Determination of the efficiency of the world railway companies by method of DEA and comparison of their efficiency by Tobit analysis

Aziz Kutlar · Ali Kabasakal · Murat Sarikaya

Published online: 13 July 2012
© Springer Science+Business Media B.V. 2012

Abstract This paper attempts to measure the performance of railway companies that produce passenger and freight services around the world. The data covering 10 years from 2000 to 2009 is analyzed first via the data envelopment analysis method in order to obtain technical efficiency and allocative efficiency scores of 31 railway companies for the purpose of the study. In the analysis conducted by use of the CCR model, while total 17 firms were efficient in the first year, this figure reaches to 18 companies for the last year with one more addition. While only two companies seem efficient in the first year, this figure goes down to one for the last year. With input oriented and variable return analysis conducted by use of the BCC model, the firms having technical efficiency at the beginning of the period were 20 in number. At the end of the period, the figure reaches to 24. Next, the outputs of DEA are correlated by Tobit regression and tried to determine decisiveness of the outputs on the efficiency. It has been seen that the same output composition used with Tobit analysis gives more compliant results with the allocative efficiency scores rather than with the technical efficiency scores.

Keywords Data truncating and censoring · Data envelopment analysis · Tobit analysis · Railway

1 Introduction

Railway transportation is an activity to transport cargo and/or passengers on a certain railway track, although different in gauge. Occasionally classified as natural monopoly, this type of
transportation has been performed by monopoly (usually national) companies in many countries also by the effect that it involves high constant costs.

Structural changes in the railway firms have sometimes occurred as a result of breakages in the political history of the world. Upon disintegration of the Soviet Union, the national railway companies appeared in the former Soviets and that political tension has continued recently in the Georgia-Caucasus region shows that the railway industry could still maintain its variability in this region. Countries that emerged after disintegration of Yugoslavia have established their national railway companies. Even autonomous administration of each ethnical region in Bosnia-Herzegovina has formed its own regional railway firm. As to the example of Spain, although there is no weakness seen in the political integrity of the country, the existence of regional-national companies operating in Catalan and Bask regions, different in gauge, is considerable UIC (2010).

Especially in the recent periods, with the pressure stemming from the other types of transportation, the efficiency of this transportation has started to be discussed and, as a result, serious structural changes started to be implemented. According to Duman (2006), although the changes made are not same in each country, they are generally realized in the form of restructuring, incorporation or privatization. Cowie (1999) states that as a result of the Directive 91/440 issued by the European Union, British, German, Swedish and some other European railway companies have been divided as a result of restructuring, privatized and converted to partnership, including franchising by method of concession or exemption granted by the government.

In this study, total 31 firms engaging with railway transportation on passenger and cargo basis worldwide are examined. Only three of these firms listed in Table 1 are private; and except for eight firms, all firms integrated ones where infrastructure and transportation services are collected under a single corporate roof. Data used in the study has been compiled from the publication in 2011 of TR State Railways (TCDD) and International Railway Association (UIA). When comprehensive information has been required about the firms, corporate websites of the firms and internet information sources were used. As infrastructure maintenance and all transportation activities have been performed as integrated for some firms the values have been taken as they are when compiling the data; and as infrastructure maintenance and transportation activities have been separated for some firms, the respective values have been taken from different companies considering the relations among the companies and completed by processing for the firm which has been studied. Data of 1999 organizations, which are members of the International Railway Association, has been dealt with individually. The complete and compliant data out of the input and output data to be used in the analysis has been included in the study. Six inputs including costs and five outputs have been used. Comprehensive information about these inputs and outputs are given under the empirical heading.

In this study, literature review follows introduction at section two. Then, a brief explanation of methodology used in the study takes place at section three. Empirical results of the analyses are found in section four. Finally conclusion and suggestions are placed at the end, in section five.

2 Literature

A series of studies were made by using data envelopment analysis (DEA), Frontier Function and econometric methods with respect to railways, airways and other transportation meth-