

# ***THE EVOLUTION AND MAIN DETERMINANTS OF PRODUCTIVITY IN BRAZILIAN ELECTRICITY DISTRIBUTION: A STOCHASTIC FRONTIER ANALYSIS***

**Mariana Iooty**, UFRRJ and Energy Economics Group at IE/UFRJ-Brazil, miooty@ufrj.br/miooty@ie.ufrj.br

**Francisco Ramos Real**, University of La Laguna, frramos@ull.es

**Beatriz Tovar de la Fe**, Universidad las Palmas de Gran Canaria, btovar@daea.ulpgc.es

**Edmar de Almeida**, Energy Economics Group at IE/UFRJ, edmar@ie.ufrj.br

## **Overview**

Until the 1980s, the regulatory framework of Brazilian electricity sector was mainly characterized by the practice of cross subsidies, central planning of expansion, cost of service practice, and the presence of state-owned firms in all segments, generation, transmission and distribution. The financial deterioration of the state-owned firms during the 1980s boosted a restructuring process. In the 1990s the pro-market reforms were implemented, with the objective of promoting a growth of the sector's investment rate, by attracting the private capital, and the improvement of the sector's productivity. In the distribution segment, the restructuring process took place by the privatization of most of the firms, with the exception of some smaller state-owned companies.

This paper is devoted to assess the evolution of productivity electricity distribution sector in Brazil. It employs both the stochastic frontier analysis (SFA) and the DEA (data envelopment analysis) on a panel of firms from 1998-2005. The paper intends to decompose the productivity evolution of the distribution firms in terms of technical efficiency; allocative efficiency; scale-efficiency and technical progress. This exercise aims to help the understanding of the main determinants of productivity evolution, focusing its relationship with the restructuring process implemented in the 1990s.

The paper is organized as follows. The first section provides a brief presentation of the regulatory framework of Brazilian electricity distribution sector, covering both the restructuring process of the 1990s and the current situation. The second section discusses both the SFA and DEA techniques. The third section presents the empirical results. The fourth and last section presents in a nutshell the main findings of this study.

## **Methods**

The (relative) efficiency is generally represented by frontier functions. This paper uses both methods the two most commonly used methods of estimating frontiers - stochastic frontier analysis (SFA) and data envelopment analysis (DEA) and.

## **Results**

The data used in this paper consists of a balanced panel of 18 Brazilian electricity distribution over a 8-year period from 1998 to 2005. These companies included in the study deliver about a 54.6% of Brazilian electricity consumption in 2005.

Looking across the results for both DEA and SFA methods in 1998 and 2005 it can be seen that only 8 of the 17 sample companies present a consistently high performance during the period under analysis.

TFP index records a yearly positive growth of 1.5% in 1998-2005 period. Among the TFP components, technical efficiency shows the worst average performance (-1.7%), and scale change has the second worst record (-0.7%).

It is worth noting that although the positive growth rate for all the 1998-2005 period the biennium 2001-2002 and 2002-2003 presented a falling performance. This decreasing performance is mainly explained by the contraction of production frontier which is probably related to the electricity shortage in Brazil, occurred in 2001, which affected all the companies in distribution segment.

Considering all the sample firms, 58.8% of them (10 in 17) showed an increase in TFP rates.

## Conclusions

The efficiency analysis of the electricity distribution companies is a relevant research subject since it allows verifying the impacts of reform process. This paper has made up use of a short panel data for which efficiency analysis can be made. Two methods were used as a sensitivity exam, data envelopment analysis (DEA) and stochastic frontier analysis (SFA).

During the period under analysis, only 8 of the 17 sample companies present a consistently high performance, and 58.8% of them showed an increase in TFP rates. Considering also the decreasing performance of TFP in the 2001-2002 and 2002-2003 it becomes clear that the electricity shortage, occurred in 2001, has probably altered the general environment where the Brazillian electricity distributors make their decision and so affected the results here showed. The contraction of the production frontier and the falling technical efficiency of the firms, at last in a while, was a consequence of process. That is possibly why the technical change has been the main component behind the TFP evolution.

## References

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