THE EFFECT OF TRANSMISSION NETWORK UNBUNDLING AND OWNERSHIP STRUCTURE ON EUROPEAN ELECTRICITY SECTOR PERFORMANCE

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Overview

As part of the energy transition, the European Commission aims to decarbonize the EU gas market by supporting the uptake of renewable and low-carbon hydrogen (EC, 2021). The future development hydrogen markets raises questions about the optimal regulatory framework that can support the growth of hydrogen transmission infrastructure, production and demand. Although hydrogen infrastructure and markets are still in the early stages of development, regulators may nevertheless learn from the experiences with models of structural reforms in European electricity and gas markets in defining the regulatory framework of hydrogen networks. In this paper, we study the welfare effects of the unbundling and ownership structure of European electricity transmission system operators (TSOs). More specifically, we investigate whether vertical unbundling has been effective in facilitating investments in transmission capacities and networks in European electricity markets and whether investments depend on the ownership structure of TSOs. To answer our research questions, we focus on the variation of structural unbundling regimes and utility ownership structures across European electricity markets.

Methods

To capture the effect of vertical unbundling on grid investments, we use a dynamic panel regression model for the electricity sector in 28 EU countries over the period 1990 – 2018. As a measure of our dependent variable, y_{it}^{T}, we use the annual growth rate in the length (in km) of the transmission network (Nardi, 2012). As our main independent variable, we include the degree of vertical separation of the transmission grid (administrative unbundling, legal unbundling, Independent Transmission Operator, Independent System Operator, ownership unbundling). Other explanatory variables include the percentage of public ownership of the transmission network, the type of incentive regulation (cost-based, incentive-based, or hybrid schemes), and other regulatory indicators, such as the level of third party access, liberalization, and minimum consumption thresholds. Let the parameter s denote time with $s \in (t, t-1)$. Then, we obtain the following model:

$$y_{is}^{T} = \alpha_0 + \Sigma_{k=2}^{K}\beta_1 VS_{i,s-1} + \beta_2 OS_{i,s-1} + \Sigma_{k=2}^{K}\beta_3^{k} IR_{i,s-1} + \beta_4 R_{i,s-1} + \beta_5 C_{i,s-1} + \varepsilon_{i,s} \quad (1)$$

where $VS \in$ {AU, LU, ITO, ISO, and OU} describes the degree of vertical separation, OS represents the percentage of public ownership, $IR \in$ {C, I, and H} represents the regulatory regime for incentive regulation, $R_{i,t}$ is the set of regulatory indicators, containing information on the conditions of market entry (third party access), whether consumers are free to choose between different suppliers (liberalization), whether consumers are subject to minimum consumption thresholds before being allowed to switch between alternative suppliers (minimum consumption thresholds) and if there are limitations on access to production or import markets (barriers) in country i, for. Further, C represents the set of control variables, such as the market share of the largest electricity generator in the utility's control area, the ratio of kWh consumption to real GDP, and net imports of electricity relative to total electricity consumption in country i at time s-1.

Results

Regarding the degee of vertical separation, there are different hypotheses regarding the effect on grid investments. On the one hand, higher levels of vertical seperation may positively affect grid investments as it solves the structural conflict of interest been incumbent and entrant: the vertically integrated utility has an incentive to stragically withhold investments in transmission capacity to protect its' market power in the generation segment. On the other hand, grid investments may be negatively affected as vertical unbundling results in coordination failures and the loss of vertical synergies. Further, higher levels of vertical integration, such as under legal unbundling, may enhance grid investments, as other parts of the vertically integrated firm are still able to benefit from transmission investment made by the incumbent. Concerning the ownership structure, the effect on grid investments are ambiguous (Gugler et al., 2013). On the one hand, private utilities are expected to invest more in the network due to more efficient management of available resources and incentive effects (X-efficiencies). On the other hand, public utilities are expected to prioritize network quality and invest more in network infrastructure and services than private utilities, that are more concerned

with profit-maximizaiton through cost saving and efficiency measures. Following the results in Nardi (2012), we expect that higher degrees of vertical separation of transmission networks will positively affect grid investments. However, for higher degrees of vertical separation, we expect a decrease in the quality of network services, due to the presence of coordination failures. Further, considering the above, we expect that higher shares of public ownership of networks will positively affect investments in infrastructure.

Conclusions

In designing the regulatory framework for hydrogen markets, policy makers can learn from the experiences with models of structural reforms in European electricity and gas markets in defining the regulatory framework of hydrogen networks. According to our hypotheses, in order to foster investments in hydrogen infrastructure, we expect it is desirable that hydrogen transmission network operators are vertically unbundled from commercial segments (i.e., generation and retail) and that the share of public ownership of hydrogen transmission infrastructure is high.

References

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