Spatial models with copulas and their applications to finance

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Abstract

Traditional models in spatial econometrics utilize a spatial weight matrix as a means to express spatial dependence, but its choice is quite arbitrary ([1]). Besides, it imposes a linear structure between dependent variables; in its simplest form, a dependent variable at one spatial unit is a linear combination of dependent variables at other spatial units. When the underlying disturbance distribution is assumed to be Gaussian or elliptical in general, the model may not allow asymmetry in dependence structure and tail dependence for spatial interactions. These restrictions are too strict in financial applications ([4]). In this paper, existent models are generalized to allow for some nonlinear and tail dependence in dependent variables by employing a copula approach to the disturbance distribution. Using skew-t copulas, it is possible to detect nonlinear and tail dependence which cannot be incorporated by linear models. After discussing some properties of the resulting model, a two-step estimation method is proposed for dependence parameters. The recent resampling procedures are then applied with the empirical beta copula to compute confidence intervals. Simulation results illustrate the applicability of the procedure. Statistical inference methods for the spatial versions of CAPM and APT in [3] are proposed, and some real applications to financial data will be given. Possibility of extension to larger spatial panel models (e.g., [2]) will also be discussed.

References

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