Department of Statistics

STATISTICS COLLOQUIUM

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Instrumental Variables Quantile Regression with Multivariate Endogenous Variable

MONDAY, October 14, 2019 at 4:30 PM

Eckhart 133, 5734 S. University Avenue

ABSTRACT

We propose methodology for optimization and inference with the inverse quantile regression (IQR) estimator for the instrumental variable quantile regression (IVQR) problem. We suggest a mixed integer linear programming (MILP) formulation which computes the global optimum of the non-smooth, non-convex IQR estimation problem, is solved rapidly using modern solvers, and accommodates multivariate endogenous variables. This formulation accommodates subvector inference for the causal estimate via inversion of a regression rankscore test, thus adapting the standard method of inference for linear quantile regression to the instrumental variables case. In contrast to competing large sample approaches, this inference method does not require nonparametric density estimation in the homoskedastic case, and thus circumvents the need to select a bandwidth parameter. To accommodate subvector inference under weak identification, we suggest two complementary methods. We provide a mixed integer quadratically constrained programming (MIQCP) formulation to compute confidence sets for subvectors as a projection from regression rankscore test confidence sets for the entire weakly identified vector. We provide a new test producing rectangular confidence regions such that less power is foregone by projecting the regions on principal axes to obtain simultaneously valid confidence intervals, and approximately no loss of power is induced when all but one weakly identified variable are nuisance parameters which may be profiled out. We carry out a causal quantile regression analysis of the impact of different types of institutions on the wealth of nations using the data set of Acemoglu and Johnson (2005), allowing for three endogenous variables.

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