Group Performance Evaluation, An Application of Data Envelopment Analysis

H. Bagherzadeh valami [a]
hadi_bagherzadeh@yahoo.com

a Department of Mathematics, Shahr-e-rey Branc h, Islamic Azad University, Tehran , Iran
Tel.:+98-21-5277800-10, Fax: +98-21-5277888, P.O. Box 18735/334

Abstract

The contribution of this paper is to provide an approach for evaluating the performance of a group of decision making units (DMUs) based on the production technology. Group evaluation is an application of data envelopment analysis (DEA). DEA uses linear programming to provide a suitable technique to estimate a multiple-input/multiple-output empirical e.cient function. In this paper, an approach for evaluating the performance of a group of DMUs is proposed. Suppose A is a subset of J. On the basis of the observed inputs-outputs of DMUs in A and under the five assumptions, the respective PPS of A is denoted by T^A and defined as follows:

$$T^A = \{(X,Y) \mid X \geq \sum_{j \in A} \lambda_j X_j ,\ Y \leq \sum_{j \in A} \lambda_j Y_j ,\ \lambda_j \geq 0 (j \in A)\} \qquad \textbf{(1)}$$

where, for convenience, instead of DMUj$\in$A, we write j$\in$A. The output distance function of the input-output vector (X, Y) related to set A is defined as

$$\begin{aligned} D_A(X,Y) &= Max \quad \phi \\ s.t. \quad & \sum_{j \in A} \lambda_j x_{ij} \leq x_i, \quad i=1,\dots,m, \\ & \sum_{j \in A} \lambda_j y_{rj} \leq y_r, \quad r=1,\dots,s, \qquad \textbf{(2)} \\ & \lambda_j \geq 0, \qquad j \in A. \end{aligned}$$

Similar to Malmquist productivity indices, $\frac{D_{A1}(X,Y)}{D_{A2}(X,Y)}$ measures the technology frontier shift between two groups A1 and A2 with respect to point (X, Y), such that $\frac{D_{A1}(X,Y)}{D_{A2}(X,Y)} \geq 1$ implies that group A1 uses a more effcient technology than A2 and has a better performance.

Definition 1. Group A1 performs better than group A2 with respect to input-output vector (X, Y), if $D_{A1}(X,Y) > D_{A2}(X,Y)$.

The comparison in definition 1 is dependent on input-output vector (X, Y).
A group can be justly evaluated by selecting some suitable input-output vectors. The comparison of the two groups' performances can be done using the geometric mean of their technology changes with respect to all DMUs in J such that the performance of group A1 is better than that of group A2

if

$$(\prod_{j=1}^{n} \frac{D_{A1}(X_j, Y_j)}{D_{A2}(X_j, Y_j)})^{\frac{1}{n}} \geq 1$$

Definition 2. The performance score of group A $\subseteq$J is defined as

$$P(A) = (\prod_{j=1}^{n} D_A(X_j, Y_j))^{\frac{1}{n}} \quad \textbf{(3)}$$

Therefore, group A1 performs better than group A2 if P (A1) > P (A2).
It mights sound more sensible in the evaluation to compare a group A with all DMUs (J) as reference points. But the reason for comparing all DMUs (J) with group A as a reference group is to ignore the performance of ine.cient DMUs in A, and consider only the production ability of group A in the evaluation.

AMS : Operations Research, No. 90.
keywords: **Group Evaluation, Performance, DEA.**

References

1. M. J. Farrell, The measurement of pro ductive e.ciency,Journal of the Royal Statistical Society Series A, General 120 (1957) 253-281.
2. A. S. Camanho, R. G. Dyson. Data envelopment analysis and Malmquist indices for measuring group performance. Journal of Productivity Analysis (2006) 26: 35-49.
3. G. R. Jahanshahloo, F. Hosseinzadeh Lotfi, H. Bagherzadeh Valami. Malm-quist productivity index with interval and fuzzy data, an application of Data envelopment analysis International Mathematical Forum (2006) 33: 1607-1623.
4. S.Malmquist, . Index numbers and indi.erence surfaces, Traba jos de Es-tadistica, 4 (1953), 209-242.
5. A.Charnes, W.W.Cooper, E.Rhodes, Measuring the e.ciency of decision making units, European Journal of Operational Research, 2 (1978), 429-444.