Package 'bidask'

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Type Package

Title Efficient Estimation of Bid-Ask Spreads from Open, High, Low, and Close Prices

Version 1.0.0

Description Implements an efficient estimation procedure of bid-ask spreads from open, high, low, and close prices as described in Ardia-Guidotti-Kroencke <https://www.ssrn.com/abstract=3892335>. Moreover, it provides an implementation of the estimators proposed in Roll (1984) <doi:10.1111/j.1540-6261.1984.tb03897.x>, Corwin-Schultz (2012) <doi:10.1111/j.1540-6261.2012.01729.x>, and Abdi-Ranaldo (2017) <doi:10.1093/rfs/hhx084>.

License GPL-3

URL https://github.com/eguidotti/bidask

BugReports https://github.com/eguidotti/bidask/issues

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NeedsCompilation no

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edge *Efficient Estimation of Bid-Ask Spreads from OHLC Prices*

Description

Implements an efficient estimation procedure of the bid-ask spread from Open, High, Low, and Close prices as proposed in Ardia, Guidotti, Kroencke (2021).

Usage

```
edge(open, high, low, close, na.rm = FALSE)
```

Arguments

`open`	numeric vector of Open prices.
`high`	numeric vector of High prices.
`low`	numeric vector of Low prices.
`close`	numeric vector of Close prices.
`na.rm`	a `logical` value indicating whether `NA` values should be stripped before the computation proceeds.

Details

Prices must be sorted in ascending order of the timestamp.

Value

The spread estimate.

References

Ardia, D., Guidotti E., & Kroencke T. A. (2021). Efficient Estimation of Bid-Ask Spreads from Open, High, Low, and Close Prices. Available at SSRN: https://www.ssrn.com/abstract=3892335

sim *Simulation of OHLC Prices*

Description

This function performs simulations consisting of `n` periods (e.g., days) and where each period consists of a given number of `trades` (e.g., each minute). For each trade, the true value of the stock price, P_m, is simulated as $P_m = P_{m-1}e^{\sigma x}$, where σ is the standard deviation per trade and x is a random draw from a unit normal distribution. The standard deviation per period is equal to the `volatility` and the standard deviation per trade equals the `volatility` divided by the square root of the number of `trades`. In each simulation, the trades are assumed to be observed with a given `probability`. The bid (ask) for each trade is defined as P_m multiplied by one minus (plus) half the assumed bid-ask `spread` and we assume a 50% chance that a bid (ask) is observed. High and low prices equal the highest and lowest prices observed during the period. Open and Close prices equal the first and the last price observed in the period. If no trade is observed at time t, then the previous Close at time $t-1$ is used as the Open, High, Low, and Close prices at time t. The simulations may include close-to-open returns (e.g., overnight `jumps`).

Usage

```
sim(
  n = 10000,
  trades = 390,
  prob = 1,
  spread = 0.01,
  volatility = 0.03,
  jump = 0,
  drift = 0,
  askhigh = FALSE,
  bidlow = FALSE,
  units = "day"
)
```

Arguments

`n`	the number of periods to simulate.
`trades`	the number of trades per period.
`prob`	the probability to observe a trade.
`spread`	the percentage spread.
`volatility`	the close-to-close volatility.
`jump`	the close-to-open volatility.
`drift`	the expected return per period.
`askhigh`	if `TRUE`, returns the column `AskHigh` containing 1 if the High price is buyer initiated and 0 otherwise.

bidlow	if TRUE, returns the column BidLow containing 1 if the Low price is seller initiated and 0 otherwise.
units	the units of the time period. One of: sec, min, hour, day, week, month, year.

Value

Simulated OHLC prices.

References

Corwin, S. A., & Schultz, P. (2012). A simple way to estimate bid-ask spreads from daily high and low prices. The Journal of Finance, 67 (2), 719-760. doi:10.1111/j.15406261.2012.01729.x

Abdi, F., & Ranaldo, A. (2017). A simple estimation of bid-ask spreads from daily close, high, and low prices. The Review of Financial Studies, 30 (12), 4437-4480. doi:10.1093/rfs/hhx084

Ardia, D., Guidotti E., & Kroencke T. A. (2021). Efficient Estimation of Bid-Ask Spreads from Open, High, Low, and Close Prices. Available at SSRN: https://www.ssrn.com/abstract=3892335

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spread *Estimation of Bid-Ask Spreads from OHLC Prices*

Description

This function estimates bid-ask spreads from open, high, low, and close prices with several methods.

Usage

```
spread(
  x,
  width = nrow(x),
  method = "EDGE",
  probs = c(0.025, 0.975),
  na.rm = FALSE,
  trim = 0
)
```

Arguments

x	xts object with columns named Open, High, Low, Close, representing OHLC prices.
width	integer width of the rolling window to use, or vector of endpoints defining the intervals to use. By default, the whole time series is used to compute a single spread estimate.
method	the estimator(s) to use. Choose one or more of: EDGE, AR, AR2, CS, CS2, ROLL, O, OC, OHL, OHLC, C, CO, CHL, CHLO, or GMM. See details.

probs — vector of probabilities to compute the critical values when the method EDGE is selected. By default, the critical values at 2.5% and 97.5% are computed.

na.rm — a logical value indicating whether NA values should be stripped before the computation proceeds.

trim — the fraction (0 to 0.5) of observations to be trimmed from each end before the spread is computed. Values of trim outside that range are taken as the nearest endpoint.

Details

The method EDGE implements the Efficient Discrete Generalized Estimator proposed in Ardia-Guidotti-Kroencke (2021).

The methods O, OC, OHL, OHLC, C, CO, CHL, CHLO implement the generalized estimators described in Ardia-Guidotti-Kroencke (2021). They can be combined by concatenating their identifiers, e.g., OHLC.CHLO uses an average of the OHLC and CHLO estimators. The method GMM combines the 8 OHLC estimators with the Generalized Method of Moments.

The method AR implements the estimator proposed in Abdi & Ranaldo (2017). AR2 implements the 2-period adjusted version.

The method CS implements the estimator proposed in Corwin & Schultz (2012). CS2 implements the 2-period adjusted version. Both versions are adjusted for overnight returns as described in the paper.

The method ROLL implements the estimator proposed in Roll (1984).

Value

Time series of spread estimates.

References

Roll, R. (1984). A simple implicit measure of the effective bid-ask spread in an efficient market. The Journal of Finance, 39 (4), 1127-1139. doi:10.1111/j.15406261.1984.tb03897.x

Corwin, S. A., & Schultz, P. (2012). A simple way to estimate bid-ask spreads from daily high and low prices. The Journal of Finance, 67 (2), 719-760. doi:10.1111/j.15406261.2012.01729.x

Abdi, F., & Ranaldo, A. (2017). A simple estimation of bid-ask spreads from daily close, high, and low prices. The Review of Financial Studies, 30 (12), 4437-4480. doi:10.1093/rfs/hhx084

Ardia, D., Guidotti E., & Kroencke T. A. (2021). Efficient Estimation of Bid-Ask Spreads from Open, High, Low, and Close Prices. Available at SSRN: https://www.ssrn.com/abstract=3892335

Examples

```
# simulate a price process with spread 1%
x <- sim(spread = 0.01)

# estimate the spread with EDGE
edge(x$Open, x$High, x$Low, x$Close)
```

```
# by default this is equivalent to
spread(x)

# use a rolling window of 21 periods
spread(x, width = 21)

# compute the spread for each month
ep <- xts::endpoints(x, on = "months")
spread(x, width = ep)

# compute the critical values at 5% and 95%
spread(x, probs = c(0.05, 0.95))

# use multiple estimators
spread(x, method = c("EDGE", "AR", "CS", "ROLL", "OHLC", "OHL.CHL", "GMM"))
```

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