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EFFIENCY ANALYSIS OF EAST AND WEST GERMAN ELECTRICITY DISTRIBUTION COMPANIES –DO THE "OSSIS" REALLY BEAT THE "WESSIS"?

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Overview

The issue of efficiency analysis in electricity distribution was neglected in Germany until the German energy regulator (Bundesnetzagentur) was established in July 2005. The chosen regulatory framework is incentive regulation and will most likely be implemented in 2007. The design of the current consultation process of Bundesnetzagentur displays evidence to suggest that the regulation will be based on efficiency measurements. Although electricity distribution benchmarking becomes more and more important, the scientific analysis for Germany so far is scarce. Frontier Economics and Consentec (2003) undertook a brief analysis of the technical efficiency scores for 27 German electricity distribution companies. A larger sample is used in Hirschhausen, Cullmann and Kappeler (2006) who had made various assessments of the technical and scale efficiency scores of up to 307 German electricity distribution companies. The former study found only a couple distributors from East Germany to have high efficiency scores whereas the later paper stressed the fact that the average Eastern German utility features a higher technical efficiency than its Western counterpart across a wide variety of empirical model specifications. Our study focuses on these regional differences and extends the latter analysis by variations of the technical and structural parameters that account for regional differences in order to reflect on the one hand a consistent and robust pattern of the German situation and on the other hand to point out potential efficiency drivers explaining the differences. In addition, the goal of the paper is to contribute to the current discussion on sound modeling of technical efficiency benchmarks of German electricity distributors.

Methods

Our paper focuses on this technical efficiency difference puzzle and gives evidence to the discussion whether the result of the higher average efficiency of the East German electricity distributors is robust. Therefore we conduct in addition to Hirschhausen, Cullmann and Kappeler (2005) further model variations, with respect to the model parameters and the data used. We apply non-parametric and parametric tests to assess the technical efficiency: the non-parametric data envelopment analysis (DEA) with constant returns to scale (CRS) and variable returns to scale (VRS), and stochastic frontier analysis (SFA) on specific inputs and outputs based on the original sample of up to 307 (259 West and 48 East) German electricity distributors. Furthermore, the DEA with variables returns to scale accounts for differences in the size of the enterprises and enables us to assess the scale efficiency of the electricity distributors.

In the first step, the structural differences of the electricity distributors in Eastern and Western Germany are identified by analyzing the descriptive statistics of the raw data from 2001. In a second step we define different models dealing with different input and output parameters to describe the production process of the utilities. The proper choice of variables is important for a sound outcome of an efficiency analysis as it is emphasized in Jamasb and Pollit (2001). We then test in a further step, various hypotheses to explain the observed technical and structural

differences between the regions. The used variables are based on technical data and on structural parameters in addition. We use labor and capital as inputs and units sold and number of customers as well as an inverse density index as outputs.

Results

The analysis of the descriptive statistics displays the following main characteristics of the average Eastern German electricity distributor compared to its counterpart from West Germany: (1) it serves more customers but (2) sells less units of electricity particularly for other electricity companies and (3) operates in a more sparsely inhabited area (4) owning a grid that has a higher share of cost-intensive cable than its West German counterpart. With regard to our different model specifications, first results of efficiency estimates indicate that the degree of efficiency differences is sensitive to the choice of variables. Some of the results of the tested hypotheses support the earlier findings of significant differences favoring the East. But in opposite we find also evidence within the following model that the German situation has to be interpreted carefully: accounting for technical differences, we test the hypothesis that a disaggregation of the grid in cable and aerial lines is more appropriate than a composed capital input due to the fact that cables are more cost-intensive than aerial lines and the cost factor is almost undetermined. In addition, we test the importance of incorporating the units sold to other electricity companies for a sound analysis of efficiency differences between both German regions. The outcome of a combined test of both hypotheses with DEA indicates a significant decrease of overall technical efficiency and a convergence under CRS of 48 per cent for East Germany and 46 per cent for the West Germany. The mean technical efficiency for East German distributors with 52 per cent is significantly lower than the score of 62 per cent for West German distribution companies under VRS. A comparison of the DEA results with CRS of the study by Hirschhausen, Cullmann and Kappeler (HCK) (2006) and our findings can be seen in Figure 1, where the 48 Eastern German distributors are displayed by utility number 1 to 48.

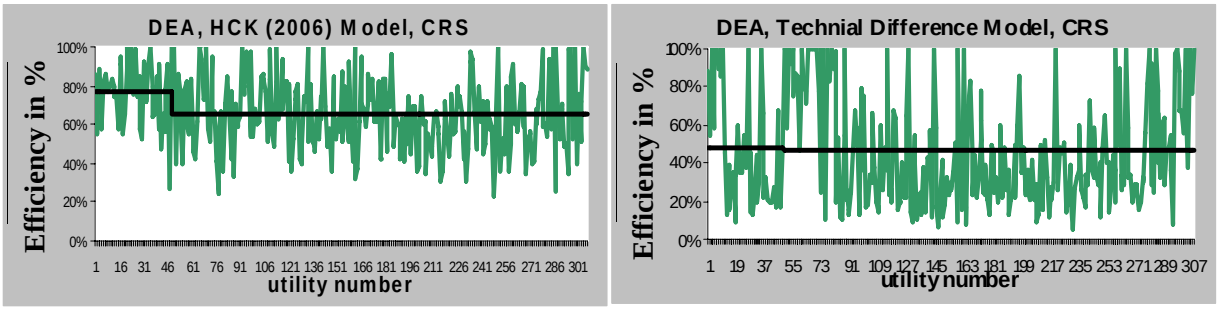

Figure 1: Comparison of the model of HCK (2006) and the Technical Difference Model

Conclusions

Our study enriches the discussion about benchmarking electricity distribution companies in Germany with a detailed description of the physical data on the one hand and variations of inputs and outputs found to be appropriate on the other hand, in explaining the efficiency differences between electricity distributors in East and West Germany. We conclude, that technical efficiency outcomes are sensitive to the variables used and we advice the regulator to be aware of this fact in designing the regulatory framework for the German electricity distributors.