Modeling and forecasting electricity forward prices: A Dynamic Semiparametric Factor Model approach

Rafał Weron[1] and Szymon Borak[2]

[1] *Hugo Steinhaus Center, Institute of Mathematics and Computer Science, Wrocław University of Technology, Wyspiańskiego 27, 50-370 Wrocław, Poland*
rafal.weron@pwr.wroc.pl

[2] *CASE – Center for Applied Statistics and Economics, Humboldt-Universität zu Berlin, Spandauer Str. 1, 10178 Berlin, Germany*
borak@wiwi.hu-berlin.de

ABSTRACT

The Dynamic Semiparametric Factor Model (DSFM) is a new principal component type approach originally introduced for modeling the complex structure of implied volatility surfaces [1]. It can be seen as a combination of functional principal component analysis and nonparametric curve estimation. Here we employ it to recover and model the dynamics of electricity forward curves in the Nordic power market Nord Pool. The forward curves are approximated by unknown basis functions moving in a finite dimensional function space. We use only finite dimensional fits to the forward electricity curves, which are obtained in the *local* neighborhood of forward price–maturity pairs for a given day. Curve estimation and dimension reduction is achieved in one single step.

After the DSFM model is calibrated to forward prices it is used for out-of-sample predictions of future forward curves. More specifically, the time-varying coefficients of the basis functions are predicted 1, 5, 10 and 25 days ahead using ARMA-type models and then these predictions are combined with the basis functions to yield forecasts of the whole forward electricity curves at future points in time. The presented approach leads to more accurate forecasts than application of the classical Principal Component Analysis (PCA) [2, 3].

References

[1] Fengler, M., Härdle, W., Mammen, E. (2007) *A semiparametric factor model for implied volatility surface dynamics*, Journal of Financial Econometrics, doi: 10.1093/jjfinec/nbm005. See also: SFB 649 Discussion Paper 2005-020.

[2] Koekebakker, S., Ollmar, F. (2005) *Forward curve dynamics in the Nordic electricity market,* Managerial Finance 31, 2005, 74-95.

[3] Weron, R. (2006) *Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach*, Wiley, Chichester.