B.E. International Program

Faculty of Economics, Thammasat University

Semester: 1/2015
EE 425 Econometrics 1
Homework #4 (Dummy Variable and Multicollinearity)

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1. Given data in the following table, run the regression models:

(a) $Y_t = \alpha + \beta X_t + u_t$

(b) $Y_t = \alpha + \beta X_t + \lambda_2 Q_2 + \lambda_3 Q_3 + \lambda_4 Q_4 + u_t$

(c) $Y_t = \beta X_t + \lambda_1 Q_1 + \lambda_2 Q_2 + \lambda_3 Q_3 + \lambda_4 Q_4 + u_t$

(*i*) Explain each equation and show the estimated equation for each quarter.

(*ii*) Test whether each quarter is significantly different from the first quarter or not. Which model will you choose to perform such a test and why?

(*iii*) Try regress Model (c) with the inclusion of a constant term (intercept α). What do you get as a result?

Table:

	X_t	Y_t	Quarterly Dummy Variable			
	Time	**Sales**	Q_1	Q_2	Q_3	Q_4
2005	1	24	1	0	0	0
	2	29	0	1	0	0
	3	29	0	0	1	0
	4	50	0	0	0	1
2006	5	24	1	0	0	0
	6	30	0	1	0	0
	7	29	0	0	1	0
	8	51	0	0	0	1
2007	9	26	1	0	0	0
	10	29	0	1	0	0
	11	30	0	0	1	0
	12	52	0	0	0	1
2008	13	25	1	0	0	0
	14	30	0	1	0	0
	15	29	0	0	1	0
	16	53	0	0	0	1

2. To assess the effect of the Fed's policy of deregulating interest rates beginning in July 1979, Sidney Langer estimated the following model for the quarterly period of 1975-III to 1983-II.*

$$\hat{Y}_t = 8.5871 - 0.1328P_t - 0.7102Un_t - 0.2389M_t$$
$$\text{Se}(1.9563) \quad (0.0992) \quad (0.1909) \quad (0.0727)$$
$$+ 0.6592Y_{t-1} + 2.5831\,\text{Dum}_t$$
$$(0.7549) \quad (0.7549)$$
$$R^2 = 0.9156$$

where Y = 3-mounth Treasury bill rate
P = expected rate of inflation
Un = seasonally adjusted unemployment rate
M = changes in the monetary base
Dum = dummy, taking value of 1 for observations beginning July 1, 1979

(a) Interpret the above results.
(b) What has been the effect of rate deregulation? Do the results make economic sense?
(c) The coefficients of P_t, Un_t and M_t are negative. Can you offer an economic rationale?

3. To study the rate of growth of population in a country over the period 1980-2002. A researcher estimated the following models:

Model I: $\ln(pop)_t = 4.73 + 0.024t$
t statistic = (781.25) (54.71)

Model II: $\ln(pop)_t = 4.77 + 0.015t - 0.075D_t + 0.011(D_t t)$
t statistic = (2477.92) (34.0) (-17.03) (25.54)

where pop = population in millions, t = trend variable, D_t = 1 for observations beginning in 1988 and 0 before 1988, and ln stands for natural logarithm.

a. In Model I, what is the rate of growth of the population in this country over the sample period?
b. Are the population growth rates statistically different pre- and post- 1988? How do you know? If they are different, what are the growth rates for 1980-1987 and 1988-2002?

* Sidney Langer, "Interest Rate Deregulation and Short-Term Interest Rates," unpublished term paper.

4. From the table below

Y	X_2	X_3
-10	1	1
-8	2	3
-6	3	5
-4	4	7
-2	5	9
0	6	11
2	7	13
14	8	15
6	9	17
8	10	19
10	11	21

a) Can you estimate β_1, β_2 and β_3 from the model $Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$? Why or why not?

b) If not, what linear function can you estimate? Show the necessary calculations.

5. Based on the annual data for the U.S. manufacturing sector during 1979-2002 Mr. Dean obtained 2 models of the Cobb-Douglas production function.

$$\ln Y = 2.81 - 0.53 \ln K + 0.91 \ln L + 0.047\, t \quad \text{..... (1)}$$

Standard error (s.e) = (1.38) (0.34) (0.14) (0.021)

R^2 = 0.97 F = 189.8

and

$$\ln\left(\frac{Y}{L}\right) = -0.11 + 0.11 \ln\left(\frac{K}{L}\right) + 0.006t \quad \text{..... (2)}$$

(s.e) = (0.03) (0.15) (0.006)

R^2 = 0.65 F = 19.5

a) Is there multicollinearity in regression (1)? Why do you think so?

b) If regression (1) comes from $Y = \beta_1 K^{B_2} L^{B_3} \ell^{B_4 t}$, what reasons did Mr. Dean use in transforming it into regression (2)?

c) Can you compare R^2 from the above 2 regressions? Why or why not?

6. From the data on total cost (Y) and output (X) below;

Output (X)	Total cost (Y)
1	193
2	226
3	240
4	244
5	257
6	260
7	274
8	297
9	350
10	420

a) Plot Y (vertical axis) against X (horizontal axis)
b) Run the regression for the cubic or third-degree polynomial function to capture the elongated S curve.

Model: $Y_i = \beta_1 + \beta_2 X_i + \beta_3 X_i^2 + \beta_4 X_i^3 + u_i$

Evaluate your results.
c) Find the correlation matrix for the explanatory variables in (b).
d) From (b) and (c), do you think the estimated model suffers from serious multicollinearity. Provide your comments.