Econ 444 Elementary Econometrics
Fall 2007

ANSWERS TO SAMPLE PROBLEMS for CHAPTERS 6,7,8, AND 10

1. (a) Because economic theory suggests that the demand for food falls when the price of food rises, we expect $\beta_1 < 0$. Hence the alternative hypothesis $H_A : \beta_1 < 0$ is appropriate.
(b) At the 5% level, the critical value is 1.753 for d.f.$= 18 - 3 = 15$.

(b-1) $t = -1.5/0.5 = -3$. Hence we reject the null hypothesis.

(b-2) $t = -1.5/0.9 = -1.667$. Hence we do not reject it.

(b-3) $t = -1.5/1.2 = -1.25$. Hence we do not reject it.

(b-4) The point estimate of β_1 is positive, hence we do not reject it.

(b-5) The point estimate of β_1 is positive, hence we do not reject it.

(b-6) The point estimate of β_1 is positive, hence we do not reject it.

(c) We have elastic demand when $\beta_1 < -1$. Hence $H_A : \beta_1 < -1$ is appropriate.
(d) At the 5% level, the critical value is 1.753 for $d.f. = 18 - 3 = 15$.

(d-1) $t = [-2.1 - (-1)]/0.5 = -2.2$. Hence we reject the null hypothesis.

(d-2) $t = [-2.1 - (-1)]/0.9 = -1.345$. Hence we do not reject it.

(d-3) $t = [-2.1 - (-1)]/1.2 = -0.917$. Hence we do not reject it.

(d-4) $t = [-1.4 - (-1)]/0.15 = -2.667$. Hence we reject it.

(d-5) Because $\beta_1 > -1$, we do not reject the null hypothesis.

(e) Because economic theory suggests that the demand for food rises when income rises, we expect $\beta_2 > 0$. Hence the alternative hypothesis $H_A : \beta_2 > 0$ is appropriate.
(f) At the 5% level, the critical value is 1.753 for $d.f. = 18 - 3 = 15$.

(f-1) $t = 1.5/0.5 = 3$. Hence we reject the null hypothesis.

(f-2) $t = 1.5/0.9 = 1.667$. Hence we do not reject it.

(f-3) $t = 1.5/1.2 = 1.25$. Hence we do not reject it.

(f-4) $t = 0.5/0.15 = 3.333$. Hence we reject it.

(f-5) Because the point estimate of β_2 is negative, we do not reject it.

2. (a) $N = 1962 - 1941 + 1 = 22$.

The answers are given in class for the class format.

(b) When the price proportionally rises by one percent, the food budget share proportionally decreases by 0.0328 percent on the average.

(c) Since economic theory suggests that the budget share for food falls when the price rises, we expect $\beta_1 < 0$. Hence $H_A : \beta_1 < 0$ is appropriate. The critical value is 1.729.

(d) If Engel's law holds, then $\beta_2 < 0$. Hence the one tailed test with $H_A : \beta_2 < 0$ is appropriate. The critical value is 1.729 and $t = -2.349$. Hence we do reject the null hypothesis.

$$F = \frac{R^2/K}{(1-R^2)/(N-K-1)} = \frac{0.761/3}{(1-0.761)/18} = 19.104 \tag{1}$$

The critical value is 5.09. Hence we reject the null hypothesis.

(f) $\hat{Y}_t = 0.263 - 0.0312 \times 15 - 0.0233 \times 60 - 0.3776 \times 1 = 0.263 - 0.468 - 1.38 - 0.3776 = -1.9626$ is the predicted value during WWII and $\hat{Y}_t = 0.263 - 0.0312 \times 15 - 0.0233 \times 60 = 0.263 - 0.468 = -0.205$ is the predicted value after WWII.

(g) First, in terms of economic theory, it is possible that a war affects people's preferences and their demand for food. On the other hand, it is more likely that a war affects preferences and demand for luxury goods than preferences and demand for food. So it is not clear if the war dummy is necessary for demand for food.

Second, we use t-test as a measure to see if the war dummy variable is an irrelevant variable. Because it is not clear whether or not the war will increase the budget share for food, we use the two-tailed test. For the hypothesis that the dummy variable coefficient is zero is -0.6761. We fail to reject the hypothesis of zero coefficient even at the 10% level (1.734 is the critical value for the 10% level.) Hence we prefer the regression (7) in terms of this measure.

Third, we use the adjusted adjusted R^2 as another measure. For Regression (7),

$$\bar{R}^2 = 1 - (1-R^2)\frac{N-1}{N-K-1} = 1 - (1-0.758)21/19 = 0.733. \tag{2}$$

For Regression (8),

$$\bar{R}^2 = 1 - (1-R^2)\frac{N-1}{N-K-1} = 1 - (1-0.761)21/18 = 0.721. \tag{3}$$

Fourth, we compare how estimates of β_1 and β_2 change when the dummy variable is omitted by comparing estimates of these coefficients in the results for (7) and (8). The difference is smaller than the standard error for each coefficient.

Hence we prefer Regression (7).

3. When a regression has a multicollinearity, the standard error of each coefficient tends to be large, and the absolute value of the t-value tends to be small.

4. In this case, we can scale Y and X by X_i^2 to obtain homoskedasticity of the error term. Hence the WLS is obtained by applying the OLS to

$$\frac{Y_i}{X_i^2} = \beta_0 \frac{1}{X_i^2} + \beta_1 \frac{1}{X_i} + \frac{\epsilon_i}{X_i^2} \tag{4}$$

In order to apply the OLS to (4), we transform the data to create the new data for $\frac{Y_i}{X_i^2}$, $\frac{1}{X_i^2}$, and $\frac{1}{X_i}$. Then we run a multiple regression with $\frac{Y_i}{X_i^2}$ as the dependent variable, and $\frac{1}{X_i^2}$, and $\frac{1}{X_i}$ as the explanatory variables without computing the intercept term.