

Measurement of Influence of the COVID-19 Pandemic on Efficiency of Japan's Railway Companies

Authors : Hideaki Endo, Mika Goto

Abstract : The global outbreak of the COVID-19 pandemic has seriously affected railway businesses. The number of railway passengers decreased due to the decline in the number of commuters and business travelers to avoid crowded trains and a sharp drop in inbound tourists visiting Japan. This has affected not only railway businesses but also related businesses, including hotels, leisure businesses, and retail businesses at station buildings. In 2021, the companies were divided into profitable and loss-making companies. This division suggests that railway companies, particularly loss-making companies, needed to decrease operational inefficiency. To measure the impact of COVID-19 and discuss the sustainable management strategies of railway companies, we examine the cost inefficiency of Japanese listed railway companies by applying stochastic frontier analysis (SFA) to their operational and financial data. First, we employ the stochastic frontier cost function approach to measure inefficiency. The cost frontier function is formulated as a Cobb-Douglas type, and we estimated parameters and variables for inefficiency. This study uses panel data comprising 26 Japanese-listed railway companies from 2005 to 2020. This period includes several events deteriorating the business environment, such as the financial crisis from 2007 to 2008 and the Great East Japan Earthquake of 2011, and we compare those impacts with those of the COVID-19 pandemic after 2020. Second, we identify the characteristics of the best-practice railway companies and examine the drivers of cost inefficiencies. Third, we analyze the factors influencing cost inefficiency by comparing the profiles of the top 10 railway companies and others before and during the pandemic. Finally, we examine the relationship between cost inefficiency and the implementation of efficiency measures for each railway company. We obtained the following four findings. First, most Japanese railway companies showed the lowest cost inefficiency (most efficient) in 2014 and the highest in 2020 (least efficient) during the COVID-19 pandemic. The second worst occurred in 2009 when it was affected by the financial crisis. However, we did not observe a significant impact of the 2011 Great East Japan Earthquake. This is because no railway company was influenced by the earthquake in this operating area, except for JR-EAST. Second, the best-practice railway companies are KEIO and TOKYU. The main reason for their good performance is that both operate in and near the Tokyo metropolitan area, which is densely populated. Third, we found that non-best-practice companies had a larger decrease in passenger kilometers than best-practice companies. This indicates that passengers made fewer long-distance trips because they refrained from inter-prefectural travel during the pandemic. Finally, we found that companies that implement more efficiency improvement measures had higher cost efficiency and they effectively used their customer databases through proactive DX investments in marketing and asset management.

Keywords : COVID-19 pandemic, stochastic frontier analysis, railway sector, cost efficiency

Conference Title : ICEEFTI 2024 : International Conference on Engineering Economics and Finance for Transportation Infrastructure

Conference Location : Tokyo, Japan

Conference Dates : March 18-19, 2024