Price Dispersion in the Norwegian Retail Electricity Market

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Outline

- Norwegian electricity market
- Theoretical approach
- Price development in electricity contracts
- Estimation of Cointegrated VAR-models
- Results
- Policy implications and conclusion
From monopoly structure to competitive market structure in the early 1990s

- An independent electricity pool established
- Competition at the production level
- Competition in the retailing segment
- Prices available for comparison at an on-line information clearinghouse site
Development in households switching

Figure: Number of switches of electricity retailer
Electricity contract allocation

Figure: Contract allocation

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Problem Statement

Although we have

- Homogeneous good and competitive market structure
- Price information available
- More than 20 years since switching fees were eliminated

Prices seem to vary...
This study analyzes the presence of price dispersion from a two-pronged approach:

1. Development of price dispersion in electricity contracts
2. Identify factors of importance in explaining dispersion in prices by the Cointegrated VAR-framework
Theoretical approach

Two main approaches to rationalize price dispersion:

- Positive search costs as a rationale to explain dispersion in prices
  - Stigler (1961)

- Information clearinghouse perspective to rationalize price dispersion

Theoretical rationalization of price distribution (Rosenthal (1980) -approach)

Theoretical expectations about price distribution in contracts can be expressed as:

Distribution of prices $F(p)$:

$$F(p) = 1 - \left( \frac{v - p}{p - m} \cdot \frac{L}{S} \right)^{\frac{1}{n-1}} \quad \text{on} \quad [p_0, v] \quad (1)$$
Loyals expect to pay:

\[ E(p) = \int_{p_0}^{\lambda} pdF(p) \]  \hspace{1cm} (2)

Shoppers expect to pay:

\[ E[p_{min(n)}] = \int_{p_0}^{\lambda} pdF_{min}^{(n)}(p) \]  \hspace{1cm} (3)
Fixed price 1 year contract

- Dispersion over time
- Max, Min Median
- Variance
Fixed price 3 year contract

1. Dispersion over time
2. Min, max, median
3. Variance
Market price contract

1. Dispersion over time
2. Min, max, median
3. Variance
Standard variable contract

1. Dispersion over time
2. Min, max, median
3. Variance

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Three findings from price plots:

- Prices are trending over time
- Prices are not converging (the law of one price)
- Increased dispersion in prices over time (in all contract types)
Our approach to estimate price dispersion development in the short and long run is the Cointegrated VAR model.

If there are one or more linear combinations of I(1) variables that are I(0), we have cointegration relationships:

- estimate long-run equilibrium
- estimate speed of adjustment to equilibrium
\[ Y_t = \Pi_1 Y_{t-1} + \ldots \Pi_k Y_{t-k} + \varepsilon_t \] (4)

We reformulate (5) to a vector equilibrium correction model, such as:

\[ \Delta Y_t = \Gamma_1 \Delta t_{-1} + \ldots + \Gamma_{k-1} \Delta Y_{t-k+1} + \alpha \tilde{\beta}' \tilde{Y}_{t-1} + \gamma_0 + \gamma + \varepsilon_t \] (5)
From the cointegration rank test of a linear combination of price dispersion ($PD$), system price ($system$), and switch ($switch$) we determine:

- A cointegration rank of 1 in:
  - 1 year fixed price contracts
  - market price contracts
  - variable price contracts

- **No** cointegration rank in the 3 year fixed price contract
## Estimation results

<table>
<thead>
<tr>
<th>Std. variable</th>
<th>Market price</th>
<th>Fixed price 1 year</th>
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</thead>
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<tr>
<td>( \beta )</td>
<td>( \beta )</td>
<td>( \beta )</td>
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<tr>
<td>PD</td>
<td>1</td>
<td>1</td>
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<tr>
<td>switch</td>
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<td>0.0000071</td>
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<tr>
<td>system price</td>
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<td>0.012</td>
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<td>trend</td>
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<td>−0.0619</td>
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<tr>
<td>( \alpha )</td>
<td>( \alpha )</td>
<td>( \alpha )</td>
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<tr>
<td>PD</td>
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<td>−0.120</td>
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<tr>
<td>switch</td>
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<tr>
<td>system price</td>
<td>−3.054</td>
<td>−40.13</td>
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</tbody>
</table>
Estimated long run structure of models

The models after imposing rank $r = 1$ and including restrictions on $\beta$s yields the long run relationship for $\beta'Y_{t-1}$ for the three equations expressing price dispersion ($PD$) in market price contract (7), standard variable contract (8), and fixed price 1 year contract (9).

The estimated long run structure for the models:

\[ PD_{mp} = -0.000000707sw_{t-1} - 0.0122sy_{t-1} + 0.062t \]  \hspace{1cm} (6)

\[ PD_{sv} = -0.005sw_{t-1} - 0.05sy_{t-1} + 0.664t \]  \hspace{1cm} (7)

\[ PD_{f1} = -0.0001sw_{t-1} - 0.009sy_{t-11} + 0.034t \]  \hspace{1cm} (8)
Prices are not converging

Our analysis detects heterogeneities among contracts in how changes in switching affects the distribution of prices

Our analysis detects that a change in system price is more reflected in PD for the standard variable contract

The direction of the estimated parameters is according to the theoretical model

The significant trend estimate indicates that there are additional factors that are driving price distribution
Although...

1. The switching fee eliminated
2. A system in place for switching and comparing prices

This is not sufficient to eliminate price dispersion
Thank you!

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