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Efficiency Effects of Quality of Service and Environmental Factors: Experience from Norwegian Electricity Distribution

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Since the 1990s, following the introduction of electricity sector reforms around the world many energy regulators have adopted incentive-based regulation approaches for oversight and governance of the natural monopoly electricity networks. The increasing popularity of incentive regulation has in turn resulted in adoption of efficiency and benchmarking analysis as part of the price and revenue setting process as well as in academic research.

A long-standing issue in incentive regulation of network utilities has been how to treat the issue of quality of service in the benchmarking models as there are clear trade-offs between quality of service on the one hand and operating and capital costs on the other. This in turn leads how to treat external factors such as the weather conditions that are beyond the influence of individual firms (observable heterogeneity) and those factors that are not identifiable (unobserved heterogeneity) on measured cost and quality performance of regulated firms.

Norway presents a particularly suitable case to study quality of service and the weather effects. The quality of available data at utility level is high. In addition, there is large number of network utilities operating in different climatic and geographical conditions. In this paper we analyse the effect of a large number of geographic and weather factors and unobserved heterogeneity on a set of 128 Norwegian electricity distribution utilities for the 2001-2004 period. We utilize data on almost 100 geographic and weather variables in order to identify real economic inefficiency while controlling for the effect of observable and unobserved heterogeneity among the network companies.

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We use the factor analysis technique to reduce the number of environmental factors into few composite variables and to avoid the problem of multi-collinearity. We then estimate the established stochastic frontier models of Battese and Coelli (1992; 1995) as well as the more recently suggested true fixed effects models of Greene (2004; 2005) without and with environmental variables.

Our results show that in the former models some of the composite environmental variables have a significant effect on the performance of utilities. However, these effects vanish in the estimated true fixed effects models. We conclude that the latter models capture the entire unobserved heterogeneity among the firms and as a result show significantly higher average efficiency scores for them.

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