The International College of Economics and Finance
Econometrics – 2019-2020. First Semester exam, December 26, 2019.

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

1.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 unit then Y increases approximately by β_2 per cent.

2.The function of expenditures for cosmetics depending on disposable personal income has been estimated using OLS, for a representative sample of people:

$$Y=\beta_0+\beta_1 D_1+\beta_2 X+\beta_3 X(1-D_2)+u$$

where Y is expenditure for jewelry, X is disposable personal income,
D_1 = 1 for females and 0 for males,
D_2 = 1 for males and 0 for females.
For this regression the following is correct:

1) The estimates of intercept are the same for male and female subsamples, while the estimates of slope coefficient, generally speaking, differ for them;
2) The estimates of slope coefficient are the same for male and female subsamples, while the estimates of intercept, generally speaking, differ for them;
3) Both intercepts and slope coefficients estimated, generally speaking, differ for male and female subsamples;
4) Both intercepts and slope coefficients estimated are the same for male and female subsamples;
5) The combination of intercept and slope dummies is incorrect, and the model can not be estimated.

3. A student regressed the logarithm of earnings *LOG(EARN)* on the variables *HGC* (highest grade completed), *ASVABC* (abilities indicator), *FEMALE* (dummy for gender), *ETHWHITE* (dummy for ethnicity, whites), and the interactive dummy *FEMALE*ETHWHITE*. Then he decided to replace the interactive variable by *MALE*ETHNW*, where *MALE=1-FEMALE*, and *ETHNW=1-ETHWHITE*. Which of his following statements is correct:

1) The estimated slope coefficients of *HGC* and *ASVABC* will in general change;
2) The coefficient of *MALE*ETHNW* will be the same as that of *FEMALE*ETHWHITE* in the initial regression.
3) The coefficient of *MALE*ETHNW* will be the same in absolute value as that of *FEMALE*ETHWHITE* in the initial regression, but will have the opposite sign.
4) The coefficients of the variables *FEMALE* and *ETHWHITE* will stay the same.
5) The intercept will stay the same as in the initial regression.

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

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + (\beta_1+\beta_2+\beta_3)x_3 + u, \qquad \text{then:}$$

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) all the above statements are incorrect.

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

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

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

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

6. The consumption C_t in M.Friedman's model depends on the permanent income $Y^P{}_t$: $C_t=\beta Y^P{}_t$. The regression of C_t on the actual income Y_t is estimated: $C_t=a+bY_t+e_t$, where $Y_t=Y^P{}_t+Y^T{}_t$ ($Y^T{}_t$ is transitory income being a random variable with zero expected value and constant variance). If the true value β is equal 0.8, and the population variance of $Y^P{}_t$ is 3 times larger than of $Y^T{}_t$, then on large samples the probability limit of the estimator b is equal to:

1) 0.4; 2) 0.5; 3) 0.6; 4) 0.7; 5) 0.8.

7. In the regression model $y = \alpha + \beta x + u$ (where the disturbance term u satisfies Gauss-Markov conditions and is normally distributed) the explanatory variable x includes random measurement errors (which are independent, normally distributed, homoscedastic, not autocorrelated, with zero expected values), ($\beta<0$). In this case, when estimating the model using OLS, for large samples

1) the estimate of α will be biased upwards;
2) the estimate of α will be biased downwards;
3) the estimate of α will be unbiased;
4) the estimate of α may be biased upwards or downwards, depending on the sign of the mean value of x;
5) the estimate of α may be biased upwards or downwards, depending on the sign of α.

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

1) $\sum_{i=1}^{n} \hat{u}_i = 0$;
2) $\overline{Y} = \overline{\hat{Y}}$;
3) $TSS = ESS + RSS$;
4) $\sum_{i=1}^{n} \hat{u}_i \hat{Y}_i = 0$;
5) None of the above.

9. Econometric model is described by the following three equations:

(1) $y_1 = \alpha + \beta y_3 + \gamma x_1 + \sigma x_3 + u_1$

(2) $y_2 = \delta + \varepsilon y_1 + \lambda x_2 + u_2$

(3) $y_3 = \mu + \theta y_1 + \omega y_2 + u_3$

where y_1, y_2 and y_3 are endogenous variables, x_1, x_2 and x_3 are exogenous variables; u_1, u_2 and u_3 are disturbance terms (independent and satisfying the Gauss-Markov conditions). Choose the correct statement:

1) equation (2) is exactly identified;
2) equation (1) is exactly identified;
3) equation (3) is exactly identified;
4) equation (3) is underidentified;
5) statements 1-4 are incorrect.

10. Economic model is described by the following simultaneous equations:

(1) $y_1 = \alpha + \pi y_2 + \gamma x_1 + \varphi x_2 + u_1$

(2) $y_2 = \delta + \tau y_1 + u_2$

where y_1 and y_2 are endogenous variables, x_1 and x_2 are stochastic exogenous variables, u_1 and u_2 are disturbance terms satisfying Gauss-Markov conditions. Indicate the correct statement:

1) you may apply TSLS in (1), but not in (2);
2) you may apply TSLS in (2), but not in (1);
3) you may apply TSLS in both (1) and (2);
4) you may not apply TSLS in either (1) or (2);
5) TSLS is not needed since the OLS provides consistent estimates in (1) and (2).

11. Two parties participated in elections, Bear party and Beer party. 45 people voted, 9 of them voted for the Bear party, and the rest voted for the Beer party. Suppose that there are fixed (unknown) probabilities to vote for the Bear party and for the Beer party. What is the maximum likelihood (ML) estimate of the probability to vote for the Beer party?

1) 55%; 2) 66%; 3) 73%; 4) 80%; 5) 90%.

12. The model with the dependent variable P_i (monthly pension), as a function of Work Experience WE_i and the average earnings $EARN_i$ is being considered:

$$P_i = \beta_1 + \beta_2 WE_i + \beta_3 EARN_i + u_i$$

The value of pension is restricted by the values P_U and P_L from the top and from the bottom. Some observations with the minimum and maximum pensions are available in the sample. Please indicate the **incorrect** statement among the following ones:

1) The OLS estimators of the model coefficients are biased and inconsistent;
2) If to exclude the observations with $P_i = P_U$ and $P_i = P_L$, the OLS estimators of the model coefficients remain biased and inconsistent.
3) If the true values of β_2 and β_3 are positive, then their OLS estimators are biased upwards;
4) If the true values of β_2 and β_3 are positive, then their OLS estimators are biased downwards;
5) MLE provides the consistent estimators for β_2 and β_3.