

National Graduate Institute for Policy Studies

**STRUCTURAL REFORMS POLICY AND TECHNICAL EFFICIENCY: AN
EMPIRICAL EVIDENCE FROM INDIAN ELECTRICITY DISTRIBUTION
SECTOR**

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SUMMARY OF DISSERTATION

In this dissertation, we evaluate the impact of various external, environmental variables on the technical efficiency of the electricity distribution sector. For this purpose, we deploy two-stage bootstrap-DEA methodology, using the panel data across Indian states for the period 1995-2012. Bias corrected technical efficiency scores of decision making units (DMUs) are estimated using the bootstrap-DEA technique in the first-stage. While doing so, we also test the returns to scale of the underlying production technology of these DMUs. In the second stage we estimate the impact of external, environmental variables beyond the control of DMUs, on these technical efficiency scores. For example in Chapter 3, we considered ownership, population density, consumer structure, and subsidy as environmental variables; while in Chapter 4, we considered reforms legislation, tariff order, various unbundling structures, real GDP per capita, and size, in addition to population density and consumer structure.

This dissertation has found any interesting results. First, our results indicate that constant returns to scale are exhibited in the underlying production technology of the state-level electricity distribution sector in India. Second, we found that publicly owned utilities have efficiency advantages in India, but deduced that the reason behind such an advantage is

open for further research. Third, we discovered that, in high population density areas, private enterprises have efficiency advantages in electricity distribution over public sector utilities. Fourth, when the impact of reforms and of different unbundling structures were examined, we found that the transmission unbundling (i.e., generation and distribution sectors are together and transmission is separate), has a significant positive impact on the technical efficiency of the distribution sector as compared to one under a fully vertically integrated electric monopoly. Fifth, we discovered that Indian electricity reforms legislation had negative impact on the technical efficiency of the distribution sector. Sixth, we found that “small-sized” states with partially or fully unbundled structures experience significant positive impact on the technical efficiency of their electricity distribution sector. The “medium-sized” states, on the other hand, show negative (but statistically insignificant) impact on the efficiency of their distribution sector after partial or full unbundling. It appears that, unlike “medium-sized” states, managers of “small-sized” state/distribution sectors have “size advantage,” as they are able to adjust quickly to gain from “economies of scale” in order to overcome “diseconomies of scope” caused by unbundling of vertical monopolies. While analyzing the impact of state-level, time-varying covariates, we found that real GDP per capita and consumer structure have positive impact on technical efficiency of the electricity distribution sector in India, but it is not statistically significant. Last, we discovered that population density, which also represents consumer density, has a significant positive impact on the technical efficiency, while government subsidies have a negative impact on the performance of distribution utilities. Our results for these state-level variables are in conformity with the existing literature.

After introduction in Chapter 1, Chapter 2 of the dissertation gives brief background of Indian electricity reforms and the world trend in electricity reforms through existing literature. Chapter 3 uses post-reform, firm-level, electricity distribution data from three Indian states for the period of 2005-2012, to examine the impact of ownership, government subsidy, consumer structure, and population density on the technical efficiency of these distribution utilities. Chapter 4 broadens the perspective from the utility-level to the state-level distribution sector, using data for 21 Indian states over the period of 18 years, which include pre-reform and post-reform periods. We specifically investigate the impact of reforms legislation, tariff orders, different forms of unbundling structures, and size on the efficiency scores. Chapter 5 summarizes the findings of the empirical analyses of Chapters 3 and 4, and discusses the policy implications and future direction for research.