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Combining day-ahead forecasts for British electricity prices

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ABSTRACT

This paper considers how well the approach of combining forecasts extends to the context of electricity prices. With the increasing popularity of regime switching and time-varying parameter models for predicting power prices, the multi model and evolutionary considerations that usually support the combining of simpler time series methods may be less applicable when the individual models incorporate these features. We address this question with a backtesting analysis on British day-ahead prices. Furthermore, given the volatility of power prices and concerns about accurate forecasting under extreme price excursions, we evaluate the results using various error metrics including expected shortfall. The comparisons are furthermore carefully simulated to consider model selection uncertainty in order to realistically test the value of combining as an ex ante policy. Overall, our results support combining for both accurate operational planning and risk management.

1. Introduction

The value of combining forecasts to achieve accurate predictions is now well-established, with extensive research and convincing applications extending back over 50 years to the work of Granger and his colleagues at Nottingham (Bates and Granger, 1969; Newbold and Granger, 1974; Reid, 1968, 1969). Despite this body of knowledge, it is quite surprising to observe the absence of substantial research on combining in the context of forecasting electricity prices. Since the established research on electricity markets suggests a wide variety of candidate methods for price forecasting (see, for example, Bunn, 2004; Serati et al., 2008; Weron, 2006) but without any predominant method having emerged, and with model selection varying over time (Chen and Bunn, 2010), the benefits of combining would appear to be very propitious. However, given that the approach of regime switching, which has an implicit multimodel structure, and time-varying parameter models, which capture model evolutions, has become widely advocated to represent power price dynamics, it is possible that these specifications, to the extent that such models are included in the candidate set of predictive models, may encapsulate and thereby preclude any benefits of simple combinations. We therefore investigate this open question through a detailed study of the effectiveness of combining a set of four carefully specified models, ARMAX, linear regression, Markov regime switching and time-varying regressions, as applied to day-ahead forecasting of British half-hourly power prices.

Methods of increasing sophistication (see, for example, Sánchez, 2008; Yang, 2004) followed the simple adaptive time series approach of Bates and Granger (1969), including Bayesian (Bunn, 1975, 1977), and econometric (Granger and Ramanathan, 1984), as well as extensions to large data sets (Stock and Watson, 2001, 2004), but, for robust forecasting, it has appeared hard to improve upon simple averaging (Clemen, 1989; Makridakis and Winkler, 1983; Smith and Wallis, 2009; Stock and Watson, 2001, 2004). In our study, we still, however, compare different combination methods with constant and adaptive weights. We analyze forecasting performances using several error metrics for evaluating prediction accuracy on the levels and a quantile defined measure, namely the expected shortfall, for evaluating prediction accuracy on the tails. To consider a variety of performance measures is important in this context, because the spiky nature of power prices has strong implications in terms of the riskiness of using different models or different performance measures.

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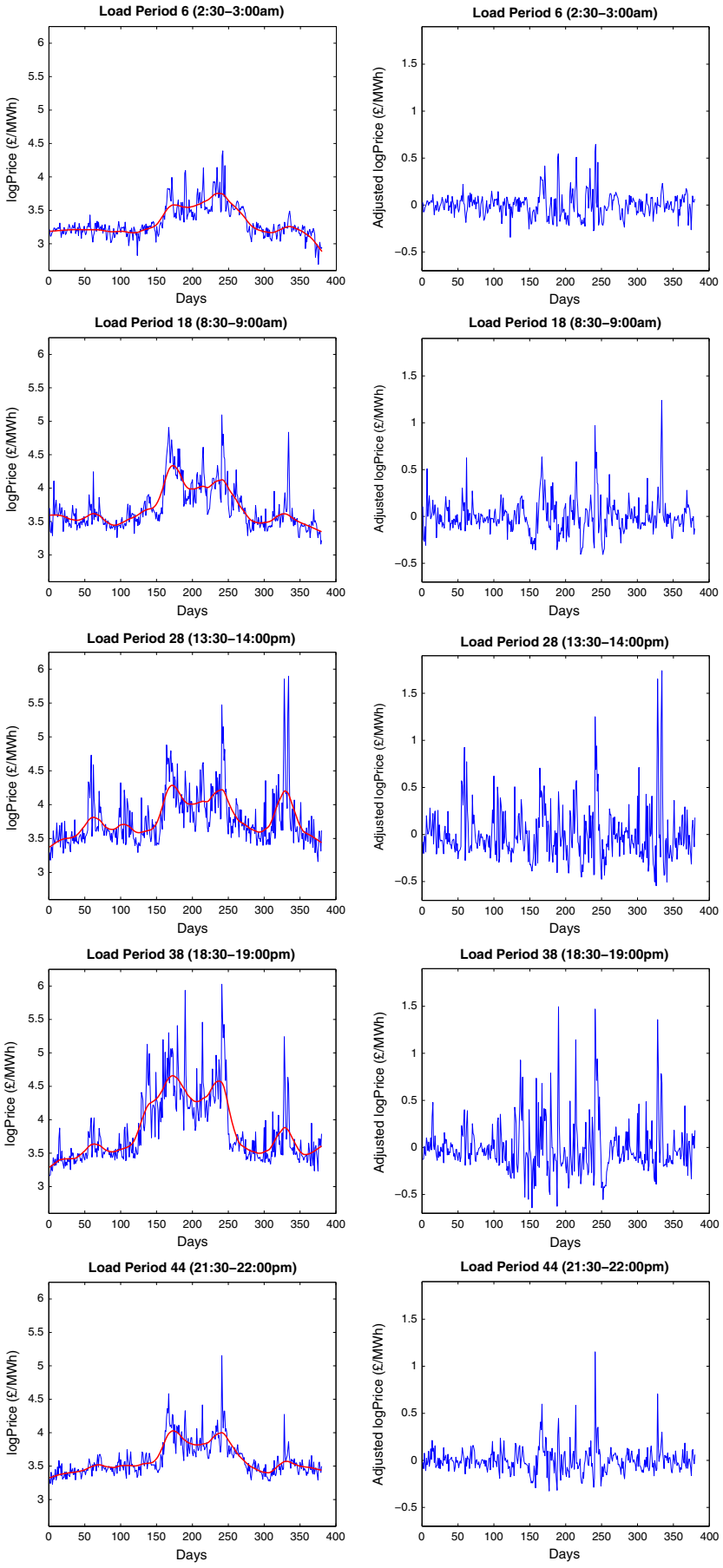

Fig. 1. Left panels: log-price time series, $logP_{jt}$, with superimposed D_{jt} for the period April 2005–September 2006. Right panels: the adjusted series p_{jt}.