

# Package ‘StepwiseTest’

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**Type** Package

**Title** Multiple Testing Method to Control Generalized Family-Wise Error Rate and False Discovery Proportion

**Version** 1.0

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**Description** Collection of stepwise procedures to conduct multiple hypotheses testing. The details of the stepwise algorithm can be found in Romano and Wolf (2007) <[DOI:10.1214/009053606000001622](https://doi.org/10.1214/009053606000001622)> and Hsu, Kuan, and Yen (2014) <[DOI:10.1093/jjfinec/nbu010](https://doi.org/10.1093/jjfinec/nbu010)>

**License** GPL (>= 2)

**Imports** Rcpp (>= 0.12.2)

**Suggests** foreach, tseries

**LinkingTo** Rcpp, RcppArmadillo

**NeedsCompilation** yes

**Repository** CRAN

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StepwiseTest-package    *Multiple Testing Method to Control Generalized Family-Wise Error Rate and False Discovery Proportion*

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## Description

Collection of stepwise procedures to conduct multiple hypotheses testing. The details of the stepwise algorithm can be found in Romano and Wolf (2007) <DOI:10.1214/009053606000001622> and Hsu, Kuan, and Yen (2014) <DOI:10.1093/jjfinec/nbu014>.

## Usage

```
FWERkControl(test_stat, boot_stat, k, alpha)
FDPControl(test_stat, boot_stat, gamma, alpha)
```

## Arguments

|           |                                        |
|-----------|----------------------------------------|
| test_stat | m x 1 column vector of test statistics |
| boot_stat | m x B matrix of bootstrap statistics   |
| k         | Number of false rejections             |
| gamma     | False discovery proportion             |
| alpha     | The desired FWER(k) or FDP level       |

## Value

Reject: A 0/1 numeric vector where the element j equals 1 indicates the model j is significant.  
CV: The critical value.

## Author(s)

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## References

Romano, J. P. and Wolf, M. (2005). "Stepwise multiple testing as formalized data snooping." *Econometrica*, 73, 1237-1282.

Romano, J. P. and Wolf, M. (2007). "Control of generalized error rates in multiple testing." *Annals of Statistics*, 35, 1378-1408.

Hsu, P.-H., Hsu, Y.-C., and Kuan, C.-M. (2010). "Testing the predictive ability of technical analysis using a new stepwise test without data-snooping bias." *Journal of Empirical Finance*, 17, 471-484.

Hsu, Y.-C., Kuan, C.-M., and Yen, M.-F. (2014). "A generalized stepwise procedure with improved power for multiple inequalities testing." *Journal of Financial Econometrics*, 12, 730-755.

**Examples**

```
# Specify the model parameters
m_null = 3
m_alt = 7
m = m_null + m_alt
mu = c( rep(0, m_null), rep(0.5,m_alt) )
rho = 0.25
omega= (1-rho)*diag(1,m) + rho*matrix(1,m,m)
v=t(chol(omega))

# generate the data
n = 100
y = mu%%matrix(1,1,n)+ v %% matrix(rnorm(m*n),m,n)

# calculate the test statistics and bootstrap statistics
library(foreach)
library(tseries)
B = 100
y_mean = apply(y,1,mean)
y_sig = apply(y,1,sd)
t_stat = as.matrix(sqrt(n)*y_mean/y_sig)
s = tsbootstrap(1:n,B,b=2,type="stationary")
b_stat = foreach(i=1:B,.combine=cbind) %do% {
  y_boot = y[, s[,i]]
  y_mean_boot = apply(y_boot,1,mean)
  sqrt(n)*(y_mean_boot - y_mean)/y_sig
}

# Multiple test that controls FWER(1) at 5% significance level
FWERkControl(t_stat,b_stat,1,0.05)

# Multiple test that controls FWER(3) at 5% significance level
FWERkControl(t_stat,b_stat,1,0.05)

# Multiple test that controls FDP(0.1) at 5% significance level
FDPControl(t_stat,b_stat,0.1,0.05)
```

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