

Accepted Manuscript

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PII: S0047-259X(17)30037-4

DOI: <http://dx.doi.org/10.1016/j.jmva.2017.01.009>

Reference: YJMVA 4213

To appear in: *Journal of Multivariate Analysis*

Received date: 24 May 2016



Please cite this article as: H. Cho, S. Kim, M.-O. Kim, Multiple quantile regression analysis of longitudinal data: Heteroscedasticity and efficient estimation, *Journal of Multivariate Analysis* (2017), <http://dx.doi.org/10.1016/j.jmva.2017.01.009>

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Multiple quantile regression analysis of longitudinal data: heteroscedasticity and efficient estimation

Hyunkeun Cho, Seonjin Kim, and Mi-Ok Kim¹

Abstract

The objective of this paper is two-fold: to propose efficient estimation of multiple quantile regression analysis of longitudinal data and to develop a new test for the homogeneity of independent variable effects across multiple quantiles. Estimating multiple regression quantile coefficients simultaneously entails accommodating both association among the multiple quantiles and association among the repeated measurements of the response within subjects. We formulate simultaneous estimating equations using basis matrix expansion which accounts for the above-mentioned associations. The empirical likelihood method is adopted to estimate multiple regression quantile coefficients. Theoretical results show that the proposed simultaneous estimation is asymptotically more efficient than separate estimation of individual regression quantiles or ignoring the within-subject dependency. The proposed method also offers an empirical likelihood ratio test examining the homogeneity of the independent variable effects across the multiple quantiles. The Wilk's theorem holds for the test statistic, and thus the test is easy to implement. Simulation studies and real data example of a multi-center AIDS cohort study are included to illustrate the proposed estimation and testing methods, and empirically examine their properties.

Key words and phrases: Asymptotic efficiency, empirical likelihood, heteroscedasticity test, longitudinal data, multiple quantiles.

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