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

\[
salary = 0.5 + 0.2 \cdot educ
\]

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 \((educ)\):

\[
bw = 3200 - 12 \cdot cigs + 15 \cdot educ
\]

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 $\beta_0$.
- [ ] yield an estimate of $\beta_0$ that is equal to $1000 \cdot \hat{\beta}_0$.
- [ ] yield the same estimate of $\beta_1$.
- [ ] yield an estimate of $\beta_1$ that is equal to $0.001 \cdot \hat{\beta}_1$. 


yield an estimate of $\beta_1$ that is equal to $1000 \cdot \hat{\beta}_1$.

can increase the $R^2$ by 0.0001 percent.

can 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 \( \beta_0 \).
- □ yield an estimate of \( \beta_0 \) that is equal to \( 0.01 \cdot \hat{\beta}_0 \).
- □ yield the same estimate of \( \beta_1 \).
- □ yield an estimate of \( \beta_1 \) that is equal to \( 0.1 \cdot \hat{\beta}_1 \).
- □ yield an estimate of \( \beta_1 \) 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.
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 \( \theta \) depends on the point estimate of this parameter, \( \hat{\theta} \).

☐ The length of a 95%-confidence interval for a parameter \( \theta \) 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:

\[ F(K, L) = K^\alpha L^{1-\alpha}, \quad \text{with } 0 < \alpha < 1 \]

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:

$$MPK = \alpha \cdot (Y/K),$$

$$MPL = (1 - \alpha) \cdot (Y/L),$$

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:

\[ u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}, \quad \sigma > 0. \]

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:

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

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 $\lambda$ denotes a shadow price.

○ Correct

○ Incorrect
b) The first-order conditions are:

\[
\frac{\partial \mathcal{L}}{\partial c_A} = \frac{\varphi}{c_A} - 2 \cdot \lambda \overset{!}{=} 0, \\
\frac{\partial \mathcal{L}}{\partial c_B} = \frac{1 - \varphi}{c_B} - \lambda \overset{!}{=} 0, \\
\frac{\partial \mathcal{L}}{\partial \lambda} = 10 - 2 \cdot c_A - c_B \overset{!}{=} 0.
\]

○ Correct

○ Incorrect
13 Small Open Economy

a) Consider a small open economy. Notation:

\[ Y : \text{GDP} \quad NFA : \text{net foreign asset holdings} \]
\[ I : \text{investment (incl. inventory)} \quad T : \text{tax revenues} \]
\[ G : \text{government expenditures} \quad S : \text{private savings} \]

\[ \Delta \] 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