The International College of Economics and Finance
Econometrics - 2021. October 21 Mid-Term.

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. Having a sample with data for variables X and Y, a student has estimated consequently two simple regressions, X on Y and Y on X. For these two regressions, generally speaking:
   1) R^2 values are the same while RSS values are different;
   2) RSS values are the same while R^2 values are different;
   3) the values of RSS and R^2 are the same;
   4) the values of RSS and R^2 are different;
   5) all the above is incorrect.

2. A researcher has observed data of three economic variables, y, x_1 and x_2, and he considers three hypotheses: (a) y depends on x_1 and x_2, without an intercept; (b) y depends only on x_1, with an intercept, and (c) y depends only on x_2, with an intercept. After the estimation of these three models, the values of RSS were equal to RSS_a, RSS_b and RSS_c respectively. Which of the following statements is correct?
   1) $RSS_a > \max\{RSS_b, RSS_c\}$
   2) $RSS_a > RSS_b + RSS_c$,
   3) $RSS_a < \min\{RSS_b, RSS_c\}$
   4) $RSS_a < RSS_b + RSS_c$,
   5) RSS_a can be greater or less than $RSS_b + RSS_c$

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

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

4. The following semi-logarithmic model is estimated: $Y = \beta_1 + \beta_2 \log X_2 + u$. Interpretation of the coefficient β_2 is the following:
   1) If X_2 increases by one unit then Y increases approximately by $100\beta_2$ per cent;
   2) If X_2 increases by one unit then Y increases approximately by $\beta_2/100$ per cent;
   3) If X_2 increases by one per cent then Y increases approximately by $100\beta_2$ units;
   4) If X_2 increases by one per cent then Y increases approximately by $\beta_2/100$ units;
   5) If X_2 increases by one per cent then Y increases approximately by β_2 units.

5. The population covariance of the OLS intercept and slope coefficient's estimators in the Simple Linear Regression model $\text{cov}(\hat{\beta}_1, \hat{\beta}_2)$:

1) Has always the same sign as the mean value of the explanatory variable $\overline{X}$;
2) Has always the opposite sign than mean value of the explanatory variable $\overline{X}$;
3) It may have the same or opposite sign than the mean value of the explanatory variable;
4) It does not depend on the mean value of the explanatory variable;
5) It is always negative.

6. A student did estimate the linear function $y=\mu+\alpha z+\beta w+\gamma v+u$ (1) . Then he decided to estimate the function $y\text{-}w\text{-}2v=\mu+\alpha z+u$ (2) considering it as a restricted version of (1). Then:

1) The model (2) is a restricted version of (1) with one restriction $\gamma=2\beta$;
2) The model (2) is a restricted version of (1) with one restriction $\beta+2\gamma=1$;
3) The model (2) is a restricted version of (1) with two restrictions $\beta=0$ and $\gamma=0$;
4) The model (2) is a restricted version of (1) with two restrictions $\beta=1$ and $\gamma=2$;
5) The model (2) is not a restricted version of (1).

7.On the data of 43 observations, Cobb-Douglas production functions (1) and (2) were estimated:

$$\ln Y = \beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + u \qquad (1)$$
$$\ln Y = \beta_0 + \beta_1 (\ln L_i + \ln K_i) + u \qquad (2)$$

The R^2 *(*determination coefficients) for these models are 0.8 in (1) and 0.6 in (2) respectively. *F* – statistic for testing the hypothesis $\beta_1=\beta_2$ in (1) equals

1) 10; 2) 20; 3) 32; 4) 40; 5) R^2 in (2) can not be less than in (1).

8. A dependence between *EDUC* (aggregate expenditure on education), *GDP* (gross domestic product, and *N* (the population of the age below 25) is under investigation. Two specifications given below are being estimated for the sample of 65 countries in 2020.

(1) $$\log E\hat{D}UC = \hat{\alpha}_{11} + \hat{\alpha}_{12} \log GDP + \hat{\alpha}_{13} \log N$$

(2) $$\log\left(\frac{E\hat{D}UC}{N}\right) = \hat{\alpha}_{21} + \hat{\alpha}_{22} \log GDP + \hat{\alpha}_{23} \log N$$

The following statement is **incorrect** about these models:

1) $RSS_1=RSS_2$ 2) $R^2_1= R^2_2$; 3) $\hat{\alpha}_{11} = \hat{\alpha}_{21}$; 4) $\hat{\alpha}_{12} = \hat{\alpha}_{22}$; 5) none of the above.

9. The models $Y_i = \beta_1 + \beta_2 X_i + u$ and $logY_i = \beta_1 + \beta_2 X_i + u$ become comparable in terms of Residual Sums of Squares if you transform the values of X into X^* using the formula:

1) $X_i^* = X_i$ / geometric mean of X; 2) $X_i^* = X_i$ / mean of X;

3) The models are comparable in terms of *RSS* without any transformation;

4) not just X_i, but also Y_i should be transformed to make the models comparable in terms of *RSS;*

5) it does not matter if X_i are transformed; Y_i should be transformed to make the models comparable in terms of *RSS.*

10. You have the linear regression model $\boldsymbol{Y = \beta_1 + \sum_{j=2}^{k} \beta_j X_j + u}$ estimated as $\hat{Y} = b_1 + \sum_{j=2}^{k} b_j X_j$

The Ramsey RESET test for nonlinearity assumes that

1) Any non-linear regression of Y on Xs is estimated;
2) Quadratic regression of Y on Xs is estimated;
3) Some power functions of $\hat{Y}$ are added to the original model as regressors;
4) The dependent variable is transformed as $Y_i^* = Y_i$ / geometric mean of Y;
5) None of the above.

11. If Theil U_2 coefficient $U_2 = \sqrt{\frac{\frac{1}{h}\sum(\hat{Y}_{T+p} - Y_{T+p})^2}{\frac{1}{h}\sum(Y_{T+p} - Y_{T+p-1})^2}}$ is greater than 1, then the forecast $\hat{Y}_t$ is:

1) Better than the "naïve" forecast $Y^*_{T+p}=0$;
2) Worse than the "naïve" forecast $Y^*_{T+p}=0$;
3) Better than the "naïve" forecast $Y^*_{T+p}=Y_{T+p-1}$;
4) Worse than the "naïve" forecast $Y^*_{T+p}=Y_{T+p-1}$;
5) This is not the U_2 but the Theil Inequality coefficient.

12. The ratio of the standard error of the prediction error and the standard error of regression:

1) Is always less than 1; 2) Is always greater than 1; 3) Can be less, greater or equal to 1;
4) can be negative, positive, or equal to 0; 5) can not be calculated.