HSE and University of London Double Degree Programme in Data Science and Business Analytics

Elements of Econometrics, 2023-2024

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Class 7: Dummy variables.

Problem 1
Let the regression equation be
$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \epsilon_i$
Number of observations equals to 20
Outline briefly how would you test:
(d) $\beta_1 = \beta_2$
(e) $\beta_1 + \beta_2 = 1$
(f) $\beta_1 + \beta_2 = 1$ against $\beta_1 + \beta_2 < 1$

Problem 2
Show that test for significance is actually F-test with naive restricted model (model on a constant term).

Problem 3
Discuss how to test

(a) change in intercept

(b) change in slope

(c) change in both slope and intercept

Problem 4
Show that Chow test is equal to F-test for linear restrictions.

Problem 5

A researcher investigates the market of private math tutors in Moscow, with particular interest to those who can also teach in English. He took a random sample of 30 profiles of tutors who provide private teaching in math and run some regressions trying to find factors influencing the prices of teaching (P_i - price of a standard two-hour lesson in thousands of roubles, D_i - distance in the number of metro stations from the center of Moscow to the teacher's place, H_i - dummy variable indicating if the tutor can visit the client, E_i - dummy variable indicating ability to teach the subject in English):

(1) $\hat{P}_i = 6.59 - 0.16D_i$, $R^2 = 0.185$
      (0.49)   (0.06)

(2) $\hat{P}_i = 4.51 + 2.54H_i$, $R^2 = 0.4$
      (0.4)   (0.58)

(3) $\hat{P}_i = 5.31 - 0.08D_i + 1.95H_i + 0.07D_i * H_i$, $R^2 = 0.437$
      (0.64)   (0.06)   (0.95)   (0.07)

(4) $\hat{P}_i = 4.52 - 0.08D_i + 2.18H_i + 1.58E_i - 0.39H_i * E_i$, $R^2 = 0.553$
      (0.61)   (0.06)   (0.75)   (0.7)   (1.09)

(a) Interpret and compare the results of all 4 estimated models. What is the difference in the meaning and in the assumptions (explicit or implicit) used for equation (3) compared to equation (1)?

(b) Is equation (3) significant? Is factor "distance" (the variables D_i and $D_i * H_i$ taken together) significant in equation (3)? Is factor "teaching at student's place" (the variables H_i and $D_i * H_i$ taken together) significant in equation (3)? Are all dummy variables taken together in equation (4) significant?

(c)   Another approach to the analysis of influence of qualitative factors is Chow test. Explain how you will do Chow test for the analysis of the influence of the place of teaching. Can you predict the result of this test? Explain how you will do Chow test for the analysis of the influence of both the place of teaching and ability to teach in English. Write the equation that allows to do F-test for restrictions that is equivalent to the last of the two Chow tests.