Uncertainties, Information Precision, and Merging in the Energy Sector

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Overview

The impact of distributed energy resources (DER) on large-scale power generators and utilities depends on the scale of DER generation, policy frameworks, and the specific characteristics of the utility's infrastructure that enables grid integration and two-way power flow (e.g., AMI, digitalization, etc.). Empirical evidence suggests that energy utilities consider mergers as a strategic response to the challenges but also opportunities presented by integrating a growing number of DER sources. In this paper, we study the incentives to merge for energy producers in the presence of distributed renewable energy producers under uncertainties and asymmetric information about costs. To this end, we consider merging under uncertain oligopolistic structure. Firms face common and private information with different noisy signals and compete in a differentiated marketplace. We determine the equilibrium under non-uniform quality of signals across firms and analyse market outcome with respect to the quality of the privately held information, i.e., information precision. Finally, we explore the implications of our results in terms of efficiency in the use of information, i.e. the social value of information for players. Comparative statics of equilibrium and numerical simulations illustrate the results that our model delivers.

Methods

The model adopted in this paper aims to place our results in relation to the respective literature. There is a fixed number of energy producers. Further, there are two types of assets or technologies to produce energy: fossil-fuel sources to generate and sell a given amount of electricity, and green energy using cleaner production process like renewable. To analyze merging under uncertainties and asymmetric information about costs, we use a Cournot oligopoly with product differentiation to represent the output competition among these firms. We then characterize the equilibrium under pre and post merging situation by considering affine information structure with common and private shocks (signaling games). Under such informational constraints, we show that the Bayesian Nash equilibrium is unique. Finally, we examine the consequences of varing the informativeness of signals and its effects on equilibrium outcomes.

Results

- We examine firms' incentives to merge under differentiated oligopolistic structure with uncertainties and asymmetric information about costs.
- We consider signaling games and determine the Bayesian Nash Equilibrium under affine information structure with common and private values.
- We analyse pre and post mergers aquilibrium and explore the impact of more accurate information on merging, i.e., more precise information about private shocks.
- Comparative statics are performed meaningfully in order to analyze merging issues in response to changes in the quality of information and variations in the parameters of the model which sometimes are inherently difficult to estimate.

Conclusions

Facing industry wide and firm-specific shocks, there are enormous opportunities to make the best use of available set of data to enhance the quality of the environment. Such information may be used to overcome a serious lack of information on polluted activities, and could have impact on firms' behavior and levels of pollution. More precise information may yield efficient merging outcomes. In addition, it may help antitrust authorities in their decisions.

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