Short- to Mid-Term Day-Ahead Electricity Price Forecasting Using Futures: Executive Summary

Rick Steinert, Florian Ziel

A vast majority of researchers and practitioners focus on modeling the time series of electricity prices by detecting crucial factors for the formation of prices and try to quantify the impact of these factors. These factors are usually chosen from a set of fundamental and easily relatable variables, such as the production of different energy sources as well as the demand for electricity.

However, even though these approaches are very accurate in modeling, e.g. describing the price movements of electricity prices, they often have issues with forecasting electricity prices especially when more than one day is considered. The reason for that is that most of these relevant factors, e.g. wind energy production, cannot be forecasted accurately for a long time period.

Therefore we decided to build up a model which does not infer prices from these fundamental factors but instead uses the true source of price in an economic sense: the market expectations. To get an insight in this unobservable variable we use future products. These future products are an almost direct representation of the expectation of market participants for prices in the future. As there are many different maturities traded for electricity prices, we can infer for much longer forecasting horizons than many other approaches. We therefore decided to use the data of the electricity market of Germany and Austria (EEX and EPEX) from 2015 to 2017. Figure 1 shows

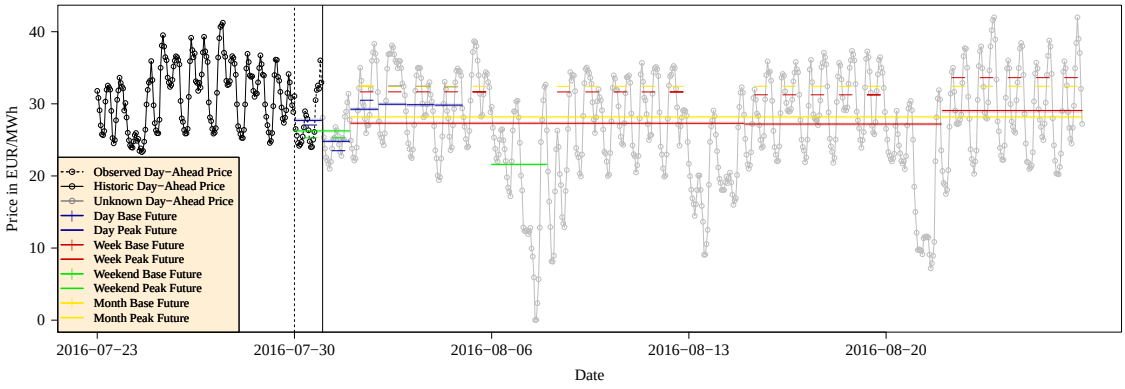

Figure 1: The day-ahead electricity price and the considered future products of our model. The different colored lines show Future products traded at the end of 29.07.2016 aligned to the time to which their underlying corresponds. Vertical lines depict the difference of one day for which the day-ahead price is known in the future.

the different traded futures and their correspondence to the real electricity price of the future. It can be seen that, especially for the upcoming week, the futures provide good insights about the overall level of the electricity price. It is important to acknowledge that the traders who invested in futures could not know the electricity prices of later than 29.07.2016 but still were able to create a realistic approximation of the price situation.

Our model therefore considers future prices as input variable for modeling the prices of day-ahead electricity in the future, together with deterministic common sense factors like weekdays, holidays and seasons of the year. A sparse estimation and selection algorithm is able to automatically detect which futures are relevant and which not.

Utilizing our model for forecasting hourly day-ahead electricity prices from May 2016 to April 2017 leads to superior forecasting results for up to 28 days. To prove that we compared our model with very strong benchmarks of the literature. We can show that our model outperforms these models for almost every hour of the forecasting period, even when the benchmark model uses fundamental regressors like load and wind and solar power. The selection algorithm helps us to gain insights on the price formation which have never been documented before. We find that the day future for a specific day also influences the prices of the following day, but usually only the early morning hours. We were also able to conclude that the weekend peak future has only little explanatory power for the electricity prices.

The results are beneficial for researches but especially for practitioners, as they show that producing own forecasts for factors like wind power and electricity demand might be not always necessary. Modelers can just infer from futures about the day-ahead prices of the future. For a practitioner this is especially useful as forecasting these complex time series is usually out of scope resulting in additional company expenses as these forecasts have to be bought from other sources. The findings of our paper may also spread awareness about the common mistakes of treating modeling and forecasting a time series as the same thing. Even if fundamental factors are better for modeling and therefore explaining the movement of electricity prices it might be still an inferior idea to use them for forecasting, as these factors cannot be easily forecasted for the given forecasting horizon.