Jean-Marie Dufour
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McGill University
Department of Economics
Econ 467D2: Econometrics
Final exam

No documentation allowed
Hand calculator allowed
Time allowed: 3 hours

40 points 1. Answer by TRUE, FALSE or UNCERTAIN to each one of the following statements, and justify briefly your answers (maximum: 1 page per statement).

(a) By studentizing least squares residuals, outliers are eliminated.

(b) The Durbin-Watson test is a test meant to detect autocorrelated errors.

(c) For a white noise process, autocorrelations and partial autocorrelations are identical.

(d) The Ljung-Box statistic is always larger than the Box-Pierce statistic.

(e) When an autoregressive model satisfies the unit root hypothesis, the associated polynomial has only one root.

(f) The Dickey-Fuller procedure allows one to test whether au autoregressive model is stationary.

(g) The generalized least squares method is a special case of the instrumental variables method.

(h) The two-stage least squares method is an instrumental variables method that corrects heteroskedasticity.

15 points 2. Consider a $MA(1)$ model:

$$X_t = \overline{\mu} + u_t - \theta u_{t-1}\,,\ t \in \mathbb{Z}$$

where $u_t \sim WN(0,\, \sigma^2)$ and $\sigma^2 > 0$.

(a) Prove that the first autocorrelation of this model cannot be greater than 0.5 in absolute value.

(b) Find the values of the model parameters for which this upper bound is attained.

(c) If $\overline{\mu} = 0$, $\theta = 0.5$, $X_{100} = 1$ and $X_{99} = 100$, compute the best linear forecasts of X_{101}, X_{102} and X_{103}.

15 points 3. Consider the model

$$y_t = x_t'\beta + u_t \ , \quad t = 1, \ldots, T \tag{1}$$

where

$$u_t = \rho u_{t-1} + \varepsilon_t \ , \quad t = \ \ldots \ , 0, \ 1, \ 2, \ \ldots \tag{2}$$

$$|\rho| < 1 \ , \tag{3}$$

$$\{\varepsilon_t\}_{t=1}^{T} \text{ is a sequence of i.i.d. disturbances,} \tag{4}$$

$$\mathsf{E}\,(\varepsilon_t) = 0 \ , \quad \mathsf{V}\,(\varepsilon_t) = \sigma^2 \ , \forall t \ . \tag{5}$$

(a) Explain how the above linear regression could be transformed to make the disturbances i.i.d. (when ρ is unknown).

(b) Discuss how ρ could be estimated in the above model.

(c) Discuss how β cold be estimated in the above model.

10 points 4. Describe a case where the uses of the seemingly unrelated regression technique does not yield an improvement over ordinary least squares applied to each equation and justify your answer.

20 points 5. Consider the following demand and supply model:

$$q_t = a_1 + b_1 p_t + c_1 Y_t + u_{t1} \ , \quad \text{(demand function)} \tag{6}$$

$$q_t = a_2 + b_2 p_t + u_{t2} \ , \quad \text{(supply function).} \tag{7}$$

where

$q_t =$ quantity (at time t), $p_t =$ price, $Y_t =$ income, $R_t =$ rain volume,

u_{t1} and u_{t2} are random disturbances.

(a) Derive the reduced form of this model.

(b) Explain why applying least squares to the equations (6)-(7) may not be an appropriate method to estimate the parameters of these two equations.

(c) Are the parameters of equations (6)-(7) identified? Explain your answer.

(d) Propose an estimation method for the parameters of equations (7) and discuss its properties.