

**Economics 3950
Spring 2008
Dr. Richard Mueller**

Assignment #5

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, April 14, 2008 by 12:00 in D-552.**

1. (30 points total) Exercise 9.19, p. 427.
2. (40 points total) Exercise 10.5, pp. 488-9.
3. (15 points total) Exercise 12.5, p. 540.

Grand Total: 85 points

Answer Key

1.
 - a. The error term is assumed to be $u_t = \rho u_{t-1} + \varepsilon_t$, the null hypothesis that $\rho = 0$, and the alternative is that $\rho > 0$. For the DW test, $d = 0.981$, $n = 30$, $k' = 3$, $d_L = 1.21$ and $d_U = 1.65$. There is evidence of first-order autocorrelation because $d < d_L$. For the LM test, estimate the model and obtain \hat{u}_t . Regress \hat{u}_t against a constant, l_price , l_income , l_temp , and \hat{u}_{t-1} . $(n-1)R^2 = 6.098$. Because the corresponding p-value is 0.014 (the critical value for the chi-squared with 1 d.f. and $\alpha = .05$ is 3.841), we reject the null hypothesis and conclude that there is significant autocorrelation.
 - b. Estimates are unbiased and consistent, but inefficient.
 - c. HILU procedure: First generate $l_demand_t^* = l_demand_{t-1} - \rho * l_demand_{t-1}$ (where ρ is any value between -1 and $+1$), etc. for the other variables. Use these transformed variables and estimate the modified model and compute its error sum of squares (ESS). Next choose a different ρ and repeat the procedure. By systematically searching the ρ -values from -1 to $+1$ we get a series of ESS values. Choose that ρ for which ESS is the lowest. The estimates corresponding to these are the HILU estimates. Estimates are “better” in the sense of greater asymptotic efficiency.

COCHRANE-ORCUTT procedure may also be used here.
2.
 - a. When Y is low (i.e., close to zero) saving would be expected to be negative because consumers would have to borrow. Hence $\alpha < 0$. As Y increases, we would expect desired savings to increase also. Hence $\beta > 0$. If desired saving is above actual saving, we would expect actual saving to increase. Thus, $\lambda > 0$.
 - b.
$$S_t = S_{t-1} + \lambda(\alpha + \beta Y_{t-1}) - \lambda S_{t-1}$$

$$= (1 - \lambda)S_{t-1} + \lambda\alpha + \lambda\beta Y_{t-1}$$

This gives the model as

$$S_t = \beta_1 + \beta_2 Y_{t-1} + \beta_3 S_{t-1} + \mu_t$$
 - c. Consistency is the property that as the sample size, n , approaches infinity, $\hat{\beta}$ approaches the true value β in all cases. IT requires the two conditions, $E(\mu_t) = 0$ and $Cov(X_t, \mu_t) = 0$ or that X_t is given for every X in the model. Estimates are consistent because $E(\mu_t) = 0$ and Y_{t-1} and S_{t-1} are given at time t .

Unbiasedness requires the same two conditions stated above. Estimates are biased because $\hat{\beta}$ depends on S_{t-1} which is a non random variable. This makes the expected value of $\hat{\beta}$ not equal to β (the true value).
 - d.
$$\hat{\beta}_1 = (1 - \hat{\lambda}) \therefore \hat{\lambda} = 1 - \hat{\beta}_1$$

$$\hat{\beta}_2 = \hat{\lambda} \hat{\alpha} \therefore \hat{\alpha} = \hat{\beta}_2 / \hat{\lambda} = \hat{\beta}_2 / (1 - \hat{\beta}_1)$$

$$\hat{\beta}_3 = \hat{\lambda} \hat{\beta} \therefore \hat{\beta} = \hat{\beta}_3 / (1 - \hat{\beta}_1)$$
3. Since we want to know whether a particular employee joins the union or not, we would want to survey individual employees and we would also want to survey these employees that come from different companies. As in the application in Section 12.2, the logit model in Equation 12.3 would be appropriate with a general maximum likelihood procedure. Several characteristics of the individual would be measure (e.g., age, gender, face, education and/or other skill level, occupation, number of

children, income, etc.). Firm data would include firm-specific data (e.g., the amount of the union membership fee, firm's location (i.e., province), percentage of workers who are union members already, industry, size of firm, etc.).