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McGill University
ECN 706
Special topics in econometrics
Mid-term exam

No documentation allowed
Time allowed: 1.5 hour

15 points 1. Provide brief answers to the following questions (maximum of 1 page per question).

(a) Explain the difference between the "level" of a test and its "size".

(b) Explain the difference between the "level" of a confidence set and its "size".

(c) Discuss the link between tests and confidence sets: how confidence sets can be derived from tests, and vice-versa.

30 points 2. Provide brief answers to the following questions (maximum of 1 page per question).

(a) Explain the notion of weak identification.

(b) Discuss the consequences of the possible lack of identification on the construction of confidence sets.

(c) Explain the notion of "identification-robust" method.

(d) In the context of a linear simultaneous equations model, provide an example of a method which is identification-robust and a method which is not identification-robust.

30 points 3. Consider the linear regression model

$$y = X\beta + u \tag{0.1}$$

where y is a $T \times 1$ vector of observations on a dependent variable, X is a $T \times k$ fixed matrix of explanatory variables (observed), $\beta = (\beta_1, \ldots, \beta_k)'$, and u is a $T \times 1$ vector of unobserved error terms.

(a) Suppose the elements of u are independent and identically distributed according to a $N[0, \sigma^2]$ distribution, where σ^2 is an unknown constant, and $k > 1$. We wish to build a confidence interval with level 0.95 for the ratio $\theta = \beta_2/\beta_1$. Propose a method for doing this.

(b) Suppose the elements of u are independent and identically distributed according to a $\sigma t(1)$ distribution, where $t(1)$ represents a Student t distribution with 1 degree of freedom and σ is an unknown constant. Propose a method for testing the hypothesis $H_0 : \beta_1 = 1$ at level $\alpha = 0.05$ in the context of this model such the size of the test is exactly equal to $\alpha = 0.05$.

25 points 4. Consider the following equilibrium model:

$$\begin{aligned} Q_t &= a + b p_t + u_{1t}\,, \\ p_t &= c + d p_{t-1} + u_{2t} \qquad , t = 1, \ldots, T \\ p_0 &\text{ is fixed} \end{aligned}$$

where the disturbances $(u_{1t},\, u_{2t})'$, $t = 1, \ldots, T$ are independent $N[0, I_2]$, Q_t represents the quantity sold, and p_t the price. For which parameters is the vector $p = (p_1, \ldots, p_T)'$

(a) sequentially exogenous?

(b) exogenous?

(c) strongly exogenous?

(d) Further, does Q_t cause p_t in the sense of Granger?

Justify your answers.