RISK EXPOSURE IN ELECTRICITY MARKETS : THE NEED FOR INTRA-DAY HEDGING

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Overview

As market intermediaries, electricity retailers buy electricity from the wholesale market or self-generate for re(sale) on the retail market. Electricity retailers are uncertain about how much electricity their residential customers will use at any time of the day until they actually turn switches on. While demand uncertainty is a common feature of all commodity markets, retailers generally rely on storage to manage demand uncertainty.
On electricity markets, retailers are exposed to joint quantity and price risk on an hourly basis given the physical singularity of electricity as a commodity. In the literature on electricity markets, few articles deal on intra-day hedging portfolios to manage joint price and quantity risk whereas electricity markets are precisely hourly markets. The contributions of the article are twofold. First, we define through a VaR and CVaR model optimal portfolios for specific hours (3 am, 6 am,. . . ,12 pm) based on electricity market data from 2001 to 2011 for the French and German markets. We prove that the optimal hedging strategy differs depending on the cluster hour. Secondly, we demonstrate the significantly superior efficiency of intra-day hedging portfolios over daily (therefore weekly and yearly) portfolios. Over a decade (2001–2011), our results clearly show that the losses of an optimal daily portfolio are at least nine times higher than the losses of optimal intra-day portfolios.
The paper is organized as follows: in section 2 we analyse the market risks faced by a retailer. Section 3 demonstrates the limits of hedging with linear financial instruments compared to physical hedging for all cluster hours. Section 4 is devoted to comparing from numerical simulations the risk profiles of different intra-day portfolios' made exclusively (or conjointly) of forwards, options, and/ or physical assets (electricity plants). The last section concludes and provides policy recommandations.

Methods

We demonstrate through numerical simulations based on hourly volume and price data from the French and German electricity spot markets, how a portfolio consisting of forward contracts, options, and/or physical assets can be optimized on an intra-day basis to reduce a retailer's net revenue exposure. We use the Value at Risk (95%) and the corresponding CVaR to compare the risk profile of the simulated intra-day and daily portfolios.

Results

The paper contributes to the literature on electricity retailers'risk hedging. We simulate optimal intra-day portfolios given that electricity markets are hourly markets. First, we demonstrate that the optimal hedging strategy differs depending on the cluster hour with respect to VaR and CVaR risk indicators. Second, we prove the significantly superior efficiency of intra-day hedging portfolios over daily (therefore weekly and yearly) portfolios. Over a decade (2001–2011), our results clearly show that the losses of an optimal daily portfolio are at least nine times higher than the losses of optimal intra-day portfolios.

Conclusions

A clear understanding of risk management strategies within electricity markets is crucial for market players, energy regulators, and financial investors. Without appropriate risk management instruments, the contribution of electricity retail markets to the global performance of the electricity industry will remain uncertain. We believe that this article contributes to a better understanding of risk management issues in electricity markets. The challenge for energy regulators is to enhance the liquidity of risk management instruments such as intra-day options to minimize vertical integration.

A relevant research extension is to propose a dynamic framework for hedging strategies with distinct and/or additional financial derivatives.

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