

Package ‘ioanalysis’

August 7, 2015

Title Input-Output Analysis
Version 0.1
Author Ignacio Sarmiento-Barbieri
Maintainer Ignacio Sarmiento-Barbieri <srmtbr2@illinois.edu>
Description Input and Output Analysis.
Depends R (>= 3.1.1), ggplot2, xlsx, Matrix
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LazyData true

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agg.matrix	<i>Aggregation Matrix</i>
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Description

Aggregates Input-Output Matrices. Construct an aggregation matrix of kxn dimension.

Usage

agg.matrix(mat,d.mip)

Arguments

mat	Matrix. How sectors should be aggregated. First column should be the new sector in order, the remaining columns the sectors that are going to be aggregated
dimcol	Numeric. Column dimension

Value

Returns matrix to be pre and post multiplied to aggregate sectors.

Author(s)

Ignacio Sarmiento-Barbieri

References

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. *PyIO. Input-Output Analysis with Python*. REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

Examples

```
temp<-matrix(sample(1:30), 10)
temp[,1]<-seq(1:10)

S<-agg.matrix(temp,40)
```

extraction

Implements Extraction Method

Description

Applies the Extraction method as outlined in Dietzenbacher et al. (1993)

Usage

```
extraction(mip, X, f, v, forward=FALSE, write.xlsx=FALSE, name="Extraction.xlsx")
```

Arguments

mip	Matrix. Input output matrix
X	Vector. Input in each column
f	Vector. Final demand vector
v	Vector. Primary input vector
write.xlsx	Logical. If TRUE writes an excel file
name	String. Name of the excel file

Details

The matrix should be read cautiously. Columns indicate the sector under analysis. So the first column gives the impact when sector 1 is hypothetically extracted from the system. Thus $A[1,1]$ is the impact to sector 1 when that sector is hypothetically extracted. $A[1,2]$ gives the impact to sector 1 when sector 2 was hypothetically extracted. $A[2,1]$ represents the impact to sector 2 when sector 1 is hypothetically extracted and so on.

The diagonal of the output matrix represents Dietzenbacher's feedback effect.

Value

Returns a matrix with the Extraction matrix

References

Dietzenbacher Erik & van der Linden Jan A. & Steenge Alben E. (1993). *The Regional Extraction Method: EC Input–Output Comparisons*. Economic Systems Research. Vol. 5, Iss. 2, 1993

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. *PyIO. Input-Output Analysis with Python*. REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

Examples

```
#Follows the example in PyIO 2.0 Quick Start
```

```
mip<-matrix(c(16,5,24,0,6,17,10,0,7,17,11,48,26,0,8,0,43,82,33,13,17,81,51,4,35,9,93,7,19,99,30,2,19,20,19
mip
```

```
X<-c(700,320,607,432,375,345,561,187)
```

```
f<-c(622,203,283,138,220,75,349,78)
```

```
extraction(mip,X,f, v,forward=FALSE,write.xlsx=FALSE, name="Extraction.xlsx")
```

gosh.inv	<i>Gosh Inverse</i>
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Description

Computes the Goshian Inverse

Usage

```
gosh.inv(mip, X, write.xlsx=FALSE, name="Gosh_Inv.xlsx")
```

Arguments

mip	Matrix. Input output matrix
X	Vector. Input in each column
write.xlsx	Logical. If TRUE writes an excel file
name	String. Name of the excel file

Details

The Goshian inverse is derived from the output allocation matrix table $A=[a_{ij}]$ where

$$a_{ij} = z_{ij} / X_i$$

where z_{ij} is the input from i required in the production of j . X_i is the corresponding output in each row. The Goshian inverse is then computed as

$$(I - A)^{-1}$$

Returns a data.frame with the Goshian Inverse

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. *PyIO. Input-Output Analysis with Python*. REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

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```
mip<-mat_40x40[1:40,2:41] #Input-output coefficients
```

```
X<-mat_40x40$DT.a.PB[1:40] #Total output vector
```

```
G<-gosh.inv(mip,X,linkages=TRUE,write.xlsx = FALSE)
```

key.sector

Impact Analysis: Backward and Forward linkages

Description

Computation of Backward and Forward linkages. It aims to identify those sectors whose economic activity exerts a greater than average influence on the whole economy. Key sectors are identified by calculating backward and forward linkages. Let

$$B = (I - A)^{-1} = [b_{ij}]$$

be the Leontief inverse matrix and let B_j and B_i be the column and row multipliers of this Leontief inverse. The sector j 's backward linkage (BL_j) and forward linkage (FL_i) are defined as:

$$BL_j = \frac{\frac{1}{n} \sum_{i=1}^n b_{ij}}{\frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n b_{ij}}$$

$$FL_i = \frac{\frac{1}{n} \sum_{j=1}^n b_{ij}}{\frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n b_{ij}}$$

The usual interpretation is to propose that, if

$$BL_j > 1$$

, a unit change in final demand in sector j will generate an above-average increase in activity in the economy. Similarly, for

$$FL_i > 1$$

, it is asserted that a unit change in all sector's final demand would create an above average increase in sector i . Thus, a key sector is identified as one having both indices greater than one.

Usage

```
key.sector(mip, X, epsilon=0.1, key=TRUE, cutoff=1, write.xlsx=TRUE, name="Key_sector.xlsx")
```

Arguments

mip	Input-output matrix
X	Total input or output
epsilon	Replaces zeros in X
key	Logical. If TRUE identifies key sectors
cutoff	Cutoff above which are the key sectors
write.xlsx	Logical. If TRUE writes an excel file
name	String. Name of the excel file

Details

The function takes the sector names from the column names of the Input-output matrix. If key=TRUE it orders the sectors first by the Backward Linkage and second by Forward Linkage

Value

Returns a vector with the calculated Backward and Forward linkages for each sector

Author(s)

Ignacio Sarmiento-Barbieri

References

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. "PyIO. Input-Output Analysis with Python". REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

See Also

See Also [leontief.inv](#)

Examples

```
#Uses the 40x40 matrix included in the package

mip<-mat_40x40[1:40,2:41] #Input-output coefficients

X<-mat_40x40$DT.a.PB[1:40] #Total output vector

key<-key.sector(mip,X, key=FALSE, write.xlsx=FALSE)
```

leontief.inv	<i>Leontief Inverse</i>
--------------	-------------------------

Description

Computes the Leontief Inverse and Backward and Forward Linkages

Usage

```
leontief.inv(mip, X, linkages=TRUE, write.xlsx=TRUE, name="Leontief_Inv.xlsx")
```

Arguments

mip	Matrix. Input output matrix
X	Vector. Input in each column
linkages	Logical. If TRUE computes Backward and Forward Linkages
write.xlsx	Logical. If TRUE writes an excel file
name	String. Name of the excel file

Details

The Leontief inverse is derived from the input-output table $A=[a_{ij}]$ where

$$a_{ij} = z_{ij} / X_j$$

where z_{ij} is the input from i required in the production of j . X_j is the corresponding input in each column. The Leontief inverse is then computed as

$$(I - A)^{-1}$$

The user has the option to compute the Backward and Forward Linkages for Key-sector Analysis. The sector j 's Backward Linkage (BL_j) is defined as:

$$BL_j = \frac{\frac{1}{n} \sum_{i=1}^n b_{ij}}{\frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n b_{ij}}$$

Value

Returns a data.frame with the Leontief Inverse

Author(s)

Ignacio Sarmiento-Barbieri

References

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. *PyIO. Input-Output Analysis with Python*. REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

Examples

```
mip<-mat_40x40[1:40,2:41] #Input-output coefficients
X<-mat_40x40$DT.a.PB[1:40] #Total output vector
L<-leontief.inv(mip,X,linkages=TRUE,write.xlsx = FALSE)
```

multipliers

Multiplier Analysis

Description

According to Nazara et al. (2003) and Blair and Miller (2009) four multipliers can be calculated from an input-output matrix: output multiplier, input multiplier, income multiplier and employment multiplier.

Output multiplier: it is computed from the Leontief inverse. Let

$$B = [b_{ij}]$$

be the Leontief inverse matrix the output multiplier for sector j,

$$O_j = \sum_{i=1}^n b_{ij}$$

Input multiplier: it is computed from the Goshian inverse. Let

$$G = [g_{ij}]$$

be the Goshian inverse matrix the input multiplier for sector j,

$$I_j = \sum_{i=1}^n g_{ij}$$

Income multiplier: the calculation of this multiplier requires a wage vector (z) to calculate the household input coefficient (a):

$$a_{n+1,i} = \frac{z_{n+1,i}}{X_i}$$

with the Leontief inverse, the household income multiplier for sector j is

$$H_j = \sum_{i=1}^n a_{n+1,i} b_{ij}$$

Employment multiplier: the calculation of this multiplier requires a sectoral employment vector (e) to calculate the labor input coefficient (w):

$$w_{n+1,i} = \frac{e_i}{X_i}$$

with the Leontief inverse, the employment multiplier for sector j is

$$E_j = \sum_{i=1}^n w_{n+1,i} b_{ij}$$

Usage

```
multipliers(mip, X, z, e, write.xlsx=TRUE, name="output_multiplier.xlsx")
```

Arguments

mip	Input-output matrix
X	Vector. Total input or output
z	Vector. Household input coefficient
e	Vector. If TRUE identifies key sectors
write.xlsx	Logical. If TRUE writes an excel file
name	String. Name of the excel file

Value

Returns a data frame with the calculated multipliers for each sector

Author(s)

Ignacio Sarmiento-Barbieri

References

Blair, P.D. and Miller, R.E. (2009). "Input-Output Analysis: Foundations and Extensions". Cambridge University Press

Nazara, Suahasil & Guo, Dong & Hewings, Geoffrey J.D., & Dridi, Chokri, 2003. "PyIO. Input-Output Analysis with Python". REAL Discussion Paper 03-T-23. University of Illinois at Urbana-Champaign. (<http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>)

Wu, P.C (2009). "PyIO 2.0 Quick Start". (<http://www.real.illinois.edu/pyio/>)

See Also

See Also [leontief.inv](#) [gosh.inv](#)

Examples

```
#Follows the example in PyIO 2.0 Quick Start

mip<-matrix(c(16,5,24,0,6,17,10,0,7,17,11,48,26,0,8,0,43,82,33,13,17,81,51,4,35,9,93,7,19,99,30,2,19,20,19,
X<-c(700,320,607,432,375,345,561,187)

e<-c(10,20,30,52,10,75,51,40)

z<-c(29870.9,18720,66563.8,2607,19007.7,69883,10194.2,173.1)

L<-multipliers(mip=mip,X=X,z=z,e=e)
```

upstream	<i>upstreamness</i>
----------	---------------------

Description

Measures upstreamness as of equation 9 in Antras et al. (2012)

Usage

```
upstream(linv,y,x,m, write.xlsx=TRUE, name="Upstream.xlsx")
```

Arguments

linv	Matrix. Input output matrix
y	Output Vector
x	Exports Vector
m	Imports Vector
write.xlsx	Logical. if TRUE writes an excel file
name	String. name of the excel file

References

Pol Antràs & Davin Chor & Thibault Fally & Russell Hillberry, 2012. *Measuring the Upstreamness of Production and Trade Flows*, " NBER Working Papers 17819, National Bureau of Economic Research, Inc.

Ignacio Sarmiento-Barbieri

##— Should be DIRECTLY executable !! — ##- ==> Define data, use random, ##- or do help(data=index) for the standard data sets.

The function is currently defined as function (x)

vs.io	<i>VS share of total exports</i>
-------	----------------------------------

Description

Vertical Specialization (VS) share of total exports. The formula for VS as a share fo total exports for country k is

$$VS \text{ share of total exports} = \frac{VS}{X_k} = \frac{A * L * X}{X_k}$$

where A is the nxn imported coefficient matrix,L is the Leontief inverse, X is an nx1 vector of exports, n is the number of secotrs, adn Xk is the sum of exports across the n sectors.

Usage

```
vs.io(imp,exp,leon=1,namesector, write.xlsx=TRUE, name="Level_Verticalization.xlsx")
```

Arguments

<code>imp</code>	Is the nxn imported coefficient matrix
<code>exp</code>	Numeric Vector. Exports
<code>leon</code>	Leontief Inverse as output of function <code>leontief.inv()</code>
<code>namesector</code>	Character. Name of Sector i
<code>write.xlsx</code>	Logical. if TRUE writes an excel file
<code>name</code>	String. name of the excel file

Value

Returns a data frame with the $A*L*X$ product, the total exports and the level of verticalization for each sector. `Total.exp.` returns a scalar, equals to the sum of exports across sectors

Author(s)

Ignacio Sarmiento-Barbieri

References

Hummels, David & Ishii, Jun & Yi, Kei-Mu, 2001. *The nature and growth of vertical specialization in world trade*. Journal of International Economics, Elsevier, vol. 54(1), pages 75-96, June.

See Also

See Also [leontief.inv](#)

Examples

```
#Uses the 40x40 matrix included in the package

exp<-mat_40x40$X[1:40] #Exports Vector
class(exp) #the class is numeric
imp<-mat_imp_40x40[1:40,2:41]/mat_40x40$DT.a.PB[1:40] #Imports Coef Matrix
class(imp) #the class is data.frame
namesector<-colnames(mat_40x40[2:41])
class(namesector) #character

hum<-vs.io(imp,exp,namesector, write.xlsx=FALSE)

#Using the Leontief Inverse
leon<-leontief.inv(mat_40x40[1:40,2:41], mat_40x40$DT.a.PB[1:40])[,1:40]
hum2<-vs.io(imp,exp,namesector,leon=leon, write.xlsx=FALSE)
```

vs.ki	<i>Vertical Specialization</i>
-------	--------------------------------

Description

VS is the imported input content of exports for country k in sector i. The Vertical specialization chain is $VS_{ki} = (\text{imported intermediates} / \text{gross output}) * \text{exports}$. The first term is the share of imported inputs into gross production. Multiplying this ratio by the amount that is imported provides the monetary value for the imported input content of exports.

Usage

```
vs.ki(imp,exp,out,namesector, write.xlsx=TRUE, name="Level_Verticalization.xlsx")
```

Arguments

imp	Vector. Imported intermediates of sector i
exp	Vector. Exports
out	Vector. Gross Output
namesector	String. Name of Sector i
write.xlsx	Logical. if TRUE writes an excel file
name	String. name of the excel file

Details

The dimension of the four arguments must coincide.

Value

Returns a data frame

Author(s)

Ignacio Sarmiento-Barbieri

References

Hummels, David & Ishii, Jun & Yi, Kei-Mu, 2001. *The nature and growth of vertical specialization in world trade*. Journal of International Economics, Elsevier, vol. 54(1), pages 75-96, June.

Examples

```
##---- Should be DIRECTLY executable !! ----
##-- ==> Define data, use random,
##--or do help(data=index) for the standard data sets.

## The function is currently defined as
function (x)
{
}
```

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