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

Elements of Econometrics, 2023-2024

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Class 9: Variable transformation

Problem 1

Interpret the coefficients in the following models:

(a) $y_i = \beta_0 + \beta_1 x_i + \epsilon_i$

(b) $\log(y)_i = \beta_0 + \beta_1 \log(x)_i + \epsilon_i$

(c) $y_i = \beta_0 + \beta_1 \log(x)_i + \epsilon_i$

(d) $\log(y)_i = \beta_0 + \beta_1 x_i + \epsilon_i$

Problem 2

Show that for a model with a dummy variable

$y_i = \beta_0 + \beta_1 x_i + \beta_2 d_i + \epsilon_i$

the percent change associated with switching from 0 to 1 is $100 \cdot (e^{\beta_2} - 1)$.

Problem 3

Interpret the coefficients in the following models:

(a) $y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 \epsilon_i$

(b) $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{1i} x_{2i} + \epsilon_i$

Problem 4

A researcher studies the dependence of the prices on the paintings (in thousands of dollars) on various factors, in particular on the "age" of the painting Age_i (in decades from the current year to the year of creation of the piece of art) and on the size of the canvas S_i (in square feets). She collected data on 19 paintings sold at a certain auction to estimate equation (1)

$$(1) \widehat{P}_i = \underset{(0.57)}{2.35} - \underset{(0.011)}{0.028} Age_i + \underset{(0.02)}{0.037} S_i, R^2 = 0.325, \qquad RSS = 0.417$$

(a)   Give the interpretation to all coefficients of this equation.

(b)   The supervisor advised the student to take into account also the availability of the provenance (a history of possession of an artwork, confirming the authenticity of the object) – score from 0 to 10. The researcher estimates two additional equations (2), (3)

$$(2) \widehat{P}_i = \underset{(0.71)}{0.87} - \underset{(0.016)}{0.062} Age_i + \underset{(0.024)}{0.02} S_i + \underset{(0.13)}{0.36} PV_i, R^2 = 0.554, \qquad RSS = 0.276$$

and

$$(3) \widehat{P}_i = \underset{(0.75)}{-0.097} - \underset{(0.017)}{0.085} Age_i + \underset{(0.025)}{0.11} S_i + \underset{(3.55)}{2.69} PV_i - \underset{(0.05)}{0.07} PV_i Age_i - \underset{(0.14)}{0.08} PV_i S_i, R^2 = 0.691, RSS = 0.191$$

What is the difference in interpretation of coefficients of the equations (1), (2), (3)? Is provenance significant according (2) and (3)?