Indian Institute of Technology Kharagpur
Department of Humanities and Social Sciences
End-Spring Semester: 2022-23   Time: 3hrs   Full Marks: 50
Subject: Econometric Analysis I (EM20202/HS20202)
Instruction: Answer all the questions; Write answers following the sequence of questions

1. Comment on the following statements with justification/proof: $3 \times 6 = 18$

    (a) An increase in the number of observations improves explanatory power and statistical significance of the coefficients of an estimated econometric model.

    (b) Low values of the variance inflation factors (VIFs) are necessary as well as sufficient to conclude that the estimated model does not have severe multicollinearity problem.

    (c) In estimating the generalized difference model, one should always prefer the Hildreth-Lu search procedure vis-à-vis the Cochrane-Orcutt iterative process to get more appropriate value of the autocorrelation coefficient.

    (d) Pure autocorrelation problem can always be distinguished from specification bias on the basis of the Durbin-Watson d statistic.

    (e) The general test of White gives more robust conclusion on the presence of heteroscedasticity vis-à-vis the Breusch-Pagan-Godfrey test.

    (f) As compared to the method of weighted least squares, logarithmic transformation of the variables is a better approach to resolve the problem of heteroscedasticity.

2. For the model $Y_i = \alpha + \beta X_i + \gamma Z_i + u_i$, derive the expression for $\text{var}(\hat{\gamma})$. What will the expression change if all the observations of Z are identical?

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3. Explain how one of the following two models can be selected:

    (a) $Y_i = \alpha_0 + \sum_{j=1}^{k} \alpha_j X_{ji} + \sum_{j=1}^{m} \beta_j W_{ji} + u_i$, and (b) $Y_i = \gamma_0 + \sum_{j=1}^{k} \gamma_j X_{ji} + \sum_{j=1}^{p} \delta_j Z_{ji} + v_i$

    Will the selection criteria differ if one of the models is of the following form?

    $Y_i = \phi_0 + \sum_{j=1}^{k} \phi_j X_{ji} + \sum_{j=1}^{m} \varphi_j W_{ji} + \sum_{j=1}^{p} \lambda_j Z_{ji} + \varepsilon_i$?

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4. Why is equality of variances of the random disturbance term of different sub-group/sub-period regression models necessary to carry out the Chow Test of structural stability? What will you do if this condition is not satisfied?

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5. For the model $Y_t = \alpha + \beta X_t + u_t$ with $u_t = \rho u_{t-1} + v_t$, examine if $\hat{\sigma}^2 = \dfrac{\sum_{t=1}^{n} \hat{u}_t^2}{n-2}$ is an unbiased estimator of $\text{var}(u_t)$.

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6. Explain how inclusion of a linear trend component can reduce the problem of autocorrelation. Can the problem of autocorrelation be reduced further if a quadratic or a cubic trend component is added into the model? Justify your answer.

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7. Suppose for the model $Y_t = \alpha + \beta X_t + u_t$, while the Goldfeld-Quandt test concludes no problem of heteroscedasticity, the Park test indicates presence of the same. What may be the possible reason(s) behind such contradictory results? What should one do in such cases?

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8. Explain how one can resolve severe multicollinearity problem in an estimated model. What possible consequences can such remedial measures cause? Justify your answer.

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9. Consider the following two models:

   (a) $Y_i = \beta_1 + \beta_2 D_{1i} + \beta_3 X_i + \beta_4 (D_{1i} \cdot X_i) + u_i$; and (b) $Y_i = \alpha_1 D_{1i} + \alpha_2 D_{2i} + \alpha_3 (D_{1i} \cdot X_i) + \alpha_4 (D_{2i} \cdot X_i) + v_i$

   Here, Y stands for household income; $D_1 = 1$ for urban households and $D_1 = 0$ otherwise; $D_2 = 1$ for rural households and $D_2 = 0$ otherwise

   Explain how interpretation of the coefficients of the first model will differ from that of the second model. Which model will you prefer to estimate? Justify your answer.

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