

Executive summary for “Space-time modeling of electricity spot prices”

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Whilst there is much research on the temporal dynamics of electricity spot prices (see e.g. Efimova and Serletis 2014; Haldrup et al. 2010; Haldrup and Nielsen 2006; Park et al. 2006 and Huisman and Mahieu 2003), less attention has been paid to the role of spatial dynamics of electricity spot prices. However, such dynamics are necessarily important when prices and loads are determined in a network grid of power exchange.

We study the joint space-time dynamics of electricity spot prices using data for the Nord Pool power grid. A general spatial Durbin model that incorporates the temporal as well as spatial lags of spot prices is presented. By using different spatial weight matrices statistical tests show significant spatial dependence in the spot price dynamics across areas and estimation of the model shows that the spatial lag variable is as important as the temporal lag variable in describing the spot price dynamics. We use the partial derivatives impact approach to decompose the price impacts into direct and indirect effects and demonstrate how price effects transmit to neighboring markets and decline with distance.

Accounting for spatial interaction effects in spot prices is important not only for estimation accuracy and efficiency but also may provide better forecasting performance. Incorporating past and current spot prices in nearby bidding markets is shown to improve the forecast accuracy of the joint space-time model compared to the non-spatial model. The forecast improvements are found for 7 and 30 days ahead predictions in particular.

The Nordic power grid and the associated power market has experienced significant deregulation over the past 15 years. This concerns both the design of the auction market conditions and improvements in the physical power transmission system. The purpose of such deregulation and liberalization has been to improve the general competitive market environment for power. Intuitively, such deregulation should increase spatial price correlation across power grid points. In an attempt to examine such market integration and competition, a model with time varying parameters is estimated for an expanded sample period and it is found that the spatial correlation within the power grid has increased over time. We interpret this

to indicate an increasing degree of market integration within the sample period.