

Midterm 2 - 50 Points

You must answer all questions. Please write your name on every page. The exam is closed book and closed notes. You may use calculators, but they must not be graphing calculators. Do not use your own scratch paper.

You must show your work to receive full credit

I have neither given nor received unauthorized aid on this examination, nor have I concealed any similar misconduct by others.

Signature KEY

1. (35 Points) Suppose that you estimate firm profits as a function of capital and labor employed by the firm:

$$\log(\text{Profits}) = \beta_0 + \beta_{\text{capital}} \text{capital} + \beta_{\text{labor}} \text{labor} + u$$

Profits are operating profits in millions of dollars, *capital* is the value of capital in millions of dollars and *labor* is the number of workers employed.

a.) Using a sample of manufacturing firms, suppose you estimate $\hat{\beta}_{\text{capital}} = 0.05$. Please **derive** using derivatives the interpretation for $\hat{\beta}_{\text{capital}}$. Please interpret this estimate. (10 Points)

$$\frac{\partial \text{Profits}}{\text{Profits}} \stackrel{!}{=} \hat{\beta}_{\text{cap}} \partial \text{capital}$$

$$\frac{\partial \text{Profits}}{\text{Profits}} \times 100 = (\hat{\beta}_{\text{cap}} \cdot 100) \partial \text{capital}$$

$$\% \Delta \text{Profits} = 5 \partial \text{capital}$$

+2

Hold my labor constant, a 1 million \$ increase in

capital yields a 5% increase in profits / +2

- b.) In running the regression, I forgot to include *inputs*. A colleague states that there is an upward bias in the coefficient on *capital*, since "there is a positive relationship between profits and inputs!!!!". What is the missing piece of this statement such that there is an upward bias? (5 Points)

A positive association between inputs and capital. +5

- c.) Within our standard regression model, Assumption (4) for unbiasedness requires that $\sigma_x^2 > 0$. Intuitively, why is this required for unbiased estimates? (5 Points)

Because we cannot estimate the effects of x on y when there is no variation in the independent variable; i.e., $\sigma_x^2 = 0$. +5

- d.) One of the restrictions on R^2 is that $0 \leq R^2 \leq 1$. Why can't R^2 be greater than 1? (5 points)

+2 R^2 tells us the variation explained by the model. We cannot explain more variation than exists in the dependent variable. +3

- e.) The population of manufacturing firms includes values of Profits between -10 million and 100 million dollars. Though the sample is random from the population, which firms are excluded from the regression equation that is estimated in (a)? (5 Points)

Firms with Profits ≤ 0 . +5

Since I did not ask why, not required to say because of logs.

- f.) Suppose I take another sample from the same population, and estimate that $\hat{\beta}_{capital} = 0.1$. Which estimate, (a) or (f), is correct and why? (5 Points)

+5 There is natural sampling variation, so neither is correct. Getting exactly the population value is extremely unlikely.

2. (15 Points) Using a random sample of workers in California, I estimate the following equation:

$$\text{Hours} = \beta_0 + \beta_1(\text{educ} - 12) + \beta_2\text{exper} + u$$

Hours is hours worked per week, *educ* is years of schooling, and *exper* is years of experience. Please note that 12 years of schooling indicates completing a high school education.

a.) Suppose you estimate that $\hat{\beta}_2 = 1$. Please interpret this estimate. (5 Points)

Holding education constant, ⁺² a one year increase in experience yields an additional hour worked per week. ₊₃

b.) Suppose that $\hat{\beta}_0 = 40$. Please interpret this estimate. (10 Points)

On average, a person with 12 years of education and zero experience works 40 hours a week. ₊₄ ₊₂

could also be "high school education"

Please enjoy your weekend.