Common unobserved determinants of intraday electricity prices

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Executive summary

Electricity prices have special statistical properties where long-memory effects, varying-level periodicities, cross-dependencies and other exogenous influences work together to form a complex data-generating process. The need to accurately model all these features typically leads to complex vector parametrizations, a modelling option which often leads to numerical instability, overfitting and poor transparency. A natural counterpart to an overparameterized model generated from the cross-section of electricity prices is to implement factor decomposition techniques to simplify the modeling process by identifying a more compact structure of lower dimensionality.

In this paper, we employ multilevel factor modelling techniques to unravel systematic unobserved determinants of the intraday and interzonal price curve dynamics for the Pennsylvania-New Jersey-Maryland (PJM) interconnection. These techniques make an explicit separation of global drivers from region-specific common factors, thereby facilitating the identification of the actual sources of co-variability. Our empirical findings confirm the hypothesis that the common unobserved determinants of power prices in the PJM interconnection obey a block structure, some of which affect particular segments of our panel. We argue that a multilevel factor approach offers a more systematic and transparent representation of intertemporal and cross-sectional patterns in PJM electricity prices compared to computationally intensive VARMAX parametrizations and single-level factor models, which are often presented in the literature as plausible modelling alternatives.

Keywords: Multilevel factor models; power price dynamics; day-ahead electricity markets; PJM interconnection

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