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27 décembre 2024

Report on the HABILITATION THESIS entitled
Structural tests for time series
by
ŠÁRKA HUDECOVÁ

The habilitation thesis presents a selection of five papers realized by Šárka Hudecová and her co-authors on goodness-of-fit and change-point tests for binary and count time series and on copula-based modelling of the innovations of multivariate location-scale models.

The four chapters of the thesis describe the work in a concise and very clear way.

In paper 1, authored solely by Šárka Hudecová, a test using a weighted CUSUM of residuals is introduced to detect a break in the dynamics of a binary time series. The asymptotic distribution is established under explicit assumptions and its applicability is empirically demonstrated.

Paper 2, which I found particularly compelling, proposes a methodology to assess the adequacy of a count time series model. This is achieved by comparing a non-parametric estimator of the probability-generating function (PGF) of the marginal distribution with an estimator derived from the assumed model. The approach focuses on INAR and INARCH models. Under general regularity conditions satisfied by baseline models, the asymptotic distribution of the goodness-of-fit test statistic is established. Since the asymptotic distribution is not easy to estimate, a bootstrapping procedure is proposed and its asymptotic validity is established. Paper 3 builds on this framework by introducing an online detector statistic to identify breaks in count time series.

Papers 4 and 5 explore the estimation of a copula structure for the innovations of multivariate time series. In Paper 4, the mean and variance are first estimated non-parametrically. In paper 5, the technique differs in that the mean, variance and copula are estimated parametrically, also using a multistep procedure. In both frameworks, a surprising oracle property is established, showing that the statistic based on the residuals has the same asymptotic distribution as the corresponding random variable based on the unobservable innovations. Both papers contain extensive and technically challenging proofs. Goodness-of-fit tests are also provided.

All these works, which all deal with the important topic of goodness of fit of time series models, are both theoretically significant and practically relevant. Published in leading international journals, the work strikes an excellent balance between theoretical insights and practical applications, supported by illustrative Monte Carlo simulations and real-world data analysis. This habilitation thesis represents a substantial advancement in the field of time series analysis.

A review of the habilitation thesis using the Turnitin system confirms its originality. As expected, the system indicates that overlaps are limited to the published papers and their preprints.

For all the reasons outlined above, I strongly and unreservedly support the defense of this habilitation thesis.

Sincerely,

Christian Francq
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