B.E. International Program

Faculty of Economics, Thammasat University

Semester: 1/2014
EE325 Introductory Econometrics
Homework#2 (Due on October 2nd, 2014)

Attempt only 5 questions

1. Although we can simply study about Y (regressand) by using its mean value to explain, we also have to concern regression analysis, why? Explain.

2. Phillip's Curve shows inverse relationship between unemployment and inflation rate, $\pi_t = a - bU_t$. There is an argument that Phillip's Curve is not true because some points (π_t, U_t) in scatter diagram are not on the curve. Unemployment level and price level could go in the same direction sometimes. Therefore, we can conclude that unemployment rate is not a function of inflation. Provide some comments on the above argument. Do you agree or disagree?

3. Given the sample data of Y and X:

Y	X
3.5	1
-3.2	-1
-0.3	0
0.3	0

Suppose that $Y_i = \beta X_i + u_i$ where $E(u_i|X_i) = 0$ and $Var(u_i|X_i) = \sigma^2$

3.1 Plot the scatter diagram of the given data

3.2 Use Ordinary least square (OLS) method to find the value of β

3.3 Suppose that b is other estimators of β such that $e_i = Y_i - bX_i$. $e_i = Y_i - bX_i$ Fill in the table below and plot the graph. Let x axis be the values of b and y axis be the values of RSS (b). Observe whether the value of RSS (b) is the same as the value of $\widehat{\beta_{OLS}}$ in b? How?

b	e_1	e_2	e_3	e_4	RSS(b)
3.60					
3.50					
3.35					
3.15					
3.00					

RSS = residual sum of square

4. Consider whether each of the following properties violate the assumptions of classical linear regression model.

4.1 $E(u_i) = 0$ for all i

4.2 $\operatorname{var}(u_i) \neq \operatorname{var}(u_j)$ for some $i \neq j$

5. Show that:

5.1 $\sum (X_i - \bar{X})^2 = \sum X_i^2 - n\bar{X}^2$

5.2 $\sum (X_i - \bar{X})(Y_i - \bar{Y}) = \sum X_i Y_i - n\bar{X}\bar{Y}$

6. Answer question 6.1 to 6.8 from this table

X_i	Y_i	$X_i - \bar{X}$	$(X_i - \bar{X})^2$	$Y_i - \bar{Y}$	$(X_i - \bar{X})(Y_i - \bar{Y})$
0	6				
1	5				
2	3				
3	1				
4	0				
$\sum X_i =$	$\sum Y_i =$	$\sum(X_i - \bar{X}) =$	$\sum(X_i - \bar{X})2 =$	$\sum(Y_i - \bar{Y})=$	$\sum(X_i - \bar{X})(Y_i - \bar{Y}) =$

6.1 Fill in the table above

6.2 Consider the two-variable model: $Y_i = \beta_1 + \beta_2 X_i + u_i,\ \ u_i \sim NIID(0, \sigma^2)$.

Use ordinary least squares(OLS) method to find estimators of β_1 and β_2. Interpret the meaning.

6.3 Predict value of Y using the estimators from (5.2) and fill in the following table.

X_i	Y_i	$(Y_i - \bar{Y})^2$	$\hat{Y}_i$	$\hat{u}_i$	$\hat{u}_i^2$	$X_i \hat{u}_i$
0	6					
1	5					
2	3					
3	1					
4	0					
		$\sum(Y_i - \bar{Y})^2 =$	$\sum \hat{Y}_i =$	$\sum \hat{u}_i =$	$\sum \hat{u}_i^2 =$	$\sum X_i \hat{u}_i =$

6.4 Plot graph and draw regression line. Does the line pass $(\bar{X}, \bar{Y})$?

6.5 Find $\hat{\sigma}^2$ and $\widehat{Var(\hat{\beta}_2)}$.

6.6 Find value of R^2 and interpret.

6.7 Test the hypothesis that X is statistically significant variable.

6.8 Establish a 95 percent confident interval for β_2.

7. Answe the following questions

7.1 Given $\sum_{i=1}^{10}(Y_i - \bar{Y})^2 = 600$ and $\sum_{i=1}^{10}\hat{u}_i^2 = 180$. Find R^2.

7.2 Given $n = 20$, $\sum_{i=1}^{20} Y_i^2 = 6000$, $\bar{Y} = 16$ and Explained Sum of Squares (ESS) is 680. Find R^2.

7.3 Given $R^2 = 0.7911$, Total Sum of Squares (TSS) = 552 and $n = 20$, find $\hat{\sigma}^2$.

8. Suppose an Indifferent Curve equation for consumption of good X and good Y is $\ln(X_i Y_i) = \beta_1 + \ln(\beta_2 X_i^{\beta_3})$

Transform the above model to linear regression model and use data in the follwing table to estimate parameter β_1 and, interpret the meaning, and test hypothesis for beta coefficients at 0.05 level of significance.

Consumption of X	1	2	3	4	5
Consumption of Y	4	3.5	2.8	1.9	0.8

9. Consider the following regression:

$$\begin{array}{lll} \hat{Y}_i = (a) + 0.5091X_i & & \\ se & 6.4138 & (b) \\ t & 3.8128 & 14.2605 \end{array}$$

Y_i = Household consumption expenditure per week

X_i = Household income per week

9.1 Find an estimator of the intercept coefficient and standard error of slope coefficient.

9.2 Interpret the meaning of slope coeffient. Does it show the expected sign ?

9.3 Establish 99%, 95% and 90% confidence interval for slope coefficient.

9.4 Test the hypothesis that slope coeffiecient = 0.2.

10. Consider the regression result:

$$\hat{Y} = 0.8345 + 1.9123X \qquad R^2 = 0.564$$
$$se \quad 3.233 \qquad 0.1417$$

If X or Y or both were divided by k, where k was a constant, how would the regression result change? Show method and explain.

11. Consider the following regression result

$$\hat{Y}_i = (a) + 0.5091X_i$$
$$se \quad 6.4138 \qquad (b)$$
$$t \quad 3.8128 \quad 14.2605$$

Y_i = weekly expenditure of households
X_i = monthly income of households
N = 200

11.1 Find the values of (a) and (b)
11.2 Interpret the meaning. Are they as expected?
11.3 Find the 99 %, 95 % and 90 % confidence intervals of the slope coefficient
11.4 Test the hypothesis that the value of slope coefficient is equal to 0.2

12.From the data collection of 13 automobile-parts manufacturing companies, consider this regression result:

$$\hat{rd} = 0.7437 + (a)sales$$
$$se = \quad (b) \qquad (0.0664)$$
$$t = (0.8797) \qquad (c)$$

where $\dfrac{\sum_{i=1}^{13}(sales_i - \bar{sales})(rd_i - \bar{rd})}{\sum_{i=1}^{13}(sales_i - \bar{sales})^2} = 0.6416$

rd_i = R&D expenditure (million baht), and

$sales_i$ = Annual sale (million baht)

12.1 Find standard error of the slope coefficient and the intercept, and the t statistic value of the slope coefficient.
12.2 Interpret the meaning of the slope coefficient and the intercept.
12.3 Find the 99%, 95% and 90% interval of the slope coefficient and the intercept.
12.4 Test the hypothesis that the slope coefficient is more than or equal to 1 at 0.05 level of significance.

13. (Optional) If u_i is normally distributed, $\sum \hat{u}_i^2$ = 9.8296, and number of observation (n) = 13
13.1 Find the 95% confidence interval of σ^2.
13.2 Test hypothesis that σ^2 = 0.6 at 0.05 level of significance

14. Consider the following statement whether they are true of false and explain.
14.1 If the p-value is higher than the significance level, we will reject the null hypotheis H_0 .
14.2 We and use t-test, F-test, and chi-square value in hypothesis testing that $H_0 : \beta_2 = 0$ where $\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i$
14.3 Type one error is the value of significance level (α) which we reject H_0 when it is true.

15. Suppose the indifferent curve from consumption of goods X and Y is as follows:

Quantity consumed of X	1	2	3	4	5
Quantity consumed of Y	4	3.5	2.8	1.9	0.8

$$\ln(Y_i / X_i) = \beta_1 + \ln(\beta_2 X_i^{\beta_3})$$

15.1 How can we transform this model into regression model?
15.2 By using information from the table, estimate value of the parameters in the model from 6.1. Also interpret the value of slope coefficient and test hypothesis whether the slope intercept is equal to zero at 95% confidence interval.
15.3 Find the 95% confidence interval of the slope coefficient from model in 6.1

16. Consider the following regression

$$\begin{aligned} &\hat{Y} = 0.8345 + 1.9123X \qquad R^2 = 0.564 \\ &se \quad 3.233 \qquad 0.1417 \end{aligned}$$

How will the above result, including the values of se and R^2, change if;
16.1 X is divided by k
16.2 Y is divided by k
16.3 Both X and Y are divided by k, where k is a constant. Show your method and explain.