



B.E. International Program

Faculty of Economics, Thammasat University



Semester: 1/2012

Subject: EE 425 Econometrics 1

Homework 1

1. From the model $Y_i = \beta_1 + \beta_2 X_i + u_i$ we can find the normal equations from the OLS estimation method

$$1.1 \quad \sum_{i=1}^n Y_i = n\hat{\beta}_1 + \hat{\beta}_2 \sum_{i=1}^n X_i$$

or $\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X}$

$$1.2 \quad \sum_{i=1}^n X_i Y_i = \hat{\beta}_1 \sum_{i=1}^n X_i + \hat{\beta}_2 \sum_{i=1}^n X_i^2$$

a) Substitute the expression for $\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X}$ into equation 1.2 and show that

$$\hat{\beta}_2 = \frac{n \sum X_i Y_i - \sum X_i \sum Y_i}{n \sum X_i^2 - (\sum X_i)^2}$$

b) Show that the expression

$$\frac{\sum x_i y_i}{\sum x_i^2} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sum (X_i - \bar{X})^2}$$

is equivalent to the expression for $\hat{\beta}_2$ in (a).

c) What are the reasons for putting the disturbance term u_i in the model?

2. Determine whether the following models are linear in parameters or linear in variables or neither. Provide your reason.

Model	Descriptive title
(a) $Y_i = \beta_1 + \beta_2 \left(\frac{1}{X_i} \right) + u_i$	Reciprocal
(b) $Y_i = \beta_1 + \beta_2 \ln X_i + u_i$	Semi-logarithmic
(c) $\ln Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$	Logarithmic or double logarithmic
(d) $\ln Y_i = \beta_1 + \beta_2 \left(\frac{1}{X_i} \right) + u_i$	Logarithmic reciprocal
(e) $Y_i = \frac{1}{1 + e^{\beta_1 + \beta_2 X_i + u_i}}$	Logistic distribution

4. The National Economic and Social Development Board (NESDB) collects and publishes Thailand's national income and GDP data as follows.

Year	Real GDP (million baht) RGDP (at 1988 prices)	Nominal GDP (million baht) NGDP (at current prices)	Real Private Consumption (at 1988 prices)
2002	3,237,042	5,450,643	1,782,648
2003	3,468,166	5,917,369	1,898,464
2004	3,688,189	6,489,476	2,016,859
2005	3,855,019	7,092,893	2,109,339
2006	4,054,504	7,844,939	2,176,210
2007	4,259,026	8,525,192	2,214,421
2008	4,364,833	9,080,466	2,278,617
2009	4,263,139	9,041,551	2,252,698
2010	4,596,112	10,104,821	2,361,231
2011 ^P	4,599,655	10,540,134	2,392,719

Note: P = preliminary

Source: www.nesdb.go.th

- a) Divide the data by 1,000,000, plot RGDP and NGDP against time. In a separate diagram, plot real consumption expenditure against real GDP.
- b) Let X = time and in 2002 = 1,.....2011 = 10, find the OLS estimators \hat{a} and \hat{b} from the following models.

$$\text{RGDP}_t = a_1 + b_1 X_t + u_t$$

$$\text{NGDP}_t = a_2 + b_2 X_t + u_t$$

Use the OLS formula $\hat{a} = \bar{Y} - \hat{b}\bar{X}$

$$\hat{b} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sum (X_i - \bar{X})^2} = \frac{\sum x_i y_i}{\sum x_i^2}$$

- c) Interpret \hat{b}_1 and \hat{b}_2 . Does the difference between \hat{b}_1 and \hat{b}_2 have any economic meaning?
- d) Let Y = consumption expenditure in 1988 prices
 X = real GDP in 1988 prices
 Model : $Y_i = \beta_1 + \beta_2 X_i + u_i$

Use the data during 2002 – 2011 to find OLS estimators for $\hat{\beta}_1$ and $\hat{\beta}_2$. What is the value of the marginal propensity to consume (MPC) during this period? What is the value of a simple closed economy multiplier from this estimated equation?
