

Package ‘HighFreq’

September 8, 2016

Type Package

Title High Frequency Data Management

Version 0.1

Date 2015-05-28

Author Jerzy Pawlowski (algoquant)

Maintainer Jerzy Pawlowski <jp3900@nyu.edu>

Description Functions for chaining and joining time series, scrubbing bad data, managing time zones and alligning time indices, converting TAQ data to OHLC format, aggregating data to lower frequency, estimating volatility, skew, and higher moments.

License GPL (>= 2)

Depends rutils,
quantmod,

Imports TTR,
caTools,
lubridate,

Remotes github::algoquant/rutils,

LazyData true

Repository GitHub

URL <https://github.com/algoquant/HighFreq>

RoxygenNote 5.0.1

R topics documented:

adjust_ohlc	2
agg_regate	3
extreme_values	3
get_symbols	4
hf_data	5
price_jumps	6
random_ohlc	7
random_taq	8
roll_apply	8
roll_hurst	10
roll_moment	11

roll_sharpe	12
roll_vwap	13
run_returns	14
run_sharpe	14
run_skew	15
run_variance	16
save_rets	17
save_rets_ohlc	18
save_scrub_agg	18
save_taq	19
scrub_agg	20
scrub_taq	21
season_ality	22
to_period	23

Index	25
--------------	-----------

adjust_ohlc	<i>Adjust the first four columns of OHLC data using the "adjusted" price column.</i>
-------------	--

Description

Adjust the first four columns of OHLC data using the "adjusted" price column.

Usage

```
adjust_ohlc(oh_lc)
```

Arguments

oh_lc an OHLC time series of prices in xts format.

Details

Adjusts the first four OHLC price columns by multiplying them by the ratio of the "adjusted" (sixth) price column, divided by the "close" (fourth) price column.

Value

An OHLC time series with the same dimensions as the input series.

Examples

```
# adjust VTI prices
VTI <- adjust_ohlc(env_etf$VTI)
```

agg_regate	<i>Calculate the aggregation (weighted average) of a statistical estimator over a OHLC time series.</i>
------------	---

Description

Calculate the aggregation (weighted average) of a statistical estimator over a OHLC time series.

Usage

```
agg_regate(oh_lc, mo_moment = "run_variance", weight_ed = TRUE, ...)
```

Arguments

oh_lc	OHLC time series of prices and trading volumes, in xts format.
mo_moment	character string representing function for estimating the moment.
weight_ed	Boolean should estimate be weighted by the trading volume? (default is TRUE)
...	additional parameters to the mo_moment function.

Details

The function `agg_regate()` calculates a single number representing the volume weighted average of an estimator over the OHLC time series of prices. By default the sum is trade volume weighted.

Value

A single numeric value equal to the volume weighted average of an estimator over the time series.

Examples

```
# calculate weighted average variance for SPY (single number)
variance <- agg_regate(oh_lc=SPY, mo_moment="run_variance")
# calculate time series of daily skew estimates for SPY
skew_daily <- apply.daily(x=SPY, FUN=agg_regate, mo_moment="run_skew")
```

extreme_values	<i>Identify extreme values in a single-column xts time series.</i>
----------------	--

Description

Identifies extreme values as those that exceed a multiple of the rolling volatility.

Usage

```
extreme_values(x_ts, win_dow = 51, vol_mult = 2)
```

Arguments

x_ts	single-column xts time series.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.

Details

Calculates the rolling volatility as a quantile of values over a rolling window. Extreme values are those that exceed the product of the volatility multiplier times the rolling volatility. Extreme values are the very tips of the tails when the distribution of values becomes very fat-tailed. The volatility multiplier `vol_mult` controls the threshold at which values are identified as extreme. Smaller volatility multiplier values will cause more values to be identified as extreme.

Value

A Boolean vector with the same number of rows as input time series.

Examples

```
# create local copy of SPY TAQ data
ta_q <- SPY_TAQ
# scrub quotes with suspect bid-offer spreads
bid_offer <- ta_q[, "Ask.Price"] - ta_q[, "Bid.Price"]
sus_pect <- extreme_values(bid_offer, win_dow=win_dow, vol_mult=vol_mult)
# remove suspect values
ta_q <- ta_q[!sus_pect]
```

get_symbols	<i>Download time series data from an external source (by default OHLC prices from YAHOO), and save it into an environment.</i>
-------------	--

Description

Download time series data from an external source (by default OHLC prices from YAHOO), and save it into an environment.

Usage

```
get_symbols(sym_bols, env_out, start_date = "2007-01-01",
            end_date = Sys.Date())
```

Arguments

sym_bols	vector of strings representing instrument symbols (tickers).
env_out	environment for saving the data.
start_date	start date of time series data. (default is "2007-01-01")
end_date	end date of time series data. (default is Sys.Date())

Details

The function `get_symbols` downloads OHLC prices from YAHOO into an environment, adjusts the prices, and saves them back to that environment. The function `get_symbols()` calls the function `getSymbols.yahoo()` to download the OHLC prices, and performs a similar operation to the function `getSymbols()` from package **quantmod**. But `get_symbols()` is faster (because it's more specialized), and is able to handle symbols like "LOW", which `getSymbols()` can't handle because the function `Lo()` can't handle them. The `start_date` and `end_date` must be either of class `Date`, or a string in the format "YYYY-mm-dd". `get_symbols()` returns invisibly the vector of `sym_bols`.

Value

A vector of `sym_bols` returned invisibly.

Examples

```
## Not run:
new_env <- new.env()
get_symbols(sym_bols=c("MSFT", "XOM"),
            env_out=new_env,
            start_date="2012-12-01",
            end_date="2015-12-01")

## End(Not run)
```

hf_data

High frequency data sets

Description

`hf_data.RData` is a file containing the datasets:

SPY an xts time series containing 1-minute OHLC bar data for the SPY etf, from 2008-01-02 to 2014-05-19. SPY contains 625,425 rows of data, each row contains a single minute bar.

TLT an xts time series containing 1-minute OHLC bar data for the TLT etf, up to 2014-05-19.

VXX an xts time series containing 1-minute OHLC bar data for the VXX etf, up to 2014-05-19.

Usage

```
data(hf_data) # not required - data is lazy load
```

Format

Each xts time series contains OHLC data, with each row containing a single minute bar:

Open Open price in the bar

High High price in the bar

Low Low price in the bar

Close Close price in the bar

Volume trading volume in the bar

Source

<https://wrds-web.wharton.upenn.edu/wrds/>

References

Wharton Research Data Service (**WRDS**)

Examples

```
# data(hf_data) # not required - data is lazy load
head(SPY)
chart_Series(x=SPY["2009"])
```

price_jumps	<i>Identify isolated price jumps in a single-column xts time series of prices, based on pairs of large neighboring returns of opposite sign.</i>
-------------	--

Description

Identify isolated price jumps in a single-column xts time series of prices, based on pairs of large neighboring returns of opposite sign.

Usage

```
price_jumps(x_ts, win_dow = 51, vol_mult = 2)
```

Arguments

x_ts	single-column xts time series of prices.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.

Details

Isolated price jumps are single prices that are very different from neighboring values. Price jumps create pairs of large neighboring returns of opposite sign. The function `price_jumps()` first calculates simple returns from prices. Then it calculates the rolling volatility of returns as a quantile of returns over a rolling window. Jump prices are identified as those where neighboring returns both exceed a multiple of the rolling volatility, but the sum of those returns doesn't exceed it.

Value

A Boolean vector with the same number of rows as input time series.

Examples

```
# create local copy of SPY TAQ data
ta_q <- SPY_TAQ
# calculate mid prices
mid_prices <- 0.5 * (ta_q[, "Bid.Price"] + ta_q[, "Ask.Price"])
# replace whole rows containing suspect price jumps with NA, and perform locf()
ta_q[price_jumps(mid_prices, win_dow=31, vol_mult=1.0), ] <- NA
ta_q <- na.locf(ta_q)
```

random_ohlc	<i>Calculate a random OHLC time series of prices and trading volumes, in xts format.</i>
-------------	--

Description

Calculate a random OHLC time series of prices and trading volumes, either by generating random log-normal prices, or by randomly sampling from an input time series.

Usage

```
random_ohlc(oh_lc = NULL, re_duce = TRUE, ...)
```

Arguments

oh_lc	OHLC time series of prices and trading volumes, in xts format.
re_duce	Boolean should oh_lc time series be transformed to reduced form? (default is TRUE)

Details

If the input oh_lc time series is NULL (the default), then a synthetic minutely OHLC time series of random log-normal prices is calculated, over the two previous calendar days. If the input oh_lc time series is not NULL, then the rows of oh_lc are randomly sampled, to produce a random time series. If re_duce is TRUE (the default), then the oh_lc time series is first transformed to reduced form, then randomly sampled, and finally converted to standard form. Note: randomly sampling from an intraday time series over multiple days will cause the overnight price jumps to be re-arranged into intraday price jumps. This will cause moment estimates to become inflated compared to the original time series.

Value

An xts time series with the same dimensions and the same time index as the input oh_lc time series.

Examples

```
# create minutely synthetic OHLC time series of random prices
oh_lc <- HighFreq::random_ohlc()
# create random time series from SPY by randomly sampling it
oh_lc <- HighFreq::random_ohlc(oh_lc=SPY["2012-02-13/2012-02-15"])
```

random_taq	<i>Calculate a random TAQ time series of prices and trading volumes, in xts format.</i>
------------	---

Description

Calculate a TAQ time series of prices and trading volumes, using random log-normal prices and a time index.

Usage

```
random_taq(in_dex = seq(from = as.POSIXct(paste(Sys.Date() - 3, "09:30:00")),
  to = as.POSIXct(paste(Sys.Date() - 1, "16:00:00")), by = "1 sec"),
  bid_offer = 0.001, ...)
```

Arguments

in_dex	time index for the TAQ time series.
bid_offer	the bid-offer spread expressed as a fraction of the prices. The default value is equal to 0.001 (10bps).

Details

The function `random_taq()` calculates an xts time series with four columns containing random log-normal prices: the bid, ask, and trade prices, and the trade volume. If `in_dex` isn't supplied as an argument, then by default it's equal to the secondly index over the two previous calendar days.

Value

An xts time series, with time index equal to the input `in_dex` time index, and with four columns containing the bid, ask, and trade prices, and the trade volume.

Examples

```
# create secondly TAQ time series of random prices
ta_q <- HighFreq::random_taq()
# create random TAQ time series from SPY index
ta_q <- HighFreq::random_taq(in_dex=SPY["2012-02-13/2012-02-15"])
```

roll_apply	<i>Apply an aggregation function over a rolling lookback window and the end points of an OHLC time series.</i>
------------	--

Description

Apply an aggregation function over a rolling lookback window and the end points of an OHLC time series.

Usage

```
roll_apply(oh_lc, agg_fun = "run_variance", win_dow = 11,
  end_points = (0:NROW(oh_lc)), by_columns = FALSE, ...)
```

Arguments

oh_lc	OHLC time series of prices and trading volumes, in xts format.
agg_fun	character string representing an aggregation function to be applied over a rolling lookback window.
win_dow	the size of the lookback window, equal to the number of bars of data used for applying the aggregation function.
end_points	an integer vector of end points.
by_columns	Boolean should the function agg_fun() be applied column-wise (individually), or should it be applied to all the columns combined? (default is FALSE)
...	additional parameters to the agg_fun function.

Details

The function roll_apply() applies an aggregation function over a rolling lookback window and the end points of an OHLC time series.

Performs similar operations to the functions rollapply() and period.apply() from package **xts**, and also the function apply.rolling() from package **PerformanceAnalytics**. (The function rollapply() isn't exported from the package **xts**.)

But the function roll_apply() is faster because it performs less type-checking and other overhead. Unlike the other functions, roll_apply() doesn't produce any leading NA values.

The function roll_apply() can be called in two different ways, depending on the argument end_points. If the argument end_points isn't explicitly passed to roll_apply(), then the default value is used, and roll_apply() performs aggregations over overlapping windows at each point in time. If the argument end_points is explicitly passed to roll_apply(), then roll_apply() performs aggregations over overlapping windows spanned by the end_points.

The aggregation function agg_fun can return either a single value or a vector of values. If the aggregation function agg_fun returns a single value, then roll_apply() returns an xts time series with a single column. If the aggregation function agg_fun returns a vector of values, then roll_apply() returns an xts time series with multiple columns equal to the length of the vector returned by the aggregation function agg_fun.

Value

An xts time series with the same number of rows as the argument oh_lc.

Examples

```
# extract a single day of SPY data
x_ts <- SPY["2012-02-13"]
win_dow <- 11
# calculate the rolling sums of the columns of x_ts
agg_regations <- roll_apply(x_ts, agg_fun=sum, win_dow=win_dow, by_columns=TRUE)
# apply a vector-valued aggregation function over a rolling window
agg_function <- function(x_ts) c(max(x_ts[, 2]), min(x_ts[, 3]))
agg_regations <- roll_apply(x_ts, agg_fun=agg_function, win_dow=win_dow)
# define end points at 11-minute intervals (SPY is minutely bars)
```

```

end_points <- rutils::end_points(x_ts, inter_val=win_dow)
# calculate the rolling sums of the columns of x_ts over end_points
agg_regations <- roll_apply(x_ts, agg_fun=sum, win_dow=2, end_points=end_points, by_columns=TRUE)
# apply a vector-valued aggregation function over the end_points of x_ts
agg_regations <- roll_apply(x_ts, agg_fun=agg_function, win_dow=2, end_points=end_points)

```

roll_hurst	<i>Calculate the rolling Hurst exponent over a rolling lookback window or the end points of an OHLC time series.</i>
------------	--

Description

Calculate the rolling Hurst exponent over a rolling lookback window or the end points of an OHLC time series.

Usage

```
roll_hurst(oh_lc, win_dow = 11, off_set = 0, roll_end_points = FALSE)
```

Arguments

oh_lc	an OHLC time series of prices in xts format.
win_dow	the size of the lookback window, equal to the number of bars of data used for aggregating the OHLC prices.
off_set	the number of bars of data in the first, stub window.
roll_end_points	Boolean should the Hurst exponent be calculated using aggregations over the end points, or by rolling over a lookback window? (default is FALSE)

Details

The function `roll_hurst()` calculates the rolling Hurst exponent in two different ways, depending on the argument `roll_end_points`.

If `roll_end_points` is `FALSE` (the default), then the rolling Hurst exponent is calculated as the logarithm of the ratios of two rolling price range estimates. The Hurst exponent is defined as the logarithm of the ratio of the range of aggregated prices, divided by the average range of prices in each bar. The aggregated prices are calculated over overlapping windows, and the Hurst exponent values are calculated at each point in time.

If `roll_end_points` is `TRUE`, then the rolling Hurst exponent is calculated as the logarithm of the ratios of two rolling variance estimates. The Hurst exponent is defined as the logarithm of the ratio of the variance of aggregated returns, divided by the variance of simple returns. The aggregated returns are calculated over non-overlapping windows spanned by the end points, using the function `to_period()`. The Hurst exponent values are calculated only at the end points. The non-overlapping aggregation windows can be shifted by using the argument `off_set`, which produces a slightly different series of rolling hurst exponent values.

Value

An xts time series with a single column and the same number of rows as the argument `oh_lc`.

Examples

```
# calculate rolling Hurst over SPY
hurst_rolling <- roll_hurst(oh_lc=SPY, win_dow=10)
# calculate Hurst over end points of SPY
hurst_rolling <- roll_hurst(oh_lc=SPY, win_dow=10, off_set=0, roll_end_points=TRUE)
# calculate a series of rolling hurst values using argument off_set
hurst_rolling <- lapply(0:9, roll_hurst, oh_lc=SPY, win_dow=10, roll_end_points=TRUE)
hurst_rolling <- rutils::do_call_rbind(hurst_rolling)
# remove daily warmup periods
hurst_rolling <- hurst_rolling["T09:41:00/T16:00:00"]
chart_Series(x=hurst_rolling["2012-02-13"],
  name=paste(colnames(hurst_rolling), "10-minute aggregations"))
```

roll_moment	<i>Calculate a vector of statistics over an OHLC time series, and calculate a rolling mean over the statistics.</i>
-------------	---

Description

Calculate a vector of statistics over an OHLC time series, and calculate a rolling mean over the statistics.

Usage

```
roll_moment(oh_lc, mo_moment = "run_variance", win_dow = 11,
  weight_ed = TRUE, ...)
```

Arguments

oh_lc	OHLC time series of prices and trading volumes, in xts format.
mo_moment	character string representing a function for estimating statistics of a single bar of OHLC data, such as volatility, skew, and higher moments.
win_dow	the size of the lookback window, equal to the number of bars of data used for calculating the rolling mean.
weight_ed	Boolean should statistic be weighted by trade volume? (default TRUE)
...	additional parameters to the mo_moment function.

Details

The function `roll_moment()` calculates a vector of statistics over an OHLC time series, such as volatility, skew, and higher moments. The statistics could also be any other aggregation of a single bar of OHLC data, for example the High price minus the Low price squared. The length of the vector of statistics is equal to the number of rows of the argument `oh_lc`. Then it calculates a trade volume weighted rolling mean over the vector of statistics over and calculate statistics.

Value

An xts time series with a single column and the same number of rows as the argument `oh_lc`.

Examples

```
# calculate time series of rolling variance and skew estimates
var_rolling <- roll_moment(oh_lc=SPY, win_dow=21)
skew_rolling <- roll_moment(oh_lc=SPY, mo_ment="run_skew", win_dow=21)
skew_rolling <- skew_rolling/(var_rolling)^(1.5)
skew_rolling[1, ] <- 0
skew_rolling <- na.locf(skew_rolling)
```

roll_sharpe	<i>Calculate the rolling Sharpe ratio over a rolling lookback window for an OHLC time series.</i>
-------------	---

Description

Calculate the rolling Sharpe ratio over a rolling lookback window for an OHLC time series.

Usage

```
roll_sharpe(oh_lc, win_dow = 11)
```

Arguments

oh_lc	an OHLC time series of prices in xts format.
win_dow	the size of the lookback window, equal to the number of bars of data used for aggregating the OHLC prices.

Details

The function `roll_sharpe()` calculates the rolling Sharpe ratio as the ratio of absolute returns over the lookback window (not percentage returns), divided by the average volatility of returns.

Value

An xts time series with a single column and the same number of rows as the argument `oh_lc`.

Examples

```
# calculate rolling Sharpe ratio over SPY
sharpe_rolling <- roll_sharpe(oh_lc=SPY, win_dow=10)
```

roll_vwap	<i>Calculate the volume-weighted average price of an OHLC time series over a rolling window (lookback period).</i>
-----------	--

Description

Performs the same operation as function `VWAP()` from package **VWAP**, but using vectorized functions, so it's a little faster.

Usage

```
roll_vwap(oh_lc, x_ts = oh_lc[, 4], win_dow)
```

Arguments

<code>oh_lc</code>	an OHLC time series of prices in xts format.
<code>x_ts</code>	single-column xts time series.
<code>win_dow</code>	the size of the lookback window, equal to the number of bars of data used for calculating the average price.

Details

The function `roll_vwap()` calculates the volume-weighted average closing price, defined as the sum of the prices multiplied by trading volumes in the lookback window, divided by the sum of trading volumes in the window. If the argument `x_ts` is passed in explicitly, then its volume-weighted average value over time is calculated.

Value

An xts time series with a single column and the same number of rows as the argument `oh_lc`.

Examples

```
# calculate and plot rolling volume-weighted average closing prices (VWAP)
prices_rolling <- roll_vwap(oh_lc=SPY["2013-11"], win_dow=11)
chart_Series(SPY["2013-11-12"], name="SPY prices")
add_TA(prices_rolling["2013-11-12"], on=1, col="red", lwd=2)
legend("top", legend=c("SPY prices", "VWAP prices"),
bg="white", lty=c(1, 1), lwd=c(2, 2),
col=c("black", "red"), bty="n")
# calculate running returns
returns_running <- run_returns(x_ts=SPY)
# calculate the rolling volume-weighted average returns
roll_vwap(oh_lc=SPY, x_ts=returns_running, win_dow=11)
```

run_returns	<i>Calculate single period returns from either TAQ or OHLC prices.</i>
-------------	--

Description

Calculate single period returns from either TAQ or OHLC prices.

Usage

```
run_returns(x_ts, extrac_tor = Cl)
```

Arguments

x_ts	xts time series of either TAQ or OHLC data.
extrac_tor	name of function to extract a field (column) from OHLC data. (default is Cl()) from package quantmod)

Details

Calculates single period returns for either TAQ or OHLC data, as the ratio of the differenced prices divided by the time index differences. Identifies the x_ts time series as TAQ data when it has six columns, otherwise assumes it's OHLC data. By default, for OHLC data, it differences the close prices, but can also difference other prices depending on the extractor function.

Value

A single-column xts time series of returns.

Examples

```
# calculate close to close returns
re_turns <- HighFreq::run_returns(x_ts=SPY)
# calculate open to open returns
re_turns <- HighFreq::run_returns(x_ts=SPY, extrac_tor=Op)
```

run_sharpe	<i>Calculate time series of Sharpe-like statistics for each bar of a OHLC time series.</i>
------------	--

Description

Calculate time series of Sharpe-like statistics for each bar of a OHLC time series.

Usage

```
run_sharpe(oh_lc, calc_method = "close")
```

Arguments

oh_lc	an OHLC time series of prices in xts format.
calc_method	character string representing method for estimating the Sharpe-like exponent.

Details

The function `run_sharpe()` calculates Sharpe-like statistics for each bar of a OHLC time series. The Sharpe-like statistic is defined as the ratio of the difference between Close minus Open prices divided by the difference between High minus Low prices. This statistic may also be interpreted as something like a Hurst exponent for a single bar of data. The motivation for the Sharpe-like statistic is the notion that if prices are trending in the same direction inside a given time bar of data, then this statistic is close to either 1 or -1.

Value

An xts time series with the same number of rows as the argument `oh_lc`.

Examples

```
# calculate time series of running Sharpe ratios for SPY
sharpe_running <- run_sharpe(SPY)
```

run_skew	<i>Calculate time series of skew estimates from a OHLC time series.</i>
----------	---

Description

Calculate time series of skew estimates from a OHLC time series.

Usage

```
run_skew(oh_lc, calc_method = "rogers.satchell")
```

Arguments

<code>oh_lc</code>	an OHLC time series of prices in xts format.
<code>calc_method</code>	character string representing method for estimating skew.

Details

The function `run_skew()` calculates skew estimates from OHLC prices at each point in time (row). The methods include Garman-Klass and Rogers-Satchell.

Value

A time series of skew estimates.

Examples

```
# calculate time series of skew estimates for SPY
sk_ew <- HighFreq::run_skew(SPY)
```

run_variance	<i>Calculate a time series of variance estimates for an OHLC time series.</i>
--------------	---

Description

Calculates the variance estimates for each bar of OHLC prices at each point in time (row), using the squared differences of OHLC prices at each point in time.

Usage

```
run_variance(oh_lc, calc_method = "garman.klass_yz")
```

Arguments

oh_lc	an OHLC time series of prices in xts format.
calc_method	character string representing method for estimating variance. The methods include: <ul style="list-style-type: none"> • "close" close to close, • "garman.klass" Garman-Klass, • "garman.klass_yz" Garman-Klass with account for close-to-open price jumps, • "rogers.satchell" Rogers-Satchell, • "yang.zhang" Yang-Zhang,

Details

The function `run_variance()` performs a similar operation to function `volatility()` from package **TTR**, but without calculating a running sum using `runSum()`. It's also a little faster because it performs less data validation. The variance estimation methods "close", "garman.klass_yz", and "yang.zhang" do account for close-to-open price jumps, while the methods "garman.klass" and "rogers.satchell" do not account for close-to-open price jumps.

Value

An xts time series with a single column and the same number of rows as the argument `oh_lc`.

Examples

```
# create minutely OHLC time series of random prices
oh_lc <- HighFreq::random_ohlc()
# calculate variance estimates for oh_lc
var_running <- HighFreq::run_variance(oh_lc)
# calculate variance estimates for SPY
var_running <- HighFreq::run_variance(SPY, calc_method="yang.zhang")
# calculate SPY variance without overnight jumps
var_running <- HighFreq::run_variance(SPY, calc_method="rogers.satchell")
```

save_rets	<i>Load, scrub, aggregate, and rbind multiple days of TAQ data for a single symbol. Calculate returns and save them to a single '*.RData' file.</i>
-----------	---

Description

Load, scrub, aggregate, and rbind multiple days of TAQ data for a single symbol. Calculate returns and save them to a single '*.RData' file.

Usage

```
save_rets(sym_bol, data_dir = "E:/mktdata/sec/",
          output_dir = "E:/output/data/", win_dow = 51, vol_mult = 2,
          period = "minutes", tzzone = "America/New_York")
```

Arguments

sym_bol	character string representing symbol or ticker.
data_dir	character string representing directory containing input '*.RData' files.
output_dir	character string representing directory containing output '*.RData' files.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.
period	aggregation period.
tzzone	timezone to convert.

Details

The function `save_rets` loads multiple days of TAQ data, then scrubs, aggregates, and rbinds them into a OHLC time series. It then calculates returns using function `run_returns`, and stores them in a variable named `'symbol.rets'`, and saves them to a file called `'symbol.rets.RData'`. The TAQ data files are assumed to be stored in separate directories for each `'symbol'`. Each `'symbol'` has its own directory (named `'symbol'`) in the `'data_dir'` directory. Each `'symbol'` directory contains multiple daily '*.RData' files, each file containing one day of TAQ data.

Value

A time series of returns and volume in xts format.

Examples

```
## Not run:
save_rets("SPY")

## End(Not run)
```

save_rets_ohlc	<i>Load OHLC time series data for a single symbol, calculate its returns, and save them to a single '*.RData' file, without aggregation.</i>
----------------	--

Description

Load OHLC time series data for a single symbol, calculate its returns, and save them to a single '*.RData' file, without aggregation.

Usage

```
save_rets_ohlc(sym_bol, data_dir = "E:/output/data/",
               output_dir = "E:/output/data/")
```

Arguments

sym_bol	character string representing symbol or ticker.
data_dir	character string representing directory containing input '*.RData' files.
output_dir	character string representing directory containing output '*.RData' files.

Details

The function `save_rets_ohlc()` loads OHLC time series data from a single file. It then calculates returns using function `run_returns`, and stores them in a variable named `'symbol.rets'`, and saves them to a file called `'symbol.rets.RData'`.

Value

A time series of returns and volume in xts format.

Examples

```
## Not run:
save_rets_ohlc("SPY")

## End(Not run)
```

save_scrub_agg	<i>Load, scrub, aggregate, and rbind multiple days of TAQ data for a single symbol, and save the OHLC time series to a single '*.RData' file.</i>
----------------	---

Description

Load, scrub, aggregate, and rbind multiple days of TAQ data for a single symbol, and save the OHLC time series to a single '*.RData' file.

Usage

```
save_scrub_agg(sym_bol, data_dir = "E:/mktdata/sec/",
  output_dir = "E:/output/data/", win_dow = 51, vol_mult = 2,
  period = "minutes", tzzone = "America/New_York")
```

Arguments

sym_bol	character string representing symbol or ticker.
data_dir	character string representing directory containing input '*.RData' files.
output_dir	character string representing directory containing output '*.RData' files.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.
period	aggregation period.
tzzone	timezone to convert.

Details

The function `save_scrub_agg()` loads multiple days of TAQ data, then scrubs, aggregates, and rbinds them into a OHLC time series, and finally saves it to a single '*.RData' file. The OHLC time series is stored in a variable named 'symbol', and then it's saved to a file named 'symbol.RData' in the 'output_dir' directory. The TAQ data files are assumed to be stored in separate directories for each 'symbol'. Each 'symbol' has its own directory (named 'symbol') in the 'data_dir' directory. Each 'symbol' directory contains multiple daily '*.RData' files, each file containing one day of TAQ data.

Value

An OHLC time series in xts format.

Examples

```
## Not run:
# set data directories
data_dir <- "C:/Develop/data/hfreq/src/"
output_dir <- "C:/Develop/data/hfreq/scrub/"
sym_bol <- "SPY"
# aggregate SPY TAQ data to 15-min OHLC bar data, and save the data to a file
save_scrub_agg(sym_bol=sym_bol, data_dir=data_dir, output_dir=output_dir, period="15 min")

## End(Not run)
```

save_taq	<i>Load and scrub multiple days of TAQ data for a single symbol, and save it to multiple '*.RData' files.</i>
----------	---

Description

Load and scrub multiple days of TAQ data for a single symbol, and save it to multiple '*.RData' files.

Usage

```
save_taq(sym_bol, data_dir = "E:/mktdata/sec/",
         output_dir = "E:/output/data/", win_dow = 51, vol_mult = 2,
         tzone = "America/New_York")
```

Arguments

sym_bol	character string representing symbol or ticker.
data_dir	character string representing directory containing input ‘*.RData’ files.
output_dir	character string representing directory containing output ‘*.RData’ files.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.
tzone	timezone to convert.

Details

The function `save_taq()` loads multiple days of TAQ data, scrubs it, and saves the scrubbed TAQ data to individual ‘*.RData’ files. It uses the same file names for output as the input file names. The TAQ data files are assumed to be stored in separate directories for each ‘symbol’. Each ‘symbol’ has its own directory (named ‘symbol’) in the ‘data_dir’ directory. Each ‘symbol’ directory contains multiple daily ‘*.RData’ files, each file containing one day of TAQ data.

Value

A TAQ time series in xts format.

Examples

```
## Not run:
save_taq("SPY")

## End(Not run)
```

scrub_agg	<i>Scrub a single day of TAQ data, aggregate it, and convert to OHLC format.</i>
-----------	--

Description

Scrub a single day of TAQ data, aggregate it, and convert to OHLC format.

Usage

```
scrub_agg(ta_q, win_dow = 51, vol_mult = 2, period = "minutes",
         tzone = "America/New_York")
```

Arguments

ta_q	TAQ time series in xts format.
win_dow	number of data points for estimating rolling volatility.
vol_mult	volatility multiplier.
period	aggregation period.
tzone	timezone to convert.

Details

The function `scrub_agg()` performs:

- index timezone conversion,
- data subset to trading hours,
- removal of duplicate time stamps,
- scrubbing of quotes with suspect bid-offer spreads,
- scrubbing of quotes with suspect price jumps,
- cbinding of mid prices with volume data,
- aggregation to OHLC using function `to.period` from package `xts`,

Valid 'period' character strings include: "minutes", "3 min", "5 min", "10 min", "15 min", "30 min", and "hours". The time index of the output time series is rounded up to the next integer multiple of 'period'.

Value

A OHLC time series in xts format.

Examples

```
# create random TAQ prices
ta_q <- HighFreq::random_taq()
# aggregate to ten minutes OHLC data
oh_lc <- HighFreq::scrub_agg(ta_q, period="10 min")
chart_Series(oh_lc, name="random prices")
# scrub and aggregate a single day of SPY TAQ data to OHLC
oh_lc <- HighFreq::scrub_agg(ta_q=SPY_TAQ)
chart_Series(oh_lc, name=sym_bol)
```

scrub_taq	<i>Scrub a single day of TAQ data in xts format, without aggregation.</i>
-----------	---

Description

Scrub a single day of TAQ data in xts format, without aggregation.

Usage

```
scrub_taq(ta_q, win_dow = 51, vol_mult = 2, tzone = "America/New_York")
```

Arguments

<code>ta_q</code>	TAQ time series in <code>xts</code> format.
<code>win_dow</code>	number of data points for estimating rolling volatility.
<code>vol_mult</code>	volatility multiplier.
<code>tzone</code>	timezone to convert.

Details

The function `scrub_taq()` performs the same scrubbing operations as `scrub_agg`, except it doesn't aggregate, and returns the TAQ data in `xts` format.

Value

A TAQ time series in `xts` format.

Examples

```
ta_q <- HighFreq::scrub_taq(ta_q=SPY_TAQ, win_dow=11, vol_mult=1)
# create random TAQ prices and scrub them
ta_q <- HighFreq::random_taq()
ta_q <- HighFreq::scrub_taq(ta_q=ta_q)
ta_q <- HighFreq::scrub_taq(ta_q=ta_q, win_dow=11, vol_mult=1)
```

<code>season_ality</code>	<i>Perform seasonality aggregations over a single-column xts time series.</i>
---------------------------	---

Description

Perform seasonality aggregations over a single-column `xts` time series.

Usage

```
season_ality(x_ts, in_dex = format(index(x_ts), "%H:%M"))
```

Arguments

<code>x_ts</code>	single-column <code>xts</code> time series.
<code>in_dex</code>	vector of character strings representing points in time, of the same length as the argument <code>x_ts</code> .

Details

The function `season_ality()` calculates the mean of values observed at the same points in time specified by the argument `in_dex`. An example of a daily seasonality aggregation is the average price of a stock between 9:30AM and 10:00AM every day, over many days. The argument `in_dex` is passed into function `tapply()`, and must be the same length as the argument `x_ts`.

Value

An `xts` time series with mean aggregations over the seasonality interval.

Examples

```
# calculate running variance of each minutely OHLC bar of data
x_ts <- run_variance(SPY)
# remove overnight variance spikes at "09:31"
in_dex <- format(index(x_ts), "%H:%M")
x_ts <- x_ts[!in_dex=="09:31", ]
# calculate daily seasonality of variance
var_seasonal <- season_ality(x_ts=x_ts)
chart_Series(x=var_seasonal, name=paste(colnames(var_seasonal),
  "daily seasonality of variance"))
```

to_period	<i>Aggregate an OHLC time series to a lower periodicity.</i>
-----------	--

Description

Given an OHLC time series at high periodicity (say seconds), calculates the OHLC prices at lower periodicity (say minutes).

Usage

```
to_period(oh_lc, period = "minutes", k = 1,
  end_points = xts::endpoints(oh_lc, period, k))
```

Arguments

oh_lc	an OHLC time series of prices in xts format.
period	aggregation interval ("seconds", "minutes", "hours", "days", "weeks", "months", "quarters", and "years").
k	number of periods to aggregate over (for example if period="minutes" and k=2, then aggregate over two minute intervals.)
end_points	an integer vector of end points.

Details

The function `to_period()` performs a similar aggregation as function `to.period()` from package `xts`, but has the flexibility to aggregate to a user-specified vector of end points. The function `to_period()` simply calls the compiled function `toPeriod()` (from package `xts`), to perform the actual aggregations. If `end_points` are passed in explicitly, then the `period` argument is ignored.

Value

A OHLC time series of prices in xts format, with a lower periodicity defined by the `end_points`.

Examples

```
# define end points at 10-minute intervals (SPY is minutely bars)
end_points <- rutils::end_points(SPY["2009"], inter_val=10)
# aggregate over 10-minute end_points:
to_period(x_ts=SPY["2009"], end_points=end_points)
# aggregate over days:
to_period(x_ts=SPY["2009"], period="days")
# equivalent to:
to.period(x=SPY["2009"], period="days", name=rutils::na_me(SPY))
```


Index

*Topic **datasets**

hf_data, [5](#)

adjust_ohlc, [2](#)

agg_regate, [3](#)

extreme_values, [3](#)

get_symbols, [4](#)

hf_data, [5](#)

price_jumps, [6](#)

random_ohlc, [7](#)

random_taq, [8](#)

roll_apply, [8](#)

roll_hurst, [10](#)

roll_moment, [11](#)

roll_sharpe, [12](#)

roll_vwap, [13](#)

run_returns, [14](#)

run_sharpe, [14](#)

run_skew, [15](#)

run_variance, [16](#)

save_rets, [17](#)

save_rets_ohlc, [18](#)

save_scrub_agg, [18](#)

save_taq, [19](#)

scrub_agg, [20](#)

scrub_taq, [21](#)

season_ality, [22](#)

SPY (hf_data), [5](#)

to_period, [23](#)