

First test in Introductory Econometrics

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1. Consider the Gauss-Markov assumptions for the linear regression model:[8 points]
 - (a) Please provide the five assumptions that are required in the *multiple* linear regression model for the BLUE property of the OLS estimator.
 - (b) What does ‘BLUE’ stand for? Is it conceivable that an estimator with a smaller variance can be constructed, even if the five assumptions hold?
 - (c) Why do we often assume a sixth property MLR.6? For what do we need that one? OLS is BLUE anyway.
 - (d) Which of the five Gauss-Markov assumptions is not necessary for the unbiasedness of OLS?

2. Problems in empirical applications.[6 points]

- (a) A macro-economist estimates an investment equation. She regresses aggregate equipment investment on a short-run interest rate (bill rate) and on a long-run interest rate (bond rate). Correlation between the two interest rates is positive and strong, approximately 0.8. MLR.1, MLR.2, MLR.4, MLR.5 are fulfilled. Will OLS be BLUE?
- (b) The same macro-economist adds a third regressor to the equation, the (arithmetic) average of the short and the long rate. What is the problem of this specification?
- (c) Just for the sake of an experiment, instead of averaging the two interest rates, she now forms the geometric average by multiplying them and taking the square root. Will she encounter any estimation problem this time, with the three regressors short rate, long rate, and geometric average?

3. Restriction tests in multiple regression.[5 points]

- (a) A micro-economist regresses the monthly salary (wage) of 500 individuals on several indicators, such as the years of education x_1 , a gender dummy x_2 , an indicator for the ethnic group x_3 , mother's salary or wage x_4 , father's salary or wage x_5 . The regression software yields coefficient estimates and standard errors, but no t -statistics. How can the economist calculate t -statistics? What are these t -statistics good for?
- (b) It turns out that t -statistics on β_2 and β_3 are small in absolute values, and the economist considers eliminating the variables x_2 and x_3 . What is the correct way to formulate this restriction as a null hypothesis, written in the parameters of the model? What is the distribution of the corresponding restriction statistic under the null?
- (c) It turns out that the p -value for the test described in (b) is 0.23. Does the test reject at a significance level of 5%?

4. Understanding basic concepts of econometrics.[6 points]

- (a) What is the difference between residuals and errors?
- (b) Why can errors never be correlated with parameters?
- (c) Why is $H_0 : \hat{\beta} = 0$ an invalid null hypothesis?