

Package ‘vrtest’

June 22, 2009

Type Package

Title Variance Ratio tests and spectral shape tests for Weak-form Market Efficiency

Version 0.94

Date 2009-06-17

Author Jae H. Kim

Maintainer Jae H. Kim <J.Kim@latrobe.edu.au>

Description A collection of variance ratio and spectral shapte tests

License GPL (>= 2)

Repository CRAN

Date/Publication 2009-06-22 07:29:05

R topics documented:

vrtest-package	2
Adjust.thin	2
Auto.VR	3
AutoBoot.test	4
Ave.Ex	5
Boot.test	6
Chen.Deo	7
Chow.Denning	8
exrates	9
Joint.Wright	9
JWright.crit	10
Lo.Mac	11
Spec.shape	12
Subsample.test	13
VR.minus.1	14
VR.plot	15

Wald	15
Wright	16
Wright.crit	17

Index	19
--------------	-----------

vrtest-package	<i>Variance Ratio tests and spectral shape tests for Weak-form Market Efficiency</i>
----------------	--

Description

A collection of variance ratio and spectral shapte tests

Details

Package: vrtest
 Type: Package
 Version: 0.94
 Date: 2009-06-17
 License: GPL version 2 or newer

Author(s)

Jae H. Kim

Maintainer: Jae H. Kim <J.Kim@latrobe.edu.au>

Adjust.thin	<i>Adjustment for thinly-traded returns</i>
-------------	---

Description

The adjustment based on AR(1) fitting as proposed by Miller et al. (1994)

Usage

Adjust.thin(y)

Arguments

y financial return time series

Value

Adjusted return

Author(s)

Jae H. Kim

References

Miller et al. (1994), Mean Reversion of Standard & Poor's 500 Index Base Changes: Arbitrage Induced or Statistical Illusion *Journal of Finance*, XLIX, 479-513.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
Adjust.thin(r)
```

Auto.VR

Automatic Variance Ratio Test

Description

A variance ratio test with holding period value chosen by a data dependent procedure

Usage

```
Auto.VR(y)
```

Arguments

y financial return time series

Value

AutoVR Automatic variance ratio test statistic

Note

R code translated from Choi's GAUSS code

Author(s)

Jae H. Kim

References

Choi, I. 1999, Testing the random walk hypothesis for real exchange rates Journal of Applied Econometrics, 14, 293-308.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
Auto.VR(r)
```

AutoBoot.test

Wild Bootstrapping of Automatic Variance Ratio Test

Description

This function returns wild bootstrap test results for the Automatic Variance Ratio Test of Choi (1999)

Usage

```
AutoBoot.test(y, nboot, wild, prob=c(0.025, 0.975))
```

Arguments

y	a vector of time series, typically financial return
nboot	the number of bootstrap iterations
wild	"Normal" for the wild bootstrap using the standard normal distribution, "Mammen" for the wild bootstrap using Mammen's two point distribution, "Rademacher" for the wild bootstrap using Rademacher's two point distribution
prob	probability limits for confidence intervals

Value

test.stat	Automatic variance ratio test statistic
pval	Wild Bootstrap p-value for the test
CI	Confidence Intervals from Bootstrap distribution

Author(s)

Jae H. Kim

References

Kim, J.H., 2009, Automatic Variance Ratio Test under Conditional Heteroskedasticity. Finance Research Letters. Forthcoming

Examples

```
r <- rnorm(100)           # log return
AutoBoot.test(r,nboot=500,wild="Normal")
```

Ave.Ex

*Average Exponential Tests***Description**

Average exponential tests of Andrews and Ploberger (1996)

Usage

```
Ave.Ex(y)
```

Arguments

y financial return time series

Value

Ex.LM	LM test
Ex.LR	LR test

Note

Traslated from Choi's Gauss codes

Author(s)

Jae H. Kim

References

Choi, I. 1999, Testing the random walk hypothesis for real exchange rates, Journal of Applied Econometrics, 14, 293-308.

Examples

```
data(exrates)
y <- exrates$ca           # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
Ave.Ex(r)
```

 Boot.test

Bootstrap Variance Ratio Tests

Description

This function returns bootstrap p-values of the Lo-MacKilay (1988) and Chow-Denning (1993) tests.

Users can choose between iid bootstrap and wild bootstrap

Usage

```
Boot.test(y, kvec, nboot, wild, prob=c(0.025,0.975))
```

Arguments

y	a vector of time series, typically financial return
kvec	a vector of holding periods
nboot	the number of bootstrap iterations
wild	"No" for iid bootstrap, "Normal" for the wild bootstrap using the standard normal distribution, "Mammen" for the wild bootstrap using Mammen's two point distribution, "Rademacher" for the wild bootstrap using Rademacher's two point distribution
prob	probability limits for confidence intervals

Value

Holding.Period	holding periods used
LM.pval	Bootstrap p-values for the Lo-MacKinlay tests
CD.pval	Bootstrap p-value for the Chow-Denning test
CI	Confidence Intervals for Lo-Mackinlay tests from Bootstrap distribution

Author(s)

Jae H. Kim

References

Kim, J.H., 2006, Wild Bootstrapping Variance Ratio Tests. *Economics Letters*, 92, 38-43.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2,5,10)
Boot.test(r, kvec, nboot=500, wild="Normal")
```

Chen.Deo

*Power Transformed Joint Variance Ratio Test***Description**

See equation (15) of Chen and Deo (2006)

Usage

```
Chen.Deo(x, kvec)
```

Arguments

`x` a vector of time series, typically financial return
`kvec` a vector of holding periods

Value

`Holding.Period` holding periods used
`VRsum` the sum of (power transformed individual VR - 1)
`QPn` QPn statistic
`ChiSQ.Quantiles_1_2_5_10_20_percent` Chi-square critical values

Author(s)

Jae H. Kim

References

Chen, W. W., and Deo, R.S., 2006, The Variance Ratio Statistic at Large Horizons, *Econometric Theory*, 22, 206-234.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Chen.Deo(r, kvec)
```

Chow.Denning *Chow-Denning Multiple Variance Ratio Tests*

Description

This function returns Chow-Denning test statistics.

CD1: test for iid series; CD2: test for uncorrelated series with possible heteroskedasticity.

Usage

```
Chow.Denning(y, kvec)
```

Arguments

y	a vector of time series, typically financial return
kvec	a vector of holding periods

Value

Holding.Periods	holding periods used
CD1	CD1 statistic
CD2	CD2 statistic
Critical.Values_10_5_1_percent	10 5 1 percent critical values

Note

See Chow and Denning (1993) for the details of critical value calculation

Author(s)

Jae H. Kim

References

Chow, K. V., K. C. DENNING, 1993, A Simple Multiple Variance Ratio Test, *Journal of Econometrics*, 58, 385-401.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Chow.Denning(r, kvec)
```

exrates	<i>wright's Exchange Rates Data</i>
---------	-------------------------------------

Description

The data set used in Wright (2001) as an application, weekly from August, 7, 1974 to May 29 1996

Usage

```
data(exrates)
```

Format

A data frame with 1139 observations on the following 5 variables.

ca a numeric vector, Canadian Dollar

dm a numeric vector, Deutch Mark

ff a numeric vector, French Franc

uk a numeric vector, UK Pound

jp a numeric vector, Japanese Yen

References

WRIGHT,J.H.,2000,Alternative Variance-Ratio Tests Using Ranks and Signs, Journal of Business & Economic Statistics, 18, 1-9.

Examples

```
data(exrates)
```

Joint.Wright	<i>A Joint Version of Wight's Rank and Sign Test</i>
--------------	--

Description

This function returns joint or multiple version of Wright's rank and sign tests. The test takes the maximum value of the individual rank or sign tests, in the same manner as Chow-Denning test

Usage

```
Joint.Wright(y, kvec)
```

Arguments

y a vector of time series, typically financial return

kvec a vector of holding periods

Value

`Holding.Period`
 holding periods used
 `JR1` Joint test based on R1 statistics
 `JR2` Joint test based on R2 statistics
 `JS1` Joint test based on S1 statistics

Author(s)

Jae H. Kim

References

Belaire-Franch G, Contreras D. Ranks and signs-based multiple variance ratio tests, Working paper, University of Valencia 2004.

Kim, J. H. and Shamsuddin, A., Are Asian Stock Markets Efficient? Evidence from New Multiple Variance Ratio Tests, Working Paper, Monash University.

Examples

```

data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Joint.Wright(r, kvec)

```

JWright.crit

Critical Values for the joint versions of Wright's rank and sign tests

Description

This function runs a simulation to calculate the critical values of the joint versions of Wright's tests.

Usage

```
JWright.crit(n, kvec, nit)
```

Arguments

`n` sample size
`kvec` holding period vector
`nit` number of iterations

Value

Holding.Period	holding period used
JR1.crit	Critical values for the joint R1 statistic
JR2.crit	Critical values for the joint R2 statistic
JS1.crit	Critical values for the joint S1 statistic

Author(s)

Jae H. Kim

References

Belaire-Franch G, Contreras D. Ranks and signs-based multiple variance ratio tests, Working paper, University of Valencia 2004.

Kim, J. H. and Shamsuddin, A., Are Asian Stock Markets Efficient? Evidence from New Multiple Variance Ratio Tests, Working Paper, Monash University.

Examples

```
kvec <- c(2,5,10)
JWright.crit(n=100,kvec,nit=10000)
```

Lo.Mac

Lo-MacKinlay variance Ratio Tests

Description

The function returns M1 and M2 statistics of Lo and MacKinlay (1998).

M1: tests for iid series; M2: for uncorrelated series with possible heteroskedasticity.

Usage

```
Lo.Mac(y, kvec)
```

Arguments

y	a vector of time series, typically financial return
kvec	a vector of holding periods

Value

Stats	M1 and M2 statistics
-------	----------------------

Author(s)

Jae H. Kim

References

LO, A. W., and A. C. MACKINLAY (1988): "Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test," *The Review of Financial Studies*, 1, 41-66.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Io.Mac(r, kvec)
```

Spec.shape

Spectral shape tests for random walk

Description

Spectral Shape tests proposed by Durlauf (1991) and Choi (1999)

Usage

```
Spec.shape(x)
```

Arguments

x financial return time series

Value

AD Anderson-Darling statistic
 CVM Cramer-von Mises statistic
 M Mellows statistic

Note

Traslated from Choi's Gauss codes

Author(s)

Jae H. Kim

References

Choi, I. 1999, Testing the random walk hypothesis for real exchange rates, *Journal of Applied Econometrics*, 14, 293-308. Durlauf, S. N., 1991, Spectral based testing of the martingale hypothesis, *Journal of Econometrics*, 50, 355-376.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
Spec.shape(r)
```

Subsample.test *Subsampling test of Whang and Kim (2003)*

Description

The function returns the p-values of the subsampling test.

Usage

```
Subsample.test(y, kvec)
```

Arguments

y a vector of time series, typically financial return
kvec a vector of holding periods

Details

The block lengths are chosen internally using the rule proposed in Whang and Kim (2003)

Value

 Holding.Period holding periods used
 Block.Length block lengths chosen
 pval p-values of the test for each block length used

Author(s)

Jae H. Kim

References

WHANG, Y.-J., J. KIM, 2003, A Multiple Variance Ratio Test Using Subsampling, *Economics Letters*, 79, 225-230.

Examples

```

data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2,5,10)
Subsample.test(r,kvec)

```

VR.minus.1 *Absolute Value of (VR - 1)*

Description

This value is sometimes used to measure the degree of market efficiency

Usage

```
VR.minus.1(y, kvec)
```

Arguments

y	financial return time series
kvec	a vector of holding periods

Value

VR.auto	the value of ABS(VR-1) with automatic selection of holding vectors
Holding.Periods	the vector of holding periods
VR.kvec	the values of ABS(VR-1) for the chosen holding periods

Note

see Auto.VR function for automatic selection of holding periods

Author(s)

Jae H. Kim

Examples

```

data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
kvec <- c(2,5,10)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
VR.minus.1(r,kvec)

```

 VR.plot

Variance Ratio Plot

Description

Plotting unstandardized variance ratios against holding periods with 95percent confidence band
Standard errors under iid returns are used.

Usage

```
VR.plot(y, kvec)
```

Arguments

y	financial return
kvec	holding period vector

Value

VR	vector of variance ratio values plotted
----	---

Author(s)

Jae H. Kim

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
VR.plot(r, kvec)
```

 Wald

Wald Test of Richardson and Smith (1991)

Description

This function returns the Wald test statistic with critical values

Usage

```
Wald(y, kvec)
```

Arguments

`y` a vector of time series, typically financial return
`kvec` a vector of holding periods

Value

`Holding.Periods`
 holding periods used
`Wald.stat` Wald test statistic
`Critical.Values_10_5_1_percent`
 10 5 and 1 percent critical values

Note

The statistic asymptotically follows the chi-squared distribution with the degrees of freedom same as the number of holding periods used

Author(s)

Jae H. Kim

References

Richardson, M., T. Smith, 1991, "Tests of Financial Models in the Presence of Overlapping Observations," *The Review Financial Studies*, 4, 227-254.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Wald(r, kvec)
```

Wright

Wright's Rank and Sign Tests

Description

The function returns R1, R2 and S1 tests statistics detailed in Wright (2000)

Usage

```
Wright(y, kvec)
```

Arguments

`y` a vector of time series, typically financial return
`kvec` a vector of holding periods

Value

`Holding.Period` holding periods used
`R1.test` rank test R1
`R2.test` rank test R2
`S1.test` sign test S1

Author(s)

Jae H. Kim

References

WRIGHT, J.H., 2000, Alternative Variance-Ratio Tests Using Ranks and Signs, *Journal of Business & Economic Statistics*, 18, 1-9.

Examples

```
data(exrates)
y <- exrates$ca # read Canadian exchange rate
nob <- length(y)
r <- log(y[2:nob]) - log(y[1:(nob-1)]) # log return calculation
kvec <- c(2, 5, 10)
Wright(r, kvec)
```

Wright.crit

Critical Values for Wright's rank and sign tests

Description

This function returns critical values of Wright's tests based on the simulation method detailed in Wright (2000)

Usage

```
Wright.crit(n, k, nit)
```

Arguments

`n` sample size
`k` holding period, a scalar
`nit` number of iterations

Value

<code> Holding.Period</code>	holding period used
<code> R1.crit</code>	Critical values for the R1 statistic
<code> R2.crit</code>	Critical values for the R2 statistic
<code> S1.crit</code>	Critical values for the S1 statistic

Author(s)

Jae H. Kim

References

WRIGHT,J.H.,2000,Alternative Variance-Ratio Tests Using Ranks and Signs, Journal of Business & Economic Statistics, 18, 1-9.

Examples

```
Wright.crit (n=100, k=2, nit=10000)
```

Index

*Topic **datasets**

exrates, [9](#)

*Topic **htest**

Adjust.thin, [2](#)

Auto.VR, [3](#)

AutoBoot.test, [4](#)

Ave.Ex, [5](#)

Boot.test, [6](#)

Chen.Deo, [7](#)

Chow.Denning, [8](#)

Joint.Wright, [9](#)

JWright.crit, [10](#)

Lo.Mac, [11](#)

Spec.shape, [12](#)

Subsample.test, [13](#)

VR.minus.1, [14](#)

VR.plot, [15](#)

vrtest-package, [1](#)

Wald, [15](#)

Wright, [16](#)

Wright.crit, [17](#)

VR.minus.1, [14](#)

VR.plot, [15](#)

vrtest (*vrtest-package*), [1](#)

vrtest-package, [1](#)

Wald, [15](#)

Wright, [16](#)

Wright.crit, [17](#)

Adjust.thin, [2](#)

Auto.VR, [3](#)

AutoBoot.test, [4](#)

Ave.Ex, [5](#)

Boot.test, [6](#)

Chen.Deo, [7](#)

Chow.Denning, [8](#)

exrates, [9](#)

Joint.Wright, [9](#)

JWright.crit, [10](#)

Lo.Mac, [11](#)

Spec.shape, [12](#)

Subsample.test, [13](#)