The Impact of the European Regulatory Reforms on the Electricity-related Patent Activities

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Energy-related innovations: one of the key drivers of the economic growth (Schmookler, 1966)

Schumpeter (1942): best encouragement through monopolies
  - Correlation of size and innovation expenditures → scale factor

Aghion and Howitt (1992): competition
  - Only the most effective firms survive
The motivation for R&D investment has been radically changed

- Before deregulation: cost-based regulation $\rightarrow$ no risk
- After deregulation: firms no longer welfare maximizers $\rightarrow$ projects directly linked to business

Sterlacchini (2010): reforms associated with R&D reduction

- Significant reductions at the very early stages of restructuring
- Dooley (1998): “the fear of finding themselves in a deregulated market and unprepared for competition is causing utilities to act in substantially the same way as if they were deregulated”

Patent activity: increase in post liberalization years followed by significant drop recently (Jamasb and Pollitt, 2011)
Little attention to the innovative investment behavior of the regulated energy firms after the reforms

- Jamasb and Pollitt (2008): literature is short of empirical investigations → inefficient regulatory policies

Our paper:
- Examines the empirical effects of el. reforms on innovation
- Separation of electricity generation and network
Privatization

- State owned firm’s poor performance and budgetary pressures → entrance of private investors for efficiency improvement
- R&D efficiency of state owned firms vs. privatized firms
- Munari (2003): negative influence of privatization on spending, but positive on patent relevance and research productivity
- Jamasb and Pollitt (2009): increased patenting activities in the post-privatization years followed by the recent sharp drop
- *Expectation:*
  - *Generation sector*: (+)
  - *Electricity network*: (-)
Liberalization

- **Goal:** production efficiency and price reduction
  - Implementation: TPA, wholesale market, opening retail market
- **Effects of liberalization on R&D**
  - Incidental loss from innovation $\rightarrow$ liquidation of smaller utilities
  - Free-riding $\rightarrow$ difficult legal protection of innovation
- Munari et al. (2002): focus of producers on long-term projects
  - Not in line with the empirical findings: short-term goals
- Dooley (1998): increased power grid R&D $\rightarrow$ gov. subsidies
- **Expectation:**
  - *Generation sector:* (-)
  - *Electricity network:* (+)
Ownership unbundling

- Vertically integrated firm: discrimination of other utilities
- Advantages: strengthens the competition
- Disadvantages:
  - Information asymmetry: investments spillovers between sectors
  - Investment coordination loss: simultaneous investment
- *Expectation: (-) in both sectors*
Regulatory regime

- **Cost-based regulation**
  - Risk-free environment: reflection in higher tariffs
  - No direct incentives to innovate: lower tariffs

- **Incentive-based regulation**
  - Direct incentives to innovate
  - Incentives to reduce R&D spendings

- **Empirical findings**
  - Incentive reg.: insufficient reward for the firms
  - Bauknecht (2011): more efficient innovation and patents

- *Expectation*: (+)
Empirical model for patent activity

- Patents usually modeled as count data
  - OLS yields biased, inefficient, and inconsistent estimates
  - Poisson model based on Johnston et al. (2010) is used

\[
(Patents_{i,t}) = \beta_1(R&D_{i,t}) + \beta_2(Macro_{i,t}) + \beta_3(Industry_{i,t}) + \beta_4(Policy_{i,t}) + \alpha_i + \epsilon_{i,t}
\]

- \( R&D \) - R&D expenditures
- \( Macro \) - Macroeconomic factors
- \( Industry \) - Industry factors
- \( Policy \) - Policy variables

- Model estimation: Fixed effects panel estimation
  - Equidispersion \( \Rightarrow \) comparison with negative binomial model
Our dataset

Unbalanced panel of 13 European countries over 1985-2008

- R&D expenditure and patent activity
  - Expenditures: cover most of the European innovation
  - Patents: number of patent applications at the EPO, categorized based on international patent classification

- Privatization:
  - Degree of private ownership → (0 - public, 4 - private).

- Liberalization (entry regulation):
  - Liberalized wholesale market variable: existence of wholesale market (0 - non-existence, 1 - existence)
  - Minimum consumption threshold: min. amount of yearly consumption level of supplier change
  - Third party access: 0 - no TPA, 1 - negotiated TPA and 2 - regulated TPA
Ownership unbundling: degree of vertical separation
  - Dummy variable: 0 - no OU, 1 - OU
Aggregated regulatory variable: weighted average of all policy variables
Incentive regulation:
  - Dummy variable: 0 - cost based, 1 - incentive based regulation
Control variables:
  - Real GDP
  - Electricity output
### Basic results

<table>
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<tr>
<th></th>
<th>Generation</th>
<th></th>
<th>Electricity network</th>
</tr>
</thead>
<tbody>
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<td>Poisson</td>
<td>Neg. Bin.</td>
<td>Poisson</td>
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<td>Neg. Bin.</td>
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Robust standard errors, *p < 0.10, **p < 0.05, ***p < 0.01
Reform effects

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<th>Generation</th>
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<td><strong>Privatization</strong></td>
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<td><strong>Entry regulation</strong></td>
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<td>-0.0615**</td>
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Robust standard errors, *p < 0.10, **p < 0.05, ***p < 0.01

D. Kucsera and S. Schmitt
The impacts of EU reforms on electricity innovation
Conclusion

Motivation:
- Missing empirical investigation of the impact of electricity reform on innovation
- Focus on the generation and transmission sector

Results:
- Privatization: (+) efficiency increase
- Liberalization: (+) short-term projects
- Ownership unbundling: (-) information asymmetry
- Incentive regulation: (+) efficiency increase
- Electricity reforms: (+)