論文要旨と審査結果報告

Report on Ph.D. Dissertation Defense

Structural Reforms' Policy and Technical Efficiency: An Empirical Evidence from Indian Electricity Distribution Sector

学位申請者氏名： Bobde Sudhir Mahadeo（PHD12202）
論文提出日： 平成 27 年 7 月 2 日（木）
論文発表会開催日：平成 27 年 7 月 30 日（木）
審査委員会開催日：平成 27 年 7 月 30 日（木）
論文最終版提出日：平成 27 年 8 月 19 日（水）
学位名：Ph.D. in Public Economics 博士（公共経済学）

審査委員（主査）：田中　誠（本学教授）
審査委員：大山 達雄（本学特別教授）
審査委員：長谷川 誠（本学助教授）
審査委員：園部 哲史（本学教授，博士課程委員長）
審査委員：後藤 美香（東京工業大学大学院社会理工学研究科教授）

□．論文要旨 Thesis overview

This thesis investigates the technical efficiency of the electricity distribution sector in India, by using a two-stage methodology of data envelopment analysis (DEA) and econometric approach. In the first stage, bias corrected technical efficiency scores of decision-making units (DMUs) are estimated using bootstrap DEA technique. In the second stage, the technical efficiency scores of DMUs are regressed on various external-environmental variables to evaluate what external factors affect the technical efficiency of the electricity distribution sector in India.

After Chapter 2 discusses the background and status of electricity reforms in India and other countries, Chapter 3 focuses on the firm-level data (both public and private entities) in three states for the years 2005–2012. The basic model for the first-stage bootstrap DEA considers number of employees, distribution line length, and transformer capacity as input variables, while number of customers and total electricity delivered are used as output variables. The external-environmental variables in the second stage include regulated tariff ratio (defined

by the ratio of the average tariff for residential customers to that for industrial consumers), customer structure of utilities (measured by the ratio of high-voltage electricity sales to total electricity sales), population density of the geographical area of utilities, dummy variable representing the public/private ownership of utilities, and subsidy amount provided by the government to the distribution utilities. The second stage analysis shows positive effects of the customer structure and population density on efficiency. It also finds positive effects of the public ownership on technical efficiency in India. However, the interaction term of the ownership dummy and population density is negative, implying that private enterprises have efficiency advantages over public utilities in high population density areas.

Chapter 4 turns to the state-level data and expands its scope to 21 states for 18 years from 1995 to 2012. The model for the first-stage bootstrap DEA uses the same variables as those in Chapter 3. In contrast, the external-environmental variables in the second stage include two additional reform-related variables, i.e., dummy variable representing the enactment of legislation and dummy variable for actual vertical unbundling of electric power utilities. The former variable represents a broad reforms package for electricity sector in each state, including the establishment of state-level regulatory commission (SERC) and issuance of tariff order by SERC. However the actual timing and specific structure of reforms were not necessarily decisive in the legislation for each state, implying that legislation could be regarded as an uncertain policy signal. The latter variable indicates the realized implementation of partial or full vertical unbundling, i.e., G-TD (only generation separated), GD-T (only transmission separated) and G-T- D (all three sectors fully separated). The second stage analysis shows negative impacts of the legislation for a reforms package on technical efficiency in India. It is argued that the uncertain political conditions in the legislation framework may have resulted in the negative impacts and disincentives. The second stage analysis also finds that partial unbundling of the form GD-T (only transmission separated) has positive effects on technical efficiency in India, while other forms of unbundling do not exhibit statistically significant impacts.

□. 審査報告 Report of the committee meeting

The referees agreed that the study contains significant contribution to the literature on the technical efficiency of electric power industries and the dissertation was worthy of a pass. They however had a number of suggestions for improvements. The comments from the referees include:

- It is useful to add a chapter that discusses world trend of the reforms in the electric power

sector and shows where Indian market stands.

- Better highlight the contributions and policy implications of the study.
- Elaborate more on the variables such as legislation, unbundling, and subsidies in the second stage.
- There are repetitions in some chapters of the draft particularly with regard to methodology.

The candidate made efforts to address the concerns of the referees and to improve the quality of the thesis. The final version meets the requirement for a Ph.D. thesis. Final recommendation was a pass.