

# Quantile ratio regression for the study of income inequality

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## Abstract

We introduce quantile ratio regression, which assumes the ratio of two quantiles of a continuous response is a function of a linear predictor. For estimation we develop an iterative two-step algorithm whereby, at each step, a non-linear quantile regression problem is solved for one quantile conditional on the other. Thanks to basic quantile properties the algorithm can be carried out on the scale of either the response or the link function. The advantage of using the latter becomes tangible when implementing a smoothed convex linear approximation to the problem, which allows to scale inference to big data. We show some theoretical properties of the estimator, and derive an efficient method to obtain standard errors. The good performance and merit of our methods are illustrated by means of a simulation study. In real data analysis we investigate income inequality in the European Union (EU) using data from a sample of about two million households, over a period of seventeen years. We find a significant association between income inequality, as measured by certain quantile ratios, and some macroeconomic indicators. We also identify countries with outlying income inequality relative to the rest of the EU. An implementation of the proposed methods in the R function `qrr`, available within the `Qtools` library.