PhD Course

Frequency domain methods in econometrics

Dates

TBA April-May 2019

Lecturer

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Course description

The course is an introduction to time series analysis in the frequency domain. Frequency domain methods rely on the periodogram, which is a transformation of the series, based on the discrete Fourier transform, with interesting properties that bring out features of the series and facilitate inference for classes of time series models. The asymptotic properties of the periodogram will be considered and used for estimating the spectrum of a random process. For a given time series model, parametric inferences can be based on a large sample approximation to the true likelihood known as the Whittle likelihood. Our illustrations deal with estimation of ARMA, unobserved component models for trend-cycle analysis and parametric and semiparametric long memory models for stochastic volatility.

1. Stationary random processes and their second order properties
- The autocovariance generating function
- The spectral density
- Generalized spectrum; cepstrum; predictability, interpolability and mutual information.
2. The periodogram
- Definition and properties
- Asymptotic properties
- Nonparametric spectral estimation
3. Maximum likelihood estimation in the frequency domain
- Derivation of the Whittle likelihood
- Applications: ARMA models, unobserved components models, long memory models.
4. Signal extraction in economics: the Baxter and King filter; the HP filter, the Wiener-Kolmogorov filter.
5. Introduction to locally stationary processes
6. Multivariate spectral density. Coherence and phase.

References

- The main reference for topics 1 and 2 is Brockwell, P.J. and Davis, R.A. (1991), Time Series: Theory and Methods, Springer-Verlag, New York, Chapters 4 and 10.

- The main reference for topic 3 is Dzhaparidze, K., (1986), Parameter Estimation and Hypothesis Testing in Spectral Analysis of Stationary Time Series.

Other important references are

- Fuller W. (1996). Introduction to statistical time series. Wiley. Chapters 3, 4, 7.
- Bloomfield, P. (2000). Fourier analysis of time series. An Introduction. Wiley.
- Percival, D. B., and Walden, A. T. (1993). Spectral Analysis for Physical Applications. Cambridge University Press.
- Brillinger R.D. (1981) Time series: data analysis and theory. SIAM
- Priestley, M. B. (1981). Spectral Analysis and Time Series. Academic Press.

- For the applications to long memory processes an excellent review is Velasco, C. (2006) `Semiparametric Estimation of Long-Memory Models'. Palgrave Handbook of Econometrics, Vol. 1. Econometric Theory, K. Patterson and T.C. Mills eds, Palgrave, MacMillan, 353-395, 2006.