

# ECON 5350 Midterm Exam – Fall 2018

Consider the following model:

$$\ln(Y_i) = \beta_1 + \beta_2 \ln(X_i) + \epsilon_i \quad (1)$$

for  $i = 1, \dots, n$ .

## 1. Classical Linear Regression Model and Functional Forms (50 pts).

- (a) Write the model in matrix form being careful to denote the dimension of all the matrices.
- (b) Derive the OLS estimator using the matrix model in part (a).
- (c) Now assume that  $Y$  is quantity and  $X$  is price. Provide an economic interpretation of the regression model and  $\beta_2$ .
- (d) What Classical assumption might be violated for the model in (c) and why?
- (e) Derive the variance-covariance matrix of  $b$  when the variance of the errors is proportional to the square of  $X_i$ .

## 2. Hypothesis Testing and Prediction (50 pts). Use regression model #1 to answer the following questions.

- (a) Using the  $R\beta = q$  framework, describe two identical methods for testing the null hypothesis:  $\beta_2 = 1$ .
- (b) How does the test in part (a) compare to a simple  $t$  test? Explain.
- (c) Describe how to test the hypothesis that  $\frac{\partial \ln Y}{\partial X} = 1$ ?
- (d) Are normally distributed errors required for the tests in parts (a) through (c)? Explain.
- (e) Describe how you would generate predictions of  $Y_i$ ,  $\hat{Y}_i$ . What is a possible complication with calculating the standard error for  $\hat{Y}_i$ ? Explain.