# Package 'GVARX'

February 8, 2019

**Type** Package

**Title** Perform Stationary Global Vector Autoregression Estimation and Inference

**Version** 1.1

**Date** 2019-02-05

**Author** Ho Tsung-wu

**Maintainer** Ho Tsung-wu <tsungwu@ntnu.edu.tw>

**Description** Perform the estimation and inference of stationary Global Vector Autoregression model (GVAR) of Pesaran, Schuermann and Weiner (2004) <DOI:10.1198/073500104000000019> and Dees, di Mauro, Pesaran and Smith (2007) <DOI:10.1002/jae.932>.

**License** GPL (>= 2)

**LazyData** TRUE

**LazyLoad** yes

**Depends** R (>= 2.10),vars,xts

**Imports** lmtest, lubridate, urca, sandwich, strucchange

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2019-02-08 15:53:28 UTC

## R topics documented:

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`averageCORgvar` *Comparing average residual correlations.*

---

## Description

Average pairwise cross-section residual correlations.

## Usage

```
averageCORgvar(out)
```

## Arguments

| | |
|---|---|
| `out` | Estimation results object generated by GVARest |

## Details

This function compares the dependency of residuals in VAR and GVAR.

## Value

| | |
|---|---|
| `varRSDcor` | A list object of average residual correlations of country-specific VAR |
| `gvarRSDcor` | A list object of average residual correlations of country-specific VAR augmented by foreign variables(GVAR) |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Mauro Filippo di and Pesaran H. M. (2013) The GVAR Handbook– Structure and Applications of a Macro Model of the Global Economy for Policy. Oxford University Press.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)

cor2_avg=averageCORgvar(out=mainOUTPUT)
as.matrix((cor2_avg$varRSDcor)[[1]])
as.matrix((cor2_avg$varRSDcor)[[2]])

as.matrix(cor2_avg$gvarRSDcor[[1]])
as.matrix(cor2_avg$gvarRSDcor[[2]])
```

---

`getCOEF` *Return country-specific standard LS coefficient estimates.*

---

## Description

Extract country-specific standard LS coefficient estimates.

## Usage

```
getCOEF(out,sheet)
```

## Arguments

| | |
|---|---|
| `out` | A list object of estimation results generated by GVARest() |
| `sheet` | The number of country in out file |

## Details

Extract country-specific standard LS coefficient estimates.

## Value

| | |
|---|---|
| `coef` | Country-specific coefficient estimates |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)
COEF=getCOEF(out=mainOUTPUT,sheet=1)
```

---

# getCOEFexo *All-country LS coefficient estimates.*

---

## Description

Extract all-country LS coefficient estimates.

## Usage

```
getCOEFexo(out)
```

## Arguments

| | |
|---|---|
| out | A list object of estimation results generated by GVARest(). |

## Details

Extract all-country LS coefficient estimates.

## Value

| | |
|---|---|
| coef | Country-specific coefficient estimates. |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)
#COEF=getCOEFexo(out=mainOUTPUT)
```

---

`getNWCOEF` *Extract country-specific LS coefficient estimates with Newy-West robust covariance.*

---

## Description

Extract country-specific LS coefficient estimates with Newy-West robust covariance.

## Usage

```
getNWCOEF(out,sheet)
```

## Arguments

| | |
|---|---|
| `out` | A list object of estimation results generated by GVARest. |
| `sheet` | The number of country in out that is to be saved. |

## Value

| | |
|---|---|
| `coef` | Country-specific coefficient estimates. |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Newey WK and West KD (1994) Automatic Lag Selection in Covariance Matrix Estimation. Review of Economic Studies,61,631-653.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)
COEF=getNWCOEF(out=mainOUTPUT,sheet=1)
```

---

`getNWCOEFexo` *Extract all-country coefficient estimates with Newy-West robust covariance.*

---

## Description

Extract all-country coefficient estimates with Newy-West robust covariance.

## Usage

```
getNWCOEFexo(out)
```

## Arguments

| | |
|---|---|
| `out` | A list object of estimation results generated by GVARest. |

## Value

| | |
|---|---|
| `coef` | Country-specific coefficient estimates. |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Newey WK and West KD (1994) Automatic Lag Selection in Covariance Matrix Estimation. Review of Economic Studies, 61, 631-653.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)
COEF=getNWCOEFexo(out=mainOUTPUT)
```

---

`getWhiteCOEF` *Extract country-specific LS coefficient estimates with White robust covariance.*

---

## Description

Extract country-specific LS coefficient estimates with White robust covariance.

## Usage

```
getWhiteCOEF(out,sheet)
```

## Arguments

| | |
|---|---|
| `out` | A list object of estimation results generated by GVARest. |
| `sheet` | The number of country in out that is to be saved. |

## Value

| | |
|---|---|
| `coef` | Country-specific coefficient estimates. |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
```

```
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)

COEF=getWhiteCOEF(out=mainOUTPUT,sheet=1)
```

---

`getWhiteCOEFexo` *Extract all-country coefficient estimates with White robust covariance.*

---

## Description

Extract all-country coefficient estimates with Newy-West robust covariance, and save them in a .csv file.

## Usage

```
getWhiteCOEFexo(out)
```

## Arguments

| | |
|---|---|
| `out` | A list object of estimation results generated by GVARest. |

## Value

| | |
|---|---|
| `coef` | Country-specific coefficient estimates. |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)
COEF=getWhiteCOEFexo(out=mainOUTPUT)
```

grangerGVAR *Granger Causality for bivariate vector autoregression model augmented by foreign variables*

## Description

Granger Causality for bivariate vector autoregression (VAR) model augmented by foreign variables

## Usage

```
grangerGVAR(data,p=2,FLag=2, type="const", lag.max,  ic,weight.matrix=NULL)
```

## Arguments

| | |
|---|---|
| data | Dataframe is a strictly balanced panel data format, the first column is cross-section ID, and the second column is timeID. For the sake of identification, both columns must be named by, respectively, ID and timeID. |
| p | The number of lag for Xt matrix. |
| FLag | The number of lag for foreign variables in country-specific VAR |
| lag.max | The maximal number of lag for estimating country-specific VAR |
| type | Model specificaiton for VAR. As in package vars, we have four selection: "none","const","trend", "both". |
| ic | Information criteria for optimal lag.As in package vars, we have four selection: "AIC", "HQ", "SC", and "FPE". |
| weight.matrix | Bilateral trade weight matrix for computing foreign variables. If the computation of foreign variables are weighted by one weighting matrix, weight.matrix must be a "data.frame". If the computation of foreign variables are weighted on a year-to-year basis, then weight.matrix must be a "list, with the same length as the weighting frequency. |

## Details

This functions implements country-specific Granger causality test for bivariate VAR only. We restrict it to the case of two-variable and country specific, becasue Granger causality will be a little complex when the VAR system has more than two variables. In a global VAR case, the reduced large matrix Xt may not be suitable for Granger causality.

## Value

| | |
|---|---|
| y1GCy2.var | VAR Granger causality: y1(The 1st variable) does not Granger cause y2 (The 2nd variable) |
| y2GCy1.var | VAR Granger causality: y2(The 2nd variable) does not Granger cause y1 (The 1st variable) |
| y1GCy2.gvar | GVAR Granger causality: y1(The 1st variable) does not Granger cause y2 (The 2nd variable) |

`y2GCy1.gvar` GVAR Granger causality: y2(The 2nd variable) does not Granger cause y1 (The 1st variable)

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Mauro Filippo di and Pesaran H. M. (2013) The GVAR Handbook– Structure and Applications of a Macro Model of the Global Economy for Policy. Oxford University Press.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")

p=2
FLag=2
type="const"
lag.max=15
ic="SC"
weight.matrix=tradeweightx

GC_OUTPUT = grangerGVAR(data=PriceVol, p, FLag, type, lag.max, ic, weight.matrix)

# VAR:y1(Price) does NOT Granger Casuse y2 (logVol)
round(GC_OUTPUT$y1GCy2.var, 4)

# VAR: y2(logVol) does NOT Granger Casuse y1 (Price)
round(GC_OUTPUT$y2GCy1.var, 4)

# GVAR: y1(Price) does NOT Granger Casuse y2 (logVol)
round(GC_OUTPUT$y1GCy2.gvar, 4)

# GVAR: y2(logVol) does NOT Granger Casuse y1 (Price)
round(GC_OUTPUT$y2GCy1.gvar, 4)
```

---

# GVARest *Estimate country-specific VAR in a GVAR setting*

---

## Description

Estimate country-specific VAR in a GVAR setting

## Usage

```
GVARest(data,p,FLag, lag.max, type="const", ic,weight.matrix=NULL)
```

## Arguments

| | |
|---|---|
| data | Dataframe is a strictly balanced panel data format, the first column is cross-section ID, and the second column is timeID. For the sake of identification, both columns must be named by, respectively, ID and timeID. |
| p | The number of lag for Xt matrix. |
| FLag | The number of lag for foreign variables in country-specific VAR |
| lag.max | The maximal number of lag for estimating country-specific VAR |
| type | Model specificaiton for VAR. As in package vars, we have four selection: "none","const","trend", "both". |
| ic | Information criteria for optimal lag.As in package vars, we have four selection: "AIC", "HQ", "SC", and "FPE". |
| weight.matrix | Bilateral trade weight matrix for computing foreign variables. If the computation of foreign variables are weighted by one weighting matrix, weight.matrix must be a "data.frame". If the computation of foreign variables are weighted on a year-to-year basis, then weight.matrix must be a "list, with the same length as the weighting frequency. |

## Value

| | |
|---|---|
| gvar | Country-specific GVAR output list |
| White | Coefficient estimates with White robust covariance |
| NWHAC | Coefficient estimates withNewy-West robust covariance |
| p | Number of lags for endogeneous variables in VAR |
| K | Number of lags for Ft variables in VAR |
| type | Model specificaiton. As in package vars, we have four selection: "none","const","trend", and "both". |
| datamat | input data=data |
| lagmatrix | GVAR's Country-secific optimal lag number. |
| lagmatrix1 | VAR's Country-secific optimal lag number. |
| exoLag | Ft lags |
| Ft | Foreign variables |
| NAMES | Names of countries |
| gvarRSD | Country-specific GVAR residuals |
| varRSD | VAR residuals |
| weight | weight.matrix |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Mauro Filippo di and Pesaran H. M. (2013) The GVAR Handbook– Structure and Applications of a Macro Model of the Global Economy for Policy. Oxford University Press.

## Examples

```
data("PriceVol")
data("tradeweight1")
data("tradeweightx")

p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx
mainOUTPUT = GVARest(data=PriceVol,p,FLag,lag.max,type,ic,weight.matrix)

mainOUTPUT$lagmatrix    # Country-specific GVAR lags
mainOUTPUT$gvar
mainOUTPUT$gvar[[1]]
coef(mainOUTPUT$gvar[[17]])
mainOUTPUT$White[[17]]
mainOUTPUT$NWHAC[[17]][1]
```

---

# GVAR_Ft *Function to generate foreign variables*

---

## Description

Function to generate foreign variables

## Usage

```
GVAR_Ft(data, weight.matrix=NULL)
```

## Arguments

| | |
|---|---|
| data | Dataframe is a strictly balanced panel data format,the first column is cross-section ID,and the second column is timeID. For the sake of identification, both columns must be named by, respectively, ID and timeID. |
| weight.matrix | Bilateral trade weight matrix for computing foreign variables. If the computation of foreign variables are weighted by one weighting matrix, weight.matrix must be a "data.frame". If the computation of foreign variables are weighted on a year-to-year basis, then weight.matrix must be a "list", with the same length as the weighting frequency. If NULL, then it computes the foreign vriables by average. |

### Value

| | |
|---|---|
| Ft | Weighted foerign variables as described in GVAR |

### Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

### References

Mauro Filippo di and Pesaran H. M. (2013) The GVAR Handbook– Structure and Applications of a Macro Model of the Global Economy for Policy. Oxford University Press.

### Examples

```
#=== Loading Data ===#
data("PriceVol")
data("tradeweight1")
data("tradeweightx")

#Generate country-specific foreign variables
Ft=GVAR_Ft(data=PriceVol,weight.matrix=tradeweight1)
k=17
head(Ft[[k]])
tail(Ft[[k]])
```

---

## GVAR_Xt *Compute the G0, G1, G2, and F1, F2 matrices for filtering Xt*

---

### Description

Compute the G0, G1, G2, and F1, F2 matrices for filtering Xt

### Usage

```
GVAR_Xt(data,p=1,FLag, lag.max, type="const", ic, weight.matrix=NULL)
```

### Arguments

| | |
|---|---|
| data | Dataframe is a strictly balanced panel data format, the first column is cross-section ID, and the second column is timeID. For the sake of identification, both columns must be named by, respectively, ID and timeID. |
| p | The number of lag for Xt matrix. |
| FLag | The number of lag for foreign variables in country-specific VAR |
| lag.max | The maximal number of lag for estimating country-specific VAR |
| type | Model specificaiton for VAR. As in package vars, we have four selection: "none","const","trend", "both". |

| | |
|---|---|
| ic | Information criteria for optimal lag.As in package vars, we have four selection: "AIC", "HQ", "SC", "FPE". |
| weight.matrix | Bilateral trade weight matrix for computing foreign variables. If the computation of foreign variables are weighted by one weighting matrix, weight.matrix must be a "data.frame". If the computation of foreign variables are weighted on a year-to-year basis, then weight.matrix must be a "list", with the same length as the weighting frequency. |

## Details

This function generates several matrices of Eq.(2.6) in Filippo and Pesaran(2013, P.17), which is resuired to recursively filter Xt; besides, it also re-calculates the transformed residuals. In this version, we do not include the impulse responses function(IRF), because the IRF can be computed by these matrices and residuals easily. We will not update it until the next version.

## Value

| | |
|---|---|
| G0 | Matrix G0 of Eq.(2.6) in Filippo and Pesaran(2013, P.17) |
| G1 | Matrix G1 of Eq.(2.6) in Filippo and Pesaran(2013, P.17) |
| G2 | Matrix G2 of Eq.(2.6) in Filippo and Pesaran(2013, P.17) |
| F1 | Matrix F1 of Eq.(2.6) in Filippo and Pesaran(2013, P.17) |
| F2 | Matrix F2 of Eq.(2.6) in Filippo and Pesaran(2013, P.17) |
| lagmatrix | Country-secific optimal lag number. |
| newRESID | New residuals=epsilon in Filippo and Pesaran (2013, P.17) |

## Author(s)

Ho Tsung-wu <tsungwu@ntnu.edu.tw>, College of Management, National Taiwan Normal University.

## References

Mauro Filippo di and Pesaran H. M. (2013) The GVAR Handbook– Structure and Applications of a Macro Model of the Global Economy for Policy. Oxford University Press.

## Examples

```
data("PriceVol")
data("tradeweightx")
data("tradeweight1")
p=2
FLag=2
lag.max=15
type="const"
ic="SC"
weight.matrix=tradeweightx

Result=GVAR_Xt(data=PriceVol,p,FLag,lag.max,type,ic, weight.matrix)
```

```
Result$G0
Result$G1
#Result$F1
Result$lagmatrix
Result$newRESID
```

---

PriceVol *Dataset price-volumn of 17 mareket indices*

---

## Description

A nine-year balanced panel price-volumn data of 17 mareket indices, 2006/8/30-2014/11/19

## Usage

```
data("PriceVol")
```

## Format

A data frame with 0 observations on the following 2 variables.

`ID` Names of country, cross-section ID

`Time` Time index

`Ret` Daily returns computed by close-to-close

`Vol` Daily transaction volumn, by log

## Source

Yahoo finance

## Examples

```
data(PriceVol)
```

tradeweight1 *A single year cross-section bilateral trade weight matrix, 2014.*

## Description

A single year cross-section bilateral trade weight matrix, 2014

## Usage

```
data("tradeweight1")
```

## Format

A matrix of 17 by 17 bilateral trade weight matrix,2014

`Australia` Bilateral trade weight matrix of Australia, 2014

`Austria` Bilateral trade weight matrix of Austria, 2014

`Belgium` Bilateral trade weight matrix of Belgium, 2014

`Brazil` Bilateral trade weight matrix of Brazil, 2014

`France` Bilateral trade weight matrix of France, 2014

`UK` Bilateral trade weight matrix of UK, 2014

`US` Bilateral trade weight matrix of US, 2014

`Canada` Bilateral trade weight matrix of Canada, 2014

`HongKong` Bilateral trade weight matrix of Hong Kong, 2014

`Indonesia` Bilateral trade weight matrix of Indonesia, 2014

`Malaysia` Bilateral trade weight matrix of Malaysia, 2014

`Korea` Bilateral trade weight matrix of Korea, 2014

`Mexico` Bilateral trade weight matrix of Mexico, 2014

`Japan` Bilateral trade weight matrix of Japan, 2014

`Swiss` Bilateral trade weight matrix of Swiss, 2014

`China` Bilateral trade weight matrix of China, 2014

`Taiwan` Bilateral trade weight matrix of Taiwan, 2014

## Details

This matrix is a 17 by 17 trade weight matrix, the column names are 17 countries. Given column j, the row-wise elements are bilateral trade weights of country j. Please make sure that the order of countries exactly matches the dataset's ID column.

## Examples

```
data(tradeweight1)
is.data.frame(tradeweight1)
```

tradeweightx *A nine-year bilateral trade weight matrix, 2006-2014*

## Description

A nine-year bilateral trade weight matrix, 2006-2014

## Usage

```
data("tradeweightx")
```

## Format

A list with 17 by 17 matrix on the following variable.

`Australia` Bilateral trade weight matrix of Australia, 2014
`Austria` Bilateral trade weight matrix of Austria, 2014
`Belgium` Bilateral trade weight matrix of Belgium, 2014
`Brazil` Bilateral trade weight matrix of Brazil, 2014
`France` Bilateral trade weight matrix of France, 2014
`UK` Bilateral trade weight matrix of UK, 2014
`US` Bilateral trade weight matrix of US, 2014
`Canada` Bilateral trade weight matrix of Canada, 2014
`HongKong` Bilateral trade weight matrix of Hong Kong, 2014
`Indonesia` Bilateral trade weight matrix of Indonesia, 2014
`Malaysia` Bilateral trade weight matrix of Malaysia, 2014
`Korea` Bilateral trade weight matrix of Korea, 2014
`Mexico` Bilateral trade weight matrix of Mexico, 2014
`Japan` Bilateral trade weight matrix of Japan, 2014
`Swiss` Bilateral trade weight matrix of Swiss, 2014
`China` Bilateral trade weight matrix of China, 2014
`Taiwan` Bilateral trade weight matrix of Taiwan, 2014

## Details

This example data is annual trade weight matrix, it is a list with length 9 (2006-2014).Each list is a year specific 17 by 17 trade weight matrix, the column names are 17 countries. Given column j, the row-wise elements are bilateral trade weights of country j. Make sure that the length of list must exactly match with the number of years. Because once you use this as tradewieght input matrix, R function will automatically compute foreign variables weighted year-by-year. Please make sure that the order of countries exactly matches the dataset's ID column.

## Examples

```
data(tradeweightx)
is.data.frame(tradeweightx)
```

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