Problem Set 5

ECN 301E - Fall 2024

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Question 1

Define the following terms in your own words.

a. Population regression line
b. Dependent variable
c. Independent variable
d. Regressor
e. Parameters
f. Error term
g. Ordinary least squares (OLS) estimators
h. Predicted value
i. Residual
j. Regression R^2
k. Standard error of the regression (SER)
l. Least squares assumptions

Question 2

A researcher, using data on class size (CS) and average test scores from 100 third-grade classes wants to estimate the following regression model:

$$TestScore = \beta_0 + \beta_1 \times CS + u.$$

Using R, the researcher obtained the following estimated regression model:

$$\widehat{TestScore} = 620.4 - 3.82 \times CS, \quad R^2 = 0.08, \quad SER = 11.5.$$

a. A classroom has 23 students. What is the regression's prediction for that classroom's average test score?

b. Last year a classroom had 19 students, and this year it has 23 students. What is the regression's prediction for the change in the classroom's average test score?

c. The sample average class size across the 100 classrooms is 21.4. What is the sample average of the test scores across the 100 classrooms? ($Hint$: Review the formulas for the OLS estimators.)

d. What is the sample standard deviation of test scores across the 100 classrooms? ($Hint$: Review the formulas for the R^2 and SER.)

Question 3

A regression of average weekly earnings (AWE, measure in dollars) on age (measured in years) using a random sample of college educated full-time workers aged 25–65 yields the following:

$$\widehat{AWE} = 630.5 + 8.6 \times Age, \quad R^2 = 0.023, \quad SER = 624.1.$$

a. Interpret the estimated coefficients.

b. Interpret the SER measure. What are the units of measurement for the SER? (Dollars? Years? or unit free?)

c. Interpret the R^2 measure. What are the units of measurement for the R^2? (Dollars? Years? or unit free?)

d. What is the predicted average weekly earnings for a worker who is 23? What is the predicted average weekly earnings for a worker who is 40?

e. Will the regression give reliable predictions for a worker who is 85 years old? Explain.

f. Given what you know about the distribution of earnings, do you think it is plausible that the distribution of errors in the regression model is normal? ($Hint$: Do you think that the distribution is symmetric or skewed? What is the smallest value of earnings, and is it consistent with a normal distribution?)

g. The average age in the sample is 38. What is the average value of AWE in the sample?

Question 4

Use R or Python to answer the following question. Your answer should include all code and outputs. The dataset is provided in the file `Growth.xlsx`, containing data on average growth rates from 1960 through 1995 for 65 countries, along with variables potentially related to growth. A detailed description is available in the `Growth_Description.pdf` file. In this exercise, you will explore the relationship between growth and trade.

a. Construct a scatterplot of average annual growth rate (`growth`) on the average trade share (`tradeshare`). Does there appear to be a relationship between the variables?

b. One country, Malta, has a trade share much larger than the other countries. Find Malta on the scatterplot. Does Malta look like an outlier?

c. Using all observations, run a regression of `growth` on `tradeshare`. What is the estimated slope? What is the estimated intercept? Use the regression to predict the growth rate for a country with a trade share of 0.5 and for another with a trade share equal to 1.0.

d. Estimate the same regression, excluding the data from Malta. Answer the same questions in (c).

e. Plot the estimated regression functions from (c) and (d). Using the scatterplot in (a), explain why the regression function that includes Malta is steeper than the regression function that excludes Malta.

f. Where is Malta? Why is the Malta trade share so large? Should Malta be included or excluded from the analysis?