Competition, Energy Law and Nuclear Safety Regulation

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I. Nuclear energy and deregulated electricity markets

II. Nuclear safety regulation and competition
Nuclear energy and deregulated electricity markets

Competitiveness

- Challenges for nuclear power in liberalized electricity markets which could impede its competitiveness:
  - Long lead time
  - Large upfront minimal capital investment
  - Lack of recent experience with new build
  - Redistribution of risk among the different stakeholders
  - Political and regulatory challenges to obtain license to build and operate a plant
  - Greater size of nuclear plant exposes investors to greater risks

Ex:

Roques et al. (2006):
- Analysis starts from the idea that the liberalisation of the energy markets makes it more difficult to invest in nuclear
- Estimate option value of nuclear in order to analyse whether this value can enable the nuclear to be competitive in a liberalized market
- Show notably that nuclear is not generating any option value for electricity producers, given the correlation between carbon, natural gas and electricity prices

Lester and McCabe (1993):
- Study suggesting that nuclear industry might not be adapted to fragmented structure of a liberalized industry, which would lower learning
Nuclear energy and deregulated electricity markets

- Financing

- Challenges of financing nuclear new build:
  - Nuclear characterised by high fixed costs of construction
  - Deregulation and privatization has led to financial risks transfer towards the electricity producers

- Literature on financial set-ups and public support schemes favorable to the emergence of nuclear power in competitive electricity markets
  - Example: Finon et Roques (2008) study the different forms of contracts and organizations which enable to share the various risks of nuclear programs
Nuclear energy and deregulated electricity markets

- **Competition**

- Main issue from a competition perspective arises when:
  - There is a single nuclear power operator
  - The share of nuclear power in the total electricity production is large
  - Nuclear generation from the existing fleet is cost efficient;

Then entry is difficult for potential new entrants and competition in base load generation is weak, both on the short term and on the long term.

- Possible policy or regulatory remedies:
  - Regulating access: ex. NOME in France (Lévêque, 2011)
  - Regulating wholesale price: ex. in South Korea (Berthélemy & Lévêque, 2011)
  - Divestiture of part of the nuclear generating assets (selling of reactors or sections of reactors while maintaining a unique operator)
Nuclear safety regulation and competition

I. Nuclear energy and deregulated electricity markets

II. Nuclear safety regulation and competition
Nuclear safety regulation and competition

- **Main preoccupations:**
  - What market failures and externalities can arise in a competitive setting and how can they lead to under-provision of safety?
  - How can safety be regulated?
  - What are the consequences of imperfect regulation in terms of safety provision incentives and nuclear power competitiveness?
  - What are the possible consequences of imperfect regulation from a competition law perspective?

- These questions will be all the more important in the post-Fukushima period as this period is likely to be characterised by:
  - An enhanced competition between NPPs’ vendors because of the cancelation or postponing of some projects
  - A greater importance given to safety standards
Nuclear safety regulation and competition

- **Unregulated setting**: externalities and market failures
  1. Problem of heterogeneous safety and quality standards
  2. Externalities in a competitive setting with several nuclear power operators

- **Regulated setting**: Incentive system combining *ex ante* safety standards and *ex post* liability rules
  1. The balance between *ex ante* regulation (i.e., standards) and *ex post* regulation (i.e., liability rules)
  2. Imperfections and challenges raised by *ex ante* regulation
  3. Imperfections and challenges raised by limited *ex post* liability
Without regulation, a problem for the provision of safety may arise when there are:

- Heterogeneous products (different safety levels)
- Asymmetric information
- Competition

If the buyer/owner of a power plant values quality and safety features but cannot observe the level of quality and safety provided – or can only observe it \textit{ex post} –, in a competitive setting, this may drive down the average level of quality.


Problem may be all the more important in the nuclear industry as:

- It involves complex technologies
- Some of the quality/safety features can only be observed/assessed \textit{ex post}, when an accident or a failure actually occurs
Externalities and Free-riding

- Safety provision is subject to potential free-riding behaviour
  - Any localized accident or failure in one power plant results in large negative externalities on other players and on the industry as a whole, notably in terms of reputation and future demand for new reactors and services
  - This impact is not internalized by manufacturers and operators in their choices of safety investment and improvement. It leads to under-provision of safety

- Impact of competition on externalities and free-riding?
  - Intuitively, we would expect that the greater the competition, i.e. the larger the number of players and the smaller the individual market shares, the largest the externalities and free-riding potential and the lower the incentive to provide safety
Nuclear safety regulation and competition

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Incentive systems: mix of *ex ante* regulation and *ex post* liability rules

- Design of incentive systems which combine:
  - *Ex ante* regulation (ex: safety standards, Pigouvian fees)
  - *Ex post* regulation (tort liability)

- Potential injurer minimizes expected total cost of safety, where total cost is a combination of the actual cost of safety/care and expected liability in the event of an accident

- The literature recognises that the combination of the 2 instruments can be necessary to achieve an efficient level of safety since both types of regulations have imperfections (See for instance: Kolstad et al., (1990); Shavell (1984a, 1984b, 1987); Wittman (1977))
In general, both *ex ante* and *ex post* regulations have imperfections, notably:

<table>
<thead>
<tr>
<th>Ex ante regulation</th>
<th>Ex post regulation</th>
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<tbody>
<tr>
<td>Heterogeneity of technologies, reactors, damages</td>
<td>Limited assets and possibility of bankruptcy of injurer</td>
</tr>
<tr>
<td>Asymmetric info. on level of effort</td>
<td>Uncertainty of suit by victims</td>
</tr>
<tr>
<td>Imperfect info. on accident costs and damages</td>
<td>Difficult estimation of risks</td>
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- Shavell (1984a) recognizes that *ex ante* regulation and *ex post* liability rules can complement each other in that their joint use can correct the inefficiencies of using either alone to correct an externality.
- Kolstad et al. (1990) have shown that exclusive use of negligence liability leads to suboptimal choice of precaution in the presence of uncertainty and that *ex ante* regulation can correct these inefficiencies.
Nuclear safety regulation and competition

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Problems of incentives to respect safety regulation standards

- *Ex ante* regulation (in general):
  - The regulator sets rules and standards and tries to enforce them and to monitor regulated entities

- Challenges:
  - Regulator may be in a situation of asymmetric information;
  - Need to design an incentive-compatible regulatory framework to give the regulated company appropriate incentives to comply with the safety standards imposed

  → Potential under-compliance
Problems of incentives to respect safety regulation standards

*Ex ante* nuclear safety regulation:

- Question: What may be the impact of the opening to competition on the compliance to *ex ante* safety regulation?

- Complex question which is difficult to assess empirically
  
    
    Give a good example of the trade-off between profit maximisation and safety provision, as well as of the limited enforcement power of the regulator
  
  - Fukushima (public regional monopoly) vs. Chernobyl (state-owned monopoly)

In theory, does the energy liberalization reinforces incentives for non-compliance to safety standards?

- Maybe, notably:
  
  - If we consider that Cost + regulation facilitates investment in safety and facilitates the pass through of the cost onto consumers
  
  - If we associate deregulation with shareholders who have short term interests
Nuclear safety regulation and competition

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Limited liability and heterogeneous rules

Nuclear liability is limited

Nuclear plants vendors and operators benefit from a limited liability by which they do not have to bear the full cost of a severe accident. This implies that they do not assume all risk they generate through the internalization of the resulting costs of damages (Trebilcock and Winter, 1997; Faure and Fiore, 2009)

Liability rules differ across Member States (Gomez-Acebo & Pombo, 2005; Handrlica, 2010): see slides 19 and 20

Discussion: What impact does it have? In terms of
- Safety provision
- Competitiveness of nuclear
- Competition law
- Equity
# The EU Nuclear Liability Patchwork

<table>
<thead>
<tr>
<th>International Regimes</th>
<th>Member States</th>
</tr>
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<tbody>
<tr>
<td><strong>Paris regime (NEA)</strong></td>
<td>Belgium, Denmark, Finland, France, the Netherlands, Germany, Sweden, Italy, the UK, Spain, Slovenia</td>
</tr>
<tr>
<td>Paris (1960) and Brussels (1963)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Denmark, Finland, the Netherlands, Germany, Sweden, Italy, the UK, Spain, Slovenia&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Signed Join Protocol (1988)</td>
<td>Belgium, France, the UK</td>
</tr>
<tr>
<td>Paris (1960)&lt;sup&gt;a&lt;/sup&gt; only</td>
<td>Portugal &amp; Greece</td>
</tr>
<tr>
<td>Paris (2004)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>None</td>
</tr>
<tr>
<td><strong>Vienna Regime (IAEA)</strong></td>
<td>Bulgaria, the Czech Republic, Estonia, Lithuania, Hungary, Poland and Slovakia, Latvia, Romania</td>
</tr>
<tr>
<td>Vienna (1963)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Czech Republic, Lithuania, Hungary and Poland</td>
</tr>
<tr>
<td>Vienna (1997)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Latvia, Romania</td>
</tr>
<tr>
<td>Signed Vienna (1997)</td>
<td>Lithuania &amp; Czech Republic</td>
</tr>
<tr>
<td>Ratified Vienna (1997)</td>
<td>Romania</td>
</tr>
<tr>
<td>Convention on Supplementary Compensation for Nuclear Damages (1997)</td>
<td>Austria, Luxembourg, Ireland, Cyprus, Malta</td>
</tr>
<tr>
<td>Nothing</td>
<td></td>
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</tbody>
</table>

<sup>a</sup> First generation  
<sup>b</sup> Second generation
Liability amounts available in EU Member States

- Luxembourg
- Ireland
- Austria
- Germany
- Netherlands
- Belgium
- Spain
- Sweden
- United Kingdom
- Romania
- France
- Slovenia
- Hungary
- Finland
- Danmark
- Italy
- Czech Republic
- Poland
- Lithuania
- Latvia
- Slovak Republic
- Bulgaria
- Portugal
- Greece

€ million

- operator liability amount
- Total compensation available
- Unlimited liabilities
Limited liability and heterogeneous rules

- **Nuclear liability is limited**
  
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- **Liability rules differ across Member States** (Gomez-Acebo & Pombo, 2005; Handrlica, 2010): see slides 19 and 20

- **Discussion**: What impact does it have? In terms of
  
  - Safety provision
  - Competitiveness of nuclear
  - Competition law
  - Equity
### Potential impacts of limited liability and heterogeneous rules regimes

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<tr>
<th>Liability amounts</th>
<th>Safety provision</th>
<th>Competitiveness</th>
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<tr>
<td>Low amounts of limited liability may lower incentives to invest in safety (Trebilcock and Winter, 1997)</td>
<td>Low amounts of limited liability may distort competitiveness of, and investment decisions in, different technologies (Heyes and Liston Heyes, 1998)</td>
<td></td>
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</tbody>
</table>

<table>
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<tr>
<th>Heterogeneity in liability regimes</th>
<th>Competition</th>
<th>Equity</th>
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<tr>
<td>Implicit subsidy to nuclear industry (Dubin and Rothwell, 1990; Faure and Fiore, 2009) may vary depending on countries and might raise a State aid concern (Handrlica, 2010)</td>
<td>For an accident happening close to a border, victims on each side of the border might not perceive the same compensation (Gomez-Acebo &amp; Pombo, 2005)</td>
<td></td>
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</tbody>
</table>
Deregulation of electricity markets has led to difficulties to finance nuclear new-build.

In principle deregulation implies that cost of safety provision and expected costs of damages in the event of a severe nuclear accident have to be internalized in costs.

Imperfect safety regulation (ex ante and ex post) may distort technology competitiveness and market competition.
References

- Dubin J.A. and G. S. Rothwell (1973), Subsidy to nuclear power through Price-Anderson liability limit, 8 CONTEM.P. ECON. POLICY 73.
- Gomez-Acebo & Pombo, (2005), Legal Study for the Accession of Euratom to the Paris Convention on third party liability in the field of nuclear energy, Legal Study for DG TREN