ECON 4003 Econometrics I

Empirical Exercise 3.2

by *Duong Trinh*

Picture the Scenario

- The owners of a motel discovered that a defective product was used during construction. It took 7 months to correct the defects during which approximately 14 rooms in the 100-unit motel were taken out of service for 1 month at a time.
- **Objective:** Investigate the losses due to these closures.
- **Data:** `motel.dta`.

Data Description of **motel.dta**

```
time days motel_rate comp_rate motel_pct comp_pct repair relprice

        Obs:   25 months

        time            month, 1=march 2003,.., 25=march 2005
        days            days in month
        motel_rate      motel room rate, $
        comp_rate       competitors room rate, $
        motel_pct       percentage motel occupancy
        comp_pct        percentage competitors occupancy
        repair          = 1 if motel under repair, = 0 otherwise
        relprice        relative price = motel_rate/comp_rate
```

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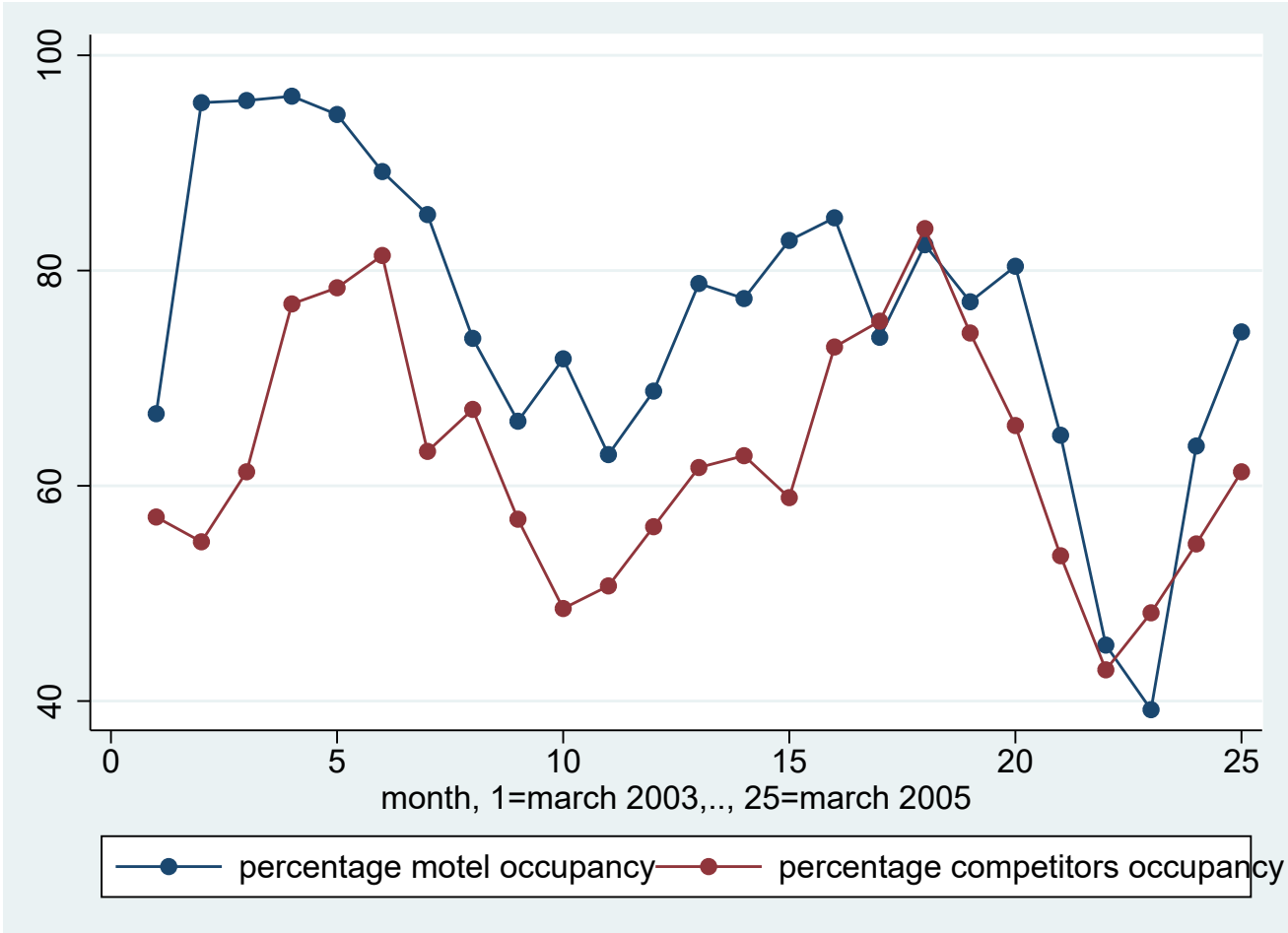

(b) Plot *motel_pct* against *comp_pct*.
Does there seem to be a relationship between these two variables?
Explain why such a relationship might exist.

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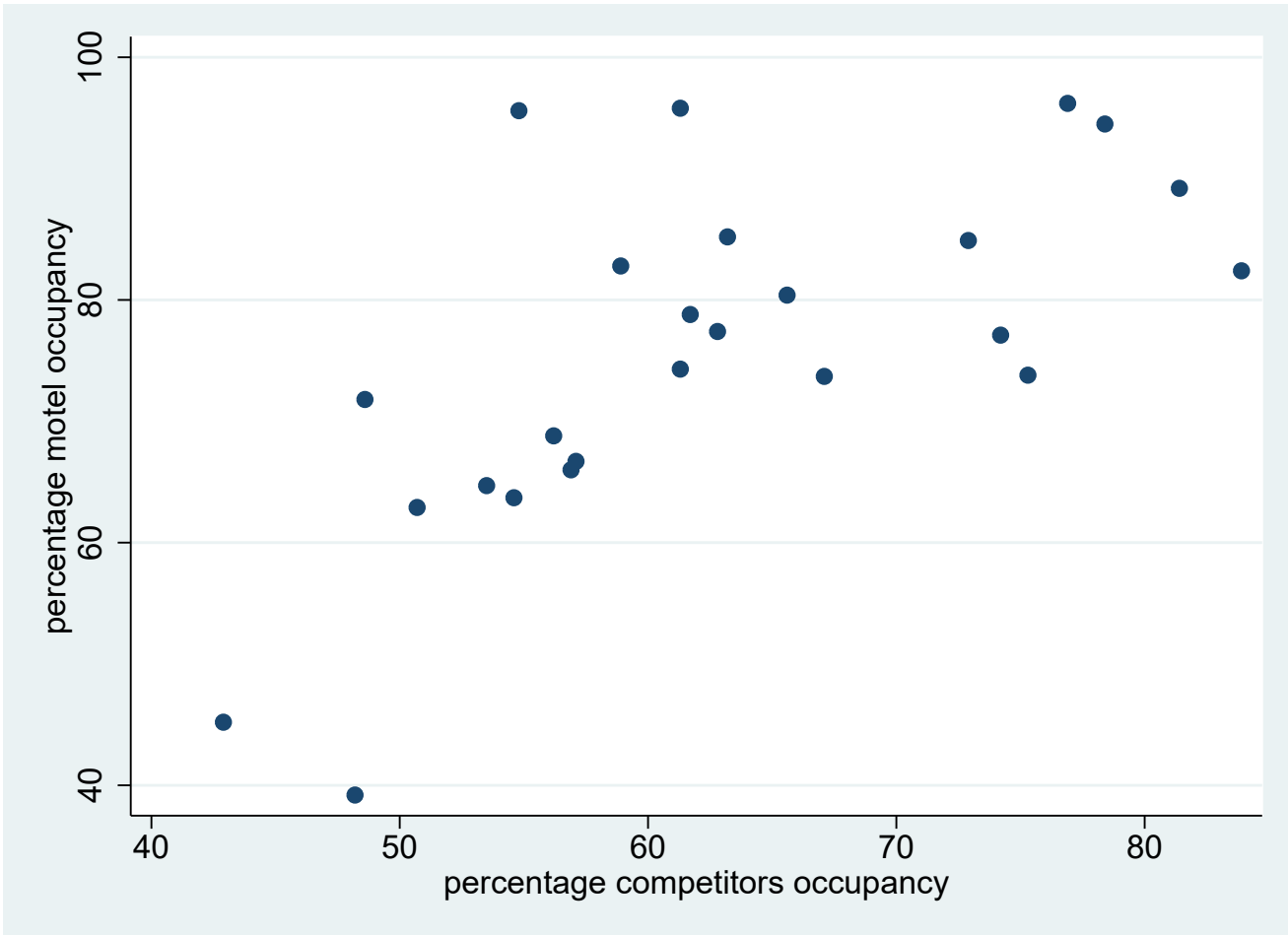

(c) Estimate the regression model $motel\_pct_t = \beta_0 + \beta_1 comp\_pct_t + u_t$ with (i) homoskedastic-only standard errors and (ii) heteroskedastic-robust standard errors. Compare your results.

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Answer. The estimated model

- with homoskedastic standard errors is:

$$\underset{(se)}{\widehat{motel\_pct}} = \underset{(12.9069)}{21.4000} + \underset{(0.2027)}{0.8646} \cdot comp\_pct \quad R^2 = 0.4417 \quad SER = 11.019$$

- with heteroskedastic-robust standard errors is:

$$\underset{(se)}{\widehat{motel\_pct}} = \underset{(14.5600)}{21.4000} + \underset{(0.2160)}{0.8646} \cdot comp\_pct \quad R^2 = 0.4417 \quad SER = 11.019$$

(d) Compute the least squares residuals from the regression in (b).
Plot the residuals against *time*.
Does the model over-predict or under-predict the motel's occupancy rates for the months of repair: $times = 17, 18, ..., 23$?

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(e) Create a new variable *relprice*100 which is the ratio of the price per room charged by the motel in question relative to its competitors multiplied by 100.
Estimate the regression model $motel\_pct_t = \gamma_0 + \gamma_1 relprice100_t + e_t$.
What is the predicted sign of the slope coefficient γ_1?
Does the sign of the estimated slope agree with your prediction?

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Answer.

$$\underset{(se)}{\widehat{motel\_pct}} = \underset{(42.8497)}{166.6561} \boxed{\underset{(0.5825)}{-1.2212} \cdot relprice}$$

$$R^2 = 0.160 \quad SER = 13.515$$

(f) Calculate the sample average occupancy rate for the motel
(i) during the time when there were no repairs being made, and
(ii) during the time when there were repairs being made?
How big a difference is there?

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Answer. The average motel occupancy rate

- during the 18 time periods when no repairs were being made: 79.35%
- during the 7 time periods when repairs were being made: 66.11%

$\Rightarrow$ A reduction of $\boxed{13.24\%}$

(g) Consider the linear regression $motel\_pct_t = \delta_0 + \delta_1 repair_t + \epsilon_i$, where *repair* is an dummy variable taking the value 1 during the repair period and 0 otherwise.
What are the estimated coefficients?
How do these estimated coefficients relate to the calculations in (f)?

(g) Consider the linear regression $motel\_pct_t = \delta_0 + \delta_1 repair_t + \epsilon_i$, where *repair* is an dummy variable taking the value 1 during the repair period and 0 otherwise.
What are the estimated coefficients?
How do these estimated coefficients relate to the calculations in (f)?

Answer.

$$\underset{(se)}{\widehat{motel\_pct}} = \underset{(2.7812)}{79.3500} \boxed{\underset{(6.9245)}{-13.2357}} \cdot repair$$

$$R^2 = 0.1765 \quad SER = 13.38$$

$$motel\_pct_t = \delta_0 + \delta_1 repair_t + \epsilon_i$$

where:

$$repair_t = \begin{cases} 0, & \text{if the motel is not repaired at t} \\ 1, & \text{if the motel is repaired at t} \end{cases}$$

Interpretation of δ_0: population mean occupancy rate in the motel when repairs being made.

$$\delta_0 = E(motel\_pct_t | repair_t = 0)$$

Interpretation of δ_1: The difference in population mean occupancy rate in the motel between when there were repairs being made and when no repairs were being made.

$$\delta_1 = E(motel\_pct_t | repair_t = 1) - E(motel\_pct_t | repair_t = 0)$$

Interpretation of $\hat{\delta_0} = 79.35$: The average motel occupancy rate when no repairs were being made is 79.35%

Interpretation of $\hat{\delta_1} = -13.2357$: The difference in average motel occupancy rate between when there were repairs being made and when no repairs were being made is -13.2357%.