

ECON 0150 | Spring 2026 | Homework 5.2

Due: Sunday April 12, at 11:59PM

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 the provided datasets to answer the following questions. Then submit your figures and answers to Gradescope.

Q1. Reading Regression Output with Interactions

A researcher studies whether the effect of class size on standardized test scores differs between public and private schools. Using data from $n = 300$ schools, they estimate:

$$\text{score}_i = \beta_0 + \beta_1 \times \text{class_size}_i + \beta_2 \times \text{private}_i + \beta_3 \times \text{class_size}_i \times \text{private}_i + \varepsilon_i \quad (1)$$

where `private` = 1 for private schools and 0 for public schools.

	coef	std err	t	P> t	[0.025	0.975]
Intercept	88.50	3.200	27.656	0.000	82.20	94.80
class_size	-0.95	0.140	-6.786	0.000	-1.22	-0.68
private	5.40	5.100	1.059	0.290	-4.63	15.43
class_size:private	0.60	0.280	2.143	0.033	0.05	1.15

- What is the predicted test score for a public school with a class size of 0? What coefficient tells you this?
- What is the effect of one additional student in class size for a public school? What coefficient tells you this?
- What is the effect of one additional student in class size for a private school? Show how you calculate this.
- Interpret the coefficient and p-value on `private` in context.
- Interpret the interaction coefficient on `class_size:private` (0.60) in context. What does it tell us about how class size affects scores differently in public versus private schools?

Q2. Do Recessions Affect Men and Women Differently? (*optional*)

In Homework 5.1, you estimated $\text{BMI5} \sim \text{unemployment_rate} + \text{Female}$, which assumes that unemployment affects BMI equally for men and women (parallel lines with the same slope). But what if the effect is different? [Zhang et al. \(2014\)](#) find that the relationship between economic conditions and health outcomes varies across subgroups. Let's test for this using interaction terms.

a) A researcher suspects that the effect of county unemployment on BMI may differ for men and women. Write a regression model that allows the effect of unemployment on BMI to differ by gender. Include both a fixed effect and an interaction term.

b) Fit an interaction model (without the fixed effect):

$$\text{BMI5}_i = \beta_0 + \beta_1 \times \text{unemployment_rate}_i + \beta_2 \times \text{unemployment_rate}_i \times \text{Female}_i + \varepsilon_i \quad (2)$$

Report the estimated coefficients. What is the effect of a 1 percentage point increase in county unemployment on BMI for Female?

c) Now fit the full model you wrote in part (a). Report all four estimated coefficients. Interpret each one in context.

d) Based on the full model in (c), calculate the predicted BMI for each of the following:

- A male in a county with 5% unemployment
- A female in the same county
- A male in a county with 10% unemployment
- A female in the same county

e) What does the interaction term ($\hat{\beta}_3$) tell us about whether the effect of unemployment on BMI differs by gender?