

# Package ‘PooledMeanGroup’

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**Title** Pooled Mean Group Estimation of Dynamic Heterogenous Panels

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**Depends** R (>= 3.2.3)

**Description** Calculates the pooled mean group (PMG) estimator for dynamic panel data models, as described by Pesaran, Shin and Smith (1999) <[doi:10.1080/01621459.1999.10474156](https://doi.org/10.1080/01621459.1999.10474156)>.

**License** GPL (>= 2)

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 PooledMeanGroup-package

*Pooled Mean Group Estimation of Dynamic Heterogenous Panels*


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## Description

Calculates the pool mean group (PMG) estimator for dynamic panel data models, as described by Pesaran, Shin and Smith (1999) <doi:10.1080/01621459.1999.10474156>. This estimator enables the intercepts, short-run coefficient and error variances to differ freely across groups, but restricts the long-run coefficients to being equal. Additionally, it allows the numbers of time series observations to differ freely across groups. This software also performs diagnostic tests of error terms, such as autocorrelation, heteroscedasticity and normality. Calculates the pooled mean group (PMG) estimator for dynamic panel data models, as described by Pesaran, Shin and Smith (1999) <doi:10.1080/01621459.1999.10474156>.

## Details

The DESCRIPTION file:

```

Package:      PooledMeanGroup
Version:      1.0
Date:         2017-12-13
Title:        Pooled Mean Group Estimation of Dynamic Heterogenous Panels
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Maintainer:  Lech Kujawski <lech.kujawski@ug.edu.pl>
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Description:  Calculates the pooled mean group (PMG) estimator for dynamic panel data models, as described by Pesaran, S
License:     GPL (>= 2)
URL:         https://www.r-project.org
  
```

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**Author(s)**

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Maintainer: Lech Kujawski <lech.kujawski@ug.edu.pl>

**References**

Pesaran, Shin and Smith (1999) <doi:10.1080/01621459.1999.10474156>

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BGtest

*BGtest*

---

**Description**

Tests autocorrelation between the current and lagged residuals. The test is a joint test of the first P autocorrelations

**Usage**

```
BGtest(residuals, explvariab, acor.ord)
```

**Arguments**

residuals	residuals for group i
explvariab	explanatory variables (regressors) for group i
acor.ord	order of tested autocorrelations

**Details**

Calculates statistics and probs of the Breusch-Godfrey autocorrelation test (with two variants: chi-squared and F)

**Value**

Chi-squared and F statistics with probs

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# creating artificial variables
x1=rnorm(30,0,1)
x2=rnorm(30,0,1)
e=rnorm(30,0,0.2)
y=1+2*x1+3*x2+e
# any model
model=lm(y~x1+x2)
# BGtest
ExpBGtest=BGtest(residuals=resid(model), explvariab=cbind(x1,x2), acor.ord=4)
ExpBGtest
```

---

 ConoverMulti

*ConoverMulti*


---

**Description**

Tests for homoscedasticity among subsamples  $k$  within a particular group  $i$  (note that the Conover test is a non-parametric test)

**Usage**

```
ConoverMulti(residuals, subsample)
```

**Arguments**

residuals	residuals for group $i$
subsample	the vector of $c(s_{1i}, s_{2i}, \dots, s_{ki})$ , where $s_{1i} + s_{2i} + \dots + s_{ki} = T_i$ (i.e., the vector divides a particular group $i$ into subsamples)

**Details**

Calculates chi-squared statistic with a prob

**Value**

Chi-squared statistic with a prob

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# creating artificial variables
x1=rnorm(30,0,1)
x2=rnorm(30,0,1)
e=rnorm(30,0,0.2)
y=1+2*x1+3*x2+e
# any model
model=lm(y~x1+x2)
# ConoverMulti
ExpConoverMulti=ConoverMulti(residuals=resid(model), subsample=c(10,10,10))
ExpConoverMulti
```

---

DataExp

*DataExp*

---

**Description**

A dataset in the form of stacked time-series. Quarterly data cover nine countries (Poland, Bulgaria, the Czech Republic, Hungary, Latvia, Lithuania, Romania, Slovakia, Slovenia; the numbers denoting particular countries form a series  $i=1,2,\dots,9$ ) from 2005q2 to 2013q4. The dataset contains the following (below) variables

**Usage**

```
data("DataExp")
```

**Format**

A data frame with 315 observations on the following 16 variables.

y10 a numeric vector  
y10spread a numeric vector  
riskavers a numeric vector  
debt a numeric vector  
deficit a numeric vector  
openess a numeric vector  
cpi a numeric vector  
growth a numeric vector  
crisk a numeric vector  
urate a numeric vector  
iip a numeric vector  
iipnetto a numeric vector  
cagdp a numeric vector  
caresvs a numeric vector  
cds a numeric vector  
bidask a numeric vector

**Examples**

```
data(DataExp)
```

---

 DiffPanel

*DiffPanel*


---

**Description**

Calculates first differences of a particular variable from a panel data set

**Usage**

```
DiffPanel(variable, quantity)
```

**Arguments**

variable	a particular variable from a panel data set in the form of stacked time series; in practice; a selected singular column from a panel data set
quantity	a vector of the number of time series observations in each group; in practice, it takes the form $c(T_1, \dots, T_n)$ since the PMG allows the numbers of time series observations to differ freely across groups (if the number of time series observations in each group is the same, then $c(T, \dots, T)$ and $T=T_1=T_2=\dots=T_n$ )

**Details**

Calculates first differences of a particular variable from a panel data set in order to bring it to stationarity. Preserves the original dimension of time series observations in each group, completing data lost due to differentiating by inserting "NA"

**Value**

First differences of a particular variable from a panel data set

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# first import DataExp, i=1...9, T1=T2=...T9=35
data(DataExp)
DataExp[1:5,]
# then execute DiffPanel
y10=data.frame(y10=DataExp[,1], row.names=row.names(DataExp))
dy10=DiffPanel(variable=y10, quantity=rep(35,9))
diip=DiffPanel(variable=DataExp[,11], quantity=rep(35,9))
cbind(y10,dy10,diip)[1:5,]
```

---

`GQtest`*GQtest*

---

**Description**

Tests for homoscedasticity

**Usage**

```
GQtest(residuals, subsample, nep)
```

**Arguments**

<code>residuals</code>	residuals for group <i>i</i>
<code>subsample</code>	the vector of $c(s1i, s2i)$ , where $s1i=Ti/2$ and $s2i=s1i+1$ (if <i>Ti</i> is EVEN) or where $s1i=Ti/2-0.5$ and $s2i=s1i+1$ (if <i>Ti</i> is UNEVEN)
<code>nep</code>	the number of estimated parameters for group <i>i</i>

**Details**

Calculates F statistic with a prob

**Value**

F statistic with a prob

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# creating artificial variables
x1=rnorm(30,0,1)
x2=rnorm(30,0,1)
e=rnorm(30,0,0.2)
y=1+2*x1+3*x2+e
# any model
model=lm(y~x1+x2)
#BGtest
ExpGQtest=GQtest(residuals=resid(model), subsample=c(15,16), nep=3)
ExpGQtest
```

---

JBtest

*JBtest*

---

### Description

Tests for normality

### Usage

```
JBtest(residuals)
```

### Arguments

residuals      residuals for group i

### Details

Calculates chi-squared statistic with a prob

### Value

Chi-squared statistic with a prob

### Author(s)

Lech Kujawski, Piotr Zientara

### Examples

```
# creating artificial variables
x1=rnorm(30,0,1)
x2=rnorm(30,0,1)
e=rnorm(30,0,0.2)
y=1+2*x1+3*x2+e
# any model
model=lm(y~x1+x2)
#JBtest
ExpJBtest=JBtest(residuals=resid(model))
ExpJBtest
```



---

`LagPanel`*LagPanel*

---

**Description**

Provides the first lag of a particular variable from a panel data set

**Usage**

```
LagPanel(variable, quantity)
```

**Arguments**

<code>variable</code>	a particular variable from a panel data set in the form of stacked time series; in practice; a selected singular column from a panel data set
<code>quantity</code>	a vector of the number of time series observations in each group; in practice, it takes the form $c(T_1, \dots, T_n)$ since the PMG allows the numbers of time series observations to differ freely across groups (if the number of time series observations in each group is the same, then $c(T, \dots, T)$ and $T=T_1=T_2=\dots=T_n$ )

**Details**

Provides the first lag of a particular variable from a panel data set. Preserves the original dimension of time series observations in each group, completing data lost due to lagging by inserting "NA"

**Value**

A lagged particular variable from a panel data set

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# first import DataExp, i=1...9, T1=T2=...T9=35
data(DataExp)
DataExp[1:5,]
# then execute LagPanel
y10=data.frame(y10=DataExp[,1], row.names=row.names(DataExp))
ly10=LagPanel(variable=y10, quantity=rep(35,9))
ldebt=LagPanel(variable=DataExp[,4], quantity=rep(35,9))
cbind(y10,ly10,ldebt)[1:5,]
```

---

 optimPMG

*optimPMG*


---

### Description

Estimates parameters of long-run and short-run relationships. Makes use of a "back-substitution" algorithm, as described by Pesaran, Shin and Smith (1999). Also estimates the information matrix as well as standard errors of estimations, as indicated in Equation 13 (Pesaran, Shin and Smith, 1999). Calculates Student's t-distribution type statistics, probs and confidence intervals. Also performs diagnostic tests of error terms, such as the Breusch-Godfrey autocorrelation test, the Goldfeld-Quandt heteroscedasticity test, the Conover nonparametric test of homogeneity of variance and the Jarque-Bera normality test

### Usage

```
optimPMG(dLL, maxIter, TetaStart, vecSR, vecLR, dataset, quantity, const)
```

### Arguments

dLL	a parameter indicating the convergence criterion; an optimization algorithm is stopped when an increase in concentrated log-likelihood function (Equation 8 in Pesaran, Shin and Smith (1999)) is less than dLL; the default value is $dLL=10^{-10}$
maxIter	a maximum number of iterations; the default value is 200
TetaStart	a vector of first (initial) Teta values, from which the algorithm starts searching for parameters ensuring the maximization of log-likelihood function
vecSR	a list of vectors containing the column numbers of variables in short-run relationships for each group (alternatively a list of vectors containing the variables names instead of column numbers). In each vector of the list the first number must indicate dy (i.e., the dependant variable)
vecLR	a vector containing the column numbers of variables in long-run relationships (alternatively a vector containing the variables names instead of column numbers). The first number must indicate ly (i.e., the lagged dependant variable)
dataset	a panel data set in the form of stacked time series, containing variables of long-run and short-run relationships (i.e., including differentiated and lagged variables)
quantity	a vector of the number of time series observations in each group; in practice, it takes the form $c(T_1, \dots, T_n)$ since the PMG allows the numbers of time series observations to differ freely across groups (if the number of time series observations in each group is the same, then $c(T, \dots, T)$ and $T=T_1=T_2=\dots=T_n$ )
const	logical. If TRUE (the default value), the intercept term is added to the model (i.e., to the short-run relationship)

## Details

Estimates parameters of long-run and short-run relationships. Also estimates the information matrix as well as standard errors of estimations, as indicated in Equation 13 (Pesaran, Shin and Smith, 1999). Calculates Student's t-distribution type statistics, probs and confidence intervals. Also performs diagnostic tests of error terms, such as the Breusch-Godfrey autocorrelation test, the Goldfeld-Quandt heteroscedasticity test and the Conover nonparametric test of homogeneity of variance and the Jarque-Bera normality test

## Value

\$LogL	the concentrated log-likelihood function
\$dLogL	the increase of concentrated log-likelihood function in last iteration
\$i	the number of iterations performed to achieve convergence
\$LR	the estimated parameters of long-run relationships
\$SR	the estimated parameters of short-run relationships
\$DiagTests	results of diagnostic tests
\$residuals	residuals

## Author(s)

Lech Kujawski, Piotr Zientara

## References

Pesaran, Shin and Smith (1999) <doi:10.1080/01621459.1999.10474156>

## Examples

```
# first import DataExp, i=1...9, T1=T2=...T9=35
data(DataExp)
DataExp[1:5,]
# then prepare lags and diffs using LagPanel and DiffPanel
y10=data.frame(y10=DataExp[,1], row.names=row.names(DataExp))
cpi=data.frame(cpi=DataExp[,7], row.names=row.names(DataExp))
dy10=DiffPanel(variable=y10, quantity=rep(35,9))
dopeness=DiffPanel(variable=DataExp[,6], quantity=rep(35,9))
ly10=LagPanel(variable=y10, quantity=rep(35,9))
diip=DiffPanel(variable=DataExp[,11], quantity=rep(35,9))
dcrisk=DiffPanel(variable=DataExp[,9], quantity=rep(35,9))
ldcrisk=LagPanel(variable=dcrisk, quantity=rep(35,9))
dcpi=DiffPanel(variable=DataExp[,7], quantity=rep(35,9))
ddcpi=DiffPanel(variable=dcpi, quantity=rep(35,9))
ldebt=LagPanel(variable=DataExp[,4], quantity=rep(35,9))
# create homogenous preliminary dataset (containing "NA" as a result of DiffPanel, LagPanel)
dataPanel=cbind(y10, dy10, ly10, DataExp[,6], dopeness, diip,
DataExp[,11], ldcrisk, DataExp[,9], ddcpi, DataExp[,7])
dataPanel=data.frame(dataPanel)
names(dataPanel)=c("y10", "dy10", "ly10", "openess", "dopeness", "diip",
"iip", "ldcrisk", "crisk", "ddcpi", "cpi")
```

```

dataPanel[1:5,]
# prepare dataset and quantity for PMG or optimPMG functions using PanelNaOmit
dataPanel=PanelNaOmit(dataset=dataPanel, quantity=rep(35,9))
dataPanel$dataset[1:5,]
dataPanel$quantity
# optimPMG
OptimPmgExp=optimPMG(
dLL=10^-10,
maxIter=200,
TetaStart=rep(x=1, times=4), # note that length(TetaStart)=length(vecLR)-1
vecSR=list(SR1=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR2=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR3=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR4=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR5=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR6=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR7=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR8=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR9=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi")),
vecLR=c("ly10", "openess", "iip", "crisk", "cpi"),
dataset=dataPanel$dataset,
quantity=dataPanel$quantity,
const=TRUE)
OptimPmgExp

```

---

PanelNaOmit

*PanelNaOmit*


---

## Description

Prepares a panel data set for further calculations by eliminating "NA" and modifying quantity or a vector of the number of time series observations in each group

## Usage

```
PanelNaOmit(dataset, quantity)
```

## Arguments

dataset	a panel data set in the form of stacked time series, containing variables of long-run and short-run relationships (i.e., including differentiated and lagged variables from DiffPanel or LagPanel)
quantity	a vector of the number of time series observations in each group; in practice, it takes the form $c(T_1, \dots, T_n)$ since the PMG allows the numbers of time series observations to differ freely across groups (if the number of time series observations in each group is the same, then $c(T, \dots, T)$ and $T=T_1=T_2=\dots=T_n$ )

**Details**

Eliminates "NA" and modifies quantity or a vector of the number of time series observations in each group

**Value**

`$dataset` panel data set for further calculations modified by eliminating "NA"  
`$quantity` modified vector of the number of time series observations in each group

**Author(s)**

Lech Kujawski, Piotr Zientara

**Examples**

```
# first import DataExp, i=1...9, T1=T2=...T9=35
data(DataExp)
DataExp[1:5,]
# then prepare lags and diffs using LagPanel and DiffPanel
y10=data.frame(y10=DataExp[,1], row.names=row.names(DataExp))
cpi=data.frame(cpi=DataExp[,7], row.names=row.names(DataExp))
dy10=DiffPanel(variable=y10, quantity=rep(35,9))
dopeness=DiffPanel(variable=DataExp[,6], quantity=rep(35,9))
ly10=LagPanel(variable=y10, quantity=rep(35,9))
diip=DiffPanel(variable=DataExp[,11], quantity=rep(35,9))
dcrisk=DiffPanel(variable=DataExp[,9], quantity=rep(35,9))
ldcrisk=LagPanel(variable=dcrisk, quantity=rep(35,9))
dcpi=DiffPanel(variable=DataExp[,7], quantity=rep(35,9))
ddcpi=DiffPanel(variable=dcpi, quantity=rep(35,9))
ldebt=LagPanel(variable=DataExp[,4], quantity=rep(35,9))
# create homogenous preliminary dataset (containing "NA") after DiffPanel, LagPanel
dataPanel=cbind(y10, dy10, ly10, DataExp[,6], dopeness, diip,
DataExp[,11], ldcrisk, DataExp[,9], ddcpi, DataExp[,7])
dataPanel=data.frame(dataPanel)
names(dataPanel)=c("y10", "dy10", "ly10", "openess", "dopeness", "diip",
"iip", "ldcrisk", "crisk", "ddcpi", "cpi")
dataPanel[1:5,]
# prepare dataset and quantity for PMG or optimPMG functions using PanelNaOmit
dataPanel=PanelNaOmit(dataset=dataPanel, quantity=rep(35,9))
dataPanel$dataset[1:5,]
dataPanel$quantity
```

**Description**

Having particular long-run parameters (exp. start values) estimates parameters of short-run relationships as well as standard errors of estimations, Student's t-distribution type statistics, probs, confidence intervals. Also performs diagnostic tests of error terms, such as autocorrelation, heteroscedasticity and normality

**Usage**

```
PMG(paramTeta, vecSR, vecLR, dataset, quantity, const)
```

**Arguments**

paramTeta	the vector of parameters of long-run relationships, as outlined in Equation 7 (Pesaran, Shin and Smith, 1999)
vecSR	a list of vectors containing the column numbers of variables in short-run relationships for each group (alternatively a list of vectors containing the variables names instead of column numbers). In each vector of the list the first number must indicate dy (i.e., the dependant variable)
vecLR	a vector containing the column numbers of variables in long-run relationships (alternatively a vector containing the variables names instead of column numbers). The first number must indicate ly (i.e., the lagged dependant variable)
dataset	a panel data set in the form of stacked time series, containing variables of long-run and short-run relationships (i.e., including differentiated and lagged variables)
quantity	a vector of the number of time series observations in each group; in practice, it takes the form $c(T_1, \dots, T_n)$ since the PMG allows the numbers of time series observations to differ freely across groups (if the number of time series observations in each group is the same, then $c(T, \dots, T)$ and $T=T_1=T_2=\dots=T_n$ )
const	logical. If TRUE (the default value), the intercept term is added to the model (i.e., to the short-run relationship)

**Details**

Having particular long-run parameters estimates parameters of short-run relationships. Also estimates the information matrix as well as standard errors of estimations, as indicated in Equation 13 (Pesaran, Shin and Smith, 1999). Calculates Student's t-distribution type statistics, probs and confidence intervals. Also performs diagnostic tests of error terms, such as the Breusch-Godfrey autocorrelation test, the Goldfeld-Quandt heteroscedasticity test and the Conover nonparametric test of homogeneity of variance and the Jarque-Bera normality test

**Value**

\$LogL	the concentrated log-likelihood function
\$LR	parameters of long-run relationships
\$SR	the estimated parameters of short-run relationships
\$DiagTests	results of diagnostic tests
\$residuals	residuals

**Author(s)**

Lech Kujawski, Piotr Zientara

**References**

Pesaran, Shin and Smith (1999) <doi:10.1080/01621459.1999.10474156>

**Examples**

```
# first import DataExp, i=1...9, T1=T2=...T9=35
data(DataExp)
DataExp[1:5,]
# then prepare lags and diffs using LagPanel and DiffPanel
y10=data.frame(y10=DataExp[,1], row.names=row.names(DataExp))
cpi=data.frame(cpi=DataExp[,7], row.names=row.names(DataExp))
dy10=DiffPanel(variable=y10, quantity=rep(35,9))
dopeness=DiffPanel(variable=DataExp[,6], quantity=rep(35,9))
ly10=LagPanel(variable=y10, quantity=rep(35,9))
diip=DiffPanel(variable=DataExp[,11], quantity=rep(35,9))
dcrisk=DiffPanel(variable=DataExp[,9], quantity=rep(35,9))
ldcrisk=LagPanel(variable=dcrisk, quantity=rep(35,9))
dcpi=DiffPanel(variable=DataExp[,7], quantity=rep(35,9))
ddcpi=DiffPanel(variable=dcpi, quantity=rep(35,9))
ldebt=LagPanel(variable=DataExp[,4], quantity=rep(35,9))
# create homogenous preliminary dataset (containing "NA" as a result of DiffPanel, LagPanel)
dataPanel=cbind(y10, dy10, ly10, DataExp[,6], dopeness, diip,
DataExp[,11], ldcrisk, DataExp[,9], ddcpi, DataExp[,7])
dataPanel=data.frame(dataPanel)
names(dataPanel)=c("y10", "dy10", "ly10", "openess", "dopeness", "diip",
"iip", "ldcrisk", "crisk", "ddcpi", "cpi")
dataPanel[1:5,]
# prepare dataset and quantity for PMG or optimPMG functions using PanelNaOmit
dataPanel=PanelNaOmit(dataset=dataPanel, quantity=rep(35,9))
dataPanel$dataset[1:5,]
dataPanel$quantity
# PMG
PmgExp=PMG(
paramTeta=c(-14.22768, -23.84427, -0.75717, 27.57753),
vecSR=list(SR1=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR2=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR3=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR4=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR5=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR6=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR7=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR8=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi"),
SR9=c("dy10", "dopeness", "diip", "ldcrisk", "ddcpi")),
vecLR=c("ly10", "openess", "iip", "crisk", "cpi"),
dataset=dataPanel$dataset,
quantity=dataPanel$quantity,
const=TRUE)
PmgExp
```

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