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$$\begin{matrix} - & & - \\ - & & - \\ - & & - \\ - & & - \\ (// & // & //) \end{matrix}$$

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DMU_j

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[x_{ij}]

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DEA

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: (i)

$$\text{Max } \frac{\sum_r u_r y_{ro}}{\sum_i v_i x_{io}}$$

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s.t.

$$\frac{\sum_r u_r y_{ro}}{\sum_i v_i x_{io}} \leq 0$$

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DMU_j

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$$u_r, v_i > 0$$

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: (ii)

$$\text{Max} \prod_{i \in \{I\}} (R_{ij})^{c_i} \quad ()$$

s.t.

$$\prod_{i \in \{I\}} (R_{ij})^{c_i} \leq [\max \{R_{ij}\} N] \quad ()$$

$$\sum_{i \in \{I\}} c_i = 1 \quad ; \quad c_i \geq 0 \quad ()$$

: (iii)

$$\text{Max} \prod_{i \in \{I\}} (R_{ij})^{c_i} + (1-t) \sum_{n=1}^N \frac{\phi J_n W_n}{\prod_{n'=1}^n (1+r_{n'j})} \quad ()$$

s.t.

$$\prod_{i \in \{I\}} (R_{ij})^{c_i} \leq [\max \{R_{ij}\} N] \quad j \in \{ \quad \} \quad ()$$

$$\frac{\phi J_n W_n}{\prod_{n'=1}^n (1+r_{n'j})} \leq y_{nj} \quad ()$$

$$\sum_{i \in \{I\}} c_i = 1 \quad ; \quad c_i \geq 0 \quad ()$$

n

$= J_n$

$= N$

n

$= W_n$

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j

$= r_{nj}$

j

$= y_{nj}$

$$\ln x \quad \ln x > 0 : \quad x > 1$$

x

Ashby

lnx
(IV)

: (IV)

$$\text{Max } \sum_{i \in \{I\}} c_i \ln R_{ij} + \ln(1-t) \left[\sum_{n=1}^N (\ln \phi_j J_{nj} W_{nj} - \sum_{n'=1}^n \ln(1+r_{nj})) \right] \quad ()$$

s.t.

$$\sum_{i \in \{I\}} c_i \ln R_{ij} \leq N \ln(\max R_{ij}) \quad ()$$

$$\sum_{i \in \{I\}} c_i = 1 \quad ()$$

$$\ln(\phi_j J_{nj} W_{nj}) - \ln\left(\sum_{n=1}^n \ln(1+r_{nj})\right) \leq \ln y_{nj} \quad ()$$

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$$\mu_I(y_{ij}) = \begin{cases} \frac{y_{ij}-a_1}{a_2-a_1} & a_1 \leq y_{ij} \leq 5a_2 \\ \frac{a_3-y_{ij}}{a_3-a_2} & a_m \leq y_{ij} \leq a_3 \end{cases} \quad ()$$

Min Max

R_{ij} []

$$: R_{ij} = \max y_{ij} - \min y_{ij} \quad ()$$

(II)

R_{ij}

$$\longrightarrow \bar{R}_j, \hat{R}_j$$

$$\longrightarrow b_j + p_j, b_j$$

:

$$\mu_{G_i}(R_{ij}) = \begin{cases} 0 & \text{if } \prod_{i \in \{I\}} (R_{ij})^{c_i} \leq \hat{R}_j \\ \frac{\prod_{i \in \{I\}} (R_{ij})^{c_i} - \hat{R}_j}{\bar{R}_j - \hat{R}_j} & \text{if } \hat{R}_j \leq \prod_{i \in \{I\}} (R_{ij})^{c_i} \leq \bar{R}_j \\ 1 & \text{if } \prod_{i \in \{I\}} (R_{ij})^{c_i} \geq \bar{R}_j \end{cases} \quad ()$$

$$\mu_{c_i}(R_{ij}) = \begin{cases} 0 & \text{if } \prod_{i \in \{I\}} (R_{ij})^{c_i} \leq b_j \\ 1 - \frac{\prod_{i \in \{I\}} (R_{ij})^{c_i} - b_j}{p_j} & \text{if } b_j < \prod_{i \in \{I\}} (R_{ij})^{c_i} \leq b_j + p_j \\ 1 & \text{if } \prod_{i \in \{I\}} (R_{ij})^{c_i} > b_j + p_j \end{cases} \quad ()$$

$$p_j = [\text{Max} \{ R_{ij} \}]^N \quad ()$$

: (V)

$$\lambda_j = \left(\frac{\prod_{i \in \{I\}} (R_{ij})^{c_i} - \hat{R}_j}{\bar{R}_j - \hat{R}_j} \quad \frac{p_j - \prod_{i \in \{I\}} (p_{ij})^{c_i} + b_j}{P_j} \right) \quad ()$$

$$\text{MAX } \lambda_j \quad ()$$

s.t.

$$\frac{\prod_{i \in \{I\}} (R_{ij})^{c_i} - \hat{R}_j}{\bar{R}_j - \hat{R}_j} \geq \lambda_j \quad ()$$

$$\frac{p_j - \prod_{i \in \{I\}} (R_{ij})^{c_i}}{p_j} \geq \lambda_j \quad ()$$

$$\sum_{i \in \{I\}} c_i = 1 \quad ()$$

$$c_i \geq 0 \quad ()$$

$I = \{\text{SALE, IB, MKVALF}\}$

:

(D = GNC) D

$$X_{\max} = \{x \mid \max \mu_D(x) = \max \min [\mu_G(x), \mu_C(x)] \} \quad ()$$

$$\mu_D(R_{ij}) = \min_j \{ \mu_G(R_{ij}), \mu_C(R_{ij}) \} \quad ()$$

$$\mu_D(R_{\max}) = \max \min \{ \mu_{G_j}(R_{ij}), \mu_{c_j}(R_{ij}) \} \quad ()$$

$$\frac{\prod_{i \in \{I\}} (R_{ij})^{c_i} - \hat{R}_j}{\bar{R}_j - \hat{R}_j} = \frac{p_j - \prod_{i \in \{I\}} (p_{ij})^{c_i} + b_j}{P_j} \quad ()$$

$$\prod_{i \in \{I\}} (R_{ij})^{c_i} = \frac{-\hat{R}_j b_j + \bar{R}(b_j + p_j)}{p_j + \bar{R}_j - \hat{R}_j} \quad ()$$

:

(IV)

$$\mu_{c_1}(R_{ij}) = \begin{cases} 0 & \text{if } \sum_{i \in \{I\}} c_i \ln R_{ij} \leq b_j \\ 1 - \frac{\sum_{i \in \{I\}} c_i \ln R_{ij}}{P_j} & \text{if } b_j < \sum_{i \in \{I\}} c_i \ln R_{ij} \leq b_j + p_j \\ 1 & \text{if } \sum_{i \in \{I\}} c_i \ln R_{ij} > b_j + p_j \end{cases} \quad ()$$

$$\mu_{c_2}(R_{ij}) = \begin{cases} 0 & \text{if } B_j \leq d_j \\ 1 - \frac{B_j - d_j}{U_j} & \text{if } d_j < B_j \leq U_j + d_j \\ 1 & \text{if } B_j > U_j + d_j \end{cases} \quad ()$$

$$p_j = N \ln(\max R_{ij}) \quad ()$$

$$B_j = \ln(1-t) \left[\sum_{n=1}^N (\ln \phi_j J_{nj} W_{nj} - \sum_{n'=1}^n \ln(1+r_{n'})) \right] \quad ()$$

$$\text{MAX } \lambda_j \quad ()$$

s.t.

$$\frac{\sum_i c_i \ln R_{ij} + B_j - \hat{R}_j}{\bar{R}_j - \hat{R}_j} \geq \lambda_j \quad ()$$

$$\frac{U_j - B_j + d_j}{U_j} \geq \lambda_j \quad ()$$

$$\frac{P_j - \sum_i c_i \ln R_{ij} + b_j}{P_j} \geq \lambda_j \quad ()$$

$$\sum_{i \in \{I\}} c_i = \quad ()$$

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) R_{ij} . () ()

$\theta =$ r_j () y_{nj} ()

() () () (% % %) r

$$R_{ij} : y_{ij}^{\max} - y_{ij}^{\min}$$

() :

t				
1	(200,210,220)	(7,8,9)	(121,150,178)	(108,205,212)
2	(220,230,240)	(7,8,9)	(135,162,173)	(209,215,225)
3	(320,330,340)	(25,30,40)	(204,218,234)	(300,312,338)
4	(350,360,370)	(10,15,20)	(227,243,261)	(339,357,362)
5	(425,430,435)	(20,25,30)	(235,241,248)	(416,428,431)

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t	(J)	(W)
1	(15,26,37)	(38,50,63)
2	(18,28,39)	(39,52,65)
3	(18,28,38)	(45,59,73)
4	(20,27,35)	(48,61,75)
5	(22,32,42)	(52,65,77)

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t		
1	14, 903	14, 688
2	19, 1	18, 381
3	24, 399	24, 125
4	28, 854	29, 45
5	33, 56	34, 17

() :

t				
1	(123,252,556)	(112,129,141)	(78,93,108)	(76,201,414)
2	(115,242,500)	(94,106,129)	(83,98,113)	(73,212,394)
3	(105,253,369)	(88,112,118)	(91,115,134)	(92,232,340)

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t		
1	17, 508	16, 34
2	21, 97	21, 2
3	26, 334	25, 87

() :

t				
1	(169,215,249)	(235,294,353)	(124,133,148)	(148,154,182)
2	(162,170,203)	(235,353,412)	(103,108,113)	(141,155,162)
3	(155,222,313)	(176,235,294)	(93,118,132)	(122,199,273)

<i>t</i>		
1	16, 208	15, 56
2	21, 194	20, 859
3	25, 824	25, 215

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- 1 - Data Envelopment Analysis
 - 2 - Range-Number
 - 3 - Range-Heterogeneity
 - 4 - Mobility
 - 5 - Uniformity
 - 6 - Decision Making Unit
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