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Maximum Likelihood Estimation and Inference in Possibly Unidentified Models

The validity of standard distributional approximation in regular statistical model critically hinges upon the identifiability of the model. Lack of identification imposes strong limitations on the construction of estimators and test statistics for nonidenifiable parameters with desirable properties. Motivated by the observation that identification failure does not preclude the possibility of making valid inference on the identifiable part of the model, the present paper studies identification, estimation and hypotheses testing in possibly unidentified parametric models. We give necessary and sufficient conditions for local identifiability of a parametric function in terms of its Jacobian matrix with respect to the parameter of the model and the Fisher information matrix. Based on local asymptotic analysis, it is shown that despite the identification failure the score and likelihood ratio statistics for testing hypothesis on the identifiable parameter have chi-square limiting distribution with degrees of freedom equal to the number of restrictions under certain regularity conditions. Moreover, stochastic dominance relations between various test statistics are provided.