Package 'panelSUR'

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Type Package

Title Two-Way Error Component SUR Systems Estimation on Unbalanced Panel Data

Version 0.1.0

Description Generalized Least Squares (GLS) estimation of Seemingly Unrelated Regression (SUR) systems on unbalanced panel in the one/two-way cases also taking into account the possibility of cross equation restrictions. Methodological details can be found in Biørn (2004) <doi:10.1016/j.jeconom.2003.10.023> and Platoni, Sckokai, Moro (2012) <doi:10.1080/07474938.2011.607098>.

License GPL (>= 3)

Encoding UTF-8

LazyData true

Depends R (>= 3.5.0)

Imports MASS, formula.tools, plm, matlib, fastmatrix

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NeedsCompilation no

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Contents

`obtainSigmas` *Compute errors' variance-covariance matrices*

Description

This function aims to obtain the errors' variance-covariance matrices.

Usage

```
obtainSigmas(modelFrame=modelFrame,
             firstEstimate=firstEstimate,
             method=method)
```

Arguments

`modelFrame`	an object of the class `prepareData`,
`firstEstimate`	an object of the class `preliminaryEstimate`,
`method`	the estimation method to be used, one of "1wayWB", "2wayWB", or "2wayQUE".

Value

An object of class `obtainSigmas`, which is a list of the following elements:

`Sigma_u`	remainder error variance-covariance matrix,
`Sigma_mu`	individual error variance-covariance matrix,
`Sigma_nu`	time error variance-covariance matrix.

`panelSUR` *panelSUR package: EC SUR system models estimation on (unbalanced) panel data*

Description

Allows to estimate one-way and two-way error component SUR systems on unbalanced panel by GLS estimator with or without cross-equation restrictions.

Details

Package:	panelSUR
Type:	Package
Version:	0.1.0
Date:	2024-03-03

References

Biørn E (2004). Regression Systems for Unbalanced Panel Data: a Stepwise Maximum Likelihood Procedure. *Journal of Econometrics*, **122**(2), 181-291.

Platoni S, Barbieri L, Moro D, Sckokai P (2020). Heteroscedastic Stratified Two-way EC Models of Single Equations and SUR Systems. *Econometrics and Statistics*, **15**, 46-66.

Platoni S, Sckokai P, Moro D, (2012a). "A Note on Two-way ECM Estimation of SUR Systems on Unbalanced Panel Data. *Econometric Reviews*, **31**(2), 119–141.

`postEstimation` *Compute post-estimation indicators*

Description

This function aims to compute some post estimation indicators.

Usage

```
postEstimation(modelFrame=modelFrame,
               firstEstimate=firstEstimate,
               system=system)
```

Arguments

`modelFrame`	an object of the class `prepareData`,
`firstEstimate`	an object of the class `preliminaryEstimate`,
`system`	an object of the class `system`.

Value

An object of class `postEstimation`, which is the list of R-squared obtained for each equation of the estimated system.

`preliminaryEstimate` *Obtain preliminary system equation estimates*

Description

This function aims to obtain the preliminary (single within one or two way) estimate of the system equations.

Usage

```
preliminaryEstimate(modelFrame=modelFrame,
                    method=method)
```

Arguments

modelFrame	an object of the class prepareData,
method	the estimation method to be used, one of "1wayWB", "2wayWB", or "2wayQUE".

Value

An object of class preliminaryEstimate, which is a list of the following elements:

f1w	centered residuals of the *oneway within* estimation obtained for each single equation of the system,
f2w	centered residuals of the *twoways within* estimation obtained for each single equation of the system,
mi_f1w	individual means of the centered *oneway within* residuals,
mi_f2w	individual means of the centered *twoways within* residuals,
mt_f2w	time means of the centered *twoways within* residuals,
m_f1w	mean of the centered *oneway within* residuals,
reglist	list of the regressor matrix of each equation,
reglist2	list of the regressors data frame of each equation,
regnames	a vector whose elements are the names of all the variables included in each equation of the system,
final_regnames	a vector whose elements are the names of the variables considered in the system equations, taking into account only the first appearance of those affected by restrictions on the coefficients.

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prepareData *Prepare data for use*

Description

This function prepares data that have to be used.

Usage

```
prepareData(data=data,
            restrictions=NULL,
            eqlist=eqlist)
```

Arguments

eqlist	a list containing the equations making up the SUR system. They should be object of the class "formula" and necessarly include the intercept,
restrictions	a vector containing constraints on the equation coefficients, which should be expressed in the form "equation_name$variable_name". Any spaces should be excluded from the restrictions definition. If one of the constraints includes an intercept term, the variable_name will be simply 'const'. Only simple restrictions involving equality between two parameters are considered, and not linear combinations involving more than two parameters,
data	a data frame of the class "pdata.frame" (mandatory).

Value

An object of class prepareData, which is a list of the following elements:

eqlist	list of the equations of the system,
neq	number of the system equations,
varlist	list of the system variables,
ncoeff	number of the system coefficients,
sumreg	position of the first variable of each equation, including the constant, in the ordered list of the variables of the system,
nconstr	number of contraints,
constr	a matrix with as many rows as constraints, and whose row elements indicate the position, in the sorted list of model variables, of the variables affected by each constraint,
nind	total number of individuals,
nt	total number of individuals observed in each period,
psur	table reporting the number of times each individual is observed,
psurmax	maximum number of times the individuals are observed in the panel,
tmax	number of period included in the panel,
sumTi	sum of squares of the numbers of times each individual is observed,
sumNt	sum of squares of the numbers of individuals observed in each time period,
vectorTi	vector containing the number of times each individual is observed,
sysdata	subset of the original data frame containing only the variables used in the estimated system,
infoSample	information on the sysdata dataframe obtained trougth the pdim command of the plm package.

printSUR *Print summary of estimated equation system*

Description

This function prints a summary of the estimated equation system.

Usage

```
printSUR(object)
```

Arguments

object	an object of class SURest.

Value

No values are returned from the printSUR function. However, when called, it generates a visual output in the console, consisting of a formatted table containing the results of the SUR estimation and other relevant information.

Examples

```
data("SURdata", package="panelSUR")

## Data preparation
library(plm)
datap <- pdata.frame(data, index=c("IND", "TIME"))

## Equations specification
eq1<-Y1~X1+X2
eq2<-Y2~X1+X2+X3
eqlist<-c(eq1,eq2)

## System estimation
mod1<-SURest(eqlist=eqlist,method="1wayWB",data=datap)

## Summary of estimation results
printSUR(mod1)
```

SURdata *Simulated data for a simultaneous equation system*

Description

The SURdata dataset consists of an unbalanced panel comprising 100 individuals observed across four time periods for a total of 220 observations (n=100, T=4, N=220). In order to construct this unbalanced panel, the procedure currently used for rotating panels, in which there is approximately the same number of individuals every year, has been used: a fixed percentage of individuals (20% in this case) is replaced each year, but they can re-enter the sample in the following years.

Usage

```
data(SURdata)
```

Format

A large unbalanced panel dataset

Source

Simulated data

SURest *EC SUR System Models Estimation on (Unbalanced) Panel Data*

Description

SURest is used to estimate one-way and two-way SUR systems on unbalanced panel data by GLS estimator also allowing cross-equation restrictions.

Usage

```
SURest(data = data,
       eqlist = eqlist,
       restrictions = NULL,
       method="1wayWB")
```

Arguments

eqlist	a list containing the equations making up the SUR system. They should be object of the class "formula" and necessarly include the intercept,

restrictions	a vector containing constraints on the equation coefficients, which should be expressed in the form "equation_name$variable_name". Any spaces should be excluded from the restrictions definition. If one of the constraints includes an intercept term, the variable_name will be simply 'const'. Only simple restrictions involving equality between two parameters are considered, and not linear combinations involving more than two parameters,
method	the estimation method to be used, one of "1wayWB", "2wayWB", or "2wayQUE" (see details),
data	a data frame of the class "pdata.frame" (mandatory).

Details

SURest is a function for the GLS estimation of SUR system models on (unbalanced) panel data. It supports the following estimation methods: one-way error component procedure based on the Biorn (2004)'s procedure (1wayWB), two-way error component procedure based on the Biorn (2004)'s procedure (2wayWB), and the two-way QUE estimation procedure by Platoni *et al.* (2012) (2wayQUE).

Value

An object of class SURest, which is a list of the following elements:

Sigma_u	remainder error variance-covariance matrix,
Sigma_mu	individual error variance-covariance matrix,
Sigma_nu	time error variance-covariance matrix,
varnames	a vector whose elements are the names of the variables considered in the system equations, taking into account only the first appearance of those affected by restrictions on the coefficients,
Estimate	vector of the coefficient estimates of the system equations, taking into account only the first appearance of those affected by restrictions,
std_error	vector of the standard errors of the coefficient estimates, taking into account only the first appearance of those affected by restrictions,
tstat	vector of the t-statistics associated to the coefficient estimates, taking into account only the first appearance of those affected by restrictions,
pvalue	vector of the p-values associated to the t-statistics,
infoSample	information on the considered dataset obtained trougth the pdim command of the plm package,
neq	number of the system equations,
Rsquared	list of R-squared obtained for each equation of the estimated system,
method	method choosen for the system estimation.

References

Biorn E, (2004), *Regression Systems for Unbalanced Panel Data: a Stepwise Maximum Likelihood Procedure*, Journal of Econometrics, 122(2), 181–291.

Platoni S, Sckokai P, Moro D (2012), *A Note on Two-way ECM Estimation of SUR Systems on Unbalanced Panel Data*, Econometric Reviews, 31(2), 119–141.

Examples

```
data("SURdata", package="panelSUR")

## Data preparation
library(plm)
datap <- pdata.frame(data, index=c("IND", "TIME"))

## Equations specification
eq1<-Y1~X1+X2
eq2<-Y2~X1+X2+X3
eq3<-Y3~X2+X3
eqlist<-c(eq1,eq2,eq3)

## Constraints specification
constraints<-c("eq1$X2=eq2$X1","eq2$X3=eq3$X2")

## System estimation
mod1<-SURest(eqlist=eqlist,restrictions=constraints,method="2wayQUE",data=datap)
```

`system` *Build and solve system for beta coefficient estimates*

Description

This function aims to built and solve the system in order to obtain beta coefficient estimates.

Usage

```
system(modelFrame=modelFrame,
       firstEstimate=firstEstimate,
       matrices=matrices)
```

Arguments

`modelFrame`	an object of the class `prepareData`,
`firstEstimate`	an object of the class `preliminaryEstimate`,
`matrices`	an object of the class `obtainSigmas`.

Value

An object of class `system`, which is a list of the following elements:

`BsurQ`	vector of the coefficient estimates of the system equations, taking into account only the first appearance of those affected by restrictions,
`std_error`	vector of the standard errors of the coefficient estimates, taking into account only the first appearance of those affected by restrictions,
`t_stat`	vector of the t-statistics associated to the coefficient estimates, taking into account only the first appearance of those affected by restrictions,
`p_value`	vector of the p-values associated to the t-statistics.

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