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

No documentation allowed
Time allowed: 1.5 hour

10 points 1. Consider a general statistical model with parameter vector θ.

(a) When is θ identifiable?

(b) When is θ locally identifiable?

20 points 2. 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?

40 points 3. 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 4. 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 $u = (u_1, \ldots, u_T)'$ is a $T \times 1$ vector of unobserved error terms. 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.

(a) 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 $\alpha = 0.05$.

(b) Propose a test for detecting serial dependence between the errors $u_1, \ldots, u_T$ such the size of the test is exactly equal to $\alpha = 0.05$.