

Q5.5

0.25 Points

Which model do you think is better: Model 1 or Model 2? Explain.

Enter your answer here

Save Answer

Q6 Code

0 Points

Upload any files that correspond to your R code and any outputs/figures associated with your answers above. It's easiest to copy and paste your code and outputs from the RStudio console and paste them into a .txt file. Any figures can be saved and uploaded as .png files. Make sure to organize and label your code so that it is easy to follow which code and output corresponds to a particular question. **Homework assignments that do not include their code and R output will be given a score of zero!**

Please select file(s) Select file(s)

Save Answer