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Trends in and determinants of technical efficiency of software companies in India

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Abstract

This paper attempts to discuss the trends in and determinants of technical efficiency of software companies in India during 1999–2008 by applying input-oriented DEA model. Based upon the PROWESS Database of CMIE, the efficiencies were estimated for the old and new companies and also for Indian, multinational and group companies. The estimations were made for a sample of 72 software companies, under VRS assumption, as dataset manifested large magnitude of differences owing to the presence of big and small companies in the sample. The sales revenue is taken as output variable, and employment, expenditure on computers and electronics equipments, operating expenditure, power, fuel, and water charges as the input variables. The results and analyses demonstrate that the mean overall technical efficiency of the software industry in India during 1999–2008 was low suggesting that software firms, on an average, were wasting 35% of their inputs. It was found that the number of companies operating on most productive scale size has declined during the period under reference. The results also suggest that Indian-owned companies were more efficient than the foreign-owned and group-owned companies. Contrary to the expectations, exports were not found to have exercised significant impact on the efficiency of Indian software industry.
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1. Introduction

Among all the services under the domain of services sector, software is one sector in which India has achieved a remarkable global brand identity over the years. The success of this industry is better understood through its contribution to services sector in the structural transformation of Indian Economy. Contribution of software sector towards services has grown from about 1% in 1997–1998 to about 13% by 2011–2012, indicative of the rising importance of software sector in the India economy. The industry has recorded a compound annual growth rate of about 49% for the last three decades (1980–2012). In 1990s, growth of this industry was phenomenal with a compound annual growth rate (CAGR) of about 69%. However, since the year 2000, the software industry has started witnessing a deceleration. Besides, with increasing integration of India with the global economy, coupled with the availability of competent manpower at relatively low cost, many foreign players have started entering the Indian market, constantly exposing software companies in India, especially export-oriented software firms, to increasing level of competition. This development gives rise to an important issue pertaining to the probability of survival and growth of software players in India in the context of intensification of competition in the domestic as well as the world markets. One probable solution to this vexed problem probably lies in the significant gains in productivity for the Indian software firms. However, this needs to be investigated further in the light of historical track record and other empirical evidences pertaining to the improvement in efficiency. The present study, therefore, endeavours to answer the following questions: Is there any increase in efficiency of software companies in India? What are the trends and determinants of efficiency? Are Indian software companies more efficient their foreign counterparts in India? The present study estimates efficiency (Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE)) of software companies in India during 1999–2008, by applying data envelopment analysis (DEA) technique. The efficiencies, then, are grouped into old and new companies, and also according to ownership of companies. Further, this study attempts to identify the determinants of efficiency.

2. Methodology

DEA technique is applied in this study to estimate efficiency of software companies in India. Given the assumptions of constant and variable returns to scale, and two measures of technical efficiency (input or output orientation measure), it is critical to understand which should be the most appropriate tool for the study. The CCR model proposed by Charnes, Cooper, and Rhodes (1978) had an input-orientation and assumed constant returns to scale. Similarly, Banker, Charnes, and Cooper (1984) proposed BCC model which had assumed variable returns to scale. In an input-oriented technical efficiency measurement, output(s) remain constant but inputs are proportionally reduced. Similarly, keeping inputs unchanged, outputs can be expanded proportionally. The latter is called output-oriented measure of technical efficiency. In an input-orientation model (input minimization) desired output is produced with minimum inputs (Yang, 2006). This model is preferred when output is given and inputs are flexible. On the other hand, in an output-orientation model (output maximization) efforts are made to maximize the output with given inputs. The choice of the model depends on the available flexibility either with the inputs or output (Avkiran, 2001). It may be noted that the input variables taken for this study comprise employment, expenditure on hardware (computers and electronics equipments), operating expenditure and utility expenses. All these variables are considered to be flexible according to the requirements. Nevertheless, the output variable may not have flexibility as it is dependent primarily on exports, an overwhelming

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