ANALYSIS AND FORECASTING OF ELECTRCITY PRICE RISKS WITH QUANTILE FACTOR MODELS

Executive Summary

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Electricity prices are well recognised for being particularly volatile with price shocks commonly attributed to various exogenous factors such as demand, fuel prices, production and system outages. Many price forecasting models use these factors to produce expected price levels, with volatility around these expectations being represented in a conventional, stochastic way. This paper takes a different approach to modelling the uncertainty in power price forecasts.

Using the technique of quantile regression, the percentiles of the day ahead predictive distribution for spot prices are estimated separately as a function of these exogenous factors. The intuitive attraction of this approach is that effect of demand, fuel prices or reserve margin variations can be modelled as having distinctly different effects at for example the 95th percentile of the predictive distribution compared to the mean or the 5th percentile. This can therefore be used for accurate day-ahead nonparametric density estimation (via multiple percentiles) of the spot price distributions, as an aid for producers, retailers, and speculators in determining their optimal strategies for short-term operations, risk management, hedging and trading.

Essentially, this approach provides explicit models for a range of "value-at-risk" price forecasts, and as such it was validated against the conventional alternatives. The paper reveals that the quantile regression models, taking into account the nonlinear effects of exogenous factors across the range of percentile, outperforms the benchmark CAViaR and GARCH models on extensive backtesting with British daily prices. Furthermore, including conditional volatility as a factor captures heteroscedasticity in transparent way, with plausible market-induced effects, without the need for a fully parametric specification of the price distribution. The benefit of being able to model the distinctly different impacts of fundamentals is evident not only in explanatory power and the potential for scenario construction in risk simulation, but also in out of sample forecasting performance at various risk levels.