American University
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ECON 522 – Econometrics – Spring 2001

Problem Set # 2

Answers

3.22

1. (a) The constant term is the estimate of the expected average life insurance for a family that has zero income (in thousands of dollars).
   (b) The coefficient on income is the expected average change in life insurance for each dollar increase in family income.
   (c) The value of $\hat{\alpha} + \hat{\beta}x_0$ is the estimate of the expected average life insurance for a family that has income x_0.
   (d) The value of R^2 is a measure of the fraction of variation in life insurance explained by the model.
2. (a) The population equation is

$$lins_t = \alpha + \beta income_t + u_t. \quad (1)$$

   (b) The population error arises because of omitted variables, nonlinearities, measurement errors and unpredictable effects.
3. (a) Though the estimates will vary, if we repeat the trial a large number of times, the average of the estimates will be the true population parameter. For the regression this means that the average of the estimated relations from repeated trials will be the population regression function on (1).
   (b) We need assumptions (3.2), (3.3) and (3.4) in the book.
   (c) The assumption that $E(u_t) = 0$ is not likely to hold since u_t captures the effects of important omitted variables such as size of the family and the age of children, these affects are not likely to be zero.
4. (a) Since you are looking at two well specified opinions, from the statement we know that this is a one-tailed test.

$$H_0 : \beta = 5 \quad H_1 : \beta < 5. \quad (2)$$

   (b) The test statistic is given by:

$$t_c = \frac{\hat{\beta} - 5}{s_{\hat{\beta}}} = \frac{3.880186 - 5}{0.112125} = 9.987$$

   Because the alternative hypothesis is one-sided, we use a one-tailed test with $18 = n - 2$ d.f. The critical value, with $a = 5\%$ is 1.734. Since $|t_c| > 1.734$, then we reject the null hypothesis.
   (c) the conclusion is that the observed estimate of β is significantly lower than 5.
   (d) For a 95% interval we need $t^*_{18}(0.025) = 2.101$. The interval is given by $\hat{\beta} \pm (t^* s_{\hat{\beta}})$ or (3.645,4.116).
5. (a) OLS is BLUE, the maximum liokelihood would not give us better results (actually it will give the same results).

(b) Yes, as we said earlier size of the family and age of the children can affect the variable *lins*. Also, wealth or asset position of the family would be important (the wealthier the family, the less need for life insurance).

3.23

1. If income is zero, tipically the family will receive earned income credit which is like a negative tax, so the constant term makes sense. The positive sign of the coefficient on income also makes sense since the higher the income the higher the income tax.
2. An increase of one billion dollars[1] in total income is expected to increase the tax, on average, by 142 milion dollars.
3. For the constant term the null hypothesis is $H_0 : \alpha = 0$ and the alternative is $H_1 : \alpha \neq 0$. Similar for β. Because the p-value for the income coefficient is lower that 5%, the coefficient is significantly lower than zero. However, the intercept is not.

3.27

1. Over 80% of the variation in salary is unexplained by the tuition charge by the business school. The salary would depend on the quality of the training, the placement, the school's reputation, etc.
2. The null hypothesis is that a particular coefficient is zero and the alternative is that it is different from zero. Under the null hypothesis, they have a t distribution with n-2=23 d.f., at 10% significance $t^*_{23}(0.05) = 1.714$. For the constant term $t_c = 11.101/12.03 = 0.922$, then we fail to reject the null hypothesis; that is it is not significantly different from zero. For the coefficient on tuition, $t_c = 1.433/0.562 = 2.55$, since $t_c > t^*$, the we reject the null and say that it is significantly different from zero.
3. The coefficient for tuition stays the same but the constant and it's sample s.d. are multiplied by 1000. The value of R^2 is also unchanged.

[1] As used in the US, that is one thousand million dollars.