Package ‘seastests’

March 8, 2019

Title  Seasonality Tests
Version  0.14.2
Description  An overall test for seasonality of a given time series in addition to a set of single season-
ality tests as used in Ollech and Webel (forthcoming): An overall seasonality test. Bundes-
bank Discussion Paper.
Depends  R (>= 3.1.0)
License  GPL-3
Encoding  UTF-8
LazyData  true
Maintainer  Daniel Ollech <daniel.ollech@bundesbank.de>
Imports  xts, zoo, forecast, stats, graphics, utils
RoxygenNote  6.0.1
Suggests  knitr, rmarkdown
VignetteBuilder  knitr
NeedsCompilation  no
Author  Daniel Ollech [aut, cre]
Repository  CRAN
Date/Publication  2019-03-08 17:20:02 UTC

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check_residuals

Description
Test the residuals of the model used for the OCSB test for serial correlation.

Usage
check_residuals(x, plot = F)

Arguments
x results of ocsb test
plot boolean, should barplot be printed?

Details
The residuals of the model used for the OCSB test should ideally be white noise. Here the Ljung-Box statistic is calculated and shown for all lags up to 2 times the frequency of the series. Be aware that the Ljung-Box statistic is a 'cumulative test'. For instance, the p-value of the Ljung-Box statistic for lag 3 is based on the null hypothesis, that the autocorrelations of the first three lags are jointly zero.

Author(s)
Daniel Ollech

References

Examples
teststat <- ocsb(ts(rnorm(100, 10, 10), frequency=12), nrun=100)
check_residuals(teststat)
freq_xts

**Obtain the frequency of an xts time series**

**Description**
Estimate the number of periods per year of an xts time series

**Usage**
freq_xts(series)

**Arguments**
- `series`: time series

**Details**
The function gives back the average number of observations per year calculated on the whole series except for the first and the last year.

**Author(s)**
Daniel Ollech

**Examples**
```r
x <- xts::xts(rnorm(100), seq.Date(from=as.Date("2010-01-01"), by="months", length.out=100))
frequency(x)
```

fried

**Friedman Rank test**

**Description**
Test for seasonality in a time series.

**Usage**
fried(x, freq = NA, diff = T, residuals = F, autoarima = T)

**Arguments**
- `x`: time series
- `freq`: Frequency of the time series
- `diff`: Shall the differenced series be tested?
- `residuals`: Shall the residuals of an ARIMA model be tested?
- `autoarima`: Use automatic instead of a (0,1,1) ARIMA model?
Details

If residuals=FALSE the autoarima settings are ignored.
If residuals=TRUE, a non-seasonal ARIMA model is estimated for the time series. And the residuals of the fitted model are used as input to the test statistic. If an automatic order selection is used, the Hyndman-Khandakar algorithm is employed with max(p)=max(q) <= 3.

Author(s)
Daniel Ollech

References


Examples

fried(ts(rnorm(120, 10, 10), frequency=12))
fried(ts(rnorm(1200, 10, 10), frequency=7))

isseasonal

Testing the seasonality of series

Description

Using a user-chosen seasonality test, the seasonality of a time series is assessed and a boolean value is returned.

Usage

isseasonal(x, test = "wo", freq = NA)

Arguments

x 
  time series

 test 
  Test to be used

 freq 
  Frequency of the time series

Details

By default, the WO-test is used to assess the seasonality of a time series and returns a boolean. Alternatively, the QS test (test='qs'), Friedman test (test='fried'), Kruskall-Wallis (test='kw'), F-test on seasonal dummies (test='seasdum') or the Welch test (test='welch') can be used.
**Author(s)**
Daniel Ollech

**References**

**Examples**
```r
isSeasonal(ts(rnorm(120, 10, 10), frequency=12))
isSeasonal(ts(rnorm(1200, 10, 10), frequency=7))
```

---

**kw**

**Kruskall Wallis test**

**Description**
Test for seasonality in a time series.

**Usage**
```r
kw(x, freq = NA, diff = T, residuals = F, autoarima = T)
```

**Arguments**
- `x` : time series
- `freq` : Frequency of the time series
- `diff` : Shall the differenced series be tested?
- `residuals` : Shall the residuals of an ARIMA model be tested?
- `autoarima` : Use automatic instead of a (0,1,1) ARIMA model?

**Details**
If residuals=FALSE the autoarima settings are ignored.
If residuals=TRUE, a non-seasonal ARIMA model is estimated for the time series. And the residuals of the fitted model are used as input to the test statistic. If an automatic order selection is used, the Hyndman-Khandakar algorithm is employed with max(p)=max(q) <= 3.

**Author(s)**
Daniel Ollech
References


Examples

```r
kw(ts(rnorm(120, 10, 10), frequency=12))
kw(ts(rnorm(1200, 10, 10), frequency=7))
```

---

**ocsb**

<table>
<thead>
<tr>
<th><strong>OCSB test</strong></th>
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**Description**

Test for seasonal unit root roots in a time series.

**Usage**

```r
ocsb(x, method = "OLS", augmentations = c(3, 0), freq = NA, nrun = 1000, seed = 123)
```

**Arguments**

- `x`: time series
- `method`: "OLS" or "ML"
- `augmentations`: non-seasonal and seasonal order of the augmentations
- `freq`: frequency to be tested
- `nrun`: number of runs in monte carlo simulation
- `seed`: seed for monte carlo simulated based generation of null distribution

**Details**

The null hypothesis of the OCSB is that a series contains a seasonal unit root. This is tested by a Dickey-Fuller type regression. The test regression has often to be augmented by autocorrelational terms to ensure white noise of the error terms.

If seasonal lags are included and method=’OLS’ the test regression is calculated by OLS, so only the seasonal lags are included. If instead of ‘OLS’ method=’ML’ a seasonal AR model is calculated, which implies that high-order non-seasonal lags will be indirectly included as well (see Box and Jenkins, 1970). For seasonal augmentations, ML is quite a bit slower than OLS. The run time can be speeded up by reducing the number of runs of the monte carlo simulation (e.g. nrun=100).

Under the null hypothesis the test statistic follows a non-standard distribution and thus needs to be simulated. The number of runs and the seed can be changed.
print.seastests

Author(s)
Daniel Ollech

References


Examples

```r
teststat <- ocsb(ts(rnorm(70, 10, 10), frequency=7), nrun=200)
check_residuals(teststat)
```

---

Generic function for class seastests

Description

Generic function for class seastests

Usage

```r
## S3 method for class 'seastests'
print(x, ...)
```

Arguments

- `x`: result from seasonality test
- `...`: additional arguments

Author(s)
Daniel Ollech

Examples

```r
a <- qs(ts(rnorm(120, 10, 10), frequency=12))
pnint(a)
summary(a)
```
Description

Test for seasonality in a time series.

Usage

qs(x, freq = NA, diff = T, residuals = F, autoarima = T)

Arguments

x          time series
freq       Frequency of the time series
diff       Shall the differenced series be tested?
residuals  Shall the residuals of ARIMA model be tested?
autoarima  Use automatic instead of a (0,1,1) ARIMA model?

Details

If residuals=FALSE the autoarima settings are ignored.

If residuals=TRUE, a non-seasonal ARIMA model is estimated for the time series. And the residuals of the fitted model are used as input to the test statistic. If an automatic order selection is used, the Hyndman-Khandakar algorithm is employed with max(p)=max(q) <= 3.

Author(s)

Daniel Ollech

References


Examples

qs(ts(rnorm(120, 10, 10), frequency=12))
qs(ts(rnorm(1200, 10, 10), frequency=7))
F-Test on seasonal dummies

Description

Test for seasonality in a time series based on joint significance seasonal dummies in a non-seasonal ARIMA model.

Usage

seasdum(x, freq = NA, autoarima = FALSE)

Arguments

x time series
freq Frequency of the time series
autoarima Use automatic instead of a (0,1,1) ARIMA model?

Details

A RegARIMA model is estimated with (0,1,1)+Seasonal dummies if autoarima=FALSE (default) or (p,d,q)+Seasonal dummies if autoarima=TRUE, (p,d,q) selected by Hyndman-Khandakar algorithm with max(p)=max(q) <= 3. Then the tests checks whether the seasonal dummies are jointly different from zero, i.e. whether deterministic seasonality can be detected in the time series.

Author(s)

Daniel Ollech

References


Examples

seasdum(ts(rnorm(120, 10,10), frequency=12))
seasdum(ts(rnorm(70, 10,10), frequency=7))
**summary.seasinttests**  
*Generic functions for class seasinttests*

**Description**

Generic functions for class seasinttests

**Usage**

```r
## S3 method for class 'seasinttests'
summary(object, ...)  
```

**Arguments**

- `object`: result from seasonal integration test
- `...`: additional arguments

**Author(s)**

Daniel Ollech

**Examples**

```r
a <- qs(ts(rnorm(120, 10, 10), frequency=12))
print(a)
summary(a)
```

---

**summary.seastests**  
*Generic function for class seastests*

**Description**

Generic function for class seastests

**Usage**

```r
## S3 method for class 'seastests'
summary(object, ...)  
```

**Arguments**

- `object`: result from seasonality test
- `...`: additional arguments
Author(s)
Daniel Ollech

Examples

```r
a <- qs(ts(rnorm(120, 10,10), frequency=12))
print(a)
summary(a)
```

---

welch

**Welch seasonality test**

Description

Test for seasonality in a time series using Welch’s ANOVA test.

Usage

```
welch(x, freq = NA, diff = T, residuals = F, autoarima = T, rank = F)
```

Arguments

- **x**: time series
- **freq**: Frequency of the time series
- **diff**: Shall the differenced series be tested?
- **residuals**: Shall the residuals of an ARIMA model be tested?
- **autoarima**: Use automatic instead of a (0,1,1) ARIMA model?
- **rank**: Use rank of series instead of actual values?

Details

If residuals=FALSE the autoarima parameter is ignored.

If rank=TRUE, the test becomes basically a combination of the Kruskall-Wallis and the Welch test.

If residuals=TRUE, a non-seasonal ARIMA model is estimated for the time series. And the residuals of the fitted model are used as input to the test statistic. If an automatic order selection is used, the Hyndman-Khandakar algorithm is employed with max(p)=max(q) <= 3.

Author(s)
Daniel Ollech

References


Examples

```r
welch(ts(rnorm(120, 10,10), frequency=12))
welch(ts(rnorm(1200, 10,10), frequency=7))
```

Description

Webel-Ollech overall seasonality test that combines results from different seasonality tests.

Usage

```r
wo(y, freq = NA)
```

Arguments

- `y`: time series
- `freq`: Frequency of the time series

Details

By default, the WO-test combines the results of the QS-test and the kwman-test, both calculated on the residuals of an automatic non-seasonal ARIMA model. If the p-value of the QS-test is below 0.01 or the p-value of the kwman-test is below 0.002, the WO-test will classify the corresponding time series as seasonal.

If residuals=FALSE the autoarima settings are ignored.

If residuals=TRUE, a non-seasonal ARIMA model is estimated for the time series. And the residuals of the fitted model are used as input to the test statistic. If an automatic order selection is used, the Hyndman-Khandakar algorithm is employed with max(p)=max(q) <= 3.

Author(s)

Daniel Ollech

References


Examples

```r
wo(ts(rnorm(120, 10,10), frequency=12))
wo(ts(rnorm(120, 10,10), frequency=7))
```
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