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( DEA)

TFP

Decision Making Unit

(DMU)

TFP

(Alirezaei et al. 2007) .

(Alirezaei et al. 2005) .

(DEA)

(Abbasiyan and Mehregan 2007) .

(DEA)

DEA/AHP CEM•A&P

(Safaie Qadyklaye et al. 2005) .

Data Envelopment Analysis

.(Azar et al . 2005)

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(Farrell 1957)

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$$\begin{aligned}
 & u_{ro}, v_{io} \geq 0 \\
 & i = 1, 2, \dots, n \quad r = 1, 2, \dots, s \\
 & j = 1, 2, \dots, m
 \end{aligned}$$

$$\begin{aligned}
 & 0 && : u_{ro} \\
 & 0 && : v_{io} \\
 & 0 && : Y_{ro} \\
 & 0 && : X_{io} \\
 & && : Y_{rj} \\
 & && : X_{ij} \\
 & && : r, i, j
 \end{aligned}$$

$r, i, j$

(Cooper)

(Edwardo)

(Charnes)

CCR

CCR (Charnes et al. 1978)

( )

Min  $\theta$

$$S.T \quad - \sum_{r=1}^s u_r Y_{ro} + \sum_{r=1}^s \lambda_j Y_{rj} \geq 0$$

$$\begin{aligned}
 \theta \sum_{i=1}^m v_i X_{io} - \sum_{i=1}^m \lambda_j X_{ij} & \geq 0 \\
 \lambda & > 0
 \end{aligned} \quad (2)$$

$j = 1, 2, \dots, m$

$N \times 1$

$\lambda$

$\theta$

(Banker)

BCC

CCR

(Banker et al. 1984)

DEA

$\theta \leq 1$

CCR

$$\begin{aligned}
 & MAX \quad \frac{\sum_{r=1}^s u_{ro} Y_{ro}}{\sum_{i=1}^n v_{io} X_{io}}
 \end{aligned}$$

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$$\begin{aligned}
 & S.T \quad \frac{\sum_{r=1}^s u_{ro} Y_{rj}}{\sum_{i=1}^n v_{io} X_{ij}} \leq 1
 \end{aligned}$$

DEA

$$\text{Min } \theta$$

$$\text{S.t. } - \sum_{r=1}^s u_r Y_{ro} + \sum_{r=1}^s \lambda_j Y_{rj} \geq 0$$

$$\theta \sum_{i=1}^m v_i X_{io} - \sum_{i=1}^m \lambda_j X_{ij} \geq 0$$

$$\begin{aligned} NI'\lambda &\leq 1 \\ \lambda &> 0 \end{aligned}$$

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CCR

BCC

DEA

CCR

CCR

BCC

DMU

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DMU

DMU

$$\text{Min } \theta$$

$$\text{S.t. } - \sum_{r=1}^s u_r Y_{ro} + \sum_{r=1}^s \lambda_j Y_{rj} \geq 0$$

$$\theta \sum_{i=1}^m v_i X_{io} - \sum_{i=1}^m \lambda_j X_{ij} \geq 0 \quad ( )$$

$$NI'\lambda = 1$$

$$\lambda > 0$$

DMU

DMU

$$\text{Max } D_k$$

$$\text{s.t. :}$$

$$-D_k Y_{11} + (Y_{11}\lambda_1 + Y_{21}\lambda_2 + \dots) \geq 0$$

$$\dots$$

$$-D_k Y_{1j} + (Y_{1j}\lambda_1 + Y_{2j}\lambda_2 + \dots) \geq 0 \quad ( )$$

$$X_{11} - (X_{11}\lambda_1 + X_{21}\lambda_2 + \dots) \geq 0$$

$$X_{1i} - (X_{1i}\lambda_1 + X_{2i}\lambda_2 + \dots) \geq 0$$

$$\lambda_t \geq 0$$

$$t = 1, 2, 3, \dots$$

K DMU

=D

=  $\lambda$

DMU

j

=Y<sub>1j</sub>

DMU

i

=X<sub>1i</sub>

CCR

BCC

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