

SIMON FRASER UNIVERSITY
Department of Economics

Econ 835
Quantitative Methods

Prof. Kasa
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MIDTERM EXAM

Answer the following questions True, False, or Uncertain. Briefly explain your answers. No credit without explanation. (5 points each).

1. Since x^2 is an exact function of x , we will encounter the problem of ‘multicollinearity’ if we attempt to use both x and x^2 as regressors.
2. \bar{R}^2 (“adjusted R^2 ”) is always less than or equal to unadjusted R^2 .
3. The power of a t -test increases when the significance level of the test is increased from 5% to 10%.
4. The Least Squares residuals from a regression of Y on X are uncorrelated with X but correlated with Y .
5. Heteroskedasticity causes the ‘usual’ estimates of the standard errors of the coefficients to be biased downwards.
6. All else equal, increasing the variance of the explanatory variables leads to more precise parameter estimates.

The following questions are short answer. Briefly explain your answer. Clarity will be rewarded.

7. (15 points). Suppose you have data on the wages, education, and labor market experience of a (cross-sectional) sample of Canadian residents. You also have information on whether they were born in Canada or are immigrants. This information is coded as a dummy variable, $D_{Ii} = 1$ if individual- i is an immigrant, or $D_{Ii} = 0$ if individual- i was born in Canada.
 - (a) Specify a model to test the hypothesis that immigrants receive lower wages for the same qualifications. State explicitly what your null and alternative hypotheses would be, and what test statistic you would compute.
 - (b) Specify a model to test the hypothesis that the returns to education are greater for immigrants. (Note: since we are interested in the *percentage return* to education, what should be the functional form of the dependent variable?)
8. (15 points). State the Gauss-Markov Theorem. On what assumptions is it based? Why is it important?

9. (10 points). What happens when you regress Y on just a constant? That is, what is the Least Squares coefficient estimate, and what is an estimate of its variance?
10. (10 points). Briefly describe White's test for heteroskedasticity. How do you compute it? What is its (asymptotic) distribution? Explain the intuition behind it.
11. (10 points). Suppose you want to estimate the effect of X on Y , holding constant the effect of Z . However, your computer package can only estimate bivariate regressions (i.e., regressions with only one explanatory variable). What would you do? (And don't say that you would buy another software package!)
12. (10 points). Describe a Monte Carlo experiment to examine the 'power function' of a t -test in a bivariate regression. (Note: the power function just maps out the probability of correctly rejecting the null hypothesis when it is false). Also note, you do not have to write down an actual computer program. Just clearly describe the logical structure that such a program would have, e.g., what information would you need to specify, and how would you do it? (Hint: the program will need to have two nested "do loops"). The goal of your analysis is a plot of rejection probabilities against a variable representing the discrepancy between the null and alternative hypothesis.