

Package ‘boiwsa’

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Type Package

Title Seasonal Adjustment of Weekly Data

Version 1.1.2

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Description Perform seasonal adjustment of weekly data. The package provides a user-friendly interface for computing seasonally adjusted estimates of weekly data and includes functions for the creation of country-specific prior adjustment variables, as well as diagnostic tools to assess the quality of the adjustments. The method is described in more detail in Ginker (2023) <[doi:10.13140/RG.2.2.12221.44000](https://doi.org/10.13140/RG.2.2.12221.44000)>.

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gridExtra

LazyData true

Depends R (>= 2.10)

URL <https://github.com/timginker/boiwsa>

BugReports <https://github.com/timginker/boiwsa/issues>

NeedsCompilation no

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Contents

| | |
|-------------------------|---|
| boiwsa | 2 |
| dates_il | 3 |
| find_opt | 4 |
| find_outliers | 5 |
| fourier_vars | 6 |

| | |
|----------------------------|----|
| gasoline.data | 7 |
| genhol | 7 |
| holiday_dates_il | 8 |
| lbm | 9 |
| my_ao | 9 |
| my_rosh | 10 |
| plot.boiwsa | 11 |
| plot_spec | 11 |
| print | 12 |
| print.boiwsa | 12 |
| simple_td | 13 |
| summary | 14 |
| summary.boiwsa | 14 |

| | |
|--------------|-----------|
| Index | 15 |
|--------------|-----------|

| | |
|--------|---|
| boiwsa | <i>Seasonal adjustment of weekly data</i> |
|--------|---|

Description

Performs seasonal adjustment of weekly data. For more details on the usage of this function see the paper or the examples on Github.

Usage

```
boiwsa(
  x,
  dates,
  r = 0.8,
  auto.ao.seacrh = TRUE,
  out.threshold = 3.8,
  ao.list = NULL,
  my.k_1 = NULL,
  H = NULL,
  ic = "aicc",
  method = "additive"
)
```

Arguments

| | |
|----------------|---|
| x | Input time series as a numeric vector |
| dates | a vector of class "Date", containing the data dates |
| r | Defines the rate of decay of the weights. Should be between zero and one. By default is set to 0.8. |
| auto.ao.seacrh | Boolean. Search for additive outliers |
| out.threshold | t-stat threshold in outlier search. By default is 3.8 |

| | |
|---------|---|
| ao.list | Vector with user specified additive outliers in a date format |
| my.k_1 | Numeric vector defining the number of yearly and monthly trigonometric variables. If NULL, is found automatically using the information criteria |
| H | Matrix with holiday- and trading day factors |
| ic | Information criterion used in the automatic search for the number of trigonometric regressors. There are three options: aic, aicc and bic. By default uses aicc |
| method | Decomposition type: additive or multiplicative |

Value

sa Seasonally adjusted series
 my.k_1 Number of trigonometric variables used to model the seasonal pattern
 sf Estimated seasonal effects
 hol.factors Estimated holiday effects
 out.factors Estimated outlier effects
 beta Regression coefficients for the last year
 m lm object. Unweighted OLS regression on the full sample

Author(s)

Tim Ginker

Examples

```
# Not run
# Seasonal adjustment of weekly US gasoline production

data("gasoline.data")
res=boiwsa(x=gasoline.data$y,dates=gasoline.data$date)
```

dates_il *Israeli working dates*

Description

Israeli working dates

Usage

```
dates_il
```

Format

A data frame with 21550 rows and 4 variables:

DATE_VALUE Date

ISR_WORKING_DAY_PART 1: full working day, 0.5: half working day, 0: holiday

JEWISH_FULL_DATE Jewish date

DATE_WEEK_NUMBER Weekday

Source

Personal

| | |
|----------|---|
| find_opt | <i>Find optimal number of fourier variables</i> |
|----------|---|

Description

Searches through the model space to identify the best number of trigonometric variables, with the lowest AIC, AICc or BIC value.

Usage

```
find_opt(
  x,
  dates,
  H = NULL,
  AO = NULL,
  method = "additive",
  l.max = 24,
  k.max = 42,
  by = 6
)
```

Arguments

| | |
|--------|---|
| x | Numeric vector. Time series to seasonally adjust |
| dates | a vector of class "Date", containing the data dates |
| H | (optional) Matrix with holiday and trading day variables |
| AO | (optional) Matrix with additive outlier variables |
| method | Decomposition method: "additive" or "multiplicative". By default uses the additive method |
| l.max | maximal number of the monthly cycle variables to search for |
| k.max | maximal number of the yearly cycle variables to search for |
| by | step size in the search |

Value

list with the optimal number of (yearly and monthly) fourier variables according to AIC, AICc and BIC

Examples

```
data(gasoline.data)

res=find_opt(x=gasoline.data$y,dates=gasoline.data$date)
print(res)
```

| | |
|---------------|-------------------------------|
| find_outliers | <i>Find additive outliers</i> |
|---------------|-------------------------------|

Description

Searches for additive outliers using the method described in Appendix C of Findley et al. (1998). If the number of trigonometric variables is not specified will search automatically through the model space to identify the best number of trigonometric variables, with the lowest AIC, AICc or BIC value.

Usage

```
find_outliers(
  x,
  dates,
  out.tolerance = 3.8,
  my.AO.list = NULL,
  H = NULL,
  my.k_1 = NULL,
  method = "additive"
)
```

Arguments

| | |
|---------------|--|
| x | Numeric vector. Time series to seasonally adjust |
| dates | a vector of class "Date", containing the data dates |
| out.tolerance | t-stat threshold for outliers (see Findley et al., 1998) |
| my.AO.list | (optional) Vector with user defined additive outlier variables |
| H | (optional) Matrix with holiday and trading day variables |
| my.k_1 | (optional) Vector with the number of fourier terms to capture the yearly and monthly cycle. If NULL, would perform automatic search using AICc criterion |
| method | Decomposition method: "additive" or "multiplicative". By default uses the additive method |

Value

my.k_l
 ao list of AO dates

References

Findley, D.F., Monsell, B.C., Bell, W.R., Otto, M.C. and B.C Chen (1998). New capabilities and methods of the X-12-ARIMA seasonal-adjustment program. *Journal of Business & Economic Statistics*, 16(2), pp.127-152.

Examples

```
#Not run:
# Searching for additive outliers in Gasoline data
data(gasoline.data)
ao_list=find_outliers(x=gasoline.data$y,dates = gasoline.data$date)
```

| | |
|--------------|----------------------------------|
| fourier_vars | <i>Create fourier predictors</i> |
|--------------|----------------------------------|

Description

Creates sine and cosine variables to capture intramonthly and intrayear cycles.

Usage

```
fourier_vars(k = 1, l = 1, dates)
```

Arguments

| | |
|-------|--|
| k | Number of pairs of the yearly cycle trigonometric variables |
| l | Number of pairs of the monthly cycle trigonometric variables |
| dates | Vector of dates in a date format |

Value

Matrix with fourier variables

Examples

```
# create a vector of dates
dates=seq.Date(from=as.Date("2023-01-02"),by="weeks",length.out = 100)
# Create a matrix with 20 yearly and 6 monthly pairs of sine and cosine variables
X=fourier_vars(k=20,l=6,dates=dates)
```

| | |
|---------------|--|
| gasoline.data | <i>US finished motor gasoline product supplied</i> |
|---------------|--|

Description

Weekly data beginning 2 February 1991, ending 20 January 2017. Units are "million barrels per day".

Usage

```
gasoline.data
```

Format**Data.Frame:**

A data frame with 1355 rows and 2 columns:

date date in a date format
y gasoline consumption

Source

Originally from the US Energy Information Administration. Copied from the fpp2 package.

| | |
|--------|--|
| genhol | <i>Generate Holiday Regression Variables</i> |
|--------|--|

Description

Can be used to generate moving holiday regressors for the U. S. holidays of Easter, Labor Day, and Thanksgiving; or for Israeli Rosh Hashanah and Pesach. The variables are computed using the Easter formula in Table 2 of Findley et al. (1998). Uses calendar centring to avoid bias.

Usage

```
genhol(dates, holiday.dates, start = 7, end = 7)
```

Arguments

| | |
|---------------|---|
| dates | a vector of class "Date", containing the data dates |
| holiday.dates | a vector of class "Date", containing the occurrences of the holiday. It can be generated with as.Date(). |
| start | integer, shifts backwards the start point of the holiday. Use negative values if start is after the specified date. |
| end | integer, shifts end point of the holiday. Use negative values if end is before the specified date. |

Value

a matrix with holiday variables that can be used as a user defined variable in `boiwsa()`.

References

Findley, D.F., Monsell, B.C., Bell, W.R., Otto, M.C. and B.C Chen (1998). New capabilities and methods of the X-12-ARIMA seasonal-adjustment program. *Journal of Business & Economic Statistics*, 16(2), pp.127-152.

Examples

```
# Creating moving holiday variable for Israeli Rosh Hashanah
data(gasoline.data)
data(holiday_dates_il) # dates of Israeli Rosh Hashanah and Pesach
movehol=genhol(gasoline.data$date, holiday.dates = holiday_dates_il$rosh)
```

| | |
|------------------|-------------------------------------|
| holiday_dates_il | <i>Israeli moving holiday dates</i> |
|------------------|-------------------------------------|

Description

Rosh Hashanah and Pesach dates

Usage

```
holiday_dates_il
```

Format

A data frame with 51 rows and 3 variables:

year Year

rosh Rosh Hashanah date

pesah Pesach date

Source

Personal

| | |
|-----|---|
| lbn | <i>Weekly number of initial registrations in Israeli Employment Services (adjusted for strikes)</i> |
|-----|---|

Description

Weekly data beginning 11 January 2014, ending 4 January 2020.

Usage

lbn

Format**Data.Frame:**

A data frame with 313 rows and 2 columns:

date date in a date format

IES_IN_W_ADJ number of initial registrations

Source

Internal

| | |
|-------|--|
| my_ao | <i>Create additive outlier variables</i> |
|-------|--|

Description

Creates a matrix with additive outlier variables. Uses the original data dates and the user specified outlier dates.

Usage

```
my_ao(dates, out.list)
```

Arguments

dates Vector of dates in a date format

out.list Vector of outlier dates in a date format

Value

AO matrix with outlier variables

Examples

```
# create a sequence of dates
dates=seq.Date(from=as.Date("2023-01-02"),by="weeks",length.out = 100)
# create a vector of outlier dates
my_ao_dates=as.Date(c("2023-01-02","2023-01-03"))
# create a matrix of AO variables
my_ao(dates = dates,out.list = my_ao_dates)
# as you can see there is only one column corresponding to 2023-01-02,
# the second date is ignored because it is not present in the dates vector
```

my_rosh

Internal function for a specific application

Description

Creates a dummy moving holiday variable for the weekly number of initial registrations at the Employment Service in Israel.

Usage

```
my_rosh(dates, holiday.dates, start = -11, end = 12)
```

Arguments

| | |
|---------------|--|
| dates | a vector of class "Date", containing the data dates |
| holiday.dates | a vector of class "Date", containing the occurrences of the holiday. It can be generated with as.Date(). |
| start | -11 for rosh, 3 for pesach |
| end | 12 for rosh, -1 for pesach |

Value

rosh holiday variable

Examples

```
# Creating moving holiday dummy variable for Israeli Rosh Hashanah
data(gasoline.data)
data(holiday_dates_il) # dates of Israeli Rosh Hashanah and Pesach
movehol=my_rosh(gasoline.data$date,holiday.dates = holiday_dates_il$rosh)
```

| | |
|-------------|-------------|
| plot.boiwsa | <i>Plot</i> |
|-------------|-------------|

Description

S3 method for objects of class "boiwsa". Produces a ggplot object of seasonally decomposed time series.

Usage

```
## S3 method for class 'boiwsa'
plot(x, ...)
```

Arguments

| | |
|-----|--|
| x | Result of boiwsa |
| ... | Additional arguments (currently not used). |

| | |
|-----------|---|
| plot_spec | <i>Original and SA data AR spectrum</i> |
|-----------|---|

Description

AR spectrum of the (detrended) original and seasonally adjusted data. Computed using `stats::spec.ar()` with order set to 60.

Usage

```
plot_spec(x)
```

Arguments

| | |
|---|----------------|
| x | boiwsa results |
|---|----------------|

Value

AR spectrum plot

Examples

```
# Not run
# Seasonal adjustment of weekly US gasoline production
res=boiwsa(x=gasoline.data$y,dates=gasoline.data$date)
plot_spec(res)
```

| | |
|-------|-------------------------------|
| print | <i>Generic print function</i> |
|-------|-------------------------------|

Description

This is the generic print function.

Usage

```
print(x, ...)
```

Arguments

| | |
|-----|--|
| x | An object to print. |
| ... | Additional arguments (currently not used). |

| | |
|--------------|--|
| print.boiwsa | <i>Print method for boiwsa objects</i> |
|--------------|--|

Description

S3 method for objects of class boiwsa. Prints a short model summary including the number of trigonometric terms and the position of outliers.

Usage

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

Arguments

| | |
|-----|--|
| x | Result of boiwsa. |
| ... | Additional arguments (currently not used). |

| | |
|-----------|---|
| simple_td | <i>Generate simple working day variable</i> |
|-----------|---|

Description

Aggregates the count of full working days within a week and normalizes it.

Usage

```
simple_td(dates, df.td)
```

Arguments

| | |
|-------|--|
| dates | a vector of class "Date", containing the data dates |
| df.td | dataframe with working days. Its should consist of 2 columns named as "date" and "WORKING_DAY_PART". date column should be of class "Date". WORKING_DAY_PART should be similar to ISR_WORKING_DAY_PART in dates_il |

Value

matrix with trading day variables

Examples

```
library(dplyr)
data(dates_il)
data(gasoline.data)

dates_il%>%
  dplyr::select(DATE_VALUE, ISR_WORKING_DAY_PART)%>%
  `colnames<-`(c("date", "WORKING_DAY_PART"))%>%
  dplyr::mutate(date=as.Date(date))->df.td

td=simple_td(dates = gasoline.data$date,df.td = df.td)
```

| | |
|---------|---------------------------------|
| summary | <i>Generic summary function</i> |
|---------|---------------------------------|

Description

This is the generic summary function.

Usage

```
summary(object, ...)
```

Arguments

| | |
|--------|--|
| object | An object to summarize. |
| ... | Additional arguments (currently not used). |

| | |
|----------------|-------------------------|
| summary.boiwsa | <i>Summary function</i> |
|----------------|-------------------------|

Description

S3 method for objects of class "boiwsa". Prints the regression summary output.

Usage

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

Arguments

| | |
|--------|--|
| object | An object of class boiwsa. |
| ... | Additional arguments (currently not used). |

Index

* datasets

- dates_il, [3](#)
- gasoline.data, [7](#)
- holiday_dates_il, [8](#)
- lbm, [9](#)

boiwsa, [2](#)

dates_il, [3](#)

find_opt, [4](#)

find_outliers, [5](#)

fourier_vars, [6](#)

gasoline.data, [7](#)

genhol, [7](#)

holiday_dates_il, [8](#)

lbm, [9](#)

my_ao, [9](#)

my_rosh, [10](#)

plot.boiwsa, [11](#)

plot_spec, [11](#)

print, [12](#)

print.boiwsa, [12](#)

simple_td, [13](#)

stats::spec.ar(), [11](#)

summary, [14](#)

summary.boiwsa, [14](#)