

Introduction to Econometrics. Final examination

1. Prove with detailed reasons that for $S = X + Y$ we have $\text{var}(S) = \text{var}(X) + 2\text{cov}(X, Y) + \text{var}(Y)$.
2. Essay type question. Explain the meaning and importance of the least squares assumptions:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + u_i, i = 1, \dots, n, \text{ where}$$

1. u_i has conditional mean zero given $X_{1i}, X_{2i}, \dots, X_{ki}$; that is,

$$E(u_i | X_{1i}, X_{2i}, \dots, X_{ki}) = 0.$$

2. $(X_{1i}, X_{2i}, \dots, X_{ki}, Y_i), i = 1, \dots, n$ are independently and identically distributed (i.i.d.) draws from their joint distribution.
3. Large outliers are unlikely: X_{1i}, \dots, X_{ki} and Y_i have nonzero finite fourth moments.
4. There is no perfect multicollinearity.

Comment the assumptions of "correct functional form" of the regression and "homoscedasticity/heteroscedasticity".

3. Using the regression results in column (2) of the Appendix 1:
 - a. Is age an important determinant of earnings? Use an appropriate test to explain your answer.
 - b. Sally is an 29-year-old female college graduate. Betsy is 34-year-old female college graduate. Construct a 95% confidence interval for the expected difference between their earnings.
4. Consider a regression model $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i$. Use the rewriting or reparametrization approach (called "Approach #2 in the book") to transform the regression so that you can use a t-statistic to test
 - a. $\beta_1 = \beta_2$;
 - b. $\beta_1 + a\beta_2 = 0$, where a is a constant.