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McGill University
ECON 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 simplified equilibrium model:

$$\begin{aligned} D_t &= \alpha + 2p_t + u_{1t}\,, \\ S_t &= c + u_{2t}\,, \\ Q_t &= D_t = S_t \qquad , t = 1, \ldots, T \end{aligned}$$

where D_t is the demand for a product, S_t the supply for the same product, and Q_t the quantity produced and sold. We suppose that the vectors $(u_{1t},\ u_{2t})'$, $t = 1, \ldots, T$, are independent and $N[0,\ I_2]$.

(a) Find the reduced form of this model.

(b) For which parameters is the vector $Q = (Q_1, \ldots, Q_T)'$ exogenous? Justify your answer.

(c) For which parameters is the vector $p = (p_1, \ldots, p_T)'$ exogenous? Justify your answer.

(d) Are the variables Q_t and p_t simultaneous?