ECON207 Session 2 Review Exercises

AY2024/25 Term 1

Question 1. The regression model

$$Y_i = \beta_1 X_i + \epsilon_i$$

is the "simple linear regression model without intercept".

- (a) Derive the formula for the OLS estimator for β_1 , given a sample $\{X_i, Y_i\}_{i=1}^n$.
- (b) OLS estimation of the simple linear regression model with intercept requires that your sample satisfies $\sum_{i=1}^{n} (X_i \overline{X})^2 > 0.$
 - i. What is the corresponding requirement for OLS estimation of the simple linear regression without intercept?
 - ii. Give an intuitive explanation for why you can estimate an a simple linear regression model without intercept even though $\sum_{i=1}^{n} (X_i \overline{X})^2 = 0$?
- iii. If $E(Y \mid X) = \beta_0 + \beta_1 X$ in population, with $\beta_0 \neq 0$, but you estimate β_1 using a simple linear regression model without intercept. Will your estimate of β_1 be biased?

Question 2. Derive the OLS estimator for β_0 in the regression model $Y_i = \beta_0 + \epsilon_i$. What will be the R^2 ?

Question 3. Suppose that in your sample $\{X_i, Y_i\}_{i=1}^n$ you have $\sum_{i=1}^n (X_i - \overline{X})^2 > 0$, but $\sum_{i=1}^n (Y_i - \overline{Y})^2 = 0$. You estimate a simple linear regression model with intercept

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \,.$$

What will be your estimates of β_0 and β_1 ? What will be the R^2 ?