



HÁSKÓLI ÍSLANDS

Vertical integration, long-term contracts and spot electricity markets

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Background

- Increased integration of generators into retail (and vice versa to some extent)
 - Netherlands, UK
- Concerns:
 - Viability of wholesale markets
 - reduced liquidity in spot market
 - Distorted incentives for entry
 - limited competition

Aim of this project

- Understand interplay of
 - retail
 - long-term contracting
 - spot market
- What are the drivers of VI ?
 - VI: generation+retail
- How does VI affect market performance?
- Implications of different regulatory regimes

Approach

- Supply and demand fluctuates so market participants face risk
- Our model: focus on risk in spot market
- Market participants are risk averse and have hedging motive

Setup

- Supply: Generators
- Demand:
 - Retailers (independent and integrated)
 - Price-elastic net non-retail demand in spot market
- Markets:
 - Spot market
 - Retail market
 - Contract market
- Key features:
 - Uncertainty
 - Risk aversion
 - (Market power)

Generation

- Each generator owns a number of generation plants
- Can integrate vertically into retail by buying retail outlets
- A generator can sell his output through:
 - Long-term contract market y_L, p_L
 - ‘His’ retail outlets x, r
 - Spot market y, p
- Cost $c(x + y_L + y)$

Retail

- Retail prices are regulated, but there may be different regulatory regimes, e.g.
 - Fixed retail price
 - Retail price indexed to spot price with regulated markup (Denmark, Norway)
- Non-integrated retailers buy power in
 - (Long-term) contract market
 - Spot market

Objectives

- Generators and retailers maximize expected utility of profit

– Generators: $\max EU(\pi)$

$$\pi = rx + p_L y_L + py - c(x + y_L + y)$$

– Retailers: $\max EV(\varphi)$

$$\varphi = rd - p_L z_L - pz$$

Overview of players

- Generators that sell some retail
 - ... where some may be retailers that have some generation!
- Independent power producers
- Independent retailers

Uncertainty

- Several possible sources:
 - Demand at each retail outlet
 - Generation costs and plant shutdowns
 - Non-retail demand in spot market, $D(p, w)$
where w is an exogenous demand shock

One shot game in several stages

1. Retail involvement and structure
 - Quantities
 - Price regime (e.g. fixed or indexed)
2. Long-term contract market clears
3. Quantities bid into spot market (Cournot)
4. Generation at each plant determined
5. Uncertainty revealed
 - Non-retail demand in spot market realized, $D(p,w)$
6. Spot market clears
 - Price
 - Sales of each generator
 - Purchases of each retailer

Results: Fixed retail price

- VI provides same type of hedge for generators as fixed price LTCs
- When gen's increase retail involvement they reduce LTC sales 1-1
 - sales are shifted from LTC to retail
 - no direct effect on spot market supply of generators
- Retailers' demand in spot market is reduced by VI
- In equilibrium
 - spot market prices fall, LTC prices rise
 - prices are driven apart
 - trade reduced
 - inefficiency in production exacerbated
- Incentives to VI when market effects are taken into account

Spot price linked retail price

- No hedging motive for VI
- If VI occurs
 - Generators shift sales from spot market to retail
 - no change in LTC supply
 - Retailers' demand in spot market is reduced by less than supply of generators
 - retailers' demand in LTC market is reduced
 - In equilibrium:
 - spot market prices rise, LTC prices fall
 - spot and LTC prices are brought closer together
 - market performance enhanced

Market power – fixed retail price

- Risk aversion and market power interact:
 - Hedging risk exacerbates distortions of market power
- Consistent with recent related work:
 - Mansur (2003) analyzes impact of market power in PJM market
 - Kühn and Machado (2004) analyze impact of market power in Spanish market
 - In both cases retail prices are assumed to be fixed and regulated

Regulatory implications

- Fixed retail price provides hedge which...
 - draws generators into retail
 - reduces trade and liquidity in contract and spot markets
 - induces inefficiency in generation
- Spot market linked retail price ...
 - provides no hedging motive for vertical integration
 - makes long-term contracts attractive as a hedging device
 - reduces inefficiency in generation

