## The International College of Economics and Finance

## Econometrics - 2021. First Semester Exam, December 23.

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

1. A student had estimated 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 $y-l+2=\lambda+\rho(k-l)+u$ (2) considering it as a restricted version of (1). Then:

   1) The model (2) is a restricted version of (1) with the restriction $\alpha = \beta$;
   2) The model (2) is a restricted version of (1) with the restriction $\alpha = -\beta$;
   3) The model (2) is a restricted version of (1) with the restriction $\alpha+\beta=1$;
   4) The model (2) is a restricted version of (1) with the restriction $\alpha+\beta=2$;
   5) The model (2) is not a restricted version of (1).

2. For the Model $Y_i = \beta_2 X_i + u$ (Model B assumptions are satisfied: the variable $X$ is stochastic), the following 3 estimators of $\beta_2$ are proposed: $b^1 = \frac{\bar{Y}}{\bar{X}}$, $b^2 = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sum (X_i - \bar{X})^2}$, $b^3 = \frac{\sum X_i Y_i}{\sum X_i^2}$.

   The following is correct in general for these estimators:

   1) All the estimators $b^1$, $b^2$ and $b^3$ are consistent;
   2) All the estimators $b^1$, $b^2$ and $b^3$ are inconsistent;
   3) The estimators $b^1$ and $b^3$ are consistent, while $b_2$ is inconsistent;
   4) The estimators $b^1$ and $b^2$ are consistent, while $b^3$ is inconsistent;
   5) The estimators $b^2$ and $b^3$ are consistent, while $b^1$ is inconsistent.

3. For the sample of 33 observations, functions (1) and (2) were estimated:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + u \qquad (1)$$
$$Y = \beta_0 + \beta_1 (X_1 + X_2) + u \qquad (2)$$

The $R^2$ (determination coefficients) for these models are 0.9 in (1) and 0.7 in (2) respectively. $F$ – statistic for testing the hypothesis $\beta_1=\beta_2$ in (1) equals

1) 6.7; 2) 20; 3) 30; 4) 60; 5) None of the above.

4. The double logarithmic function of expenditures for souvenirs depending on disposable personal income has been estimated using OLS for a representative sample of people:

$$\log(Y) = \beta_0 + \beta_1 LXD_1 + \beta_2 LXD_2 + \beta_3 D_1 + u$$

where $Y$ is expenditure for souvenirs, $X$ is disposable personal income,
$D_1$ = 1 for females and 0 for males,
$D_2$ = 1 for males and 0 for females;

$LXD_1=log(X)\times D_1$ ; $LXD_2=log(X)\times D_2$.

For this regression the following is correct:

1) The estimates of intercept are the same for male and female subsamples, the estimates of the slope coefficients differ;
2) The estimates of slope coefficients are the same for male and female subsamples, the estimates of the intercept differ;
3) There is perfect multicollinearity and the estimation can not be done;
4) Both intercepts' and slope coefficients' estimates are the same for male and female subsamples;
5) Both intercepts' and slope coefficients' estimates differ for male and female subsamples.

5. The Durbin–Wu–Hausman can be used for detection of the following:

I. Heteroscedasticity;
II. Measurement errors;
III. Simultaneous equations bias;
IV. Endogeneity of explanatory variables.

1). I, II and III only.
2). II, III and IV only.
3). III and IV only.
4). II and IV only.
5). All I-IV.

6. If you have estimated the parameters of the following model using the OLS (Model B assumptions are satisfied): $y = \alpha + \beta_1 X_1 + 2\beta_2 X_2 + (\beta_2/\beta_3)X_3 + u,$ then:

1) you can get an unbiased estimate of $\beta_3$;
2) you can not get an unbiased estimate of $\beta_3$, but can get a consistent estimate of it;
3) you can not get an unbiased, or biased but consistent estimate of $\beta_3$;
4) the model is nonlinear in parameters, and you can not estimate them;
5) the model includes a restriction, and hence its parameters can not be estimated.

7. Multiple linear regression model with 11 explanatory variables is estimated for a sample with 120 observations. There is heteroscedasticity in the model, and the standard deviation of disturbance term is proportional to the variable $x_1$: $\sigma_{ui} = \gamma x_{1i}$. Which test(s) may be applied in this case?:

1) Only Goldfeld-Quandt test may be applied here, White tests are invalid;
2) Only White test without cross terms may be applied here;
3) Only White test with cross terms may be applied here;
4) Goldfeld-Quandt test and White test without cross terms may be applied here;
5) Goldfeld-Quandt test and White test with cross terms may be applied here.

8. 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 $\alpha$ will be always biased upwards;
2) the estimate of $\alpha$ will be always biased downwards;
3) the estimate of $\alpha$ will be biased upwards if the values of $x$ are positive and biased downwards if the values of $x$ are negative;
4) the estimate of $\alpha$ will be biased upwards if the values of $x$ are negative and biased downwards if the values of $x$ are positive;
5) the direction of bias of the estimate of $\alpha$ depends on the sign of its true value.

9. For the simultaneous equations model with 12 equations, 12 endogenous variables and 10 exogenous variables, the following statement is true for any equation:

1) an equation is likely to be underidentified if 10 variables are missing from it;
2) an equation is likely to be exactly identified if 10 variables are missing from it;
3) an equation is likely to be overidentified if 11 variables are missing from it;
4) an equation is likely to be exactly identified if 12 variables are missing from it;
5) an equation is likely to be underidentified if 11 variables are missing from it.

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

(1) $y_1 = \alpha + \gamma y_2 + \varphi x_1 + \pi x_2 + \mu x_3 + u_1$

(2) $y_2 = \delta + \tau y_1 + \lambda x_1 + \beta x_2 + u_2$

where $y_1$ and $y_2$ are endogenous variables, $x_1$, $x_2$ and $x_3$ are exogenous variables, $u_1$ and $u_2$ are independent disturbance terms satisfying Gauss-Markov conditions. Indicate the correct statement:

1) Two Stage Least Squares estimates of (1) coefficients will be unbiased and consistent;
2) Two Stage Least Squares estimates of (2) coefficients will be unbiased and consistent;
3) Two Stage Least Squares estimates of (2) coefficients will be biased but consistent;
4) Two Stage Least Squares estimates of (1) coefficients will be biased but consistent;
5) Two Stage Least Squares will not provide any estimates of both (1) and (2).

11. Logit estimation of the model describing the probability to pass the exam $F(Z_i)=p(Pass_i=1|\,X_i,\beta)$ has given the result $Z=-7.4+0.03\cdot X$, where $X$ is the number of hours devoted to studying the subject. Increase of the probability $p(Degree_i=1)$ under one point increase of $X$, for $X=86$ approximately equals:

1) $\dfrac{\exp(7.4-0.03\cdot 86)}{(1+\exp(7.4-0.03\cdot 86))^2}\cdot 0.03$; 2) $\dfrac{0.03}{1+\exp(7.4-0.03\cdot 86)}$;

3) $\dfrac{\exp(7.4-0.03\cdot 86)}{(1+\exp(7.4-0.03\cdot 86))^2}$; 4) $\dfrac{1}{1+\exp(7.4-0.03\cdot 86)}$;

5) None of the above.

12. If $U_0$ coefficient $U_0 = \sqrt{\dfrac{\frac{1}{h}\sum(\hat{Y}_{T+p} - Y_{T+p-1})^2}{\frac{1}{h}\sum(Y_{T+p} - Y_{T+p-1})^2}}$ is greater than 1, then the forecast $\hat{Y}_t$ for the period from $t=T+1$ to $t=T+h$ , where $t=T+p$, 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 neither Theil $U_2$ nor the Theil Inequality coefficient.