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Weather Factors and Performance of Network Utilities: A Methodology and Application to Electricity Distribution

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Since the mid-1990s, some energy regulators have begun to use benchmarking techniques in incentive regulation of electricity distribution networks as natural monopoly activities. The earlier applications of the methods adopted were based on relatively simple models. However, a debate has since persisted regarding the effect of contextual and environmental factors on cost and quality performance of the networks and hence what variables the benchmarking models should include.

From a methodological point of view, this issue poses challenges as the list over all the factors that can potentially affect performance is long. Meanwhile the number of network utilities firms in most countries is small. Moreover, the lack of useful and accurate data makes rigorous analysis of the effect of environmental factors a difficult task.

Weather conditions in service areas of the networks are frequently named as having an important effect on the performance of distribution networks. However, weather is a complex phenomenon and comprises a range of different but correlated factors interacting with each other. A logical approach to the problem is to reduce the number of variables into a smaller but representative subset of variables. It is important to achieve this objective with minimum data requirement. In order to address this issue, some studies have used employed statistical techniques in order to reduce the number of relevant variables to a smaller but representative set of composite factors.

In this paper we examine whether the use of popular statistical variable reduction techniques is conceptually and econometrically sound for analyzing the effect of weather on the network costs. We

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present a new approach for estimating the effect of weather conditions on the costs of electricity distribution networks using parametric techniques. In order to do this, we estimate cost functions with the whole set of available weather variables, identifying, when necessary, a subset of these variables that can accurately reflect the effects of weather conditions as a whole.

The findings show that weather conditions significantly affect distribution costs. This means that the absence of weather variables from benchmarking models can have a downward biased impact on estimations of the effect of quality of service on cost levels of networks. In addition, we find that the performance of statistical weather composites to capture this effect is poor. Finally, we show that there is a distinction between the effects of persistent and time varying weather conditions.

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