

Handling conditional correlation GARCH models with the **cchgarch2** package

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The **cchgarch2** package is designed to provide functions for estimation and simulation of conditional correlation (CC-) GARCH models. It can estimate the Constant Conditional Correlation (Bollerslev, 1990), Dynamic Conditional Correlation (Engle, 2002) and corrected Dynamic Conditional Correlation (Aielli, 2013) GARCH models in a relatively large dimension. The package is also capable of simulating multivariate time series from the CC-GARCH models.

A couple of *R* packages are available for handling the major variants of the CC-GARCH models. An advantage of **cchgarch2** over the other existing packages is that it allows for modeling a multivariate counterpart of the univariate GARCH model in the conditional variance part. With this modeling strategy, volatility spillovers in the GARCH part can be incorporated into the model (Nakatani and Teräsvirta, 2009). In particular in the bivariate model, the estimating functions are constructed in such a way that it can capture negative volatility spillovers (Nakatani and Teräsvirta, 2008; Conrad and Karanasos, 2010).

cchgarch2 is a successor of the **cchgarch** package available at CRAN. In addition to inheriting many of the functionalities from its predecessor, **cchgarch2** improves user-interface by defining classes and associated methods. Numerical optimization of the likelihood function is now carried out by the `solnp()` function in the **Rsolnp** package, which makes it possible to impose non-linear restrictions on the parameters. These restrictions are necessary to keep the time-varying conditional covariance matrices positive definite as well as to keep the sequence of conditional variances stationary. Performance issues are improved by the use of *C* code.

In the presentation, basic usage of **cchgarch2** will be illustrated by analyzing real data. Extension to handling negative volatility spillovers in larger dimensional models will also be discussed.

References

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