



Constrained Functional Time Series: One-day Ahead Prediction of Daily Demand and Offer Curves

Simone Vantini
Politecnico di Milano

Thursday, 7th May
12:30pm Room 3-E4-SR03 Via Röntgen 1 Milano

Abstract

Motivated by market dynamic modeling in the Italian Natural Gas Balancing Platform, we propose a model to analyze time series of bounded and monotonic functions. In detail, we provide the constrained functions with a suitable pre-Hilbert structure and introduce a useful isometric bijective map associating each possible bounded and monotonic function to an unconstrained. We then introduce a functional-to-functional autoregressive model that we use to predict the entire demand/offer function. We estimate the model by minimizing the squared L^2 distance between functional data and functional predictions with a penalty term based on the Hilbert-Schmidt squared norm of autoregressive lagged operators. We have proved that the solution always exist, unique and that it is linear on the data with respect to the introduced geometry thus guaranteeing that the plug-in predictions of future entire demand/offer functions satisfy all required constraints. We also provide an explicit expression for estimates and predictions. The approach is of general interest and can be generalized in any situation in which one has to deal with constrained monotonic functions (strictly positive or bounded) which evolve through time (e.g., dose response functions right-censored survival curves or cumulative distribution functions).

References:

Canale, A., Vantini, S. (2014): Constrained Functional Time Series: an Application to Demand and Supply Curves in the Italian Natural Gas Balancing Platform, MOX report 42/2014, Dept. of Mathematics - Politecnico di Milano.

Available at mox.polimi.it