Economics 3950
Spring 2005
Dr. Richard Mueller

Assignment #4

Instructions: These questions should be answered using a text editor or a word processor where you can cut and paste output from your statistical program (where necessary). Please mark question numbers clearly. This assignment is **due on Monday, March 30, 2008 by 12:00 in D-552.**

1. (70 points total) Exercise 7.7, pp. 330-1.

2. (30 points total) Exercise 7.22, pp. 337-8.

3. (35 points total) Exercise 8.21, pp. 374-5.

Grand Total: 135 points

Answer Key

1. a. The control season is Winter because no dummy variable has been defined for it.
   b. When the price of a car goes up, we would expect sales to decline so that $\beta < 0$, Income will have a positive effect so that $\alpha > 0$. If the interest rate increases, the cost of financing a car will go up and hence the demand for cars will decrease. Thus, we would expect $\delta < 0$.
   c. Let α = a0 +a1SPRING + a2SUMMER + a3FALL. Substituting this in the basic model we get the unrestricted Model (U) as LPCCARS = a0 +a1SPRING + a2SUMMER + a3FALL +βLPRICE + γLPINCOME + δLPINTRATE + error. This is the same as Model B.
   d. Ho: a1 = a2 = a3 = 0. H1: At least one term is nonzero.
   e. Compute Fc = [(0.31044-0.17699)/3]/[0.17699/(40–7)] = 8.29.
   f. Fc ~ F(3,33)
   g. From the F-table for 1 per cent level F* with 3 and 33 d.f. is a value between 4.31 and 4.51.
   h. Since Fc > F* we can reject the null hypothesis.
   i. To decide on the variables to exclude, we can do a t-test. The degrees of freedom for the t-statistics in Model B in the table is 33. For a 1(10) per cent level of significance, t* is between 2.704 and 2.750 (1.684 and 1.697). Any variable with a corresponding t-statistic below this is a candidate to be dropped. According to this rule we would drop SUMMER and FALL and this would result in Model C. Of course, if we look at t-statistics with absolute values of less than 1, we couldn't drop anything.
   j. The model with the lowest model selection statistics is preferable as the best. Six out of the eight criteria choose Model C as the best. Another criterion to use is the significance of the coefficients. All the coefficients in Model C are highly significant. Thus, Model C would be chosen as best model.
   k. Let β = b0 +b1SPRING + b2SUMMER + b3FALL. Substituting this in Model B we get the unrestricted Model D as LPCCARS = a0 +a1SPRING + a2SUMMER + a3FALL+boLPRICE +b1SPRING*LPRICE + b2SUMMER*LPRICE + b3FALL*LPRICE + γLPINCOME + δLPINTRATE + error.
   l. Ho: b1 = b2 = b3 = 0.
   m. First regress LPCCARS against all the explanatory variables in Model B and save the error sum of squares as ESSB. Next create Z1 = SPRING*LPRICE, Z2 = SUMMER*LPRICE, and Z3 = FALL*LPRICE. The regress LPCCARS against the variables in model B plus the three Zs and save the error sum of squares as ESSD. Next compute Fc = [(ESSB-ESSD)/3]/[ESSD/(40-10)]. Under the null Fc ~ F(3,30). The the F-table for 1 per cent look up F* = 4.51. If Fc > 4..51 we would reject the null hypotheses.
   n. Ignoring the negative sign of the coefficient, computer tc = (βhat – 1)/(std. error). Since the standard error is not directly given, we obtain is as std. error = coeff/t-stat = 1.76/9.6 = 0.183. From this we have tc = (1.760 – 1)/0.183 = 4.15. Under the null hypothesis this has 40 – 5 = 35 d.f. and we can reject the hull hypothesis. Thus, since the observed price elasticity is greater than 1, we can say that demand is price elastic is these data.

2. a. Ho: $\beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$.
   b. Model A is the unrestricted model and Model B is the restricted model. Compute: Fc = [(ESSB-ESSA)/5]/[(ESSA)/(116-10)] = 122.51. Under Ho, Fc ~ F with 5 and 106 d.f.
   c. From the F table for 1 per cent level, F* is between 3.17 and 3.34. Since Fc > F* we reject Ho and conclude that there has been a significant change in the structure.
   d. Six of out the eight model section criteria choose Model C as the best. But Model C has β_2 and β_8 with p-values slightly above 10 per cent. Omitted variable bias suggests that it is better to leave a variable in a model if it appears to have some effect. Since these two are only marginally insignificant, Model C is best.

e.

	1980	1990
FAMSIZE	4.944	4.944+9.760=14.704
HIGHSCHL	0.223	0.223+0.199=0.422
COLLEGE	0.339	0.339+0.871=1.210

f. In 1990 and increase in family size of one person resulted in average increase of $14,704 in median income where this was only $4,944 in 1980.

A one per cent increase in high school graduates increased median income on average by $422 in 1990, which is $199 more than in 1980.

A one per cent increase in college graduates increase median income on average of $339 in 1980 and $1,210 in 1990.

3. a.

$$\sigma_t^2 = \alpha_o + \alpha_1 EDUC_t + \alpha_2 UE_t + \alpha_3 DR_t + \alpha_4 URB_t + \alpha_5 WH_t + \alpha_6 UE_t^2 + \alpha_7 DR_t^2 + \alpha_8 URB_t^2 + \alpha_9 WH_t^2$$

b. Ho: $\alpha_i = 0 \ for \ i = 1,2,...,9$

c. LM = nR^2 = 50*[1 – (888.498/1725.33)] = 24.25

d. Under the null hypothesis, $LM \sim X_9^2$.

e. LM*(0.01) = 21.666. Since LM > LM*, we reject Ho and conclude that there is significant heteroscedasticity.

f. Ignoring heteroscedasticity, as OLS does, does not jeopardize unbiasedness nor consistency, but OLS estimates are no longer efficient and hypothesis tests are invalid.

g. i. Compute

$$\hat{\sigma}_t^2 = 105.356 - .273 EDUC_t - 6.183 UE_t - 5.332 DR_t - .883 URB_t - 1.001 WH_t + .557 UE_t^2 + .307 DR_t^2 + .007 URB_t^2 + .011 WH_t^2$$

ii. Compute $w_t = 1/\sqrt{\hat{\sigma}_t^2}$

iii. Regress $w_t WLFP_t$ against all non-squared terms weighted by w_t in the equation in part (a) and leave out the constant.