

Medium-term probabilistic forecasting of electricity prices: a hybrid approach

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Abstract— This paper provides a focus upon forecasting electricity prices in the medium term (from a few weeks to several months ahead) in which accurate estimates of tail risks, e.g. at the 1%, 5%, 95% and 99%, are important. Medium term forecasting and risk analysis are important for operational scheduling, fuel purchasing, trading and profit management. We extend the research on hybrid forecasting methods, which link detailed fundamental price formation models, using optimization techniques and market equilibrium considerations, with econometric re-calibration to the time series data. This paper is innovative in its use of quantile regression to undertake the recalibration and provide accurate risk estimates. It is shown that probabilistic outputs from the fundamental model add value over expected value inputs to the quantile regressions and that if the fundamental model is itself well-specified to diurnal variation through the inclusion of relevant explanatory variables such as demand or climatic conditions, then it is not necessary to undertake the quantile regressions separately for each hour of the day. A real application of the proposed methodology is successfully tested on the Spanish electric power system, in which the high penetration of intermittent wind generation creates extreme price risks. The hybrid method outperforms the more conventional fundamental model, making particular use of wind generation data in the quantile re-calibrations.

Index Terms— Electricity prices, probabilistic forecasting, hybrid model, fundamentals, quantile regression.

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