

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), $\beta = (\beta_1, \dots, \beta_k)'$, 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:

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

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 $(u_{1t}, u_{2t})'$, $t = 1, \dots, T$, are independent and $N[0, I_2]$.

- (a) Find the reduced form of this model.
- (b) For which parameters is the vector $Q = (Q_1, \dots, Q_T)'$ exogenous? Justify your answer.
- (c) For which parameters is the vector $p = (p_1, \dots, p_T)'$ exogenous? Justify your answer.
- (d) Are the variables Q_t and p_t simultaneous?