Abstract

In this paper, we implemented Functional Principal Component Analysis (FPCA) to forecast electricity prices and evaluated its forecast accuracy for single- and multi-days-ahead forecast. Using non-parametric smoothing, the model is applicable to functional time series data which are observed discretely. FPCA was then applied to decompose the functional data to obtain a set of functional principal components (FPC) and their corresponding FPC scores. We then fitted a vector autoregressive (VAR) or vector autoregressive exogenous (VARX) model using electricity load as the exogenous variable to generate forecast for the individual FPC scores. Finally, the price forecast was obtained by using truncated Karhunen-Loève expansion. This proposed method will be applied to data from the California and Singapore electricity market. From our study, we observed that the exogenous variable, historical load, and the indicator variable, weekday-weekend binary variable, has little predictive power for forecasting electricity prices in the two electricity markets we studied. The study also compared the forecast performance of our proposed model against the benchmark naïve model and other time series based models. Through the comparisons, we found that our proposed model performs decently when compared to other models when the time series structure is stable. However, for markets where there were a clear structural change, all the time series based models failed to outperform the benchmark naive model for multi-days-ahead forecast.