

Economics 471: Introductory Econometrics

Department of Economics, Finance and Legal Studies

University of Alabama

Fall 2015

Midterm I

The exam consists of three questions on three pages. Each question is of equal value.

1. A researcher is using data for a sample of 274 male employees to investigate the relationship between hourly wage rates y_i (measured in dollars per hour) and firm tenure x_i (measured in years). Preliminary analysis of the sample data produces the following sample ($n = 274$) information:

$$\begin{array}{lll} \sum_{i=1}^n y_i = 1945.26 & \sum_{i=1}^n x_i = 1774.00 & \sum_{i=1}^n y_i^2 = 18536.73 \\ \sum_{i=1}^n x_i^2 = 30608.00 & \sum_{i=1}^n x_i y_i = 16040.72 & \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y}) = 3446.226 \\ \sum_{i=1}^n (y_i - \bar{y})^2 = 4726.377 & \sum_{i=1}^n (x_i - \bar{x})^2 = 19122.32 & \sum_{i=1}^n \hat{u}_i^2 = 4105.297 \end{array}$$

Use the above sample information to answer all the following questions. Answer all questions assuming the simple linear regression model $y_i = \alpha + \beta x_i + u_i$. Show explicitly all formulas and calculations.

- Use the above information to compute OLS estimates of the intercept coefficient α and the slope coefficient β .
- Interpret the slope coefficient estimate you calculated in part (a). In other words, explain what the numeric value you calculated for β means.
- Calculate an estimate of σ^2 , the error variance.
- Calculate an estimate of $Var(\hat{\beta})$, the variance of $\hat{\beta}$.
- Compute the value of R^2 , the coefficient of determination for the estimated OLS sample regression equation. Briefly explain what the calculated value of R^2 means.
- Calculate the sample value of the t -statistic for testing the null hypothesis $H_0 : \beta = 0$ against the alternative hypothesis $H_1 : \beta \neq 0$. What do you conclude from this test?

2. Consider the model $y_i = \beta x_i + u_i$, $i = 1, 2, \dots, n$.

- (a) Use ordinary least-squares (or method of moments) to derive the estimator of β .
- (b) Show that the estimator in part (a) is an unbiased estimator.
- (c) Derive the variance of the estimator from part (a).

3. In the course packet we are concerned with the impact of homework on test scores. In the regression below we regress test scores on homework without an intercept term. Please use the EViews table below to answer the following questions:

- (a) Interpret the coefficient estimate?
- (b) If we started with zero hours of homework, how many hours would it take to get a perfect score on the exam (100)?
- (c) State the null for the test statistic (t-statistic).
- (d) Give the formula for the test statistic in part (c) as well as the value for the test statistic.
- (e) Give the formula for the R^2 as well as the value of the goodness-of-fit measure.

Dependent Variable: TESTSCORES

Method: Least Squares

Date: 08/11/08 Time: 07:10

Sample: 1 3733

Included observations: 3733

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HOMEWORK	60.30165	0.594503	101.4320	0.0000
R-squared	-7.265076	Mean dependent var	52.43538	
Adjusted R-squared	-7.265076	S.D. dependent var	9.566599	
S.E. of regression	27.50306	Akaike info criterion	9.466739	
Sum squared resid	2822953.	Schwarz criterion	9.468407	
Log likelihood	-17668.67	Durbin-Watson stat	1.231258	
