Proposal: Modelling Causal-Noncausal Processes

Prof. Alain Hecq (Maastricht University)

The causal-noncausal models represent stationary processes characterized by locally explosive patterns, such as bubbles and spikes. The univariate causal-noncausal models were examined, for example, by Breidt et al. (1991) and Lanne and Saikkonen (2011), and extended to multivariate analysis by Lanne and Saikkonen (2013), Gourieroux and Jasiak (2017), and Davis and Song (2020). In applied research, causal-noncausal models were used to study various economic and financial variables, including Bitcoin prices [Hencic and Gouriéroux (2015), Cavaliere et al. (2020)], stock market indices [Gourieroux and Zakoian (2017)], com-modity prices [Hecq and Voisin (2021), Lof and Nyberg (2017)], and inflation rates [Lanneand Saikkonen (2013), Hecq and Voisin (2023)].

One of the main advantages of these models is their ability to capture complex nonlinear patterns, such as local trends and conditional heteroskedasticity, while still resembling traditional linear time series models in specification. However, the standard Box–Jenkins approach to identifying and estimating linear time series processes does not apply here, as it relies on the assumption of Gaussian errors. Under this assumption, causal and noncausal dynamics cannot be distinguished (see Gouriéroux and Monfort (2015)). Therefore, identification requires assuming non-Gaussian error distributions in causal–noncausal processes.

The aim of this small course is to provide an overview of the use of causal and noncausal models for economic and financial time series. I would propose a list of sessions with the following sort of draft schedule:

1) Introduction to mixed causal and noncausal models, model representations
2) Estimation of univariate noncausal models by MLE
3) The GCov estimator
4) Multivariate noncausal models
5) Comovement in mixed causal and non causal models
6) Forecasting and impulse responses

Examples using MATLAB and R routines will be examined at each session.