Bergische Universität Wuppertal

Wirtschaftswissenschaft

Schumpeter School of Business and Economics

Self Test

for Master Programme

"Applied Economics" - Empirical Analysis Track

1 Data

a) A study that investigates the inflation rate in the U.S. between 1960 and 2019 is an example for a study using

- ☐ time-series data.
- ☐ cross-sectional data.
- ☐ panel data.

b) A study that investigates differences in the unemployment across U.S. states in January 2017 is an example of the analysis of:

- ☐ time-series data.
- ☐ cross-sectional data.
- ☐ panel data.

2 Regression: Interpretation #1

Consider the results of a regression of the hourly wage rate (wage; in Euro) on a binary explanatory variable (health; 1=health problems; 0=no health problems):

$$\text{wage} = 12.8 - 0.9 \cdot \text{health}$$

Which statement is correct?

☐ Persons without health problems earn on average 12.8 Euro.

☐ Persons with health problems earn 9% less than persons without health problems.

☐ The estimated wage difference between persons with and without health problems is 12.8 Euro.

3 Regression: Interpretation #2

Consider the results of a regression of monthly income (measured in 1000 Euro) (salary) on the number of years of education (educ):

$$\text{salary} = 0.5 + 0.2 \cdot \text{educ}$$

Which statement is correct?

☐ Average income without education is 0.5 Euro.

☐ Average income increases by 0.2 Euro if years of education increase by one year.

☐ Average income for a worker with two years of education is 900 Euro.

4 Multivariate regression: Interpretation

Consider the results of a regression of birth weight of newborns (in gram) (bw) on the number of cigarettes smoked by the mother during pregnancy per day (cigs) and the mother's years of education (educ):

$$\text{bw} = 3200 - 12 \cdot \text{cigs} + 15 \cdot \text{educ}$$

Which statement is correct?

☐ With an additional year of education average birth weight is larger by 15 gram.

☐ Newborns of non-smoking mothers with 10 years of education have on average a birth weight that is 15 gram larger than newborns of smoking mothers with 10 years of education.

- ☐ Newborns of non-smoking mothers with 10 years of education have on average a birth weight that is 15 gram larger than newborns of non-smoking mothers with 9 years of education.

- ☐ Education has a stronger influence on the birth weight of newborns than smoking.

5 Regression: Interaction terms

Consider the regression of the wage rate (wage) on two binary explanatory variables - gender (female) and marital status (married) – as well as an interaction term:

$$\text{wage} = a + b \cdot \text{female} + c \cdot \text{married} + d \cdot \text{female} \cdot \text{married}$$

The interaction term...

- ☐ allows that estimated wage differences by marital status can differ by gender.
- ☐ is not meaningful, since it is 0 for all men.
- ☐ shows the effect of marital status on the wage rate.

6 Regression: changes in the scaling of variables

Consider a simple linear regression model $Y_i = \beta_0 + \beta_1 X_i + U_i$, for $i = 1, \ldots, 100$, where Y_i is measured in hundreds of kilograms and X_i is measured in Euro. The model parameters are estimated via ordinary least squares. The corresponding estimates are denoted by $\hat{\beta}_0$ and $\hat{\beta}_1$ and the goodness of fit is measured via the regression R^2.

a) Which of the statements with respect to $\hat{\beta}_0$, $\hat{\beta}_1$ and the R^2 are correct in the following situation: measuring X in thousands of Euro instead of in Euro and re-estimating the model via ordinary least squares will

- ☐ yield the same estimate of β_0.
- ☐ yield an estimate of β_0 that is equal to $1000 \cdot \hat{\beta}_0$.
- ☐ yield the same estimate of β_1.
- ☐ yield an estimate of β_1 that is equal to $0.001 \cdot \hat{\beta}_1$.

- ☐ yield an estimate of β_1 that is equal to $1000 \cdot \hat{\beta}_1$.
- ☐ increase the R^2 by 0.0001 percent.
- ☐ yield the same R^2.

b) Which of the statements with respect to $\hat{\beta}_0$, $\hat{\beta}_1$ and the R^2 are correct in the following situation: measuring Y in tons instead of in hundreds of kilograms and re-estimating the model via ordinary least squares will

- ☐ yield the same estimate of β_0.
- ☐ yield an estimate of β_0 that is equal to $0.01 \cdot \hat{\beta}_0$.
- ☐ yield the same estimate of β_1.
- ☐ yield an estimate of β_1 that is equal to $0.1 \cdot \hat{\beta}_1$.
- ☐ yield an estimate of β_1 that is equal to $10 \cdot \hat{\beta}_1$.
- ☐ decrease the R^2 by 1 percent.
- ☐ yield the same R^2.

7 Hypothesis Testing: probability of type I and type II error

Suppose you perform a one-sided hypotheses test using a significance level of 5 percent.

a) Which of the following statements is correct: if the null hypothesis is not rejected, then

- ☐ the probability that the null hypothesis is false is 95%.
- ☐ the probability that the null hypothesis is false is 5%.
- ☐ the probability that the null hypothesis is false is at most 95%.
- ☐ the probability that the null hypothesis is false is at least 5%.
- ☐ the probability that the null hypothesis is false is unknown.

b) Which of the following statements is correct: if the null hypothesis is rejected, then

☐ the probability that the null hypothesis is true is 95%.

☐ the probability that the null hypothesis is true is 5%.

☐ the probability that the null hypothesis is true is at most 5%.

☐ the probability that the null hypothesis is true is at least 95%.

☐ the probability that the null hypothesis is true is unknown.

8 Hypothesis Testing: test decision

Suppose you perform a one-sided hypotheses test, i.e. the hypotheses are $H_0 : \mu \leq a$ against $H_1 : \mu > a$, where a is an arbitrary constant. Under the null hypothesis the test statistic is standard normally distributed. Based on a random sample, the value of the test statistic is computed and is given by $z^* = 1.877$. Using a 5%-significance level, the test decision is:

☐ reject the null hypothesis.

☐ do not reject the null hypothesis.

☐ no test decision possible.

9 General statistics

Which of the following statements are correct?

☐ Any consistent estimator is also unbiased.

☐ The length of a 95%-confidence interval for a parameter θ depends on the point estimate of this parameter, $\hat{\theta}$.

☐ The length of a 95%-confidence interval for a parameter θ depends on the size of the sample that is used to estimate the confidence interval.

☐ Consider two random variables Y with mean $E(Y) = \mu_Y$ and Z with $E(Z) = \mu_Z$. Then, it holds for the random variable $X = a + b \cdot Y + c \cdot Z$, with a, b, and c being constant, that $E(X) = a + b \cdot \mu_Y + c \cdot \mu_Z$.

☐ Consider two random variables Y with variance $Var(Y) = \sigma_Y^2$ and Z with $Var(Z) = \sigma_Z^2$ and covariance $Cov(Y, Z) = \sigma_{Y,Z}$. Then, it holds for the random variable $X = a + b \cdot Y + c \cdot Z$, with a, b, and c being constant, that $Var(X) = b^2 \cdot \sigma_Y^2 + c^2 \cdot \sigma_Z^2 + 2 \cdot b \cdot c \cdot \sigma_{Y,Z}$.

10 Cobb Douglas

Assume a firm operates under perfect competition. The production function is Cobb-Douglas:

$$F(K, L) = K^{\alpha} L^{1-\alpha}, \qquad \text{with } 0 < \alpha < 1$$

where K denotes capital and L labor.

a) The marginal product of capital MPK is

$$MPK = \frac{\partial F(K, L)}{\partial K} = \alpha \cdot K^{\alpha-1} L^{1-\alpha}.$$

○ Correct

○ Incorrect

b) The marginal product of labor MPL is

$$MPL = \frac{\partial F(K,L)}{\partial L} = (1-\alpha) \cdot K^{\alpha} L^{-\alpha}.$$

○ Correct

○ Incorrect

c) The marginal productivities can be written as:

$$\begin{aligned} MPK &= \alpha \cdot (Y/K), \\ MPL &= (1-\alpha) \cdot (Y/L), \end{aligned}$$

where Y denotes production, $Y = F(K,L) = K^{\alpha} L^{1-\alpha}$.

○ Correct

○ Incorrect

11 CRRA utility

Consider a utility function with constant elasticity of marginal utility of consumption:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}, \qquad \sigma > 0.$$

a) The first derivative is

$$u'(c) = c^{-\sigma} > 0.$$

○ Correct

○ Incorrect

b) The second derivative is

$$u''(c) = -\sigma c^{-\sigma-1} < 0.$$

◯ Correct

◯ Incorrect

c) The elasticity of the marginal utility of consumption with respect to consumption is

$$\frac{\partial u'(c)}{\partial c}\frac{c}{u'(c)} = \frac{u''(c)c}{u'(c)} = \frac{-\sigma c^{-\sigma-1}c}{c^{-\sigma}} = -\sigma.$$

◯ Correct

◯ Incorrect

12 Consumer choice

A consumer has to decide between two consumption goods, A and B. The utility function of the consumer is:

$$u(c_A, c_B) = \varphi \cdot \ln(c_A) + (1-\varphi) \cdot \ln(c_B), \qquad 0 < \varphi < 1.$$

Goods prices are $P_A = 2$ and $P_B = 1$. Household income is 10.

a) The Lagrange function for the optimization problem is

$$\mathcal{L} = \varphi \cdot \ln(c_A) + (1-\varphi) \cdot \ln(c_B) + \lambda \cdot (10 - 2 \cdot c_A - c_B),$$

where λ denotes a shadow price.

○ Correct

○ Incorrect

b) The first-order conditions are:

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial c_A} &= \frac{\varphi}{c_A} - 2 \cdot \lambda \overset{!}{=} 0, \\ \frac{\partial \mathcal{L}}{\partial c_B} &= \frac{1-\varphi}{c_B} - \lambda \overset{!}{=} 0, \\ \frac{\partial \mathcal{L}}{\partial \lambda} &= 10 - 2 \cdot c_A - c_B \overset{!}{=} 0.\end{aligned}$$

◯ Correct

◯ Incorrect

13 Small Open Economy

a) Consider a small open economy. Notation:

Y : GDP
I : investment (incl. inventory)
G : government expenditures
NFA : net foreign asset holdings
T : tax revenues
S : private savings

a) Δ denotes the time-difference operator, i.e., $\Delta NFA = NFA_{t+1} - NFA_t$, and t denotes time. Domestic private savings S in the small open economy are given by:

- ○ $S = I + G - T$
- ○ $S = I + G - T + \Delta NFA$
- ○ $S = \Delta NFA$

b) Assume that prices of assets are constant. Consider the statement: *A positive current account implies an increase in net foreign assets*.

Correct or incorrect?

◯ Correct

◯ Incorrect