

## EE325 STATA session III

### Multiple regression and Dummy variables

1. **(Class example) Table 9.1** Public school teachers' salaries (Dollars) by geographical region. Consider and estimate the following model with the dummy variable:

$$Y_i = \beta_1 + \beta_2 D_{2i} + \beta_3 D_{3i} + u_i$$

Where  $Y$  = (average) salary of public school teacher in state  $i$

$D_{2i}$  = 1 if the state is in the Northeast or North Central = 0 otherwise

$D_{3i}$  = 1 if the state is in the South = 0 otherwise

$t$  = time

$D$  = 1 for observations in 1970-1981

= 0 otherwise

Find the mean salary of public school teacher in the South and the mean salary of public school teacher in the Northeast or North Central.

2. **(Class example) Table 8.9** Savings and Personal Disposable income (billions of dollars), United States, 1970-1995.

a) Given the data in the table, estimate the following linear savings function using personal disposable income

$$\text{Time period 1970-1981: } Y_t = \lambda_1 + \lambda_2 X_t + u_{1t} \quad n_1 = 12$$

$$\text{Time period 1982-1995: } Y_t = \gamma_1 + \gamma_2 X_t + u_{2t} \quad n_2 = 14$$

$$\text{Time period 1970-1995: } Y_t = \alpha_1 + \alpha_2 X_t + u_{3t} \quad n_1 + n_2 = 26$$

b) On the basis of the Chow test that there was a difference in the regression of savings on income between the two periods. Consider and estimate the following model with the dummy variable:

$$Y_t = \alpha_1 + \alpha_2 D_t + \beta_1 X_t + \beta_2 (D_t X_t) + u_t$$

Where Y = Savings

X = Personal disposable income

t = time

D = 1 for observations in 1982-1995

= 0 otherwise

- i. Test the coefficients individually statistically significant at the 5 percent level? From this test, how would you describe the difference in the two regressions (coincident regression, parallel regression, concurrent regression, dissimilar regression)?
- ii. Write down the mean personal savings function for 1970-1981 and the mean personal savings function for 1982-2005.

3. (Class example) Table 9.4 U.S. refrigerator sales over the sample period

$$Y_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + u_t \quad (1)$$

$$Y_t = \beta_1 + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + u_t \quad (2)$$

Where  $Y$  = Sales of refrigerators (in thousands)

$D = 1$  for relevant quarter

$= 0$  otherwise

4. (Class participation credit) Table 9.3 U.S. Dishwasher sales over the sample period

$$Y_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + u_t \quad (1)$$

$$Y_t = \beta_1 + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + u_t \quad (2)$$

Where  $Y$  = Sales of dishwasher (in thousands)

$D = 1$  for relevant quarter

$= 0$  otherwise

5. (Class participation credit) Table 9.7 provides data on a sample of 114 workers in an industrial town in southern India in 1990. The variables are defined as follows:

$WI$  = weekly wage income in rupees

$Age$  = age in years

$D_{sex} = 1$  for male workers and 0 for female workers

$DE_2$  = a dummy variable taking a value of 1 for workers with an education level up to primary

$DE_3$  = a dummy variable taking a value of 1 for workers up to a secondary level of education

$DE_4$  = a dummy variable taking a value of 1 for workers with higher than secondary education

$DPT$  = a dummy variable taking a value of 1 for workers with permanent jobs and a value of 0 for temporary workers

We estimate the following regression model:

$$\ln WI_i = \beta_1 + \beta_2 AGE_i + \beta_3 D_{sex} + \beta_4 DE_2 + \beta_5 DE_3 + \beta_6 DE_4 + \beta_7 DPT + u_i \quad (1)$$

$$\ln WI_i = \lambda_1 + \lambda_2 AGE_i + \lambda_3 D_{sex} + \lambda_4 DE_2 + \lambda_5 DE_3 + \lambda_6 DE_4 + \lambda_7 D_{sex} DE_2 + \lambda_8 D_{sex} DE_3 + \lambda_9 D_{sex} DE_4 + \lambda_{10} DPT + u_i \quad (2)$$

$$\ln WI_i = \gamma_1 + \gamma_2 AGE_i + \gamma_3 D_{sex} + \gamma_4 D_{sex} DE_2 + \gamma_5 D_{sex} DE_3 + \gamma_6 D_{sex} DE_4 + \gamma_7 DPT + u_i \quad (3)$$

**6. (Class example) Table 10.5 Consumption expenditure in relation to income and wealth.**

- a) Regress consumption expenditure on income and wealth and interpret your regression.
- b) Is there evidence of multicollinearity in the data? How do you know?
- c) Compute the variance inflation factor and explain.
- d) If there is the multicollinearity problem, what remedial action, if any, would you take?

**7. (Class participation credit) Table 10.7 Consumption Function for United States, 1947-2000.**

- a) Regress consumption expenditure on real disposable personal income and real wealth and real interest, interpret your regression.
- b) Is there evidence of multicollinearity in the data? How do you know?
- c) Compute the correlations and variance inflation factor and explain.
- d) If there is the multicollinearity problem, what remedial action, if any, would you take?