**Package ‘nonparaeff’**

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**Suggests** gtools

**Description** This package contains functions for measuring efficiency and productivity of decision making units (DMUs) under the framework of Data Envelopment Analysis (DEA) and its variations.

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additive

Linear Programming for the Additive Model

Description
Solve the Additive Model under the VRS assumption

Usage
additive(base = NULL, frontier = NULL, noutput = 1)

Arguments
base A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimension, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
frontier A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimension, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
noutput The number of outputs (N).

Details
The additive model under the VRS assumption is as follows:
\[ \theta_{ADD}^{k*} = \max_{\lambda, s^+, s^-} \left( \sum_{m=1}^{M} s^{-}_m + \sum_{n=1}^{N} s^+_n \right) \]
\[ \text{s.t.:} x_m^k = \sum_{j=1}^{J} x_j^k \lambda^j + s^-_m (m = 1, 2, \cdots, M); \]
\[ y_n^k = \sum_{j=1}^{J} y_j^k \lambda^j + s^-_n (n = 1, 2, \cdots, N); \]
\[ \sum_{j=1}^{J} \lambda^j = 1; \quad \lambda^j \geq 0^+ (j = 1, 2, \cdots, J); \quad s^-_m \geq 0^+ (m = 1, 2, \cdots, M); \quad s^+_n \geq 0^+ (n = 1, 2, \cdots, N). \]

Value
A data frame with J1*(J1+M+N), which has efficiency scores, optimal weights and optimal slacks. Take a look at the example below.

Author(s)
Dong-hyun Oh, <oh.donghyun77@gmail.com>
References


See Also


Examples

```r
## Simple Example
my.dat <- data.frame(y = c(1, 2, 4, 6, 7, 9),
                      x = c(3, 2, 6, 4, 8, 10))
(re <- additive(my.dat, noutput = 1))

## Property of the Additive Model
dat1 <- data.frame(y = c(1, 1, 1, 1, 1),
                    x1 = c(2, 3, 6, 3, 6),
                    x2 = c(5, 3, 1, 8, 4))

re1 <- additive(dat1, noutput = 1)
re2 <- additive(dat2, noutput = 1)
re3 <- additive(dat3, noutput = 1)
```

Description

Solve the AR-DEA

Usage

```
ar.dual.dea(base = NULL, frontier = NULL,
            noutput = 1, orientation=1, rts = 1, ar.l = NULL,
            ar.r = NULL, ar.dir = NULL, dual = FALSE)
```
Arguments

- **base**: A data set for DMUs to be evaluated. A data frame with $J_1*(M+N)$ dimension, where $J_1$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.
- **frontier**: A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with $J_2*(M+N)$ dimension, where $J_2$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.
- **noutput**: The number of outputs ($N$).
- **orientation**: Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure.
- **rts**: Returns to scale. 1 for the CRS assumption, and 2 for the VRS assumption.
- **ar.l**: A data frame for the assurance region of which is the left-hand.
- **ar.r**: A vector for the assurance region of which is the right-hand.
- **ar.dir**: A vector for the assurance region of which is the direction.
- **dual**: Logical.

Details

The AR model under the CRS assumption is calculated. For model specification, take a look at Cooper et al. (2007).

Value

A data frame with $J_1*(M+N)$, which has efficiency scores, optimal virtual prices. Take a look at the example below.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

dea, dual.dea
Examples

```r
# AR constraint of 0.25 <= v2/v1 <= 1.
library(Hmisc)
library(lpSolve)
ar.dat <- data.frame(y = c(1, 1, 1, 1, 1),
                     x1 = c(2, 3, 6, 3, 6),
x2 = c(5, 3, 1, 8, 4, 2))
(re <- ar.dual.dea(ar.dat, noutput = 1, orientation = 1, rts = 1, ar.1 = matrix(c(0, 0, 0.25, -1, -1, 1), nrow = 2, ncol = 3), ar.r = c(0, 0), ar.dir = c("<=", "<=")))
```

---

**cost.dea**  
*Linear Programming for Cost Minimization*

**Description**
Solve the Cost Minimization Problem with Given Input Prices

**Usage**
```
cost.dea(base = NULL, frontier = NULL, noutput = 1, input.price = NULL)
```

**Arguments**
- **base**: A data set for DMUs to be evaluated. A data frame with \( J_1 \times (M+N) \) dimensions, where \( J_1 \) is the number of DMUs, \( M \) for the number of inputs, and \( N \) for the number of outputs.
- **frontier**: A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with \( J_2 \times (M+N) \) dimensions, where \( J_2 \) is the number of DMUs, \( M \) for the number of inputs, and \( N \) for the number of outputs.
- **noutput**: The number of outputs (\( M \)).
- **input.price**: A vector for market prices of input factors.

**Details**
The cost minimization problem under the CRS assumption is calculated. For model specification, take a look at Cooper et al. (2007).

**Value**
A data frame with \( J_1 \times (M+6) \), which has optimal \( M \) input factors, minimized cost when overally efficient, minimized cost when technically efficient, revealed cost, overall efficiency, allocative efficiency, and technical efficiency.
Author(s)

Dong-hyun Oh, <oh.donghyun7@gmail.com>

References


See Also

revenue.dea

Examples

```r
dat.io <- data.frame(y = c(1, 1, 1, 1, 1, 1),
                     x1 = c(2, 3, 5, 9, 6, 3),
                     x2 = c(8, 6, 3, 2, 7, 9))
dat.wm<- c(w1 = 1, w2 = 2)    # market prices of input factors
(re <- cost.dea(base = dat.io, noutput = 1, input.price = dat.wm))
```

---

**ddf**  
*Linear Programming for the Directional Distance Function*

Description

Solve the Additive Model under the VRS assumption

Usage

```r
ddf(base = NULL, frontier = NULL, noutput = 1, direction = NULL)
```

Arguments

- **base**  
  A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimension, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

- **frontier**  
  A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimension, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

- **noutput**  
  The number of outputs (N).

- **direction**  
  A directional vector for inputs and outputs.
Details

The DDF under the VRS assumption is calculated. For model specification, take a look at Cooper et al. (2007).

Value

A data frame with $J_1*(J_1+M+N)$, of which has efficiency scores, optimal weightes and optimal slacks. Take a look at the example below.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

direc.dea

Examples

```r
## Simple Example of one input and one output.
my.dat <- data.frame(y = c(1, 2, 4, 6, 7, 9, 9),
                     x = c(3, 2, 6, 4, 8, 8, 10))
(re <- ddf(my.dat, noutput = 1, direction = c(1, 1)))
```

---

**dea**

*Linear Programming for the Data Envelopment Analysis*

Description

Solve input(output)-oriented DEA under the CRS (VRS)

Usage

dea(base = NULL, frontier = NULL, noutput = 1, orientation=1, rts = 1, onlytheta = FALSE)
Arguments

base
A data set for DMUs to be evaluated. A data frame with $J_1*(M+N)$ dimension, where $J_1$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

frontier
A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with $J_2*(M+N)$ dimension, where $J_2$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

noutput
The number of outputs ($N$).

orientation
Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure.

rts
Returns to scale. 1 for the CRS assumption, and 2 for the VRS assumption.

onlytheta
Logical. If onlytheta is TRUE, then only efficiency scores are obtained. If it is FALSE, then optimal lambda's and slacks are also obtained.

Details

The input (output) -oriented DEA under the CRS (VRS) assumption are calculated. For model specification, take a look at Cooper et al. (2007).

Value

If onlytheta is TRUE, then a ($J_1*1$) data.frame is obtained. If onlytheta if FALSE, then a data frame with a $J_1*(J_1+M+N)$ dimension is obtained, in which optimal weights, input slacks and output slacks are presented.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also
dual.dea

Examples

```r
## input-oriented DEA under the CRS assumption (1 input and 1 output)
tab3.1.dat <- data.frame(y = c(1, 2, 4, 6, 7, 9, 10),
                         x = c(3, 2, 6, 4, 8, 8, 10))
(re <- dea(base = tab3.1.dat, noutput = 1, orientation = 1, rts = 1,
          onlytheta = FALSE))
```
## direc.dea

Linear Programming for the Directional Distance Function with Undesirable Outputs

### Description

Solve the DDF with undesirable outputs. The directional vector is (y’s, b’s).

### Usage

```
direc.dea(base = NULL, frontier = NULL, ngood = 1, nbad = 1)
```
Arguments

base
A data set for DMUs to be evaluated. A data frame with \(J_1 \times (M+P+Q)\) dimension, where \(J_1\) is the number of DMUs, \(M\) for the number of inputs, \(P\) for the number of good outputs, and \(Q\) for the undesirable outputs.

frontier
A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with \(J_2 \times (M+P+Q)\) dimension, where \(J_2\) is the number of DMUs, \(M\) for the number of inputs, \(P\) for the number of good outputs, and \(Q\) for the undesirable outputs.

ngood
The number of good outputs (P).

nbad
The number of bad outputs (Q).

Details

The DDF with undesirable outputs under the CRS assumption is calculated. For model specification, take a look at Chung et al. (1997).

Value

A \(J_1\) vector of which is inefficiency score.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

ddf

Examples

```r
## Simple Example of one input, one good output, and one bad output.
my.dat <- data.frame(yg = c(2, 5, 7, 8, 3, 4, 6),
                     yb = c(1, 2, 4, 7, 4, 5, 6),
                     x = c(1, 1, 1, 1, 1, 1, 1))
direc.dea(my.dat, ngood = 1, nbad = 1)
```
**dual.dea**

Linear Programming for the Dual Data Envelopment Analysis

**Description**

Solve the Dual DEA

**Usage**

```r
dual.dea(base = NULL, frontier = NULL, noutput = 1, orientation=1, rts = 1)
```

**Arguments**

- `base` A data set for DMUs to be evaluated. A data frame with $J_1*(M+N)$ dimension, where $J_1$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.
- `frontier` A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with $J_2*(M+N)$ dimension, where $J_2$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.
- `noutput` The number of outputs ($N$).
- `orientation` Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure.
- `rts` Returns to scale. 1 for the CRS assumption, and 2 for the VRS assumption.

**Details**

The input-oriented dual DEA under the CRS assumption is calculated. For model specification, take a look at Cooper et al. (2007).

**Value**

A data frame with $J_1*(1+M+N)$ dimension, of which has efficiency scores, optimal virtual prices for inputs and outputs.

**Author(s)**

Dong-hyun Oh, <oh.donghyun77@gmail.com>

**References**


See Also
de, ar.dual.dea

Examples

## An output-oriented primal problem with 1 input and 2 outputs
tab5.1.dat <- data.frame(y1 = c(4, 8, 8, 4, 3, 1),
    y2 = c(9, 6, 4, 3, 5, 6),
    x = c(1, 1, 1, 1, 1, 1))
(re <- dea(tab5.1.dat, noutput = 2, orientation = 2, rts = 1))

## An output-oriented dual problem with 1 input and 2 outputs
re <- dual.dea(tab5.1.dat, noutput = 2, orientation = 2, rts = 1)

description

Solve input(output)-oriented DEA under the CRS (VRS) with convexhull. Do not use when the
total number of inputs and outputs are greater than eight. If used, it may take more than hundreds
day to get results.

Usage
effdea.bf(base = NULL, frontier = NULL, noutput = 1,
    orientation = 1, rts = 1, convhull = TRUE)

Arguments

- **base**: A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimention,
  where J1 is the number of DMUs, M for the number of inputs, and N for the
  number of outputs.

- **frontier**: A data set for DMUs to be used in constructing a production possibility set
  (PPS). A data frame with J2*(M+N) dimention, where J2 is the number of
  DMUs, M for the number of inputs, and N for the number of outputs.

- **noutput**: The number of outputs (N).

- **orientation**: Orientation of measurement. 1 for the input-oriented measure, and 2 for the
  output-oriented measure.

- **rts**: Returns to scale. 1 for the CRS assumption, and 2 for the VRS assumption.

- **convhull**: Logical. If this is TRUE, very efficient calculation of efficiency score is used.
  However, when the total number of inputs and outputs is larger than eight, it is
  very slow for this option. In cases when the total number of inputs and outputs
  is larger than eight, use FALSE for this argument.
**Details**

This function uses the `convhull` function in geometry package. After finding convex hull of *frontier* by using the `convhull` function, points on the convex hull are used in constructing the second production possibility set (PPS). Then efficiency scores in *base* are calculated based on the second PPS.

**Value**

A data frame with J1*1 dimension, which shows efficiency scores.

**Author(s)**

Dong-hyun Oh, <oh.donghyun77@gmail.com>

**References**


**See Also**

dual.dea

**Examples**

```r
## input-oriented DEA under the CRS assumption (1 input and 1 output)
tab3.1.dat <- data.frame(y = c(1, 2, 4, 6, 7, 9),
                        x = c(3, 2, 6, 4, 8, 10))
(re <- effdea.b.f(base = tab3.1.dat, noutput = 1, orientation = 1, rts =
                1, convhull = TRUE))
```

---

**Description**

Calculate productivity growth index under the DEA framework.

**Usage**

```r
faremalm2(dat = NULL, noutput = 1, id = "id", year = "year")
```
Arguments

dat A data frame to be evaluated. The format of this data frame is data.frame(id, year, outputs, inputs). This data frame should have a balanced panel data form.
noutput The number of outputs.
id A column name for the producer index.
year A column name for the time index.

Details

The Malmquist productivity growth index is calculated. For model specification, take a look at Fare et al. (1994).

Value

A data frame with (id: the id index of the original data. time: the time index of the original data. y's: original outputs x's: original inputs Dt2t2: \(D^{t+1} x^{t+1}, y^{t+1}\) Dt2t2: \(D^{t} x^{t+1}, y^{t+1}\) Dt2t: \(D^{t+1} x^{t}, y^{t}\) ec: efficiency change tc: technical change pc: productivity change

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also
dea

Examples

malm.dat <- data.frame(id = rep(LETTERS[1:3], 3),
  time = rep(1:3, each = 3),
  y = c(1, 2, 2, 3, 2, 8, 3, 2, 5),
  x = c(2, 3, 7, 3, 5, 6, 8, 9, 6))
malm.rel <- faremalm2(malm.dat, noutput = 1, id = "id", year = "time")

## Malmquist productivity growth index of OECD countries
library(pwt) ## Use Penn World Table
my.dat <- pwt5.6
head(my.dat)
fdh <- Linear Programming for the Free Disposable Hall

Description
Solve input(output)-oriented FDH

Usage
fdh(base = NULL, frontier = NULL, noutput = 1, orientation=1)

Arguments

base
A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimention, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

frontier
A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimention, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

noutput
The number of outputs (N).

orientation
Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure.
Details

The input (output) -oriented FDH is calculated.

Value

A data frame of J1*1 dimension which shows efficiency scores.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

dea, orderm

Examples

```r
## input-oriented FDH with 1 input and 1 output.
tab7.1.dat <- data.frame(y = c(1, 2, 4, 6, 7, 9, 9),
                        x = c(3, 2, 6, 4, 8, 8, 10))
(re <- fdh(tab7.1.dat, noutput = 1, orientation = 1))

## input-oriented FDH with 2 input and 1 output.
tab7.10.dat <- data.frame(y = c(1, 1, 1, 1, 1, 1),
x1 = c(2, 3, 6, 3, 6, 6),
x2 = c(5, 3, 1, 8, 4, 2))
(re <- fdh(tab7.10.dat, noutput = 1, orientation = 1))
```

Description

Solve input-oriented DEA under the CRS

Usage

```r
int.dea(base = NULL, frontier = NULL, noutput = 1, intinput = 1,
         orientation=1, epsilon = 1e-06)
```
int.dea

Arguments

base
A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimension, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

frontier
A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimension, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.

noutput
The number of outputs (N).

intinput
The number of integer inputs.

orientation
Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure. This argument is ignored.

epsilon
Non-Armechidean number. Use the default value.

Details
The input-oriented IDEA under the CRS assumption is calculated. See Kuosmanen and Matin (2009).

Value
A data frame of J1*(1+J1+N+M+Q+Q), which shows efficiency scores, optimal weights, optimal slacks for outputs and inputs, optimal slacks for integer-valued inputs, and optimal integer inputs.

Author(s)
Dong-hyun Oh, <oh.donghyun77@gmail.com>

References

See Also
dea

Examples

int.dat <- data.frame(y = c(1, 1, 1, 1),
                      x1 = c(2, 7, 3, 7, 9),
                      x2 = c(4, 1, 4, 2, 4))
int.dea(int.dat, noutput = 1, intinput = 1)
Description

Solve LP with free variables

Usage

lp2(direction = "min", objective.in, const.mat, const.dir,
    const rhs, free var = NULL)

Arguments

direction Character string giving direction of optimization: "min" (default) or "max."
objective.in Numeric vector of coefficients of objective function
const.mat Matrix of numeric constraint coefficients, one row per constraint, one column per variable (unless transpose.constraints = FALSE; see below).
const.dir Vector of character strings giving the direction of the constraint: each value should be one of "<", "<="", "="", "==", ">," or ">=". (In each pair the two values are identical.)
const rhs Vector of numeric values for the right-hand sides of the constraints.
free var Vector of numeric values for indicating free variables. If this argument is NULL, no free variables is included.

Details

lp2 extends lpSolve::lp() to incorporate free variables easily.

Value

An lp object. See 'lp.object' for details.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

See Also

lp
Examples

```r
# Set up problem: maximize
# x1 + 9 x2 + x3 subject to
# x1 + 2 x2 + 3 x3 <= 9
# 3 x1 + 2 x2 + 2 x3 <= 15
#
# f.obj <- c(1, 9, 3)
f.con <- matrix(c(1, 2, 3, 3, 2, 2), nrow=2, byrow=TRUE)
f.dir <- c("<=", "<=")
f.rhs <- c(9, 15)
#
# Now run.
#
# lp2("max", f.obj, f.con, f.dir, f.rhs)
lp2("max", f.obj, f.con, f.dir, f.rhs, free.var = c(0, 1, 0))
```

orderm  

Efficiency Measures with the order-m Method.

Description

Calculate order-m efficiency scores

Usage

```r
orderm(base = NULL, frontier = NULL, noutput = 1, orientation=1, M = 25, B = 500)
```

Arguments

- `base`: A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimension, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
- `frontier`: A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimension, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
- `noutput`: The number of outputs (N).
- `orientation`: Orientation of measurement. 1 for the input-oriented measure, and 2 for the output-oriented measure.
- `M`: The number of elements in each of the bootstrapped samples.
- `B`: The number of bootstrap replicates

Details

Value
A data frame with J1*1 dimention, which shows efficiency scores.

Author(s)
Dong-hyun Oh, <oh.donghyun77@gmail.com>

References

See Also
fdh

Examples
x <- abs(runif(200, min = 0.1, max = 4))
y <- 3*x*abs(rnorm(200))
dat.orderm <- data.frame(y = y, x = x)
dat.orderm.out <- rbind(dat.orderm, c(4, 0.1)) ## add one outlier.
(eff <- orderm(dat.orderm.out, noutput = 1, M = 25, B = 20))

revenue.dea

Linear Programming for Revenue Maximization

Description
Solve the Revenue Maximization Problem with Given Output Prices

Usage
revenue.dea(base = NULL, frontier = NULL, noutput = 1, output.price = NULL)

Arguments
base A data set for DMUs to be evaluated. A data frame with J1*(M+N) dimention, where J1 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
frontier A data set for DMUs to be used in constructing a production possibility set (PPS). A data frame with J2*(M+N) dimention, where J2 is the number of DMUs, M for the number of inputs, and N for the number of outputs.
noutput The number of outputs (M).
output.price A vector for market prices of outputs.
The revenue maximization problem under the CRS assumption is calculated. See Cooper et al. (2007).

A data frame with $J_1*(N+6)$, which has optimal $N$ output factors, maximized revenue when overall efficient, maximized revenue when technically-efficient, revealed revenue, overall efficiency, allocative efficiency, and technical efficiency.

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```r
sbm.tone

Solve Slacks-based Model under the CRS (Tone, 2001)

```
Arguments

base A data set for DMUs to be evaluated. A data frame with $J_1*(M+N)$ dimension, where $J_1$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

frontier A data set for DMUs to construct a production possibility set (PPS). A data frame with $J_2*(M+N)$ dimension, where $J_2$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

noutput The number of outputs ($N$).

Details

The SBM under the CRS assumption is calculated. See Tone (2001).

Value

A data frame with $(1+J_1+M+N)$, which shows efficiency scores, optimal weights, and optimal input and output slacks.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

* sbm.vrs

Examples

tab7.6.dat <- data.frame(y = c(1, 1, 1, 1, 1),
                           x1 = c(1, 3, 6, 2, 5, 9),
                           x2 = c(4, 1, 1, 8, 5, 2))
(re <- sbm.tone(tab7.6.dat, noutput = 1))
Description

Solve Slacks-based Model under the VRS (Tone, 2001)

Usage

\texttt{sbm.vrs(base = NULL, frontier = NULL, noutput = 1)}

Arguments

- **base**: A data set for DMUs to be evaluated. A data frame with $J_1 \times (M+N)$ dimension, where $J_1$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

- **frontier**: A data set for DMUs to construct a production possibility set (PPS). A data frame with $J_2 \times (M+N)$ dimension, where $J_2$ is the number of DMUs, $M$ for the number of inputs, and $N$ for the number of outputs.

- **noutput**: The number of outputs ($N$).

Details

The SBM under the VRS assumption is calculated. See Tone (2001).

Value

A data frame with $(1+J_1+M+N)$, which shows efficiency scores, optimal weights, and optimal input and output slacks.

Author(s)

Dong-hyun Oh, <oh.donghyun77@gmail.com>

References


See Also

\texttt{sbm.tone}
Examples

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  tab7.6.dat <- data.frame(y = c(1, 1, 1, 1, 1), 
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```
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