Ownership unbundling, investments and consumer prices – A panel data analysis

Stephan Schmitt and Margarethe Rammerstorfer

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Global demand for electricity is increasing continuously, serious changes on the supply side
- Annual demand is expected to grow at 2.7% from 2007 - 2015 (World Energy Outlook 2009)
- Share of renewables will increase from 18% in 2007 to 22% in the year 2030

Necessity for huge investments in the upcoming years
- Electricity network (transmission grid, distribution lines, smart grids)
- Power generation (renewable energy, new generation plants)

Consumers and regulators are interested in:
- high security of supply (long-term)
- low prices (short-term)
Changing regulatory environment

- Far-reaching (regulatory) reform process of the electricity industry is ongoing (at least in Europe)

- Unbundling as most important single reform

- **Ownership Unbundling (OU)**: System operator of the electricity network is completely separated from the rest of the entire sector (in terms of ownership and control)

- Legal unbundling (LU)
Research questions:

- What impact does OU (of the transmission grid) have on investments?
- What impact does OU (of the transmission grid) have on final consumer prices?
Literature survey

- **Theoretical articles:**
  - Bolle and Breitmoser (2006)
  - Cremer, Cremer and de Donder (2006)

- **Empirical Studies:**
  - Alesina et al. (2005)
  - Copenhagen Economics (2005), Fiorio and Florio (2009)
  - Growitsch and Stronzik (2009) and Brau et al. (2010)
Methodology

1 Static approach
- Fixed effects estimator (= least squares dummy variable (LSDV)) vs. first differences
- Fixed effects vs. random effects
Methodology

1 Static approach

- Fixed effects estimator (= least squares dummy variable (LSDV)) vs. first differences
- Fixed effects vs. random effects

2 Dynamic approach

- Problem: Endogeneity of the LSDV estimator (bias)
- Solution 1: Instrumental variable estimation using GMM estimator (e.g. Arellano and Bond (1991) or Blundell and Bond (1998))
- Solution 2: Corrected form of the LSDV estimator (LSDVC) for unbalanced Panels (Bruno (2005))
- Monte Carlo evidence supports LSDVC against GMM, if number of cross section is relatively small (Judson and Owen (1999))
Dynamic investment model:

\[(I/E)_{it} = \rho(I/E)_{it-1} + R'_{it} \gamma + Z'_{it} \delta + \alpha_i + \beta_t + \epsilon_{it}\]

Variables:

- \(I\) Investments in country \(i\) at year \(t\)
- \(E\) Number of employees in the whole electricity industry
- \(R\) Vector of regulatory variables
- \(Z\) Vector of control variables
- \(\alpha_i\) Country-specific effects
- \(\beta_t\) Year dummies
- \(\epsilon_{it}\) Error term
(Weakly unbalanced) panel data set with 16 European OECD countries from 1995 until 2007

Investments and number of employees: Eurostat

Final consumer prices: IEA

**Regulatory variables:**
- OU (and LU): self created dummy
- other regulatory variables: OECD Regulation Database

**Control variables:** GDP per capita (OECD), long-term interest rate (OECD), per capita demand of electricity (OECD), Brent oil price (IEA), shares of hydro and nuclear generation from gross electric production (IEA)
Investments in the electricity sector
Final consumer prices

The graph illustrates the trend of final consumer prices in USD per kWh from 1995 to 2007. The data is compared across different countries:

- **Austria** (blue line)
- **France** (red line)
- **Germany** (green line)
- **Portugal** (teal line)
- **Norway** (yellow line)
- **United Kingdom** (orange line)
- **Slovakia** (pink line)

The prices are shown to vary significantly over the years, with some countries experiencing more notable increases than others. The graph highlights the economic trends and price changes in the electricity market for these countries during the specified period.
## OU increases investments

<table>
<thead>
<tr>
<th></th>
<th>Fixed Effects</th>
<th>Arellano-Bond</th>
<th>Bruno (LSDVC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment ratio (t-1)</td>
<td>-0.1145</td>
<td>0.2101*</td>
<td>0.1142</td>
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<tr>
<td></td>
<td>(0.1888)</td>
<td>(0.1142)</td>
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<tr>
<td><strong>Ownership unbundling</strong></td>
<td>0.0315**</td>
<td>0.0196**</td>
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<td>(0.0034)</td>
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<td>Liberalized wholesale market</td>
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<td></td>
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<td>Minimum consumption threshold</td>
<td>-0.0004</td>
<td>0.0003</td>
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<td></td>
<td>(0.0027)</td>
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<td>(0.0030)</td>
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<td>(0.0000)</td>
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<tr>
<td>Long-term interest rate</td>
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<td>Number of observations</td>
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<td>97</td>
<td>115</td>
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</tbody>
</table>

Robust standard errors in brackets. * $p > 0.10$, ** $p > 0.05$, *** $p > 0.01$. 

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**Investment model**

- **Price model**

**Results**

**Conclusions**

**Model**

**Literature**

**Motivation**

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Ownership unbundling, investments and prices
No impact of OU on final consumer prices

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<tr>
<td>Prices (t-1)</td>
<td>0.6754***</td>
<td>0.8601***</td>
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<td>-0.0047</td>
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<td>(0.0006)</td>
<td>(0.0005)</td>
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<td>Public ownership</td>
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<td>0.0049**</td>
<td>0.0003</td>
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<td></td>
<td>(0.0040)</td>
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<td>GDP per capita</td>
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<td>-0.0000***</td>
<td>-0.0000***</td>
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<td>Demand per capita</td>
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<td>-0.0080***</td>
<td>-0.0049**</td>
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<td>(0.0026)</td>
<td>(0.0021)</td>
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<td>Oil price</td>
<td>0.0016***</td>
<td>0.0006***</td>
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<td>(0.0001)</td>
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<td>Nuclear share</td>
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<tr>
<td>Number of observations</td>
<td>187</td>
<td>156</td>
<td>172</td>
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- Evidence that LU is not sufficient to generate the positive investment effect; OU is necessary.

- No evidence for a statistically significant effect of OU (or LU) on final consumer prices.

- Outlook: OU should be more in the focus of political discussions.
Motivation

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Thanks for your attention!

Research Institute for Regulatory Economics

Vienna University of Economics and Business