

Package: empiricaloptions (via r-universe)

September 29, 2026

Type Package

Title Empirical 'Martingale' Option Pricing from Historical Data

Version 0.1.0

Description Prices European and arithmetic Asian options directly from a single historical price series, with no option-market calibration input. An AR(1) filter removes linear predictability from discounted log-prices, a stationary block bootstrap (Politis and Romano, 1994) resamples the residuals to preserve dependence beyond the mean, and a Duan-Simonato (1998) scalar correction enforces the martingale condition required by the Fundamental Theorem of Asset Pricing. Intended for underlyings with no quoted option market to calibrate against (private indices, embedded insurance options, participation certificates).

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Encoding UTF-8

LazyData true

Depends R (>= 3.5)

Imports tseries, stats

Suggests testthat (>= 3.0.0), knitr, rmarkdown, quantmod, FinTS

Config/testthat/edition 3

RoxygenNote 7.3.2

VignetteBuilder knitr

URL <https://techtonique.r-universe.dev/empiricaloptions>

BugReports <https://github.com/thierrymoudiki/empoptions/issues>

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eq_pool	<i>Build an empirical residual pool from a historical price series</i>
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Description

Fits a no-intercept AR(1) to first-differenced, discounted log-prices, then resamples the centered residuals with a stationary block bootstrap (Politis and Romano, 1994). The resulting pool is the reusable input to [eq_price](#) and [eq_price_asian](#): build it once per discount rate and price as many strikes, maturities, and payoff types as needed from it.

Usage

```
eq_pool(prices, r, dt = 1/252, window = NULL, n_sims = 10000L, seed = 123)
```

Arguments

prices	Numeric vector of historical prices, ordered by date, with no missing values (interpolate or drop NAs beforehand).
r	Discount / funding rate (annualized, continuously compounded) used to discount prices into log-space before differencing.
dt	Time step between observations, in years (default 1/252 for daily data).
window	Optional trailing window length, in observations, to use instead of the full history (e.g. 252 for a trailing one-year window). NULL (default) uses the full series.
n_sims	Number of bootstrap paths to draw (default 10000).
seed	Random seed used for the bootstrap draw, for reproducibility.

Value

An object of class "eq_pool": a list with the resampled residual matrix (n_w rows by n_sims columns), the fitted AR(1) coefficient, and diagnostic statistics (Ljung-Box and ARCH-LM p-values on the pre-bootstrap residuals, annualized volatility, skew, and excess kurtosis).

References

Politis, D. N. and Romano, J. P. (1994). The stationary bootstrap. *Journal of the American Statistical Association*, 89(428), 1303-1313.

Examples

```
set.seed(1)
prices <- cumprod(1 + rnorm(500, 0.0003, 0.01)) * 100
pool <- eq_pool(prices, r = 0.03)
pool
```

eq_price

*Price European options from an empirical residual pool***Description**

Reconstructs terminal prices at maturity T by cumulating bootstrap residuals in log-space, applies a Duan-Simonato (1998) scalar martingale correction, and Monte Carlo-prices the requested strikes. Calls and puts are priced from the *same* simulated terminal draws, so put-call parity holds up to Monte Carlo noise by construction.

Usage

```
eq_price(pool, S0, T, K, type = c("call", "put"), eps_scale = 1)
```

Arguments

pool	An "eq_pool" object from eq_pool .
S0	Current (spot) price of the underlying.
T	Maturity, in years.
K	Numeric vector of strikes.
type	"call" or "put".
eps_scale	Optional scalar multiplier applied to the bootstrapped residuals before reconstruction (default 1); mainly a tool for sensitivity analysis, not needed in ordinary use.

Value

A list with components prices (named by strike), c_ds (the Duan-Simonato correction applied), and sigma_atm (the annualized at-the-money volatility implied by the simulated terminal distribution).

References

Duan, J.-C. and Simonato, J.-G. (1998). Empirical martingale simulation for asset prices. *Management Science*, 44(9), 1218-1233.

Examples

```
set.seed(1)
prices <- cumprod(1 + rnorm(500, 0.0003, 0.01)) * 100
pool <- eq_pool(prices, r = 0.03)
eq_price(pool, S0 = 100, T = 0.5, K = c(95, 100, 105), type = "call")
```

eq_price_asian	<i>Price arithmetic Asian call options from an empirical residual pool</i>
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Description

Extends [eq_price](#) to a path-dependent payoff by applying a date-specific Duan-Simonato correction at each fixing date, then averaging the corrected simulated path before applying the payoff. Requires no additional inputs beyond the pool already built for European pricing.

Usage

```
eq_price_asian(pool, S0, T, K, n_fix)
```

Arguments

pool	An "eq_pool" object from eq_pool .
S0	Current (spot) price of the underlying.
T	Maturity, in years.
K	Numeric vector of strikes.
n_fix	Number of (equally spaced) fixing/averaging dates up to T.

Value

Named numeric vector of arithmetic Asian call prices, one per strike.

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