

# Package: SpuriousMemory (via r-universe)

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**Title** Testing True Long Memory Against Spurious Long Memory

**Version** 1.0.0

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**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

**Encoding** UTF-8

**NeedsCompilation** no

**RoxygenNote** 7.3.2

**Imports** fracdiff, stats

**LazyData** true

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filterx	<i>Filter a time series to reduce the short-memory dynamics using a low-order ARFIMA model</i>
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### 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)
```

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Longmemorytest      *Testing true long memory against spurious long memory*

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### 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
```

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RV5min

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

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## Description

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

*RV5min*

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**Usage**

`data(RV5min)`

**Format**

Numeric vector

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