

Robust Estimation for Integer-valued GARCH Models Using a New Hybrid Loss

Fukang Zhu

School of Mathematics, Jilin University, China

Email: zfk8010@163.com

Title: Robust Estimation for Integer-valued GARCH Models Using a New Hybrid Loss

Abstract: The integer-valued GARCH model is a popular tool in modeling time series of counts arising from finance and epidemiology. The commonly used maximum likelihood estimation is strongly influenced by outliers, so there is a need to develop robust $SM\hat{S}$ -estimator for this model. This paper has three aims. First, a so-called tri-weight loss function is proposed because of an unavoidable technical assumption when establishing large-sample properties of $SM\hat{S}$ -estimator, which is a modification of Tukey's biweight function and is three times continuously differentiable. The reason that the differentiability is three times not twice is what we also want to establish the uniqueness of the estimator besides other properties. We further generalize the tri-weight loss and propose a hybrid of the tri-weight loss for relatively small errors and the exponential squared loss for relatively large ones, which is of independent interest. Second, Mallows' quasi-likelihood estimator (MQLE) is proposed as an $SM\hat{S}$ -estimator and its existence, uniqueness, consistency and asymptotic normality are established. In addition, a data-adaptive algorithm for computing MQLE is given based on a data-driven selection of tuning parameters in the loss function. Third, simulation studies and real data analysis are conducted to illustrate the performance of the new estimator and comparison with existing estimators is made.