

NEGATIVE ELECTRICITY PRICES AND RISK PREMIA - NEW EMPIRICAL EVIDENCE FOR THE GERMAN/AUSTRIAN DAY-AHEAD MARKET

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Overview

The process of liberalization in Europe and the growth of electricity from renewable energy sources led to a significant increase in trading activities on wholesale markets. Due to the fact that electricity cannot be economically stored and that forecasts of spot prices are often inaccurate, risk management plays an important role in forward markets. A risk premium, defined as the difference between the forward price and the expected spot price, is often paid as a compensation for bearing price and/or demand risks. According to Bessembinder and Lemmon (2002), the risk premium is negatively related to the variance of spot prices as well as positively related to the skewness of spot prices. Furthermore, it tends to be higher if expected demand increases. There are empirical evidences showing that power traders behave like risk-averse rational economic agents (Longstaff and Wang, 2004; Viehmann, 2011).

Viehmann (2011) analyzes whether risk premia are paid in the German/Austrian day-ahead market. He compares price data of the Energy Exchange Austria (EXAA) and of the subsequent European Power Exchange (EPEX). On both exchanges electricity can be traded for the same market area, but auction results of the EXAA are published two hours before the EPEX. Results of Viehmann (2011) suggest that market participants are willing to pay significant negative and positive risk premia for hourly contracts from October 2005 to September 2008.

Since September 1, 2008 negative electricity prices are possible at the EPEX day-ahead market. They can occur in periods of low demand or interconnection failure. Secondly, the higher feed-in of electricity from renewable energy sources enforced by the German Renewable Energy Act may result in negative prices as well (Fanone et al., 2013). Viehmann (2011) concludes that negative prices might result in a left-skewed price distribution and therefore lead to larger negative premia for the hours affected. However, he could not observe negative electricity prices in the data, because the first negative price at the EPEX day-ahead market occurred at October 5, 2008. Negative prices at the EXAA are only possible since October 15, 2013.

This paper provides new empirical evidence for the German/Austrian day-ahead market by using data from October 2008 to November 2015. It contributes to the literature by investigating the impact of negative and left-skewed electricity prices on the forward premium. Furthermore, the relatively long observation period allows for testing the long-term stability of model parameters.

Methods

In this paper, risk premia are calculated with realized price data assuming random noise for the forecast error (ex-post approach). Following Viehmann (2011), average risk premia are calculated for every individual hour under consideration of intra-weekly pattern. In order to test whether these means are statistically significant different from zero, t-tests with Newey-West standard errors are conducted. To take into account the impact of negative spot prices, sub-samples with positive spot prices are calculated for the periods from October 1, 2008 to October 14, 2013 and from October 15, 2013 to November 17, 2015. The consistency of the model from Bessembinder and Lemmon (2002) is tested with rolling and recursive regressions of the risk premium on the variance and skewness of the spot prices.

Results

The results suggest that risk premia are still paid in the German/Austrian day-ahead market, but their absolute value decreased remarkably. Negative electricity prices have a strong impact on the outcome and a downward as well as an upward bias in the affected hours can be observed. This result contradicts the theoretical considerations of Viehmann (2011) who expected larger negative premia. Regressions of the risk premium on the variance and skewness of the spot price over a rolling window indicate highly unstable parameters for the variance. They become even positively significant after the introduction of negative prices at the EXAA. The impact of price skewness during the entire period is slightly positive, but not statistically significant.

Conclusions

The results suggest that risk premia are still existent in the German/Austrian day-ahead market, but declined in its absolute value. Negative electricity prices have a strong impact on the outcome and it has to be considered whether they arise in the forward or spot market. On the one hand, negative forward prices lead to a decrease in the risk premium. On the other hand, negative spot prices have a positive impact on the risk premium. Overall, results show a downward as well as an upward bias in the affected hours. It can also be shown that risk premia cannot be explained by price risks alone as proposed by Bessembinder and Lemon (2002). Results of rolling regressions indicate highly unstable parameters for the variance and skewness of spot prices which is in line with the conclusions of Haugom and Ullrich (2012).

References

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