

Value and granularity of ICT and smart meter data in demand response systems

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WORKSHOP ON ELECTRICITY DEMAND: NEW MODELLING PERSPECTIVES

Outline

1 Introduction

2 The stochastic model

Motivation: the role of oil

- Oil can be represented as the pinnacle of cross-sectional financial asset prices.
- Oil price fluctuations due to dramatic market changes, but also political and regulatory decisions.
- Seasonal variations or technology may adversely impact a producer who uses oil as input.

Oil Risk

The notion of oil risk is multidimensional-it encompasses:

- The sensitivity of oil and gas companies stock market value to oil price fluctuations.
- The exposure of importing and exporting countries to changes in the trade balance and oil security of supply.

Lit. Revue

For most option pricing problems: 3 numerical methods are available: finite difference, lattices, and Monte Carlo process.

- Glasserman (1997) deal with high-dimensional American options, but the computational effort still grows exponentially with the number of possible exercise dates (see Jaillet et al, 2004; Meinshausen and Hambly , 2004 and Carmona and Touzi, 2008).
- Huseby and Haavardsson (2009) claims that the production needs to be choked considering the problem of production optimization for oil and gas field. This framework can find the optimal production strategy with respect to various types of objective functions.
- Huseby and Haavardsson (2010 extended to cases where the production is uncertain. Aleksandrov et al. (2012) proposed a Monte Carlo real option approach as a solution to the optimization problem of a price-taker oil producer

Optimal choice between extraction and storage

An oil producer must decide of the proportion of oil extracted he would like to sell and the proportion he would like to store.

This optimal operational strategy should be done in continuous each day and with respect to physical, operational and financial constraints such as:

- Storage capacity
- Crude oil spot price
- Total quantity available for possible extraction
- The maximum amount which could be invested at time t for the extraction choice.

We solve this optimization problem and find the optimal strategy. We deal with different scenario cases to check the robustness and the correspond solution of the optimal strategy.

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Resume:

- It is a well written and structured paper. Read with great pleasure.
- For a long time, we considered demand as rigid and that it is up to the offer to adapt.
- But the large-scale integration of intermittent resources of power generation leads to unprecedented fluctuations on the supply side (German case is so interesting).
- Problematic of intermittent resources of power generation (Renewable).
- Solution: An electricity retailer can tackle these challenges by pursuing strategies of flexible load shifting. The so-called demand response mechanisms.

Resume

- This paper addresses the associated trade-off between Information and Communication Technologies (ICT) deployment and economic benefits
- It deals so with the original problematic of the evaluation cost/benefit of an investment in a system of analyzing data of consumption of electricity.
- How much does this investment (measure the hourly consumption of customers) cost compared to what it will bring to consumers in terms of erasure ore in term of change of consumption ?

Application and Conclusion

- The ICT design of a demand response system serves as the basis of a cost-value model, which incorporates all relevant cost components and compares them to the expected savings of an electricity retailer.
- German electricity market.
 - A positive information value of smart meter read-outs is achieved within an interval of 21 to 57 min regarding variable costs.
 - Electricity retailers can achieve a profitable setting by restricting smart meter roll-out to large customers.

Questions and Comments

- How do you define a large customers ?
- German case which is a particular market in term of renewable. Can we extend to French market with the same conclusion ?
- What about capacity market since you worked only on the day-ahead electricity market ?
- Cross effect of DR are not investigated: If costumers (particularly large one) accept to stop, reduce or shift their consumptions, then the prices will be affected and the demand too.
- Operational cost: Why a costumer will accept this deal ? How much does it cost actually ? How much consumers want for this deal ? How to set it up ? Fixed income ? Proportional to volume and/or time ?
- Extension: Evaluate a model if the investments are shared by intermediaries specializing in ICT.