

Regime switching copula models for relations between returns of stock indexes.

Jozef Komorník¹, Magda Komorníková²

We have investigated relations between the returns of some major global stock indexes (New York, Tokyo, London) as well as their influence on the returns of regional indexes in South-East Asia. The existence of the time lag between New York and East Asia enabled us to identify an interesting phenomenon. The values of the Kendall correlation index for the couples of time series including the data from New York and different individual Asian partners dramatically increased when the New York time series was replaced by its values lagged by one day. This can be considered as an indication proof of a prevailing global leading influence of the N.Y. stock index. However, the intensity of the relations between all studied indexes has manifested a strong time variability (with major changes in the time periods of global recessions, as well as when major local economic disturbances with global consequences occurred).

In order to obtain more realistic models for such changes, we applied regime-switching modeling procedures utilizing Archimedean class copula models and their convex combinations (see e.g. [1], [2], [6]).

We used a semi-parametric method to estimate copula parameters. Genest et al. (1995) [2] showed that the estimator of a semi-parametric method is consistent, asymptotically normal and fully efficient at independence. Kim et al. (2008) [5] showed that the semi-parametric method for copula performs better than the general maximum likelihood estimation method and the IFM (inference functions for margins method), when the marginal distributions are unknown.

Firstly, marginal distributions are estimated using the empirical distribution. Secondly, the maximum likelihood estimation method is used to estimate the copula parameter. The semi-parametric method used in this paper is as follows:

Step 1: Calculation of MPL (maximum pseudolikelihood) estimates [2] and TIC (Takeuchi information criterion [4]).

¹ Faculty of Management, Comenius University, Slovakia, Jozef.Komornik@fm.uniba.sk

² Faculty of Civil Engineering, Slovak University of Technology, Slovakia, magda@math.sk

Step 2: Performing goodness of fit tests [7] (including the corresponding p-values) for all candidate copula models and subsequent elimination of the models that failed to pass GOF tests.

Step 3: From the remaining candidate models selecting the optimal model that attains the minimum of the TIC criterion.

Acknowledgements

The research summarized in this paper was partly supported by the Grants APVV–0073-10 and LPP-0111-09. The authors gratefully acknowledge this support.

References

- [1] Embrechts, P., Lindskog, F. and McNeil, A. (2001): Modeling dependence with copulas and applications to risk management. In: Rachev, S. (Ed.) Handbook of Heavy Tailed Distributions in Finance. Elsevier, Chapter 8, pp 329-384.
- [2] Genest, C., Favre, A. C. (2007): Everything you always wanted to know about copula modeling but were afraid to ask. Journal of Hydrologic Engineering July/August, pp 347-368.
- [3] Genest, C., Ghoudi, K. and Rivest, L.-P. (1995): A semiparametric estimation procedure of dependence parameters in multivariate families of distributions, Biometrika 82, 543-552.
- [4] Gronneberg, S., Hjort, N. L. (2008): The copula information criterion. Statistical Research Report 7, Dept. of Math. University of Oslo, ISSN 0806-3842.
- [5] Kim, G., Silvapulle, M.J. and Silvapulle, P. (2008): Estimating the error distribution in multivariate heteroscedastic time-series models, Journal of Statistical Planning and Inference 138(5), 1442-1458.
- [6] Nelsen, R.B. (1999): An introduction to copulas. Lecture Notes in Statistics 139, Springer-Verlag, New York.
- [7] Prokhorov, A. (2008): A goodness-of-fit test for copulas. MPRA Paper 9998, online at <http://mpa.ub.uni-muenchen.de/9998>.