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Efficiency and Environmental Factors in the US Electricity Transmission Industry

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The electricity industry in most developed countries has been restructured in recent decades with the aim of reducing costs, improving service quality and encouraging electricity utilities to perform efficiently. The remaining regulated segments (i.e. transmission and distribution) provide the infrastructure for the competitive segments and represent an important amount of the total price paid by final customers. Despite the fact that electricity transmission is the baseline for distribution and commercialization, there is a lack of empirical studies that analyze both economic characteristics of the technology and firms' inefficiency in electricity transmission.

To fill this gap in the literature we have analyzed firms' performance in the US electricity transmission industry for the period 2001-2009. The analysis of the economic characteristics of the technology and inefficiency of US utilities relies on the estimation of several stochastic cost frontiers. Our stochastic frontier models allow us to identify determinants of firms' inefficiency in this industry. In particular, we have included a wide range of variables as determinants of firms' inefficiency such as weather variables, a measure of companies' cost structure and growth rates of energy demand. Unlike previous papers, we control for weather conditions, one of the most decisive uncontrollable factors in electricity transportation, by including a set of weather variables that were gathered specifically for the present application.

We have found that there has not been an improvement in average efficiency in the US electricity transmission industry over the period 2001-2009. Moreover, regardless of the estimated model, our results indicate that efficiency has declined (and diverged) over time, suggesting that regulatory benchmarking techniques can identify room for improvement in performance of the US electricity transmission system.

The estimated coefficients provide useful information about firm's performance with both policy and managerial implications. We have found using more recent data than in previous papers that, given network infrastructure, electricity transmission networks exhibit natural monopoly characteristics. This result explains why electricity transmission is still regulated.

In efficiency analysis and incentive regulation of utilities it is important to control for the effect of differences in environmental factors on the performance of regulated firms. This is particularly important in the case of incentive regulation and benchmarking of electricity networks where the results of efficiency analysis have important financial implications for the firms. In this sense, our results clearly indicate that more adverse conditions generate both higher levels of inefficiency and higher costs for firms operating in areas with unfavourable weather conditions. Regulators should then take into account this cost disadvantage in setting efficiency targets within incentive regulation. We also find that investing in capital is a better strategy to deal with adverse weather conditions rather than incurring in additional operating costs. This might suggest a regulatory framework that favours capital investments to deal with unfavourable weather conditions.

Finally we have found that, as expected, firms' performance gets better when demand tends to be steady as firms cannot adjust their inputs without cost over time. This result, combined with the previous finding on the importance of capital expenditure to deal with weather conditions, suggests that regulators should also take into account that achieving long-term efficiency improvements can involve short-term increases in both capital and operational costs and, hence, a deterioration in firms' short-term relative performance.

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