

# Package ‘DEA’

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**Type** Package

**Title** Data Envelopment Analysis.

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**Description** Performs some basic models of Data Envelopment Analysis, both in multiplier and envelopment form.

**License** GPL (>= 2)

**Notes** This work has been partially supported by Ministerio de Educacion y Ciencia of Spain through “Jose Castillejo” scholarship obtained by Zuleyka Diaz Martinez. C code that performs the Simplex algorithm comes from the GNU Linear Programming Kit v. 4.8, available at <http://www.gnu.org/software/glpk/>. Many thanks to its author Andrew Makhorin (mao@gnu.org). According to the usual practice in statistics, in this package each row in the data matrices containing the inputs and outputs corresponds to an observation and each column to a variable. They are the transposed of X and Y matrices used in Cooper, W. W., Seiford, L. M. and Tone, K. (2007): “Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software”. Second edition. Springer. New York. This is a preliminar package. Any comments and suggestions are welcome.

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dea.add.env	<i>Additive model in envelopment form</i>
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### Description

Fits an additive DEA model in envelopment form. This model corresponds to eqs. 4.34-4.38 in Cooper *et al.*, 2007 (see References).

### Usage

```
dea.add.env( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some

details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the glpk solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
slack	a vector containing the sum of slacks for each DMU.

### References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

### See Also

[dea.add.mul](#)

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dea.add.mul	<i>Additive model in multiplier form</i>
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### Description

Fits an additive DEA model in multiplier form. This model corresponds to eqs. 4.39-4.43 in Cooper *et al.*, 2007 (see References).

### Usage

```
dea.add.mul( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.

dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

weights	a data frame containing the weights. Each row corresponds to a DMU and each column to a weight.
slack	a vector containing the sum of slacks for each DMU.

### References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

### See Also

[dea.add.env](#)

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dea.bcc.io.env	<i>BCC input oriented model in envelopment form</i>
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### Description

Fits an input oriented DEA model in envelopment form with variable returns to scale. This model corresponds to eqs. 4.2-4.6 in Cooper *et al.*, 2007 (see References).

**Usage**

```
dea.bcc.io.env( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

**Arguments**

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

**Details**

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of ten columns with some details about the calculus of the efficiency for each DMU. First five columns correspond to the phase I of the linear programming problem and the rest correspond to the phase II (see Cooper *et al.*, 2007, sec. 3.3). First and sixth columns indicate if the linear programs have been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solutions. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

**Value**

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>lambda</code>	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
<code>slack</code>	a vector containing the sum of slacks for each DMU.

**References**

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

**See Also**

[dea.bcc.io.mul](#)

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dea.bcc.io.mul      *BCC input oriented model in multiplier form*

---

**Description**

Fits an input oriented DEA model in multiplier form with variable returns to scale. This model corresponds to eqs. 4.7-4.10 in Cooper *et al.*, 2007 (see References).

**Usage**

```
dea.bcc.io.mul( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

**Arguments**

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

**Details**

Missing values are not allowed.

If `pslv=TRUE`, a glpk built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the glpk solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

**Value**

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>weights</code>	a data frame containing the weights. Each row corresponds to a DMU and each column to a weight.

**References**

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

**See Also**

[dea.bcc.io.env](#)

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`dea.bcc.oo.env`      *BCC output oriented model in envelopment form*

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**Description**

Fits an output oriented DEA model in envelopment form with variable returns to scale. This model corresponds to eqs. 4.22-4.26 in Cooper *et al.*, 2007 (see References).

**Usage**

```
dea.bcc.oo.env( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

**Arguments**

<code>X</code>	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
<code>Y</code>	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
<code>pslv</code>	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
<code>dual</code>	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
<code>infor</code>	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a glpk built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of ten columns with some details about the calculus of the efficiency for each DMU. First five columns correspond to the phase I of the linear programming problem and the rest correspond to the phase II (see Cooper *et al.*, 2007, sec. 3.3). First and sixth columns indicate if the linear programs have been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the glpk solver about the quality of the solutions. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

## Value

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>lambda</code>	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
<code>slack</code>	a vector containing the sum of slacks for each DMU.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.bcc.oo.mul](#)

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dea.bcc.oo.mul

*BCC output oriented model in multiplier form*

---

## Description

Fits an output oriented DEA model in multiplier form with variable returns to scale. This model corresponds to eqs. 4.27-4.30 in Cooper *et al.*, 2007 (see References).

## Usage

```
dea.bcc.oo.mul( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

<code>X</code>	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
<code>Y</code>	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
<code>pslv</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> , the simplex presolver will be used.
<code>dual</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> and the initial basic solution is dual feasible, dual simplex is used.
<code>infor</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> , information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

## Value

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>weights</code>	a data frame containing the weights. Each row corresponds to a DMU and each column to a weight.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.bcc.oo.env](#)

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dea.ccr.io.env      *CCR input oriented model in envelopment form*

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### Description

Fits an input oriented DEA model in envelopment form with constant returns to scale. This model corresponds to eqs. 3.6-3.9 in Cooper *et al.*, 2007 (see References).

### Usage

```
dea.ccr.io.env( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. If TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of ten columns with some details about the calculus of the efficiency for each DMU. First five columns correspond to the phase I of the linear programming problem and the rest correspond to the phase II (see Cooper *et al.*, 2007, sec. 3.3). First and sixth columns indicate if the linear programs have been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solutions. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
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lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
slack	a vector containing the sum of slacks for each DMU.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.ccr.io.mul](#)

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dea.ccr.io.mul	<i>CCR input oriented model in multiplier form</i>
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## Description

Fits an input oriented DEA model in multiplier form with constant returns to scale. This model corresponds to eqs. 3.2-3.5 in Cooper *et al.*, 2007 (see References).

## Usage

```
dea.ccr.io.mul( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

**Details**

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

**Value**

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>weights</code>	a data frame containing the weights. Each row corresponds to a DMU and each column to a weight.

**References**

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

**See Also**

[dea.ccr.io.env](#)

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<code>dea.ccr.oo.env</code>	<i>CCR output oriented model in envelopment form</i>
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**Description**

Fits an output oriented DEA model in envelopment form with constant returns to scale. This model corresponds to eqs. 3.60-3.63 in Cooper *et al.*, 2007 (see References).

**Usage**

```
dea.ccr.oo.env( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of ten columns with some details about the calculus of the efficiency for each DMU. First five columns correspond to the phase I of the linear programming problem and the rest correspond to the phase II (see Cooper *et al.*, 2007, sec. 3.3). First and sixth columns indicate if the linear programs have been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solutions. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

## Value

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>lambda</code>	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
<code>slack</code>	a vector containing the sum of slacks for each DMU.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>.

## See Also

[dea.ccr.oo.mul](#)

---

 dea.ccr.oo.mul      *CCR output oriented model in multiplier form*


---

### Description

Fits an output oriented DEA model in multiplier form with constant returns to scale. This model corresponds to eqs. 3.68-3.71 in Cooper *et al.*, 2007 (see References).

### Usage

```
dea.ccr.oo.mul( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. If TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

<code>eff</code>	a vector containing the technical efficiency of the DMUs.
<code>weights</code>	a data frame containing the weights. Each row corresponds to a DMU and each column to a weight.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.ccr.oo.env](#)

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dea.sbm.bcc

*BCC slack-based measure of efficiency*

---

## Description

Fits a slack-based DEA model with variable returns to scale. This model corresponds to eq. 4.48 in Cooper *et al.*, 2007 (see References) with the additional constraint  $\sum \lambda_i = 1$ .

## Usage

```
dea.sbm.bcc( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. If TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information

reported by the glpk solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

ro	a vector containing the slack-based-measure of efficiency of the DMUs.
lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
slack	a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

### References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

### See Also

[dea.sbm.ccr](#)

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dea.sbm.bcc.io      *BCC input oriented slack-based measure of efficiency*

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### Description

Fits an input oriented slack-based DEA model with variable returns to scale. This model corresponds to eq. 4.78 in Cooper *et al.*, 2007 (see References) with the additional constraint  $\sum \lambda_i = 1$ .

### Usage

```
dea.sbm.bcc.io( X , Y , pslv = FALSE, dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.

dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a glpk built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the glpk solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

## Value

a list with components:

ro	a vector containing the slack-based-measure of efficiency of the DMUs.
lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
slack	a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.sbm.ccr.io](http://dea.sbm.ccr.io)

---

dea.sbm.bcc.oo      *BCC output oriented slack-based measure of efficiency*

---

### Description

Fits an output oriented slack-based DEA model with variable returns to scale. This model corresponds to eq. 4.79 in Cooper *et al.*, 2007 (see References) with the additional constraint  $\sum \lambda_i = 1$ .

### Usage

```
dea.sbm.bcc.oo( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

ro	a vector containing the slack-based-measure of efficiency of the DMUs.
lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.

slack a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

## References

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.sbm.ccr.oo](#)

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dea.sbm.ccr	<i>CCR slack-based measure of efficiency</i>
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## Description

Fits a slack-based DEA model with constant returns to scale. This model corresponds to eq. 4.48 in Cooper *et al.*, 2007 (see References).

## Usage

```
dea.sbm.ccr( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

**Details**

Missing values are not allowed.

If `pslv=TRUE`, a glpk built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the glpk solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

**Value**

a list with components:

<code>ro</code>	a vector containing the slack-based-measure of efficiency of the DMUs.
<code>lambda</code>	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
<code>slack</code>	a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

**References**

Cooper, W. W., Seiford, L. M. and Tone, K. (2007): *Data envelopment analysis: a comprehensive text with models, applications, references and DEA-solver software*. Second edition. Springer. New York.

Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

**See Also**

[dea.sbm.bcc](#)

---

dea.sbm.ccr.io

*CCR input oriented slack-based measure of efficiency*

---

**Description**

Fits an input oriented slack-based DEA model with constant returns to scale. This model corresponds to eq. 4.78 in Cooper *et al.*, 2007 (see References).

**Usage**

```
dea.sbm.ccr.io( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

## Arguments

<code>X</code>	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
<code>Y</code>	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
<code>pslv</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> , the simplex presolver will be used.
<code>dual</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> and the initial basic solution is dual feasible, dual simplex is used.
<code>infor</code>	logical. Defaults to <code>FALSE</code> . If <code>TRUE</code> , information about the convergence of the optimization process will be sent to the console.

## Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

## Value

a list with components:

<code>ro</code>	a vector containing the slack-based-measure of efficiency of the DMUs.
<code>lambda</code>	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.
<code>slack</code>	a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

## References

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Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

## See Also

[dea.sbm.bcc.io](http://dea.sbm.bcc.io)

---

dea.sbm.ccr.oo      *CCR output oriented slack-based measure of efficiency*

---

### Description

Fits an output oriented slack-based DEA model with constant returns to scale. This model corresponds to eq. 4.79 in Cooper *et al.*, 2007 (see References).

### Usage

```
dea.sbm.ccr.oo( X , Y , pslv = FALSE , dual = FALSE , infor = FALSE )
```

### Arguments

X	inputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an input.
Y	outputs. Bidimensional data frame or object that can be coerced to a data frame. Each row corresponds to a DMU, each column to an output.
pslv	logical. Defaults to FALSE. If TRUE, the simplex presolver will be used.
dual	logical. Defaults to FALSE. IF TRUE and the initial basic solution is dual feasible, dual simplex is used.
infor	logical. Defaults to FALSE. If TRUE, information about the convergence of the optimization process will be sent to the console.

### Details

Missing values are not allowed.

If `pslv=TRUE`, a `glpk` built-in LP presolver is enabled. It may improve the numeric properties of the LP problem.

If `infor=TRUE`, each line of information sent to the console consists of five columns with some details about the calculus of the efficiency for each DMU. First column indicates if the linear program has been successfully solved, or not ("OK" or "FAULT"). The other ones contain information reported by the `glpk` solver about the quality of the solution. Their values can be "H", "M", "L" or "?", which mean high, medium, low or wrong, respectively. If all the indicators show high or medium quality, the user can be sure that the solution is quite accurate. For more details see Makhorin (2005).

### Value

a list with components:

ro	a vector containing the slack-based-measure of efficiency of the DMUs.
lambda	a bidimensional data frame containing the $\lambda$ coefficients. Each row corresponds to a DMU. The columns correspond to the $\lambda$ s.

slack            a bidimensional data frame containing the slacks for each DMU. Each row corresponds to a DMU.

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Makhorin, A. (2005): *GNU Linear Programming Kit. Reference Manual. Version 4.8*. Available at <http://www.gnu.org/software/glpk/>

### See Also

[dea.sbm.bcc.oo](#)

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