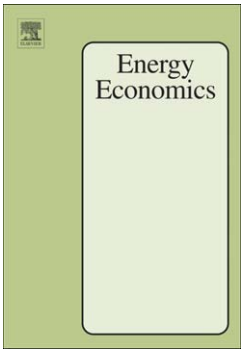

Predictability of price movements in deregulated electricity markets

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Predictability of price movements in deregulated electricity markets

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Abstract

In this paper we investigate predictability of electricity prices in the Canadian provinces of Alberta and Ontario, as well as in the US Mid-C market. Using scale-dependent detrended fluctuation analysis, spectral analysis, and the probability distribution analysis we show that the studied markets exhibit strongly anti-persistent properties suggesting that their dynamics can be predicted based on historic price records across the range of time scales from one hour to one month. For both Canadian markets, the price movements reveal three types of correlated behavior which can be used for forecasting. The discovered scenarios remain the same on different time scales up to one month as well as for on- and off- peak electricity data. These scenarios represent sharp increases of prices and are not present in the Mid-C market due to its lower volatility. We argue that extreme price movements in this market should follow the same tendency as the more volatile Canadian markets. The estimated values of the Pareto indices suggest that the prediction of these events can be statistically stable. The results obtained provide new relevant information for managing financial risks associated with the dynamics of electricity derivatives over time frame exceeding one day.

Keywords:
Deregulated electricity markets, efficient market hypothesis, detrended fluctuation analysis, financial forecasting

1. Introduction

The modern electricity market is not only a system for arranging the purchase and sale of electricity using supply and demand to set the price, but, for most major grids, is a basis for electricity derivatives, such as electricity futures and options, which are actively traded. The practical significance of this part of the market is increasing as is the importance of the related scientific research [1, 2, 3]. The markets of electricity derivatives have developed as a result of the liberalization and deregulation of electric power systems around the world. Deregulation, introduced initially to reduce and simplify the control of the business in this field, had a final goal to reach financial efficiency of electricity markets [4, 5]. However, electricity is unique as it is a non-storable commodity, and the markets remain extremely inefficient [6, 7].

Electricity prices are not a result of long-term but instant, usually on an hourly interval, balance of supply and demand. Moreover, as a consequence of the complexity of a wholesale electricity market, it can show an extremely high price volatility at times of peak demand and supply shortages. This price spikes are hard to predict and financial risk management is still a high priority for participants in deregulated electricity markets due to the substantial price and volume risks that the markets can exhibit [8, 9, 10].