

ECON 3161 Final Exam Sample Questions

Fall 2023

Final Exam Instruction:

- Exam time and location: December 8th (Friday), 11:20am – 12:50pm (90mins) at our regular classroom.
- You can bring one page of notes (double-sided) to the exam.
- The final exam only cover the topics after the midterm exam. This includes Chapters 4, 7, 17 and the three lecture notes on causal inference. Please check out the lecture notes on canvas.
- The causal inference topics will account for 10% of the total points. In addition, there will be 5% extra bonus points.
- The aim of the sample questions is to give you a sense of how the final exam questions will look like. While I may not put the exact same questions in the final, you can expect similar questions. So this file and the HWs will be good references.

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1. Consider a model that explains salaries of CEOs in terms of annual firm sales, return on equity (*roe*, in percentage form), and return on the firm's stock (*ros*, in percentage form):

$$\log(\text{salary}) = \beta_0 + \beta_1 \log(\text{sales}) + \beta_2 \text{roe} + \beta_3 \text{ros} + u. \quad (1)$$

Answer the following questions:

- (1) What is the interpretation of β_1 ?
- (2) In terms of the model parameters, state the null hypothesis that, after controlling for *sales* and *roe*, *ros* has no effect on CEO salary. State the alternative that stock market performance affects a CEO's salary.
- (3) Suppose you use *t*-test for the hypothesis testing in part (2), write down your test statistic. What is the distribution of the test statistic?
- (4) Suppose you use *F*-test for the hypothesis testing in part (2), write down your test statistic. What is the distribution of the test statistic? What is the relationship between the *F*-test statistic and the *t*-test statistic in part (3)?
- (5) Now suppose that you add one more variable *male* into the model (1), and you consider the following richer model

$$\log(\text{salary}) = \beta_0 + \beta_1 \log(\text{sales}) + \beta_2 \text{roe} + \beta_3 \text{ros} + \beta_4 \text{male} + \beta_5 \text{male} * \log(\text{sales}) + u. \quad (2)$$

where *male* is a dummy variable which takes value 1 if the CEO is a male, 0 if the CEO is a female. How would you interpret the coefficients β_4 and β_5 ? (8 points)

2. Answer the following questions:

- (1) What is the significance level?
- (2) What is the p -value?
- (3) In hypothesis testing, if a researcher rejects the null hypothesis at 5% significance level, does this imply that the researcher will reject the null hypothesis at both 10% and 1% significance level? Explain your answer.

3. (28 points) The following model is used to study housing price:

$$price = \beta_0 + \beta_1 sqft + \beta_2 bdrms + u, \quad (3)$$

where *price* is the house price measured in thousands of dollars, *sqft* is the square feet of the house, and *bdrms* is the number of bedrooms. Now suppose you want to test if *sqft* and *bdrms* jointly statistically significant, answer the following questions:

- (1) Write down your null hypothesis and alternative hypothesis.
- (2) What test will you use?
- (3) Write down the restricted and unrestricted models.
- (4) Write down your test statistic. What is the distribution of the test statistic?

4. Suppose you want to study how the factors, such as GRE (Graduate Record Exam scores), GPA (grade point average), race and sex, affect admission into graduate school. Let y denote the outcome variable of interest, which is binary variable that takes value 1 if an applicant is admitted, 0 if not admitted. Let *GRE* and *GPA* denote the applicant's GRE and GPA scores, *race* be a dummy which takes value 1 if the applicant is white, 0 if non-white, *sex* be a dummy which takes value 1 if the applicant is female, 0 if male.

(1) If a researcher uses the following regression model:

$$y = \beta_0 + \beta_1 GRE + \beta_2 GPA + \beta_3 race + \beta_4 sex + u, \quad (4)$$

What is the possible disadvantage of the above model?

(2) To overcome the disadvantage in discussed in 4(1), what model will you use? Why this model could overcome the disadvantage in 4(1)?

5. Answer the following questions:

- (1) What are the potential outcomes?
- (2) What is the fundamental problem of causal inference?