

Assignment 3

1. Determine whether the following models are linear in the parameters, or the variables, or both. Which of these models are linear regression models?

1. Reciprocal

$$Y_i = \beta_1 + \beta_2 \left(\frac{1}{X_i} \right) + u_i$$

2. Semilogarithmic

$$Y_i = \beta_1 + \beta_2 \ln X_i + u_i$$

3. Inverse semilogarithmic

$$\ln Y_i = \beta_1 + \beta_2 X_i + u_i$$

4. Logarithmic or double logarithmic

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$$

5. Logarithmic reciprocal

$$\ln Y_i = \beta_1 - \beta_2 \left(\frac{1}{X_i} \right) + u_i$$

2. Consider the following non-stochastic models (i.e., model without the stochastic error term). Are they linear regression models? If not, is it possible, by suitable algebraic manipulations, to convert them into linear models?

1.

$$Y_i = \frac{1}{\beta_1 + \beta_2 X_i}$$

2.

$$Y_i = \frac{X_i}{\beta_1 + \beta_2 X_i}$$

3.

$$Y_i = \frac{1}{1 + \exp(-\beta_1 - \beta_2 X_i)}$$

3. Table 1 gives data on gold prices and the Consumer Price Index (CPI) for the United States for the period 1977-1991.

Table 1. Price of Gold at Newyork, \$ per troy ounce and Consumer Price Index (CPI), 1982-84=100

	Price of Gold	Consumer Price Index (CPI)
1977	147.98	60.6
1978	193.44	65.2
1979	307.62	72.6
1980	612.51	82.4
1981	459.61	90.9
1982	376.01	96.5
1983	423.83	99.6
1984	360.29	103.9
1985	317.30	107.6
1986	367.87	109.6
1987	446.50	113.6
1988	436.93	118.3
1989	381.28	124.0
1990	384.08	130.7
1991	362.04	136.2

Questions

1. Using the microsoft office (Excel) to plot the scattergram gold prices (Y) and CPI (X).
2. Suppose you decide to fit the following model:

$$Y_t = \beta_1 + \beta_2 X_t + u_t$$

where

Y_t = Gold price at time t.

X_t = CPI at time t.

u_t = disturbance term at time t.

Based on the scatterplot in 1, what should be the expected signs of $\hat{\beta}_1$ and $\hat{\beta}_2$?

3. Construct the table as same as we did in class (p.49) and calculate the regression estimators $\hat{\beta}_1$ and $\hat{\beta}_2$. Then, draw the sample regression line (SRL) and fill in all important information on the figure.