

M-QUANTILE REGRESSION IN SMALL AREA ESTIMATION: ESTIMATION AND TESTING

Anna Maria Bianchi ¹, Enrico Fabrizi², Nicola Salvati³ and Nikos Tzavisis²

¹ Università degli Studi di Bergamo, (e-mail: annamaria.bianchi@unibg.it)

² Università Cattolica del S. Cuore, (e-mail: Enrico.Fabrizi@unicatt.it)

³ Università di Pisa, (e-mail: nicola.salvati@unipi.it)

⁴ University of Southampton, (e-mail: N.TZAVIDIS@soton.ac.uk)

ABSTRACT: In recent years M-quantile regression has been applied to small area estimation to obtain reliable and outlier robust estimators without recourse to strong parametric assumptions. In this paper, after a review of M-quantile regression, we cover several topics related to model specification and selection for M-quantile regression that received little attention so far. Specifically, a pseudo-R² goodness of fit measure is proposed, along with likelihood ratio and Wald type tests for linear hypotheses on the M-quantile regression parameters. A new estimator of the scale, motivated by a parametric representation of the M-quantile regression estimation, is also proposed. This parametric representation, that generalizes the Asymmetric Laplace distribution, often associated to quantile regression can be exploited to solve specific problems in M-quantile regression. For instance, when the Huber loss function is adopted, it provides the basis for a data driven choice of the tuning parameter. Finally, after reviewing applications of M-quantile regression to small area estimation, a test to assess the presence of actual area heterogeneity in the data is also proposed. The properties of the tests are theoretically studied and their finite sample properties empirically assessed in Monte-Carlo simulations. The use of the proposed methods is illustrated in a well-known real data application in small area estimation.

KEYWORDS: Generalized Asymmetric Least Informative distribution, goodness-of-fit, likelihood ratio type test, loss function, robust regression.