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STATISTICAL MODELING OF ELECTRICITY PRICES ON LITHUANIAN POWER EXCHANGE USING EXTREME VALUE THEORY

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ABSTRACT

The paper deals with the statistical analysis of electricity prices and volumes on newly launched (reshaped) Lithuanian Power Exchange and focuses on application of the extreme value theory to distinguish the extreme values of both prices and volumes, and to make forecasts (predictive inference) of those extreme values. The analysis also includes the statistical correlations of both variables of Power Exchange (prices and volumes) with Lithuanian power system demand loads.

Such type of analysis became possible only in this year, since hourly electricity trading on Lithuanian Power exchange was started from January 1, 2010. Prior to this date Lithuanian independent suppliers traded only day volumes.

The electricity prices on power exchange (and on the market, in general) may be treated as random variables. Historically, statistical models of electricity prices fluctuations in markets were based on statistical parameters as means and root mean squires (variances) of prices dataset. The extreme prices were expressed via those parameters. For short-to-medium time scales those parameters were used for future extrapolation, both for maxima and minima, to make inferences on probable values. Here the assumption on the identical, or, at least, similar statistical behavior of future prices is the backbone of prediction.

Extreme value theory seems to be a new promising tool for statistical analysis of prices under discussion.

The theory concerns mathematical modeling of extreme events. Recent developments have introduced very flexible and theoretically well motivated semi-parametric models for extreme values which now are at the stage where they can be used to address important technological problems on handling risks in areas such as wind engineering, flood monitoring and prediction, climatic changes and large insurance claims or large fluctuations in financial data. In many applications of extreme-value theory, predictive inference for unobserved events is the major target. Statistical modeling of extreme events for practical purposes counts less than 20 years.

Statistical modeling of extreme events deals with two main problems:

1. Distinguishing data of extreme events (what events we call extreme?),
2. Choosing and applying best statistical model to distinguished data.

If the both problems are solved, prediction of future events is possible.

In our investigation we applied the ***SAS*** and ***R*** statistical analysis software tools to analyse the datasets of both variables of Lithuanian Power exchange. The extreme price and electricity volumes were considered as extreme statistical events, with thresholds of extremality determined in strictly formal approach in accordance with extreme value methods. We identified the type of statistical model (probability function) of prices and volumes and made preliminary predicative inferences for upcoming time event.

KEYWORDS: modeling, electricity prices, market, statistical analysis, extreme value