AUA Fall 2022

DS 110 Statistics 2

Homework 3

Problem 1 (40 points, 10 points for each question)

Many cities in California have passed Inclusionary Zoning policies (also known as below-market housing mandates) as an attempt to make housing more affordable. These policies require developers to sell some units below the market price on a percentage of the new homes built. For example, in a development of 10 new homes each with market value $250,000, the developer may have to sell 5 of the units at $150,000. Means et al. (2007) ("Below-Market Housing Mandates as Takings: Measuring their Impact") examine the effects of such policies on house prices and number of housing units available using 1990 (before policy impact) and 2000 (after policy impact) census data on California cities. Use means.xlsx for the following exercises. For this problem you need the following variables:

- $LNPRICE$ – log of the house price
- $LNUNITS$ – log of the number of houses
- $YEAR$ – a dummy variable for the implemented policy. It equals 1 for year 2000 and 0 for 1990.
- $IZLAW$ – an indicator variable for cities where Inclusionary Zoning policies have been passed.
- $LMEDHHINC$ – log median household income
- $EDUCATTAIN$ – proportion of population with college degree
- $PROPPOVERTY$ – proportion of population below the poverty level
- $LPOP$ – log of city population

a) Regress $DLNPRICE$ and $DLNUNITS$ on $IZLAW$. Compare the estimate of the treatment effect to those from the differences-in-differences regression of $LNPRICE$ and $LNUNITS$ on the explanatory variables D, the indicator variable for year 2000 $IZLAW$, and the interaction of D and $IZLAW$.

b) Explain, algebraically, why the outcome in (a) occurs.

c) To the regression in (a) add the variable $DLMEDHHINC$. Interpret the estimate of this new variable, including its sign and significance. How does the addition affect the estimates of the treatment effect?

d) To the regression in (c), add the variables $DEDUCATTAIN$, $DPROPPOVERTY$, and $DLPOP$. Interpret the estimates of these new variables, including their signs and significance. How do these additions affect the estimates of the treatment effect?

Problem 2 (60 points, 10 points for each question)

A motel's management discovered that a defective product was used in the motel's construction. It took seven months to correct the defects, during which time approximately 14 rooms in the 100-unit motel were taken out of service for one month at a time. The motel lost profits due to these closures, and the question of how to compute the losses was addressed by Adams (2008). Use the motel.csv data to answer the following questions.

a) The occupancy rate for the damaged motel is $MOTEL\_PCT$, and the competitor occupancy rate is $COMP\_PCT$. On the same graph, plot these variables against $TIME$. Which had the higher occupancy before the repair period? Which had the higher occupancy during the repair period?

b) Compute the average occupancy rate for the motel and competitors when the repairs were not being made ($\overline{MOTEL_0}$ and $\overline{COMP_0}$) and when they were being made ($\overline{MOTEL_1}$ and $\overline{COMP_1}$). During the nonrepair period, what was the difference between the average occupancies, $\overline{MOTEL_0}$ - $\overline{COMP_0}$? Assume that the damaged motel occupancy rate would have maintained the same relative difference in occupancy if there had been no repairs. That is, assume that the damaged motel's occupancy would have been $\overline{MOTEL^*}_1 = COMP_1 + (\overline{MOTEL_0} - \overline{COMP_0})$. Compute the "simple" difference estimate of lost occupancy $\overline{MOTEL^*}_1 - \overline{MOTEL_1}$. Compute the amount of revenue lost during the seven-month period (215 days) assuming an average room rate of $56.61 per night.

c) Draw a plot that explains the calculation in part (b).

d) Alternatively, consider a regression approach. A model explaining motel occupancy uses as explanatory variables the competitors' occupancy, the relative price ($RELPRICE$) and an indicator variable for the repair period ($REPAIR$).

$$MOTEL\_PCT_t = \beta_1 + \beta_2 COMP\_PCT_t + \beta_3 RELPRICE_t + \beta_4 REPAIR_t + e_t$$

Obtain the least squares estimates of the parameters. Interpret the estimated coefficients, as well as their signs and significance.

e) Using the least squares estimate of the coefficient of $REPAIR$ from part (d), compute an estimate of the revenue lost by the damaged motel during the repair period (215 days@$56.61_b4). Compare this value to the ''simple'' estimate in part (b). Construct a 95% interval estimate for the estimated loss. Is the estimated loss from part (b) within the interval estimate?

f) Plot the least squares residuals against $TIME$. Are there any obvious patterns?