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Efficiency and productivity analyses of Indonesian manufacturing industries

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Abstract

This study estimates the technical efficiencies and total factor productivity (TFP) growths in food, textile, chemical and metal products industries from 1993 to 2000 in Indonesia by using the stochastic frontier model. Furthermore, the determinants of inefficiency are also analyzed and TFP growth is decomposed into technological progress, a scale component, and efficiency growth. The results reveal that the food, textile, chemical and metal products sectors are on average 50.79%, 47.89%, 68.65% and 68.91% technically efficient, respectively. It is noted that ownership contributed to technical inefficiencies in the food sector; location and size contributed to technical inefficiencies in the textile sector, whereas size, ownership and age contributed to inefficiencies in the chemical and metal products sectors. We note that productivity in food, textile, and metal products sectors decreased at the rate of 2.73%, 0.26%, and 1.65%, respectively, but increased at a rate of 0.5% in the chemical sector. The decomposition of TFP growth indicates that the growths are driven positively by technical efficiency changes and negatively by technological progress in all four sectors.

JEL classification : D24; C23; O14

Keywords: Indonesian manufacturing; Total factor productivity; Stochastic frontier analysis

1. Introduction

In their path breaking articles, Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977) introduced the use of stochastic frontier models to estimate technical efficiency in manufacturing firms. Since then many authors (e.g., Battese & Coelli, 1988; Kumbhakar, 1990;

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Pitt & Lee, 1981) extended their analysis of the stochastic frontier to panel data models which allows the estimation of time varying technical efficiency. The application of stochastic frontier models has also spread from manufacturing to other sectors (e.g., agriculture, financial and other services). There have been many studies devoted to the manufacturing industries, e.g., Marcos and Galvez (2000) studied technical efficiency of Spanish manufacturing firms from 1990 to 1994; Mahadevan (2000) estimated technical efficiency of 28 Singaporean manufacturing industries from 1975 to 1994; Mini and Rodriguez (2000) estimated efficiency for Philippine manufacturing firms in 1994; Kaynak and Pagan (2003) estimated technical efficiency of U.S. manufacturing industries; Kim (2003) estimated sources of efficiency in Korean manufacturing industry and Wadud (2004) studied efficiency in Australian textile and clothing firms. The relationship between firm's efficiency and its size and age was studied by Lundvall and Battese (2000) for Kenyan manufacturing industry and noted that the relationship between efficiency and firm age is not significant.

There are also several studies related to Indonesian manufacturing efficiency. Pitt and Lee (1981) used pooled data on 50 Indonesian weaving industries for the years 1972, 1973 and 1975. Based on time variant and time invariant stochastic frontier analyses their estimates of average efficiency ranged between 60% and 70%. In the garment industry in Indonesia, Hill and Kalirajan (1993) noted that the average efficiency of small firms was 62.6%. In the medium and large garment firms, Battese, Rao, and Walujadi (2001) reported technical efficiency to be around 66% during 1990–1995 for all regions. However, they also reported that the lowest technical efficiency was 48.5% for Jakarta and the highest was 83.7% for East Java.

Besides efficiency, productivity is another issue important for growth. Total factor productivity growth can be estimated through several approaches, such as the neo-classical approach, the growth accounting approach and the decomposition approach. In the neo-classical approach, productivity growth, known as TFP growth, reflects all output growth that cannot be ascribed to the inputs in production, in growth accounting approach TFP is estimated without distinguishing between components of TFP growth and the TFP growth is often used synonymously with technological progress, whereas in decomposition approach, TFP growth is broken down into technological progress, a scale component and technical efficiency changes. TFP growth for Asian countries at the micro and at the macro levels have been investigated by many authors. At the firm level, Kim and Han (2001) estimated TFP growth of Korean manufacturing industries by using decomposition method and Oguchi, Amdzah, Zainon, Abidin, and Shafii (2002) studied TFP growth for Malaysian manufacturing industries but by using a growth accounting method. By using the same method, Koh, Rahman, and Tan (2002) estimated TFP growth of Singaporean manufacturing industries, whereas Mahadevan (2002) used decomposition method to investigate productivity growth for most service sectors in the same country.

There have been some studies devoted to the estimation of TFP growth of Indonesian manufacturing industries. Using growth accounting method, Timmer (1999) utilized panel data of Indonesian manufacturing industries over the period 1975–1995 and concluded that annual TFP growth during this period was 2.8%. Using the same method, Aswicahyono and Hill (2002) studied TFP growth of 28 Indonesian manufacturing industries over the period 1975–1993. They noted that during 1976–1981 TFP grew 1.1% but between 1981 and 1993, TFP declined and contracted to −4.9% per annum. On average, the TFP growth over the period of their study was 2.3%.

During the last three decades numerous studies have been devoted to efficiency measurement by estimating frontier functions. The two approaches that have been used are: the data envelopment analysis (DEA) and the stochastic frontier models. Comprehensive reviews of these