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Comparative analysis of features of Polish and Lithuanian Day-ahead electricity market prices



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ABSTRACT

The goal of this article is to better understand the processes of electricity market price formation in Poland and Lithuania through an analysis of the features (volatility and spikes) of Lithuanian and Polish day-ahead electricity market prices and to assess how acquired electricity price features could affect the achievement of the main goals of the national energy policy. The following indicators have been calculated to determine electricity market price volatility: the oscillation coefficient, the coefficient of variation, an adjusted coefficient of variation, the standard deviation indicator, the daily velocity indicator (based on the overall average price) and the daily velocity indicator (based on the daily average price). Critical values for electricity market price have been calculated to evaluate price spikes. This analysis reveals that electricity market-price volatility is moderate in Poland and high in Lithuania. Electricity price spikes have been an observable phenomenon both in Lithuanian and in Polish day-ahead electricity markets, but they are more common in Lithuania, encompassing 3.15% of the time period analysed in Poland and 4.68% of the time period analysed in Lithuania. Volatile, spiking and increasing electricity prices in day-ahead electricity markets in Lithuania and Poland create preconditions and substantiate the relevance of implementation of the national energy policies and measures.

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1. Introduction

In the early 1990s, liberalisation provisions in the electricity sector started to be practiced by the governments of the European Union countries. The implementation of the provisions meant that electricity sector-related activities carried out by the state monopoly had to be clearly separated into electricity production, transmission, distribution and supply. It was acknowledged that while the electricity transmission and distribution sectors would remain natural monopolies, competition principles had to be implemented in the electricity production sector. Thus, the supporters of liberalised ideas sustained the concept of a market, whose functioning has to be based on the principles of

competition. They argued that this would allow receiving many benefits, including efficiency gains, price reductions, high standards of service provided and increased competitiveness.

Three packages for the liberalisation of electricity markets were published in the European Union. The first one was announced in 1996. It obtained the form of Directive 96/92/EC concerning common rules for the internal market in electricity ([The European Parliament and the Council of European Union, 1996](#)). Directive 96/92/EC established general rules for electricity generation, transmission and distribution. It laid down rules for the organisation of the electricity market, market access and criteria and procedures applicable to tendering, licensing and exploitation of the networks. The completion of a competitive electricity market was recognised as an important step towards the creation of the internal energy market. Intentions to speed up the liberalisation process as well as to detect essential shortcomings in the electricity sector, with an objective to improve the functioning of and achieve a fully

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operational electricity market led to the announcement of the second package for the liberalisation process. The Directive 2003/54/EC (The European Parliament and the Council of European Union, 2003) highlighted that network access must be non-discriminatory, transparent and fairly priced, seeking that competition in the electricity market would function. In order to complete the internal electricity market, a non-discriminatory access to the network by the transmission or the distribution system operator was acknowledged as being of high importance. In 2009, the third package of electricity market liberalisation was published. Directive 2009/72/EC (The European Parliament and the Council of European Union, 2009) states that a well-functioning internal electricity market must provide producers with the appropriate incentives for investing in new power generation, including in electricity from renewable energy sources, paying special attention to the most isolated countries and regions. Besides, a well-functioning market must provide consumers with adequate measures to promote the more efficient use of energy for which a secure supply of energy is a precondition and to reduce energy prices and help achieve the main goals of national energy policies.

These three packages of electricity market liberalisation were transferred into the national laws of the member states of the European Union and caused significant structural changes in the power sectors. As a result, electricity markets became sophisticated constructs, which had been established to tackle issues that emerged and implement goals of national energy policies. Currently, electricity markets consist of many sub-markets. The most important sub-markets operate at power exchanges that have been established during the progression of electricity market liberalisation. Currently, power exchanges operate the commodity derivatives market, intraday market, property rights market for renewable energy sources and co-generation, CO₂ emission-allowance market and a day-ahead market (a physical spot market for electrical power). Nowadays, the day-ahead sub-market performs an important role in the electricity market. It establishes prices of electrical power for other contracts concluded on the wholesale electricity market, allows market participants to initially balance their contractual positions, allows indirect pricing of the value of power enterprises (primarily generators) through pricing of the commodity that they are producing (i.e., electrical power) and provides signals to the generators in the domain of building new generation capacity.

The implementation of the packages of electricity market liberalisation in Lithuania and Poland allowed establishing day-ahead markets in these countries too. The day-ahead market in Poland was the Polish Power Exchange's (POLPX) first market, launched 6 months after the POLPX's registration in 1999. Currently, the day-ahead market of the POLPX is composed of 24-h markets, each quoting one type of hourly contract. Additionally, the day-ahead market quotes three block contracts (PASMO, Euroszczyt and Offpeak) (POLPX, 2010). The day-ahead electricity market in Lithuania is one of BaltPool's more important activities and is run according to the principles of Nord Pool Spot AS. Currently, the day-ahead electricity market enables the arrangement of hourly contracts and, because of the benefits it provides, is supported by market participants.

Some time has elapsed since the day-ahead electricity markets began operating in Lithuania and Poland. Thus, it is worthwhile to assess how electricity prices in a day-ahead electricity market have changed, what features they acquired and how they affected the achievement of the main goals of the national energy policy. This assessment is the goal of the article. The primary objectives of this study are:

- to review the scientific literature on features of day-ahead electricity market prices;

- to segregate indicators that allow an assessment of electricity market price features, that is, volatility and spiking;
- to perform an empirical examination of the features of electricity market prices that have formed in Lithuania and Poland and
- to discuss how electricity market price volatility and spikes influence the achievement of the main goals of the national energy policies of Lithuania and Poland.

Scientific literature analysis and statistical data analysis are used to meet these objectives.

2. Review of the literature

Liberalisation of the electricity markets has brought about considerable changes in the power sectors of the member states of the European Union. The process of electricity price formation has been reconsidered and this has been accepted as one of many important changes that have been caused by the process of electricity market liberalisation. After the transition to a marginal pricing method in a newly established day-ahead market, electricity prices have acquired several fairly new features, which were analysed by Conejo *et al.* (2005), Knittel and Roberts (2005), Seifert and Uhrig-Homburg (2007), Swider and Weber (2007), Karakatsani and Bunn (2008) and others. Researchers agree that electricity price volatility and price spikes are worthy of analysis, since occurrence of these features highly influences the performance results of electricity trading companies, electricity consumers and policy makers who set the main goals of the national energy policy.

2.1. Electricity market price is volatile

Volatility is one of the commonly noted features of electricity market prices. Volatility refers to the unpredictable fluctuations of a price (Zareipour *et al.*, 2007). Prior to electricity market liberalisation, electricity price volatility was minimal and controlled. However, after liberalisation, the price of electricity has simply become a price that is characterised by very high volatility (Tashpulatov, 2013) that is found neither in securities nor in other commodity markets.

Many reasons have been found for the emergence of electricity price volatility in the liberalised electricity markets. Bessembinder and Lemmon (2002) and Zareipour *et al.* (2007) determined that electricity price volatility is higher when demand is high. Interesting results have been proposed by Knittel and Roberts (2005), who noted that electricity market price volatility increases more with positive shocks than with negative shocks. Scientists call this effect the 'inverse leverage effect'.

The European Commission has produced a report on the liquidity and efficiency of wholesale energy markets in the European Union. This report states that electricity price volatility has been influenced by many factors (The Moffatt Associates Partnership, 2008), including capacity withdrawal, fluctuations of CO₂ prices, cross-border congestion, fluctuations of coal prices, erratic production in wind power plants (PPs), manipulations of the market, fluctuations of oil prices and demand seasonality. However, according to respondents, capacity withdrawal and fluctuations of CO₂ prices have been the primary factors affecting electricity price volatility.

Wolak (1998) found that price volatility depended on the rules of participation in the market. Prices have been more volatile in countries where participation in the market is mandatory as opposed to those countries where participation is voluntary.

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