

# Package ‘panelSUR’

March 8, 2024

**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](https://doi.org/10.1016/j.jeconom.2003.10.023)> and Platoni, Scokkai, Moro (2012) <[doi:10.1080/07474938.2011.607098](https://doi.org/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

**RoxygenNote** 7.3.1

**NeedsCompilation** no

**Author** Laura Barbieri [aut, cre],  
Silvia Platoni [aut]

**Maintainer** Laura Barbieri <[laura.barbieri@unicatt.it](mailto:laura.barbieri@unicatt.it)>

**Repository** CRAN

**Date/Publication** 2024-03-08 09:20:02 UTC

## R topics documented:

obtainSigmas . . . . .	2
panelSUR . . . . .	2
postEstimation . . . . .	3
preliminaryEstimate . . . . .	4
prepareData . . . . .	5
printSUR . . . . .	6
SURdata . . . . .	7
SURest . . . . .	7
system . . . . .	9

**Index****10**


---

obtainSigmas	<i>Compute errors' variance-covariance matrices</i>
--------------	-----------------------------------------------------

---

**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	<i>panelSUR package: EC SUR system models estimation on (unbalanced) panel data</i>
----------	-------------------------------------------------------------------------------------

---

**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	<i>Compute post-estimation indicators</i>
----------------	-------------------------------------------

---

## 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:

<code>f1w</code>	centered residuals of the <i>oneway within</i> estimation obtained for each single equation of the system,
<code>f2w</code>	centered residuals of the <i>twoways within</i> estimation obtained for each single equation of the system,
<code>mi_f1w</code>	individual means of the centered <i>oneway within</i> residuals,
<code>mi_f2w</code>	individual means of the centered <i>twoways within</i> residuals,
<code>mt_f2w</code>	time means of the centered <i>twoways within</i> residuals,
<code>m_f1w</code>	mean of the centered <i>oneway within</i> residuals,
<code>reglist</code>	list of the regressor matrix of each equation,
<code>reglist2</code>	list of the regressors data frame of each equation,
<code>regnames</code>	a vector whose elements are the names of all the variables included in each equation of the system,
<code>final_regnames</code>	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.

---

prepareData	<i>Prepare data for use</i>
-------------	-----------------------------

---

### 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 necessarily 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 constraints,
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 through the pdim command of the plm package.

---

printSUR	<i>Print summary of estimated equation system</i>
----------	---------------------------------------------------

---

### 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 necessarily 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 through 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 chosen 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	<i>Build and solve system for beta coefficient estimates</i>
--------	--------------------------------------------------------------

---

**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.

# Index

\* **datasets**

SURdata, [7](#)

\* **models**

printSUR, [6](#)

data (SURdata), [7](#)

obtainSigmas, [2](#)

panelSUR, [2](#)

postEstimation, [3](#)

preliminaryEstimate, [4](#)

prepareData, [5](#)

printSUR, [6](#)

SURdata, [7](#)

SURest, [7](#)

system, [9](#)