Electricity demand 3 year time trend

Diversity index

- The recent experience in the construction of new NPP in Europe casts doubts on nuclear power competitiveness:
  - **Cost overrun** Okhlo–3 in Finland (from €3 billion to €5.4 billion) and Flamanville–3 in France (from €3.3 billion to €8.5 billion)
  - **Construction delays** 5 years in Okhlo and Flamanville–3 is delayed to 2016

The overnight construction costs from U.S and France tell us:

- **Cost overruns**: NPP in Europe casts doubts on nuclear power competitiveness:
- **Technological delays**: France (From to)

The recent experience in the construction of new reactors followed different paths in terms of:

- **Cost overruns**: the U.S → 104 reactors, 20 different models
- **Technological delays**: France → 58 reactors but only 9 models

Industrial organization:

- **Multiplicity of agents**: U.S
- **One vendor and utility**: France that acted as A-E firm

**Goal of this paper**

- Investigate the role of **standardization, learning effects** and **innovation** on nuclear reactors' construction costs and lead-times

**Empirical Strategy**

We estimated a 2SLS regression model for the construction costs and lead-times.

\[
CT_i = \alpha_0 + \alpha_1 T_i + \frac{2}{3} \alpha_2 X_i + \epsilon_i
\]

(1)

\[
LT_i = \beta_0 + \beta_1 EDem_i + \frac{2}{3} \beta_2 X_i + \epsilon_i
\]

(2)

- **Instrument** Electric demand 3 year time trend
- **Learning effects** Experience at country level
- **Standardization** Diversity index
- **Technological progress** Discounted stock of priority patents
- **Capacity**: Test existence of economies of scale
- **Country/Year fixed effects**
- **Structural breaks** after TMI and Chernobyl
- **Input prices**: Labor and Cement
- **Identify the projects in which the utility acted as A-E firm**

**Result 1: Standardization benefits**

- **Building the same reactor model repeatedly** will reduce the costs
- **Standardization** allows short term cost reductions through shorter lead-times.

**Result 2: Technological progress**

- **Technological progress** is the main driver of the cost escalation in nuclear
- **Innovations** increased the construction costs but also allowed better operating and safety performance

**Result 3: Delays**

- **Delays in the construction is the second explanation to the cost escalation**
- **Diversity increases the risk of delays**
- **Stricter safety regulation after TMI and Chernobyl increased the lead-times**

**Conclusion**

- **Standardization will reduce the construction lead-times on the short run and also will reduce costs after building the same series**
- **Regulatory stability enhances nuclear power competitiveness** by reducing the risk of delays
- **Trade-off between the economies enabled by standardization and potential gains from adopting new technologies → Optimal pace of technological change**

**References**


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