Econometrics - 2022. Mid-term exam, November 1

Part 1. (30 minutes). In each of 12 multiple choice tests indicate the correct answer. One point is given for the correct answer, penalty of 0.25 points is given for an incorrect one.

1. The significance level of a test is:

   1) The probability of rejecting the null hypothesis when it is false;
   2) One minus the probability of rejecting the null hypothesis when it is false;
   3) The probability of rejecting the null hypothesis when it is true;
   4) One minus the probability of rejecting the null hypothesis when it is true;
   5) None of the above.

2. Which of the following correctly identifies a property of logarithmic transformation of variables?
   1) Taking logarithms usually expands the range of variables;
   2) Taking logarithms allows to relate in different combinations the absolute and relative changes of variables;
   3) Logarithmic regressions give usually more precise estimates;
   4) Logarithmic regressions are sensitive to the units of variables' measurement;
   5) Taking logarithms may be applied under any range of the variables.

3. The Simple Linear Regression Model is $Y_i = \beta_1+\beta_2 X_i + u$, X_i are non-stochastic, and Gauss-Markov conditions are satisfied. The estimators of β_2 coefficient: $b_{2i} = \dfrac{Y_i - \bar{Y}}{X_i - \bar{X}}$ are:

   1) Unbiased for any i;
   2) Biased for any i;
   3) May be biased or unbiased, depending on i;
   4) More precise than the OLS estimator;
   5) Are not the estimators of β_2.

4. For the Model $Y_i = \beta_1+\beta_2 X_i + u$ (Gauss-Markov conditions satisfied), the following 2 estimators of β_2 are proposed: $b_2^1 = \dfrac{\bar{Y}}{\bar{X}}$, $b_2^2 = \dfrac{\sum X_i Y_i}{\sum X_i^2}$.

   The following is correct for these estimators:
   1) Both the estimators b_2^1 and b_2^2 are unbiased;
   2) Both the estimators b_2^1 and b_2^2 are biased;
   3) The estimator b_2^2 is unbiased, while b_2^1 is biased;
   4) The estimator b_2^1 is unbiased, while b_2^2 is biased;
   5) These are not the estimators of β_2 .

5. A student added extra explanatory variable to the multiple linear regression model. As a result, the determination coefficient went up, and the adjusted determination coefficient went up too. What of the following can be stated:

1) The new explanatory variable's coefficient is significant at the 1% level;
2) The new explanatory variable's coefficient is significant at the 5% level;
3) The t-statistic for the hypothesis of equality of the new explanatory variable's coefficient to zero is less than -1;
4) The t-statistic for the hypothesis of equality of the new explanatory variable's coefficient to zero is greater than 1;
5) The t-statistic for the hypothesis of equality of the new explanatory variable's coefficient to zero is less than -1 or greater than 1;

6. For a linear regression model without intercept $Y_i = \beta X_i + u_i$, estimated as $Y_i = bX_i + e_i$ using OLS ($\hat{Y}_i = bX_i$), the following is always correct:

1) $\sum_{i=1}^{n} u_i = 0$; 2) $\sum_{i=1}^{n} e_i = 0$; 3) $TSS = ESS + RSS$;

4) $\bar{Y} = \bar{\hat{Y}}$; 5) None of the above.

7. Two multiple linear regression models have been fitted for the same sample:

$$Y = \beta_1 + \beta_2 X_2 + ... + \beta_k X_k + \beta_{k+1}(X_{k+1} + ... + X_m) + u, \quad (1)$$

$$Y = \beta_1 + \beta_2 X_2 + ... + \beta_k X_k + \beta_{k+1} X_{k+1} + ... + \beta_m X_m + u, \quad (2)$$

with sums of squared residuals SSR_1 and SSR_2 respectively. The statistic $F(m-k-1, n-m) = \frac{(SSR_1 - SSR_2)/(m-k-1)}{SSR_2/(n-m)}$ has F-distribution with $(m-k-1, n-m)$ degrees of freedom under the null hypothesis

1) $H_0 : \beta_2 = \beta_3 = ... = \beta_m = 0$;
2) $H_0 : \beta_2 = ... = \beta_k$;
3) $H_0 : \beta_{k+1} = \beta_{k+2} = ... = \beta_m = 0$;
4) $H_0 : \beta_{k+1} = \beta_{k+2} = ... = \beta_m$;
5) None of the above.

8. Imposing three linear restrictions on parameters in a regression model, estimated using OLS

1) results in minor increase of the sum of squares of deviations if at least one of the restrictions is valid;
2) results in significant increase of the sum of squares of deviations if at least one of the restrictions is valid;
3) results in significant increase of the sum of squares of deviations if at least one of the restrictions is invalid;
4) results in significant increase of the sum of squares of deviations only if all three restrictions are invalid;
5) all the above is incorrect.

9. A student did estimate the production function $y=\gamma+\alpha k+\beta l+u$ (1) , where y is the output growth rate, k is the capital growth rate, and l is the labour growth rate. Then he decided to estimate the function $y\text{-}k\text{-}l=\lambda+\rho(k\text{-}l)+u$ (2) considering it as a restricted version of (1). Then:

1) The model (2) is a restricted version of (1) with one restriction $\alpha=\beta$;

2) The model (2) is a restricted version of (1) with one restriction α+β=1 ;
3) The model (2) is a restricted version of (1) with one restriction α+β=2 ;
4) The model (2) is a restricted version of (1) with two linear restrictions;
5) The model (2) is not a restricted version of (1).

10. Using the data of a sample with 72 observations, a student has estimated two regressions:

$\widehat{Y} = 1.5 + 0.64X$ and

$\widehat{X} = -7.4 + 1.44Y$

The correlation coefficient between X and Y equals:

1) 0.96; 2) 0.8; 3) -0.8; 4) -0.96 5) none of the above.

11. The models $Y_i = \beta_1 + \beta_2 X_i + u$ and $log Y_i = \beta_1 + \beta_2 X_i + u$ become comparable in terms of Sums of Squared Residuals if you transform the values of Y and X into Y^* and X^* using the formula:

1) $Y_i^* = Y_i \cdot$ geometric mean of Y; $X_i^* = X_i$;

2) $Y_i^* = Y_i$ / geometric mean of Y; $X_i^* = X_i$;

3) $Y_i^* = Y_i$ /mean of Y; $X_i^* = X_i$ /geometric mean of X;

4) $Y_i^* = Y_i$; $X_i^* = X_i$ /geometric mean of X;

5 The models are comparable in terms of *SSR* without any transformation.

12. The population variance of prediction error σ_{PE}^2 in the simple linear regression model is strictly proportional to:

1). $1/\sum_{i=1}^{n}(X_i - \overline{X})^2$ 2) $(X^* - \overline{X})^2$

3) the standard deviation of the disturbance term σ_u;
4) the population variance of disturbance term σ_u^2;
5) none of the above.