The International College of Economics and Finance
Econometrics - 2020. Mid-term exam, October 22

Part 1. (30 minutes). In each of 12 multiple choice tests indicate the correct answer.

1. In the Simple Linear Regression Model $Y_i = \beta_1 + \beta_2 X_i + u_i$ the population covariance of the OLS estimators of the intercept and slope coefficient $cov(b_1, b_2)$ is

1) positive if the mean value of X is positive;
2) negative if the mean value of X is positive;
3) may be positive or negative if the mean value of X is positive;
4) may be positive or negative if the mean value of X is negative;
5) does not depend on the mean value of X.

2. For the Model $Y_i = \beta_2 X_i + u$ (Model   A   assumptions   satisfied, $i=1,...,n$)   the   estimator

$$b_2 = \frac{((Y_1 + Y_2 + Y_3)/3) - \overline{Y}}{((X_1 + X_2 + X_3)/3) - \overline{X}} \quad \text{is:}$$

   1) non-linear estimator of β_2;   2) unbiased estimator of β_2;   3) efficient estimator of β_2;
   4) biased estimator of β_2;   5) not an estimator of β_2.

3. In a simple regression with an intercept $\overset{\cup}{Y} = b_1 + b_2 X$, the estimated slope coefficient b_2 is equal to zero. Then the determination coefficient R^2 is

1) Equal to one;
2) Not equal to 1 or 0;
3) In some situations can be negative;
4) Equal to zero
5) Can not be calculated for the model due to violation of assumptions.

4. If a new observation and a new explanatory variable are added in the Linear Regression Model, then for OLS-estimation, the following is true:
   1) The Residual Sum of Squares (*RSS*) decreases; the Determination Coefficient R^2 may increase, decrease or stay the same;
   2) The Residual Sum of Squares (*RSS*) increases; the Determination Coefficient R^2 may increase, decrease or stay the same;
   3) Both the Determination Coefficient R^2 and the Residual Sum of Squares (*RSS*) may increase, decrease or stay the same;
   4) The Determination Coefficient R^2 increases; the Residual Sum of Squares (*RSS*) may increase, decrease or stay the same;
   5) The Determination Coefficient R^2 decreases; the Residual Sum of Squares (*RSS*) may increase, decrease or stay the same;

5. Using a sample of 570 observations, the following earnings function has been estimated:
$\log(EARN) = -0.41 + 0.22\,ASVABC + 0.34\log(S)$ ($EARN$ – hourly earnings in Rubles, $ASVABC$ – abilities indicator, S – length of studies). For this earnings function, it can be said that if S increases for one per cent, then hourly earnings increase (on average, others equal) approximately for

0.34 Rubles;   2)   0.34%;   3)   34%;   4)   0.0034%;   5) 34 Rubles.

6. For the Model $Y_i = \beta_1 + \beta_2 X_i + u$ (Model   A   assumptions   satisfied)   the   estimator
$b_2 = \dfrac{\sum (Y_i - \bar{Y})}{\sum (X_i - \bar{X})}$ is, generally speaking:

1) biased and inconsistent estimator of β_2;
2) biased but consistent estimator of β_2;
3) unbiased but inefficient estimator of β_2;
4) equal to the OLS estimator;
5) can not be calculated;

7. Introduction of two linear restrictions on parameters in a regression model, estimated using OLS
1) results in minor increase of the sum of squared errors if at least one of the restrictions is not valid;
2) results in significant increase of the sum of squared errors if at least one of the restrictions is valid;
3) results in minor increase of the sum of squared errors if both restrictions are valid;
4) results in significant increase of the sum of squared errors only if both restrictions are valid;
5) all the above is incorrect.

8. Let $Y^* = \lambda_1 + \lambda_2 Y$. In a simple regression model, b^*_1 is the OLS estimator of the intercept in the regression of Y^* on X, and b_1 is the OLS estimator of the intercept in the regression of Y on X. Then the following is correct:

1) $b^*_1 = \lambda_1 + \lambda_2 b_1$; 2) $b^*_1 = b_1$; 3) $b^*_1 = b_1 * \lambda_2$; 4) $b^*_1 = \lambda_1 + b_1$; 5) none of the above.

9. There are (1) and (2) versions of the Multiple Regression Model:

$$Y = \beta_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + u \quad (1)$$

$$Y - X_4 = \beta_1 + \beta_2(X_2 + X_3) + u \quad (2)$$

The Model (2) is the Model (1) with the following restrictions:

1) $\beta_3=0$; $\beta_4=0$;   2) $\beta_2=\beta_3$; $\beta_4=1$;   3) $\beta_{2+}\beta_3=1$; $\beta_4=1$;   4) $\beta_2=\beta_3$; $\beta_4=0$;

5) The Model (2) is not a restricted version of the Model (1).

10. A student regressed *Y* and *log(Y)* on *X*, with the intercept (regressions 1 and 2 respectively). Then he did Zarembka scaling *Y*=Y/geometric mean of Y*, and regressed *Y** and *log(Y*)* on *X* (regressions 3 and 4). Then the following is correct:

1) All the coefficients' estimates, including the intercept, are the same in regression 3 as in regression 1;
2) All the coefficients' estimates, including the intercept, are the same in regression 4 as in regression 2;
3) All the coefficients' estimates, except the intercept, are the same in regression 3 as in regression 1;
4) All the coefficients' estimates, except the intercept, are the same in regression 4 as in regression 2;
5) None of the above.

11. The population variance of prediction error σ_{PE}^2
   1) is always greater than the population variance of disturbance term σ_u^2;
   2) is always less than the population variance of disturbance term σ_u^2;
   3) can be greater, less then or equal to the population variance of disturbance term σ_u^2;
   4) is always equal to the population variance of disturbance term σ_u^2;
   5) is not related to the population variance of disturbance term σ_u^2.

12. Root mean squared error of prediction $\sqrt{\sum_{t=T+1}^{T+h} (\hat{y}_t - y_t)^2 / h}$ is always

1) Greater or equal to the Mean absolute error of prediction $\sum_{t=T+1}^{T+h} |\hat{y}_t - y_t| / h$
2) Less or equal to the Mean absolute error of prediction;
3) May be greater or less than the Mean absolute error of prediction;
4) Equal to the Mean absolute error of prediction;
5) Can not be compared with the Mean absolute error of prediction since it has different dimensity.