Package 'transx'

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Title Transform Univariate Time Series

Version 0.0.1

Description Univariate time series operations that follow an opinionated design.
The main principle of 'transx' is to keep the number of observations the same.
Operations that reduce this number have to fill the observations gap.

License GPL-3

Imports rlang

Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

URL https://github.com/kvasilopoulos/transx

BugReports https://github.com/kvasilopoulos/transx/issues

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`demean-demedian` *Removes measure of centrality from the series*

Description

Maturing

Removes the mean, the median or the mode from the series.

Usage

```
demean(x, na.rm = getOption("transx.na.rm"))

demedian(x, na.rm = getOption("transx.na.rm"))

demode(x, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
na.rm	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(2,5,10,20,30)
summary(x)

demean(x)
demedian(x)
demode(x)
```

---

diffx-rdiffx-ldiffx *Compute lagged differnces*

Description

Maturing

Returns suitably lagged and iterated difference

- `diffx` computes simple differences.
- `rdffix` computes percentage differences.
- `ldiffx` computes logged differences.

Usage

```
diffx(x, n = 1L, order = 1L, rho = 1, fill = NA)

rdiffx(x, n = 1L, order = 1L, rho = NULL, fill = NA)

ldiffx(x, n = 1L, order = 1L, rho = 1, fill = NA)
```

Arguments

x	[univariate vector]
	Univariate vector, numeric or ts object with only one dimension.
n	[positive integer(1): 1L]
	Value indicating which lag to use.
order	[positive integer(1): 1L]
	Value indicating the order of the difference.
rho	[numeric(1): NULL]
	Value indicating the autocorrelation parameter. The purpose of this parameter is to provide quasi-differencing assuming the value falls within 0 and 1.
fill	[numeric or function: NA]
	Numeric value(s) or function used to fill observations.

Examples

```
x <- c(2, 4, 8, 20)
diffx(x)
rdiffx(x)
ldiffx(x)
```

---

dtrend *Deterministic Trend*

Description

Stable

Remove global deterministic trend information from the series.

- dt_lin removes the linear trend.
- dt_quad removes the quadratic trend.
- dt_poly removes the nth-degree polynomial trend.

Usage

```
dtrend_lin(x, bp = NULL, na.rm = getOption("transx.na.rm"))

dtrend_quad(x, bp = NULL, na.rm = getOption("transx.na.rm"))

dtrend_poly(x, degree, bp = NULL, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector]
	Univariate vector, numeric or ts object with only one dimension.
bp	[positive integer(1)]
	Break points to define piecewise segments of the data.
na.rm	[logical(1): getOption("transx.na.rm")]
	A value indicating whether NA values should be stripped before the computation proceeds.
degree	[positive integer(1)]
	Value indicating the degree of polynomial

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
set.seed(123)
t <- 1:20

# Linear trend
x <-  3*sin(t) + t
plotx(cbind(x, dtrend_lin(x)))

# Quadratic trend
x2 <-  3*sin(t) + t + t^2
plotx(cbind(raw = x2, quad = dtrend_quad(x2)))

# Introduce a breaking point at point = 10
xbp <- 3*sin(t) + t
xbp[10:20] <- x[10:20] + 15
plotx(cbind(raw = xbp, lin = dtrend_lin(xbp), lin_bp = dtrend_lin(xbp, bp = 10)))
```

---

fill_linear *Fill with "linear approximation"*

Description

Fill with "linear approximation"

Usage

```
fill_linear(body, idx, ...)
```

Arguments

body	[numeric vector] The body of the vector.
idx	[integer vector] the index to replace with.
...	Further arguments passed to \link[stats]{approx}

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(5,3,2,2,5)
xlen <- length(x)
n <- 2
n <- pmin(n, xlen)
idx <- 1:n
body <- x[seq_len(xlen - n)]
fill_linear(body, idx)
```

---

fill_locf *Fill with "Last Observation Carried Forward"*

Description

Fill with "Last Observation Carried Forward"

Usage

```
fill_locf(body, idx, fail = NA)
```

Arguments

body	[numeric vector] The body of the vector.
idx	[integer vector] the index to replace with.
fail	[numeric(1) or numeric vector: fill] In case it fails to fill some values.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(5,3,2,2,5)
lagx(x, n = 2, fill = fill_locf)
leadx(x, n = 2, fill = fill_locf)

lagx(x, n = 2, fill = fill_nocb)
leadx(x, n = 2, fill = fill_nocb)
```

`fill_nocb` *Fill with "Next observation carried backwards"*

Description

Fill with "Next observation carried backwards"

Usage

```
fill_nocb(body, idx, fail = NA)
```

Arguments

`body`	[numeric vector]
	The body of the vector.
`idx`	[integer vector]
	the index to replace with.
`fail`	[numeric(1) or numeric vector: fill]
	In case it fails to fill some values.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(5,3,2,2,5)
leadx(x, n = 2, fill = fill_locf)

xlen <- length(x)
n <- 2
n <- pmin(n, xlen)
idx <- (xlen - n + 1):xlen
body <- x[-seq_len(n)]
fill_locf(body, idx, NA)
```

fill_spline *Fill with "cubic spline interpolation"*

Description

Fill with "cubic spline interpolation"

Usage

```
fill_spline(body, idx, ...)
```

Arguments

body	[numeric vector] The body of the vector.
idx	[integer vector] the index to replace with.
...	Further arguments passed to \link[stats]{spline}

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(5,3,NA,2,5)
fill_spline(x, 3)
```

filter_bk *Baxter-King Filter*

Description

Maturing

This function computes the cyclical component of the Baxter-King filter.

Usage

```
filter_bk(x, fill = NA, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.
...	Further arguments passed to bkfilter.

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_bk(unemp)
plotx(cbind(unemp, unemp_cycle))
```

`filter_bw` *Butterworth Filter*

Description

Maturing

This function computes the cyclical component of the Butterworth filter.

Usage

```
filter_bw(x, ...)
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`...`	Further arguments passed to `bwfilter`.

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_bw(unemp, freq = 10)
plotx(cbind(unemp, unemp_cycle))
```

`filter_cf` *Christiano-Fitzgerald Filter*

Description

Maturing

This function computes the cyclical component of the Christiano-Fitzgerald filter.

Usage

```
filter_cf(x, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
...	Further arguments passed to cffilter.

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_cf(unemp)
plotx(cbind(unemp, unemp_cycle))
```

---

filter_hamilton *Hamilton Filter*

Description

Maturing

This function computes the cyclical component of the Hamilton filter.

Usage

```
filter_hamilton(x, p = 4, horizon = 8, fill = NA)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
p	[integer(1): 4] A value indicating the number of lags
horizon	[integer(1): 8] A value indicating the number of periods to look ahead.
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_hamilton(unemp)
plotx(cbind(unemp, unemp_cycle))
```

filter_hp *Hodrick-Prescot Filter*

Description

Maturing

This function computes the cyclical component of the Hodrick-Prescot filter.

Usage

```
filter_hp(x, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
...	Further arguments passed to hpfilter.

See Also

select_lambda

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_hp(unemp, freq = select_lambda("monthly"))
plotx(cbind(unemp, unemp_cycle))
```

filter_tr *Trigonometric regression Filter*

Description

Maturing

This function computes the cyclical component of the trigonometric regression filter.

Usage

```
filter_tr(x, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
...	Further arguments passed to trfilter.

Examples

```
unemp <- ggplot2::economics$unemploy
unemp_cycle <- filter_tr(unemp, pl=8, pu=40)
plotx(cbind(unemp, unemp_cycle))
```

---

gmean *Geometric Mean value*

Description

Compute the sample geometric mean.

Usage

```
gmean(x, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
na.rm	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

Value

Returns a vector with the same class and attributes as the input vector.

---

leadx-lagx *Compute lagged or leading values*

Description

Stable

Find the "previous" (`lagx()`) or "next" (`leadx()`) values in a vector. Useful for comparing values behind of or ahead of the current values.

Usage

```
lagx(x, n = 1L, fill = NA)

leadx(x, n = 1L, fill = NA)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
n	[positive integer(1): 1L] Value indicating the number of positions to lead or lag by.
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.

Details

This functions has been taken and modified from the `dplyr` package, however, to reduce dependencies they are not imported.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(5,3,2,2,5)
lagx(x)
lagx(x, fill = mean)
lagx(x, fill = fill_nocb)

leadx(x)
leadx(x, fill = fill_locf)
```

---

modex *Mode value*

Description

Compute the sample median.

Usage

```
modex(x, na.rm = getOption("transx.na.rm"))

modex_int(x, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
na.rm	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

out_iqr *Detect outliers with Tukey's method*

Description

Maturing

Usage

```
out_iqr(x, cutoff = 1.5, fill = NA, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
cutoff	[numeric(1): 1.5]
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.
...	further arguments passed to quantile.

Examples

```
out_iqr(c(0,1,3,4,20))
```

out_pt *Detect outliers with Percentiles*

Description

Maturing

Usage

```
out_pt(x, pt_low = 0.1, pt_high = 0.9, fill = NA)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
pt_low	the lowest quantile
pt_high	the highest quantile
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.

Examples

```
x <- c(1, 3, -1, 5, 10, 100)
out_pt(x)
```

`out_score_z` *Detect outliers with zscore*

Description

Maturing

Usage

```
out_score_z(x, cutoff = 3, fill = NA, ...)
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`cutoff`	[numeric(1): 3]
`fill`	[numeric or function: NA] Numeric value(s) or function used to fill observations.
`...`	Further arguments passed to `score`.

Examples

```
out_score_z(c(0,0.1,2,1,3,2.5,2,.5,6,4,100))
```

`out_score_zrob` *Detect outliers Iglewicz and Hoaglin (1993) robust z-score method*

Description

Maturing

Usage

```
out_score_zrob(x, cutoff = 3.5, fill = NA, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
cutoff	[numeric(1): 3.5]
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.
...	further arguments passed to score.

Examples

```
out_score_zrob(c(0,0.1,2,1,3,2.5,2,.5,6,4,100))
```

---

out_threshold *Detect outliers with upper and lower threshold*

Description

Maturing

Usage

```
out_threshold(x, tlow = NULL, thigh = NULL, fill = NA)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
tlow	[numeric(1): NULL] The lower threshold.
thigh	[numeric(1): NULL] The upper threshold.
fill	[numeric or function: NA] Numeric value(s) or function used to fill observations.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(1, 3, -1, 5, 10, 100)
out_threshold(x, tlow = 0, fill = 0)
out_threshold(x, thigh = 9, fill = function(x) quantile(x, 0.9))
```

`out_winsorise` *Winsorize*

Description

Maturing

Replace extremely values that are defined by `min` and `max`.

Usage

```
out_winsorise(x, min = quantile(x, 0.05), max = quantile(x, 0.95))

out_winsorize(x, min = quantile(x, 0.05), max = quantile(x, 0.95))
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`min`	[numeric(1): quantile(x, 0.05)] The lower bound, all values lower than this will be replaced by this value.
`max`	[numeric(1): quantile(x, 0.95)] The upper bound, all values above than this will be replaced by this value.

Value

Returns a vector with the same class and attributes as the input vector.

See Also

`Winsorize`

Examples

```
x <- c(1, 3, -1, 5, 10, 100)
out_winsorise(x)
```

pow *nth Power Transformation*

Description

Stable

Usage

```
pow(x, pow = NULL, modulus = FALSE)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
pow	[numeric(1): NA] The nth power.
modulus	positive

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
pow(2, 2)
pow(-2, 2)
pow(-2,2, TRUE)
```

pow_boxcox *Box-Cox Transformations*

Description

Maturing

Usage

```
pow_boxcox(x, lambda = NULL, lambda2 = NULL, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
lambda	[numeric(1): NULL] Transformation exponent, λ.
lambda2	[numeric(1): NULL] Transformation exponent, λ_2.
...	Further arguments passed to pow.

Value

Returns a vector with the same class and attributes as the input vector.

References

Box, G. E., & Cox, D. R. (1964). An analysis of transformations. Journal of the Royal Statistical Society. Series B (Methodological), 211-252. https://www.jstor.org/stable/2984418

Examples

```
set.seed(123)
x <- runif(10)
pow_boxcox(x, 3)
```

---

pow_manly *Manly(1971) Transformations*

Description

Maturing

The transformation was reported to be successful in transform unimodal skewed distribution into normal distribution, but is not quite useful for bimodal or U-shaped distribution.

Usage

```
pow_manly(x, lambda = NULL)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
lambda	[numeric(1): NULL] Transformation exponent, λ.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
set.seed(123)
x <- runif(10)
pow_manly(x, 3)
```

---

pow_tukey *Tukey Transformations Transformations*

Description

Maturing

Usage

```
pow_tukey(x, lambda = NULL, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
lambda	[numeric(1): NULL] Transformation exponent, λ.
...	Further arguments passed to pow.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
set.seed(123)
x <- runif(10)
pow_tukey(x, 2)
```

---

pow_yj *Yeo and Johnson(2000) Transformations*

Description

Maturing

Usage

```
pow_yj(x, lambda = NULL, ...)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
lambda	[numeric(1): NULL] Transformation exponent, λ.
...	Further arguments passed to pow.

Value

Returns a vector with the same class and attributes as the input vector.

References

Yeo, I., & Johnson, R. (2000). A New Family of Power Transformations to Improve Normality or Symmetry. Biometrika, 87(4), 954-959. http://www.jstor.org/stable/2673623

Examples

```
set.seed(123)
x <- runif(10)
pow_yj(x, 3)
```

---

rebase *Change the base year*

Description

Maturing

Change the base year.

Usage

```
rebase(x, n = NULL)

rebase_origin(x)
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
n	[numeric(1): NULL] The index of the new base year.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- 3:10

# New base  would be 5
rebase(x, 5)

# Or the origin
rebase_origin(x)

# Fro the base to be 100 or 0 then:
rebase(x, 5)*100
rebase(x, 5) - 1
```

`root` *nth Root Transformation*

Description

Stable

- `root`: nth root
- `root_sqrt`: square root
- `root_cubic`: cubic root

Usage

```
root(x, root = NULL, modulus = FALSE)

root_sq(x, ...)

root_cubic(x, ...)
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`root`	[numeric(1): NA] The nth root.
`modulus`	[logical(1): FALSE] Transformation will work for data with both positive and negative `root`.
`...`	Further arguments passed to `root`.

Examples

```
root(4, 2)
root(-4, 2)

root(-4, 2, TRUE)
```

`scale_range` *Rescale*

Description

Maturing

Usage

```
scale_range(x, to, na.rm = getOption("transx.na.rm"))

scale_minmax(x, na.rm = getOption("transx.na.rm"))

scale_unit_len(x, na.rm = getOption("transx.na.rm"))
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`to`	[numeric(2): NULL] Values that will determine the output range.
`na.rm`	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

Details

To rescale a range between an arbitrary set of values [a, b], the formula becomes:

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(10,5,1,-2)
scale_range(x, c(-1, 2))
scale_minmax(x)
```

score *Score transformation*

Description

Stable

These functions calculate the scores according to:

- score_z: Normal(z) distribution
- score_mad: Mean absolute deviation
- score_t: t-distribution
- score_chi: chi-distribution

Usage

```
score_z(x, na.rm = getOption("transx.na.rm"))

score_mad(x, na.rm = getOption("transx.na.rm"))

score_t(x, na.rm = getOption("transx.na.rm"))

score_chisq(x, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
na.rm	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

Details

Because function are known with different names:

- score_z is identical to std_mean
- score_mad is identical to std_median

Value

Returns a vector with the same class and attributes as the input vector.

See Also

scores

Examples

```
x <- seq(-3,3,0.5)
score_z(x)
score_mad(x)
score_t(x)
```

`select_lambda` *Selecting lambda*

Description

Approaches to selecting lambda.

Usage

```
select_lambda(
  freq = c("quarterly", "annual", "monthly", "weekly"),
  type = c("rot", "ru2002")
)
```

Arguments

`freq`	[character: "quarterly"] The frequency of the dataset.
`type`	[character: "rot"] The methodology to select lambda.

Details

Rule of thumb is from Hodrick and Prescot (1997):

- Lambda = 100*(number of periods in a year)^2
- Annual data = 100 x 1^2 = 100
- Quarterly data = 100 x 4^2 = 1,600
- Monthly data = 100 x 12^2 = 14,400
- Weekly data = 100 x 52^2 = 270,400
- Daily data = 100 x 365^2 = 13,322,500

Ravn and Uhlig (2002) state that lambda should vary by the fourth power of the frequency observation ratio;

- Lambda = 6.25 x (number of periods in a year)^4

Thus, the rescaled default values for lambda are:

- Annual data = 1600 x 1^4 = 6.25
- Quarterly data = 1600 x 4^4= 1600
- Monthly data = 1600 x 12^4= 129,600
- Weekly data = 1600 x 12^4 = 33,177,600

References

Hodrick, R. J., & Prescott, E. C. (1997). Postwar US business cycles: an empirical investigation. Journal of Money, credit, and Banking, 1-16.

Ravn, M. O., & Uhlig, H. (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations. Review of economics and statistics, 84(2), 371-376.

`skewness` *Skewness/Kurtosis Value*

Description

Compute the sample skewness/kurtosis

Usage

```
skewness(x, na.rm = getOption("transx.na.rm"))

kurtosis(x, na.rm = getOption("transx.na.rm"))
```

Arguments

`x`	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
`na.rm`	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

`std` *Standarization*

Description

Maturing

Convert number of standard deviations by which the value of a raw score is above or below the mean value of what is being observed or measured.

Usage

```
std_mean(x, na.rm = getOption("transx.na.rm"))

std_median(x, na.rm = getOption("transx.na.rm"))
```

Arguments

x	[univariate vector] Univariate vector, numeric or ts object with only one dimension.
na.rm	[logical(1): getOption("transx.na.rm")] A value indicating whether NA values should be stripped before the computation proceeds.

Value

Returns a vector with the same class and attributes as the input vector.

Examples

```
x <- c(10,2,5,3)
std_mean(x)
scale(x)

std_median(x)
```

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