Package ‘seastests’

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Title  Seasonality Tests
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Description  An overall test for seasonality of a given time
series in addition to a set of individual seasonality tests as
described by Ollech and Webel (forthcoming): An overall seasonality
License  GPL-3
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\textbf{R topics documented:}

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### Description
Get differenced series

### Usage
`diff(x, lag = 1, ...)`

### Arguments
- `x`: time series
- `lag`: which lag
- `...`: further parameters given to `diff()`

Functions used internally in the seasonality package

### Author(s)
Daniel Ollech

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### Description
Get lag

### Usage
`.Lag(x, k)`

### Arguments
- `x`: time series
- `k`: number of lags

Functions used internally in the seasonality package

### Author(s)
Daniel Ollech
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)
**combined_test**

Ollech and Webel’s combined seasonality test

Description

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

Usage

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

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>time series</td>
</tr>
<tr>
<td>freq</td>
<td>Frequency of the time series</td>
</tr>
</tbody>
</table>

Details

By default, the WO-test combines the results of the QS-test and the kw-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 kw-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
combined_test(ts(rnorm(120, 10,10), frequency=12))
combined_test(ts(rnorm(120, 10,10), frequency=7))
```
**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 = "combined", freq = NA)

Arguments

x  time series

test  Test to be used

freq  Frequency of the time series

Details

By default, the combined-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
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
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

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

ocsb

Description

Test for seasonal unit root roots in a time series.

Usage

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.

Author(s)

Daniel Ollech

References


Examples

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

print.seastests

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

qs

*QS test*

Description
Test for seasonality in a time series.

Usage
```r
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

\texttt{qs(ts(rnorm(120, 10,10), frequency=12))}
\texttt{qs(ts(rnorm(1200, 10,10), frequency=7))}

---

\textit{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

\texttt{seasdum(x, freq = NA, autoarima = FALSE)}

Arguments

- \texttt{x} : time series
- \texttt{freq} : Frequency of the time series
- \texttt{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 \( \text{max}(p) = \text{max}(q) \leq 3 \). 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

\texttt{seasdum(ts(rnorm(120, 10,10), frequency=12))}
\texttt{seasdum(ts(rnorm(70, 10,10), frequency=7))}
Summary.seastests  
Generic functions for class seastests

Description
Generic functions for class seastests

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

Arguments
object  result from seasonality test
...     additional arguments

Author(s)
Daniel Ollech

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

Arguments
object  result from seasonal integration test
...     additional arguments
welch

Author(s)
Daniel Ollech

Examples
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

\[
\text{welch}(\text{ts(rnorm}(120, 10, 10), \text{frequency}=12))
\]
\[
\text{welch}(\text{ts(rnorm}(1200, 10, 10), \text{frequency}=7))
\]
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