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Using a spatial econometric approach to mitigate omitted variables in stochastic frontier models: An application to Norwegian electricity distribution networks

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An important methodological issue for the use of efficiency analysis techniques in incentive regulation of regulated utilities is how to take into account the effect of unobserved cost drivers such as environmental factors. In principal, failing to control for the effect of the relevant unobservable factors and in particular the cost drivers results in inaccurate and thus unfair remuneration of the companies in terms of allowed revenues. This issue often gives rise to disputes between the sector regulators and the regulated utilities. However, in many instances, the required data on environmental factors are not available to the regulator or that they are costly and time consuming to obtain.

This study proposes, in a novel methodology to address this issue in network utilities, combines the spatial econometric approach with stochastic frontier techniques to control for unobserved environmental conditions when measuring firms' efficiency in the electricity distribution sector. Our empirical strategy relies on the geographic location of the firms and their surrounding firms as a useful source of information inefficiency and productivity analysis of regulated utilities. To our knowledge, this approach has previously not been explored in the literature.

The underlying idea in our proposed empirical strategy is to utilise the variables from the neighbouring firms that are likely to be spatially correlated. We use these variables as proxies in order to control for the effect of unobserved cost drivers on the estimated efficiency of the utilities.

We illustrate our approach using a panel data set for the Norwegian electricity distribution utilities for the years 2004 to 2011. In order to implement our empirical strategy, we have matched the information on the concession areas of all the distribution utilities with the data provided by the Norwegian regulator on the costs of those firms. We are not aware of other studies that have carried out a similar spatial matching exercise.

The results show that the lack of information on weather and geographic conditions for individual firms can likely be compensated with the use of data from surrounding firms by using spatial econometric techniques. We have found that combining the efficiency analysis and spatial econometrics methods always improve the goodness-of-fit of the estimated models and, hence, more accurate and fairer efficiency scores are likely to be obtained.

Combining the efficiency analysis techniques and spatial econometrics methods improve the goodness-of-fit of the estimated models and, hence, more accurate (fair) efficiency scores are obtained. The methodology can also be used in efficiency analysis and incentive regulation of other types of utility sectors for academic research and by practitioners.

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