Sequential Estimation of Censored Quantile Regression Models

Songnian Chen

The Hong Kong University of Science and Technology

Abstract

For the linear regression model the least squares estimator (OLS) has by far been the most popular approach in empirical research. The quantile regression technique (QR) developed by Koenker and Bassett (1978), however, has increasingly become a major rival, due to its ability to characterize the entire conditional distribution through the construction of a family of linear quantile coefficents. While there is no OLS counterpart available for censored data, quantile regression techniques are particularly well suited to the censored data due to the equivariance nature of the quantile function with respect to monotone transformation. Despite its conceptual appeal, Powell's censored quantile method (CQR), is still not nearly as popular among applied researchers, largely due to the difficulty in its implementation because of the nonlinear and non-convex nature of the optimization problem involved. In this paper we propose the sequential censored quantile regression estimator (SCQR) for the censored quantile regression model for the entire family of quantile regression coefficients by making use of the continunity of the conditional distribution. Our estimator is easy to implement by solving a sequence of convex problems, even when there are heavy censoring and/or a large number of regressors, thereby making Powell's censored quantile techniques easily accessible to applied researchers. For the linear regression model with endogeneity, the two stage least squares estimator (2SLS) has been the main standard estimation procedure among applied researchers. The instrumental variables quantile regression (IVQR) developed by Chernozhukov and Hansen (2006) is also becoming increasingly more popular. When both censoring and endogenity are present, the 2SLS no longer applies. By combining the insights behind the SCQR and the IVQR, we develop the sequential instrumental variable censored quantile regression estimation procedure (SIVCQR) for the family of structural quantile regression coefficient process. We provide large sample properties of the SCQR and SIVCQR. Simulation results suggest that both estimators perform very well.