Hydroelectric Scheduling: Empirical Evidence

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1 Overview

Hydroelectric scheduling entails managing a set of inventories so as to release water through the turbines when electricity price is high relative to the marginal value of reservoir water. Reservoirs have a fixed size and inflow is random and, therefore, care must be taken not to spill too much of the water. Producers have some flexibility given by the water reservoirs. They can benefit from the volatile electricity prices and produce at high electricity prices and save the water when prices are low.

Theoretically the producers want to make a strategy so that the present value of future production is maximized. This is emphasized by Wallace and Fleten [2003], Näsäkkälä and Keppo [2004], who also point out that electricity derivative prices should be used in the optimization of hydropower plants. More generally, for instance the models by Fleten, Wallace, and Ziemba [2002], Ding, Dong, and Kouvelis [2007] show that firms should optimize their financial derivative positions and production simultaneously. However, empirical studies by Guay and Kothari [2003], Bartram, Brown, and Fehle [2006] indicate that non-financial firms usually do not use derivatives and, thus, there exists a gap between the theory and industry practice.

2 Methods

We use weekly data from 13 Norwegian power plants in the period 2000–2006. The data gathered is relevant to the production scheduling problem and is applied in testing of the hypotheses which are proposed based on theory of hydropower scheduling and electricity forward markets. The testing uses GMM-based regressions.

3 Results

We empirically show that Norwegian hydroelectric producers use information from the electricity derivative market. Thus, even though they do not necessary trade the derivatives in large volumes, they seem to utilize their price information in the scheduling of hydro plants.

Our data indicates that financial market information is used in the everyday generation scheduling. Further, as expected, production rises in when reservoirs levels are high, and falls when electricity price volatility is high. At low reservoir levels, the production is less sensitive to the energy spot price.

4 Conclusion

The empirical analysis shed light on how the scheduling is performed and it provides important information about how the producers act in specific situations. The results indicate that hydropower scheduling is performed in accordance with theory.

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