The International College of Economics and Finance
Econometrics - 2018. Mid-term exam, October 25

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. If you have estimated the parameters of the following model using the OLS directly (Gauss-Markov conditions are satisfied),

   $y = \alpha + \beta_1 x_1 + \beta_2 x_2 + (\beta_1+\beta_3) x_3 + u$,

   then:

   1) you can get an unbiased estimate of β_3;
   2) you can not get an unbiased estimate of β_3, but can easily get a consistent estimate of it;
   3) you can not get an unbiased, or biased but consistent estimate of β_3;
   4) you can not get any estimate of β_3;
   5) none of the above.

2. 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. For the estimators of β_2 coefficient: $b_2 = \dfrac{Y_1 - \bar{Y}}{X_1 - \bar{X}}$ (1) and $b_2 = \dfrac{Y_1 + \bar{Y}}{X_1 + \bar{X}}$ (2), the following is correct:

   1) estimator (1) is biased, while (2) is unbiased;
   2) estimator (2) is biased, while (1) is unbiased;
   3) estimators (1) and (2) are both unbiased;
   4) estimators (1) and (2) are both biased;
   5) (1) and (2) are not estimators of β_2.

3. 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 new explanatory variable's coefficient is significant at the 10% level;
   4) The *F*-statistic for the hypothesis of equality of the new explanatory variable's coefficient to zero is greater than 1;
   5) None of the above.

4. 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) $\sum_{i=1}^{n} e_i \hat{Y}_i = 0$; 3) $TSS = ESS + RSS$;

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

5. You estimate the parameters of the following model using the OLS directly (Gauss-Markov conditions are satisfied, and it is known that $\beta_1>0$; $\beta_2>0$, and $\beta_3>0$) :

$$y=\alpha+\beta_1\beta_2 x_1+\beta_2\beta_3 x_2+\beta_1\beta_3 x_3+u$$

Then the following is correct:

1) you can get unbiased estimates of β_1, β_2 and β_3;
2) you can not get unbiased estimates of β_1, β_2 and β_3, but can get consistent estimates of them;
3) you can not get unbiased or consistent estimates of β_1, β_2 and β_3 since you can estimate only their absolute values from this model;
4) you can not get any estimates of β_1, β_2 and β_3 whether consistent or not;
5) none of the above is correct.

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

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

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

with residual sums of squares RSS_1 and RSS_2 respectively. The statistic $F(m-k-1,n-m)=\dfrac{(RSS_1-RSS_2)/(m-k-1)}{RSS_2/(n-m)}$ has F-distribution with $(m-k-1,n-m)$ degrees of freedom under the null hypothesis

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

7. Using a sample of 570 observations, the following earnings function has been estimated: $\log(EARN)=-0.41+0.22ASVABC+0.034S$ ($EARN$ – 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 year, then hourly earnings increase (on average, others equal) approximately for

1) 3.4 Rubles; 2) 3.4%; 3) 34%; 4) 0.34%; 5) 34 Rubles.

8. For the Model $Y_i=\beta_1+\beta_2 X_i+u$ (Gauss-Markov conditions satisfied), the following 3 estimators of β_2 are proposed: $b_2^1=\dfrac{\bar{Y}}{\bar{X}}$, $b_2^2=\dfrac{\sum(X_i-\bar{X})(Y_i-\bar{Y})}{\sum(X_i-\bar{X})^2}$, $b_2^3=\dfrac{\sum X_i Y_i}{\sum X_i^2}$.

The following is correct for these estimators:

1) All the estimators b_2^1, b_2^2 and b_2^3 are unbiased;
2) All the estimators b_2^1, b_2^2 and b_2^3 are biased;
3) The estimator b_2^2 is unbiased, while b_2^1 and b_2^3 are biased;
4) The estimators b_2^1 and b_2^2 are unbiased, while b_2^3 is biased;
5) The estimators b_2^2 and b_2^3 are unbiased, while b_2^1 is biased.

9. 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.

10. 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 $y - k - l = \lambda + \rho(k - l) + u$ (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 $\alpha+\beta=1$;
3) The model (2) is a restricted version of (1) with one restriction $\alpha+\beta=2$;
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).

11. Using the data of a sample with 65 observations, a student has estimated two regressions:

$\widehat{Y} = 0.5 - 0.04X$ and

$\widehat{X} = -17.2 - 1.0Y$

The correlation coefficient between X and Y equals:

1) 0.1; 2) 0.2; 3) -0.2; 4) 0.04;

5) there is not enough information for calculating the correlation coefficient between X and Y.

12. In the simple regression model, the population variance of the prediction error f_{T+p} is given by:

1) $\sigma^2_{f_{T+p}} = \left\{ \frac{(X_{T+p} - \overline{X})^2}{\sum_{t=1}^{T}(X_t - \overline{X})^2} \right\} \sigma_u^2$;

2) $\sigma^2_{f_{T+p}} = \left\{ \frac{1}{T} + \frac{(X_{T+p} - \overline{X})^2}{\sum_{t=1}^{T}(X_t - \overline{X})^2} \right\} \sigma_u^2$;

3) $\sigma^2_{f_{T+p}} = \left\{ 1 + \frac{(X_{T+p} - \overline{X})^2}{\sum_{t=1}^{T}(X_t - \overline{X})^2} \right\} \sigma_u^2$;

4) $\sigma^2_{f_{T+p}} = \left\{ 1 + \frac{1}{T} + \frac{(X_{T+p} - \overline{X})^2}{\sum_{t=1}^{T}(X_t - \overline{X})^2} \right\} \sigma_u^2$;

5) none of the above.