Package 'SpuriousMemory'

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Title Testing True Long Memory Against Spurious Long Memory

Version 1.0.0

Maintainer Zhongjun Qu <qu@bu.edu>

Description Implements a test for distinguishing between true long memory and spurious long memory. Reference: Qu, Z. (2011). ``A Test Against Spurious Long Memory." Journal of Business & Economic Statistics, 29(3), 423–438. <doi:10.1198/jbes.2010.09153>.

License GPL (>= 3)

Depends R (>= 4.3.0)

Suggests knitr, rmarkdown

VignetteBuilder knitr

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Imports fracdiff, stats

LazyData true

Author Zhongjun Qu [aut, cre],
Cheolju Kim [aut]

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Contents

`filterx` *Filter a time series to reduce the short-memory dynamics using a low-order ARFIMA model*

Description

Fits ARFIMA(p, d, q) models with $p, q \in \{0, 1\}$ using `fracdiff`, selects the specification by AIC, and applies the corresponding linear filter to the series.

Usage

```
filterx(x, n = NULL)
```

Arguments

`x`	A numeric vector containing the time series to be filtered.
`n`	An integer giving the length of the filtered series. If `NULL`, the length of `x` is used.

Details

The function considers ARFIMA(1, d, 1), ARFIMA(1, d, 0), ARFIMA(0, d, 1), and ARFIMA(0, d, 0) models, computes AIC for each, and selects the model with the smallest AIC. If the absolute value of the selected AR or MA coefficient is greater than or equal to 0.99, the procedure selects a pure fractional model ARFIMA(0, d, 0). The input series is centered before estimation.

Value

A numeric vector of length `n` containing the filtered series.

Examples

```
set.seed(123)
sim <- fracdiff::fracdiff.sim(
n = 1000,
ar = 0.3,     # AR(1) coefficient
ma = -0.4,    # MA(1) coefficient
d  = 0.25     # fractional differencing parameter
)
x <- sim$series
y <- filterx(x)
```

`Longmemorytest` *Testing true long memory against spurious long memory*

Description

Tests the null hypothesis of true long memory against the alternative of spurious long memory (e.g., due to level shifts or trends) using the Qu (2011) test.

Usage

```
Longmemorytest(
  x,
  demean = TRUE,
  alpha = 0.05,
  filter = TRUE,
  print_results = TRUE
)
```

Arguments

`x`	Numeric vector of time series data
`demean`	Logical, demean the series (default: TRUE)
`alpha`	Numeric, significance level: 0.01, 0.025, 0.05, or 0.10 (default: 0.05)
`filter`	Logical, apply a pre-whitening filter to reduce short-memory dynamics that may otherwise affect the size of the test in finite samples (default: TRUE).
`print_results`	Logical, print results (default: TRUE)

Details

The test uses bandwidth parameter m = n^0.7 with trimming parameters 0.02 or 0.05 as recommended by Qu (2011). Critical values are based on these settings. Whether the pre-whitening filter is applied does not affect the asymptotic critical values.

Value

A list with elements:

`d_estimate`	Local Whittle estimate of the long memory parameter.
`test_stat_eps02`	Test statistic with trimming parameter epsilon = 0.02.
`test_stat_eps05`	Test statistic with trimming parameter epsilon = 0.05.
`critical_value_eps02`	Critical value for epsilon = 0.02 at the chosen significance level alpha.
`critical_value_eps05`	Critical value for epsilon = 0.05 at the chosen significance level alpha.

reject_eps02	Logical, TRUE if the null is rejected for epsilon = 0.02.
reject_eps05	Logical, TRUE if the null is rejected for epsilon = 0.05.
alpha	Significance level.
m	Bandwidth parameter m.
n	Sample size.

References

Qu, Z. (2011). A Test Against Spurious Long Memory. Journal of Business & Economic Statistics, 29(3), 423-438.

Examples

```
data(RV5min)
result <- Longmemorytest(log(RV5min))

# Simulated example: ARFIMA(0,d,0) with d = 0.3 (true long memory)
set.seed(123)
n  <- 2000
d0 <- 0.3
e  <- rnorm(n)
x  <- fracdiff::fracdiff.sim(n, d = d0)$series

# Apply the test (null = true long memory)
out <- Longmemorytest(x, alpha = 0.05)
out$reject_eps02    # typically FALSE
out$d_estimate

# Example: Spurious long memory due to a structural break
set.seed(123)
n <- 2000
x <- c(rnorm(n/2, 0, 1), rnorm(n/2, 2, 1))   # one-time mean shift

out <- Longmemorytest(x, alpha = 0.05)
out$reject_eps02
out$reject_eps05
```

RV5min *RV5min: realized volatility for Japanese Yen/USD spot exchange rates from Dec 1st, 1986 to Jun 30th, 1999*

Description

RV5min: realized volatility for Japanese Yen/USD spot exchange rates from Dec 1st, 1986 to Jun 30th, 1999

Usage

```
data(RV5min)
```

Format

Numeric vector

Index