

AGEC5213: ECONOMETRIC METHODS
Spring 2019

PROBLEM SET NO. 3 - due on March 27, 2019

Part I. (10 points). Consider the data set, *HW3-DATA1.txt*, to investigate the relationship between a help-wanted index (*HWIND*) and the level of unemployment (*UNEMR*, %). The data are quarterly data covering the period 2002-2007. Previously specified models assumed there was no seasonal influence on the help wanted index, other than that which would be captured by seasonal changes in the unemployment rate. Let us investigate whether this assumption is a reasonable one. Consider the model

$$HWIND_t = \beta_0 + \beta_1 UNEMR_t + \delta_1 S_{1t} + \delta_2 S_{2t} + \delta_3 S_{3t} + e_t$$

where S_{1t} takes the value 1 for first-quarter observations and 0 otherwise, S_{2t} takes the value 1 for second-quarter observations (0 otherwise) and S_{3t} takes the value 1 for third-quarter observations (0 otherwise).

- 1) Report the estimated least-squares equation. Do the estimates of δ_1 , δ_2 and δ_3 have the expected signs? (**Hint:** the fourth-quarter is typically a period of increased retail activity) Are they significantly different from zero at a 5% level of significance?
- 2) Jointly test whether the seasonal dummy variables should be included in the equation. Use a 5% level of significance.
- 3) Suppose a student estimates above model without the seasonal dummy variables. What are the limitations do you expect from this estimation?
- 4) Suppose that a dummy variable taking the value 1 for the first 16 observations is included. If you suspect there has been a structural change such that a given level of $UNEMR_t$ implies a higher value for $HWIND_t$ during the last 8 observations, what sign do you expect on the coefficient of the dummy variable. Retaining the model with the seasonal dummies, and using a 5% significance level, test the hypothesis that the coefficient of the structural-change dummy is zero against the alternative that it has the sign you expected.
- 5) Redo the test with the alternative hypothesis that the coefficient of the structural-change dummy is non zero.
- 6) A better way to investigate the structural change between the first 16 quarters and the rest of the period is to use the Chow Test. Do the Chow Test with and without seasonal dummy variables, and compare these two results.

Part II. (10 points). Consider the following total cost function where y_i represents total cost for the i -th firm and x_i represents quantity of output.

$$y_i = \beta_1 + \beta_2 x_i + \beta_3 x_i^2 + \beta_4 x_i^3 + e_i$$

Data on a sample of 28 firms in the food processing industry are in the file *HW3-DATA2.xls*

- 1) Write down the marginal cost function corresponding to the above total cost function. What sign would you expect for β_4 ?
- 2) Write down the average cost function that corresponds to the above total cost function.
- 3) Find 95% confidence interval for the parameters $\beta_2, \beta_3, \beta_4$.
- 4) Test whether the data suggest that a linear function will suffice.
- 5) Test whether the data suggest that a quadratic function will suffice.
- 6) What parameter restrictions imply a linear average cost function? Test these restrictions.
- 7) Estimate a log-log cost function of the form $\ln y_i = \alpha_1 + \alpha_2 \ln x_i + \alpha_3 (\ln x_i)^2 + e_i$. Does the RESET test suggest the log-log function is preferable to the original cubic cost function?