ECON 0150 | Fall 2024 | Homework 7

Due: Sunday, December 8

Homework is designed to both test your knowledge and challenge you to apply familiar concepts in new applications. Answer clearly and completely. You are welcomed and encouraged to work in groups so long as your work is your own. Use Python and the provided data files to answer the following questions. Then submit your answers to Gradescope.

The grader would greatly appreciate (but does not require) if you work on this homework file directly either using a tablet or by first working on a printed physical copy and then scanning the photos as pdf.

This homework covers regression analysis using Python's statsmodels and pandas libraries.

Q1. A car dealership yields the following regression equation regarding the relationship between the income of customers and the price paid:

$$Price = 5787.9 + 0.228 \times Income \tag{1}$$

Given this regression equation, which of the following statements is FALSE?

 A) When a customer's income goes up by one dollar, the customer's willingness to pay for a car goes up by roughly 23 cents.

 B) Doubling a customer's income leads to a doubling of that customer's willingness to pay for a car.

 C) As a customer's income goes down, so does the customer's willingness to pay for a car.

 D) None of the above.

Q2. Download the dataset "HW_7_Q2.csv" from the Part 3 Page. This file contains data on monthly returns between 1988 and 2005 of a World index and a country index for Italy. Using Python's statsmodels library, run a regression using ItalyReturns as the outcome variable and the WorldReturns as the predictor variable.

a) Which of the following is the sample model?

 A) $ItalyReturns = \beta_0 + \beta_a WorldReturns + \epsilon$, where $\epsilon \sim N(0, \sigma_\epsilon^2)$

 B) $WorldReturns = \beta_0 + \beta_1 ItalyReturns + \epsilon$, where $\epsilon \sim N(0, 0.318^2)$

 C) $ItalyReturns = 0.001 + 0.925 WorldReturns$, where $\epsilon \sim N(0, 0.055^2)$

 D) $WorldReturns = 0.001 + 0.925 ItalyReturns$, where $\epsilon \sim N(0, 0.093^2)$

b) Using statsmodels, calculate the standard error of the WorldReturn coefficient and a 95% confidence interval for the intercept. Which values match your results?

 A) SE = 0.055, CI = [-0.017, 0.205]

B) SE = 0.004, CI = [-0.099, 0.120]

C) SE = 0.093, CI = [-0.006, 0.009]

D) SE = 0.318, CI = [0.742, 1.108]

c) Using your fitted model, predict Italy's return when World return = -0.01 (-1%). Calculate both the point estimate and 95% prediction interval. Which matches your results?

A) Prediction = 0.055, PI = [-0.017, 0.205]

B) Prediction = 0.004, PI = [-0.099, 0.120]

C) Prediction = 0.093, PI = [-0.202, 0.020]

D) Prediction = -0.008, PI = [-0.117, 0.102]

Q3. The following data give the yearly inflation rate and money supply growth rate (both measured in percentage) for sixteen Latin American countries. A simple regression of Inflation on Growth yields the following information:

R-squared: 0.972
Adj. R-squared: 0.97
N: 16

Variable	coef	std err	t	P>|t|
const	-6.554	1.137	-5.764	0.000
Growth	1.136	0.051	22.156	0.000

a) Write out the estimated linear relationship using your regression results.

b) Using your model, calculate the expected inflation for a country with 5% money supply growth.

c) A simplistic monetarist theory claims that $\beta_1 = 1$ in the relationship Inflation = $\beta_0 + \beta_1$Growth. Test this hypothesis using the regression results.

Q4. A local real estate agent argues that house prices in Pittsburgh are related to the number of rooms in a house. You collect a random sample of 190 houses and run a simple regression using House Price (measured in dollars) as the dependent variable and Rooms (measured as the number of rooms in a house) as the independent variable. Given below is the output of the regression results.

R-squared: 0.003
Adj. R-squared: 0.000
Std Err: 26950
N: 190

Variable	coef	std err	t	P>|t|
const	245870	5810	42.318	0.000
Rooms	-539	760	-0.709	0.478

a) Calculate the 99.7% confidence interval for the slope coefficient.

b) For a house with 5 rooms, calculate the probability that it will sell for more than $270,245.

c) A real estate investor, Noah, plans to remove walls to reduce the number of rooms in his house, hoping to increase its value. Based on your regression analysis, evaluate this strategy. Support your answer with statistical evidence from your results.