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Confidence Intervals for ARMA-GARCH Value-at-Risk: The Case of Heavy Tails and Skewness

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Abstract

It is a well-known result that, when the ARMA-GARCH model errors lack a finite fourth moment, the asymptotic distribution of the quasi-maximum likelihood estimator may not be Normal. In such a scenario the conventional bootstrap turns out inconsistent. Surprisingly, simulations show that the conventional bootstrap, despite its inconsistency, provides accurate confidence intervals for ARMA-GARCH Value-at-Risk (VaR) in case of various symmetric error distributions without finite fourth moment. The usual bootstrap does fail, however, in the presence of skewed error distributions without finite fourth moment. In this case several other methods for estimating confidence intervals fail as well. A residual subsample bootstrap is proposed to obtain confidence intervals for ARMA-GARCH VaR. According to theory, this 'omnibus' method produces confidence intervals with asymptotically correct coverage rates under very mild conditions. By means of a simulation study the favorable finite-sample properties of the residual subsample bootstrap are illustrated. Confidence intervals for ARMA-GARCH VaR with good coverage rates are established, even when other methods fail in the presence of skewed model errors without finite fourth moment. The estimation of confidence intervals by means of the residual subsample bootstrap is illustrated in an empirical application to daily stock returns.

Keywords: Value-at-Risk, ARMA-GARCH, quasi-maximum likelihood, subsample bootstrap

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