THE SIGNIFICANCE OF CALENDAR EFFECTS IN THE ELECTRICITY MARKET

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Overview

This study contributes to the discovery of calendar effects and their significance in the electricity market. As one specific group of anomalies, calendar effects are often tested in order to explain the volatility of electricity prices. However, the reliability of observed calendar effects is often problematic and controversial because possible calendar effect are not an ex-ante outcome derived from theory, and the method to evaluate the significance of calendar effects is missing.

In this study we introduce a Chi-square test method by Hansen and Lunde (2005) which is able to explore all possible calendar effects and consequently test and compare the significance among possible calendar effects. The reliability of this test method is confirmed from the theoretical aspect, and this method has been applied to discover calendar effects in a series of financial markets.

We apply this test method to the real-time pricing (RTP) data from the wholesale Pennsylvania, New Jersey and Maryland (PJM) electricity market. PJM includes over 11,000 electricity transmission lines, and their RTP records continuously update hourly. Using this method we investigate all possible calendar effects listed from previous studies, and find significant differences between possible calendar effects in PJM.

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Methods

Chi-square test method; Bonferroni bound method.

Results

We observe calendar effects in the PJM market. Our results indicate that the significance of calendar effects varies wildly, and this wild variation exists in every time level, including intraday, daily, monthly and seasonal levels. We find that the electricity price has significant weekend effects and season effects. In the intraday level, the price displays an obvious hour effect during peak load hours. Moreover, we explore day-ahead forward prices and real-time prices and find they have different significant calendar effects, implying that the current forward pricing mechanism does not perform well to forecast the finalized RTP. Specifically, we investigate the calendar effects on negative prices and spike prices. We find significant hour effects on negative prices at night and effects on spike prices during daytime. Negative prices display strong weekend effects while spike prices have weekday effects. We also find evidence that accounts for the high price volatility in the electricity market. Therefore, the Chi-square test method can discover the significance of calendar effect, and consequently help explain electricity price volatility.

Conclusions

In summary, we discuss various calendar effects in the electricity market, and introduce the method to explore the significance of it. We observe various calendar effects in different time levels. By comparison of spike prices and negative prices, we find different calendar effects are significant between two price groups, and further find evidence that accounts for the high price volatility in the electricity market.

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