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Multivariate Probabilistic Forecasting for Day-ahead Electricity Prices, Battery Trading and the Financial Evaluation of Forecast Performance

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Electricity price forecasting is crucial for decision-making in energy markets and the operation of energy assets. Probabilistic forecasts are increasingly adopted because they explicitly quantify uncertainty. In many applications, probabilistic forecasts are either issued as quantile predictions, which describe the marginals, or as ensembles (or scenarios) of the full predictive distribution. Yet it remains unclear how improvements in statistical forecast quality translate into economic value. Battery storage arbitrage in day-ahead electricity markets is often used as an application-based benchmark for this purpose. In this brief paper, we analyze popular quantile-based trading strategies (QBTS) and highlight two critical flaws: QBTS do not incentivize honest probabilistic forecasting and they ignore the intertemporal dependence structure of electricity prices. Furthermore and somewhat surprisingly, we show that risk-neutral and risk-averse battery trading strategies, even if based on a fully multivariate probabilistic forecasts, cannot necessarily be used to search for the best forecast from a set of competing forecasting models. We provide theoretical justification for these claims and an empirical evaluation. Our application study is based on data from the German electricity market and highlights the difficulties of ranking price forecasting models based on battery trading strategies. We discuss these pitfalls in application-based evaluation of price forecasting and conclude with implications for forecast evaluation practice and directions for future research.

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