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Title: Bayesian Copula-GARCH models in the analysis of the financial time series dependence structure

The main aims of the PhD thesis were to propose Bayesian Copula-GARCH models and to develop methods of parameters estimation, to formally compare these models, to use these models to forecast as well as to use these Bayesian Copula-GARCH models to describe the dependence of time series on financial markets. The findings of this research were presented in five chapters of the dissertation.

In the first chapter, random vector distributions used in the econometric modelling of dependence between its components were presented. The Sklar's theorem and properties of copula were quoted. The final part of this chapter was devoted to the presentation of Copula-GARCH models and selected MGARCH structures. The second chapter of the PhD thesis discussed the Bayesian inference in Copula-GARCH models. The basics of the Bayesian inference were outlined in terms of estimation, prediction and comparison of competitive models. Next, the Bayesian Copula-GARCH models were proposed including the Monte Carlo method with Importance Sampling, which was used in the research to make numerical approximations.

The empirical part of the work was described from the third chapter onwards. In this part, at first, the results presented a comparison of the time series dependence structure on the Polish capital and currency markets respectively. The fourth chapter focused on forecasting risk at value and the expected shortfall using predictive distribution, and on comparing forecasts generated by the CAViaR and CARE structures as well. Finally, the fifth chapter analysed the selected study methods of the contagion effect occurrence in financial markets and proposed the original method investigating this effect using the Bayesian inference and VAR(1)-tCopula-tGARCH(1,1) models with the dynamic t Student copula. Moreover, there were shown verification results concerning the contagion of Canadian, German, Polish, and Hungarian markets by the American market during the financial crisis 2007-2009. The final part of the doctoral dissertation provided conclusions and proposals of the further research direction.

The research carried out in this dissertation showed that the Bayesian Copula-GARCH models can provide an adequate description of the dependence structure of financial time series, particularly in cases where the conditional marginal distributions have different properties (e.g. different thickness of the tails of univariate series) or the dependence structure is asymmetric. Empirical studies involving the formal comparison of Copula-GARCH structures with selected MGARCH models demonstrated that for the seven empirical data sets analysed in the study, only in two cases the Bayesian Copula-GARCH models turned out to be the most likely *a posteriori*. The use of the Bayesian Copula-GARCH model with an asymmetric copula with the highest posterior probability did not offer the best forecasts, assessed *ex post*, of value at risk and the expected shortfall. Nevertheless, considering the assignment of the model to the green or yellow zone, the considered empirical examples confirmed the usefulness of the Bayesian Copula-GARCH models to estimate one-ahead VaR forecasts at 1% tolerance level

and ES at 2.5% tolerance level. On the other hand, the results of research carried out on both simulation and real data showed that the proposed method of identifying the contagion effect, as understood in a narrow sense, is effective.