

# Inefficiency persistence and heterogeneity in Colombian electricity distribution utilities

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The electricity reform in Colombia introduced the separation of activities in the electricity sector and set the conditions for privatization and competition. In general, the reform has had positive effects on the ability of the sector to overcome extreme weather conditions and meet demand requirements. However, for distribution companies, competition and privatization have been slow processes and the users did not benefit from improvements in service quality for the first ten years after the reform. In fact, previous studies measuring consequences of the reform on efficiency have not found evidence of improvements, although large differences in efficiency have been found among firms.

This may indicate the presence of high adjustment costs in the sector in Colombia and important heterogeneity factors among distributors. We propose to model these conditions using a stochastic frontier model that accounts for dynamic effects and unobserved heterogeneity. The proposed inefficiency specification encompasses and extends recent studies on dynamic inefficiency behaviour in order to account for both observed and unobserved heterogeneity sources in the inefficiency and in the frontier. The inference of the model is carried out using Bayesian methods and model selection criteria are used to assess model fit and predictive performance. The sample is composed of 21 Colombian electricity distribution companies during the period 1998 – 2012.

Our findings suggest high inefficiency persistence in the sector that could be related to adjustment costs and inadequate incentive regulation. However, important differences are found among firms. In particular, firms operating mainly in rural markets and serving small customers exhibit lower adjustment costs than firms with the opposite characteristics. This condition has allowed these firms to catch up with urban firms and firms serving large users, which have exhibited higher technical efficiency during the whole period. In fact, customer density and consumption density are found to be important inefficiency drivers in the sector and unobserved heterogeneity sources are found to be relevant in distinguishing heterogeneity from inefficiency and identifying differences among firms.

In particular, firms exhibiting high inefficiency persistence and low technical efficiency should attract the attention of the regulator because they could be stuck at high inefficiency levels. Overall, our findings may be helpful for the regulator and the Ministry of Mines and Energy in Colombia in their current identification of pricing groups. Although, a geographical criterion has been followed, our results suggest that inefficiency persistence, customer density, and consumption density should be considered as the main criteria when identifying groups of distribution firms for regulatory purposes.

The evolution of efficiency in the sector is found to be very stable and no major changes can be identified until 2008. Since then, gains in technical efficiency are observed, suggesting that net benefits have been derived from recent incentive regulations introduced for reducing length of interruptions and energy losses. However, the tariff paid by users also evidenced high growth during the last five years and the proportion of the tariff assigned to the distribution component showed important increases from 2010. This suggests that incorporating customer willingness to pay into the efficiency analysis of Colombian utilities would be an interesting area for future research.

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