Advanced Materials Research Vols. 204-210 (2011) pp 193-196
© (2011) Trans Tech Publications, Switzerland
doi:10.4028/www.scientific.net/AMR.204-210.193

Classification of the Yangon's ports in Myanmar with efficiency measurement by using DEA

Mu Mu Han, Lin Guolong, Yang Bin
Logistics Research Center, Shanghai Maritime University, Shanghai 200135, China
mumuhan@gmail.com

Keyword: Yangon's ports, Efficiency, DEA, Production

Abstract: Container terminal production is both an important and complicated element in the contemporary global economy. Amongst other methods, the efficiency of container port or terminal production can potentially be analyzed by Data Envelopment Analysis (DEA). This paper aims to evaluate the efficiencies of the Yangon's ports using the two alternative techniques. This paper provides a preliminary analysis of Yangon's port sector for the period (1998-99 to 2007) using DEA in order to asses the impact of transformation. The results are therefore important in terms of the extent to which Yangon's ports will be capable of competing effectively in the port industry. The scale of merger and takeover activity across the port industry has been extensive in recent years and this can be expected to increase as new opportunities for market penetration and consolidation emerge in the new-private ports sector.

Introduction

Ports and maritime transport have existed for some thousands of years and have developed in line with the evolution of international trade which has been inherent in shaping the modern world .Thus ports and maritime transport play and important role today in global commerce. In particular, container transportation plays a key role in the process, largely because of the numerous technical and economic advantages it possesses over traditional methods of transportation.

In Myanmar, trade is crucial to a country's economy, and ports and airports are the main economic infrastructures of the country. Ports will contribute much towards Myanmar's economy," .Since, Myanmar has changed it's economic course from a centrally planned economy into a market oriented system, a series of structural reforms had been introduced and new legal policy instruments given the private sector including foreign investors and businessmen, the right to do business and to make investment in the country were enacted.

The Government of the Union of Myanmar has recognized, in the context of the market-oriented economic system, the private sector as a prime-mover of the market mechanism and pays great attention for its development. All out efforts are being made to encourage the active participation of private sectors in foreign trade and giving full support in every age.

The Yangon's ports banking sector in Myanmar was developed as private sector since the beginning of the country's transformation process in 1997. Today, there are 4 private ports and 1 public port in Myanmar. Private ports are MITT, AWPT, MIPL and MIP and then public port is MPA. Among the private ports, MIITT and MIPL are the foreign investment ports and other ports are the national investment ports. The quantity of cargo throughput in Yangon's ports has increased annually today in Myanmar ports industry. With the improvement of ports, the amount of containers handled has increased. So Yangon's ports are concerned with inter-port competition under the Myanmar economic framework.

This paper provides a preliminary analysis of the performance of the ports banking industry since the mid-1990s in order to assess the extent to which efficiency has improved. DEA is employed to examine the port performance, profitability and thus the efficiency of Yangon's ports. The paper is structured as follows: DEA and efficiency of port industrial economics are utilized to classify port efficiency by two criteria:(type of scale effects and model orientation) in Section 2.The required input and output variables are defined and the data that has been collected and collated is described in section 3. Estimates of the port efficiency of a sample of container ports are derived in Section 4. Finally, summary and conclusions are drawn in Section 5.

2. DEA and efficiency

The study reported here employs Data Envelopment Analysis (DEA). The DEA approach to efficiency measurement is a deterministic method which does not require the definition of a functional relationship between inputs and outputs. The methodology is based on the concept of productivity as developed by Debreu (1951) and Farrell (1957). Productivity is defined as the ratio between a single output and a single input. Extending this notion to a multi-dimensional case with more than one input and more than one output gives rise to the concept of an efficiency curve for a particular decision making unit (such as a port), generated using linear programming methods. A unit such as a bank may be considered to be technologically effective if it is lying on the efficiency curve; in contrast, those lying below the curve may be described as being technologically inefficient. The efficiency of a given decision making unit is measured relative to other comparable units being analyzed. Decision making units lying on the efficiency curve – described as1efficient – are assigned an efficiency coefficient equal to 1 (i.e. 100%), while any units lying below the curve – described as inefficient – will have coefficients of less than 1.
DEA models can be classified by two criteria:
(1) Type of scale effects;
(2) Model orientation.

2.1 Scale effects in DEA models

Using the approach of Farrell (1957), a measure of technological efficiency can be obtained based on various assumptions concerning the value of the empirical production possibility set (see: Färe et al (1994)). Thus, assuming constant returns to scale (CRS) and variable returns to scale (VRS), two technological efficiency measures can be obtained as the solutions to two types of linear programming tasks (see: Fried et al (1993), Färe etal (1994), Charnes et al (1994) and Cooper et al (2000)). In the analysis reported below, the following symbols are used to denote efficiency measures:
ecrs – efficiency measure under constant returns to scale,
evrs – efficiency measure under variable returns to scale,
enirs – efficiency measure under non-increasing returns to scale.

If there is a statistically significant difference between the estimated efficiency measures under constant and variable returns to scale, a comparison of the two measures may enable us to make inferences about the existence of economies of scale in given sector (such as within the port industry of a particular country or region). Scale efficiency is defined as follows:

$$esvrs = \frac{ecrs}{evrs}$$

If the results show that 0< ecrs < evrs <1, for a given decision making unit, then the derived economy of scale efficiency measure is less than 1. This unit can be described as being inefficient in terms of the scale of employed factors.

3. Data and Selection of Variables

The critical element of DEA concerns the appropriate selection of the input and output variables. With respect to the evaluation of production efficiency in the ports sector, using DEA, various models can be distinguished. In the study reported here we employ only six inputs (no of berths, berth length, apron length, yard area, shed area and no of cranes two outputs (no of vessel calls and cargo throughput). These variables have been selected on the basis of the particular aim of the research, which focuses on production efficiency and on data availability. The analysis is concern with the Yangon’s ports sector and covers the period (1998-99 to 2007).

4. Result of Efficiency Analysis

The Matlab software is employed to solve the DEA (input-oriented) model. Without precise information on the returns to scale of the port production function, two types of DEA models, namely CCR and BCC model, are applied to analyze the efficiency of container terminals.

4.1. Classification of ports

In Table1, the ports analyzed in this study are classified on the basis of the corresponding estimates for technological efficiency and returns to scale measures. Descriptions of the four types shown were set out in Table 3. We comment on each of the classification types in turn.

Type I: These are ports classified as efficient, on the basis of all efficiency measures. Such ports define the 'best practice' frontier, characterized by the most favorable input/out put ratios reported in the port sector. Ports in this group are efficient both in terms of technology scale. AWPT is Type I port. So AWPT is the best port among the five ports.

Table1. Efficiency classification of decision making units (i.e. port)

Type of port	Relationship between efficiency measures	Description
I	ecrs=1,evrs=1,esvrs=1	Efficient ports on the basis of all efficiency measure
II	ecrs=1,evrs>1,esvr<1	Ports which are efficient under constant return to scale (ecrs=1) and inefficient under variable return to scale. Ports which are inefficient in terms of the technology efficiency. The ports are operating in the region of constant return to scale.
III	ecrs<1,evrs<1,esvr>1	Ports which are inefficient under both constant and variable return to scale. The ports are operating in the region of increasing return to scale.
IV	ecrs>1,evrs>1,esvrs<1	Inefficient ports on the basis of all efficiency measure. The ports are operating in the region of decreasing return to scale.

Table2. Classification by technological and scale efficiency measures

Port Classification	Port Name
I	AWPT
II	MITT,MPL
III	MIPL
IV	MPA

Type II: These refer to ports which are efficient under constant return to scale and inefficient under variable returns to scale. At the same time, the ports in this group are technologically inefficient ports. This suggests that such ports should not change the amount of factor inputs employed as they operate in the region of constant returns to scale. They should instead focus on improving their technology. The two ports such as MITT and MPL were classified into this category. The target group for these ports is Type I. So they have the potential to improve their production efficiency as AWPT.

Type III: These banks are inefficient under both constant and constant returns to scale. At the same time, they demonstrate technological inefficiency. This group is generally made up of those ports which are too small to achieve an optimum level of the input/output ratio observed in the port sector. Since such ports operate in the region of increasing returns to scale, this group of ports has the potential to achieve the most favorable ratio of inputs to outputs. There is one port in this classification. It is MILP. The target group for these ports is type I.

Type IV: This classification refers to ports which are inefficient under constant and variable returns to scale. They are technologically inefficient. The ports in this classification are operating in the region of decreasing return to scale. Consequently, they should reduce the scale of their inputs. MPA is in this classification.

5. Summary and Conclusion

The efficiency results for the Yangon's port sector based on the DEA methodology indicate that the mean efficiency rose and was on a rising trend thereafter up to the end of the period (1998-99 to 2007). It is important to appreciate that DEA results are particularly sensitive to any variation in the dataset – the addition to or elimination of even one decision making unit (port) from the sample may have a significant impact on the efficiency measures of individual ports and the sector as a whole. DEA results are also sensitive to false or inaccurately recorded data. These reservations are especially important in relation to the Yangon's ports sector, which is in the phase of dynamic growth and ownership transformation – with direct implications for the quality of information being compiled over time. These reservations will, of course, diminish as investment in information management and reporting increases.

Acknowledgement

This work was supported in part by Shanghai Science Commission Project (No.09DZ2250400, 10692103500, 09530708200, 08170511300) and Shanghai Education Commission Project (No.J50604, 11YZ137).

Reference

[1] Ali, A. I. and Seiford, L. M. (1993), The Mathematical Programming Approach to Efficienc Efficiency Analysis, In Fried, H., Lovell C. A. K. and Schmidt, S. (eds.), The Measurement of Productive Efficiency: Techniques and Applications Oxford: Oxford University Press, pp 160-194

[2] Cooper W.W., Seiford L.M. and Tone K. (2000) Data Envelopment Analysis: A Comprehensive Text with Models, Applications, Reference and DEA Solver Software, Kulwer Academic Publishers, Nowell, Massachusetts.

[3] Charnes, A., Cooper, W. W. and Rhodes, E. (1978), Measuring the Efficiency of Decision Making Units, European Journal of Operational Research, Vol. 2, pp. 429-444.

[4] Kim, M. and Sachish, A. (1986), The Structure of Production, Technical Change and Productivity in a Port, Journal of Industrial Economics, Vol. 35, No. 2, pp. 209-223.