jstadden_8

Jared Stadden

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```
#install.packages("Benchmarking")
library(Benchmarking)

## Warning: package 'Benchmarking' was built under R version 3.6.3

## Loading required package: lpSolveAPI

## Warning: package 'lpSolveAPI' was built under R version 3.6.3

## Loading required package: ucminf

## Loading required package: quadprog

x <- matrix(c(150,400,320,520,350,320,0.2,0.7,1.2,2.0,1.2,0.7),ncol=2)
y <-
matrix(c(14000,14000,42000,28000,19000,14000,3500,21000,10500,42000,25000,150
00),ncol=2)
colnames(x) <- c("hours","supplies")
colnames(y) <- c("reimbursed","private pay")
```

FDH:

```
e1 <- dea(x,y,RTS="fdh")
e1

## [1] 1 1 1 1 1 1

peers(e1)

##      peer1
## [1,]     1
## [2,]     2
## [3,]     3
## [4,]     4
## [5,]     5
## [6,]     6

lambda(e1)

##      L1 L2 L3 L4 L5 L6
## [1,]  1  0  0  0  0  0
## [2,]  0  1  0  0  0  0
## [3,]  0  0  1  0  0  0
## [4,]  0  0  0  1  0  0
```

```
## [5,]  0  0  0  0  1  0
## [6,]  0  0  0  0  0  1

#dea.plot.isoquant(x,y,RTS="fdh")
```

CRS:

```
e2 <- dea(x,y,RTS="crs")
e2

## [1] 1.0000 1.0000 1.0000 1.0000 0.9775 0.8675

peers(e2)

##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     1     2     4
## [6,]     1     2     4

lambda(e2)

##             L1         L2 L3        L4
## [1,] 1.0000000 0.00000000  0 0.0000000
## [2,] 0.0000000 1.00000000  0 0.0000000
## [3,] 0.0000000 0.00000000  1 0.0000000
## [4,] 0.0000000 0.00000000  0 1.0000000
## [5,] 0.2000000 0.08048142  0 0.5383307
## [6,] 0.3428571 0.39499264  0 0.1310751

#dea.plot.isoquant(x,y,RTS="crs")
```

VRS:

```
e3 <- dea(x,y,RTS="vrs")
e3

## [1] 1.0000 1.0000 1.0000 1.0000 1.0000 0.8963

peers(e3)

##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     5    NA    NA
## [6,]     1     2     5

lambda(e3)
```

```
##             L1        L2 L3 L4        L5
## [1,] 1.0000000 0.0000000  0  0 0.0000000
## [2,] 0.0000000 1.0000000  0  0 0.0000000
## [3,] 0.0000000 0.0000000  1  0 0.0000000
## [4,] 0.0000000 0.0000000  0  1 0.0000000
## [5,] 0.0000000 0.0000000  0  0 1.0000000
## [6,] 0.4014399 0.3422606  0  0 0.2562995
```

```
#dea.plot.isoquant(x,y,RTS="vrs")
```

IRS:

```
e4 <- dea(x,y,RTS="irs")
e4
```

```
## [1] 1.0000 1.0000 1.0000 1.0000 1.0000 0.8963
```

```
peers(e4)
```

```
##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
## [5,]     5    NA    NA
## [6,]     1     2     5
```

```
lambda(e4)
```

```
##             L1        L2 L3 L4        L5
## [1,] 1.0000000 0.0000000  0  0 0.0000000
## [2,] 0.0000000 1.0000000  0  0 0.0000000
## [3,] 0.0000000 0.0000000  1  0 0.0000000
## [4,] 0.0000000 0.0000000  0  1 0.0000000
## [5,] 0.0000000 0.0000000  0  0 1.0000000
## [6,] 0.4014399 0.3422606  0  0 0.2562995
```

```
#dea.plot.isoquant(x,y,RTS="irs")
```

DRS:

```
e5 <- dea(x,y,RTS="drs")
e5
```

```
## [1] 1.0000 1.0000 1.0000 1.0000 0.9775 0.8675
```

```
peers(e5)
```

```
##      peer1 peer2 peer3
## [1,]     1    NA    NA
## [2,]     2    NA    NA
## [3,]     3    NA    NA
## [4,]     4    NA    NA
```

```
## [5,]     1     2     4
## [6,]     1     2     4
```

```
lambda(e5)
```

```
##             L1         L2 L3        L4
## [1,] 1.0000000 0.00000000  0 0.0000000
## [2,] 0.0000000 1.00000000  0 0.0000000
## [3,] 0.0000000 0.00000000  1 0.0000000
## [4,] 0.0000000 0.00000000  0 1.0000000
## [5,] 0.2000000 0.08048142  0 0.5383307
## [6,] 0.3428571 0.39499264  0 0.1310751
```

```
#dea.plot.isoquant(x,y,RTS="drs")
```

FRH:

```
e6 <- dea(x,y,RTS="add")
e6
```

```
## [1] 1 1 1 1 1 1
```

```
peers(e6)
```

```
##      peer1
## [1,]     1
## [2,]     2
## [3,]     3
## [4,]     4
## [5,]     5
## [6,]     6
```

```
lambda(e6)
```

```
##      L1 L2 L3 L4 L5 L6
## [1,]  1  0  0  0  0  0
## [2,]  0  1  0  0  0  0
## [3,]  0  0  1  0  0  0
## [4,]  0  0  0  1  0  0
## [5,]  0  0  0  0  1  0
## [6,]  0  0  0  0  0  1
```

*I created my table in Excel and included it as an image. It can be seen in my knitted PDF, and I have also included the image in my github.

	Efficient	Inefficient	Peers for Inefficient	Lambdas for Peers
FDH	1,2,3,4,5,6	n/a	n/a	n/a
CRS	1,2,3,4	5 (0.9775)	1,2,4	0.20L1 0.80L2 0.54L4
		6 (0.8675)	1,2,4	0.34L1 0.39L2 0.13L4
VRS	1,2,3,4,5	6 (0.8963)	1,2,5	0.40L1 0.34L2 0.26L5
IRS	1,2,3,4,5	6 (0.8963)	1,2,5	0.40L1 0.34L2 0.26L5
DRS	1,2,3,4	5 (0.9775)	1,2,4	0.20L1 0.80L2 0.54L4
		6 (0.8675)	1,2,4	0.34L1 0.39L2 0.13L4
FRH	1,2,3,4,5,6	n/a	n/a	n/a

table summarizing the outputs

The FDH and FRH methods produced the same results where all 6 facilities were considered efficient with DEA values of 1.0. Thus, none of them had peers other than themselves and the lambda values were simply weights of 1 on themselves.

The CRS and DRS methods also produced the same results as each other. They found Facilities 1, 2, 3, and 4 to be efficient. However, they found Facility 5 to be 98% efficient and Facility 6 to be 87% efficient. Facility 5 had peers in facilities 1, 2, and 4 with relative weights 0.20, 0.80, and 0.54, respectively. Likewise, Facility 6 had peers in facilities 1, 2, and 4, as well, but with relative weights 0.34, 0.39, and 0.13, respectively.

Similarly, the VRS and IRS methods had the same outputs as one another. They found Facilities 1, 2, 3, 4 and 5 to be efficient, but Facility 6 to only be 90% efficient. Facility 6 had peers in facilities 1, 2, and 5 with respective relative weights of 0.40, 0.34, and 0.26.