Package 'esback'

September 3, 2023

Type Package

Title Expected Shortfall Backtesting

Version 0.3.1

Date 2023-09-02

Description Implementations of the expected shortfall backtests of Bayer and Dimitri-
adis (2020) <doi:10.1093/jjfinec/nbaa013>
as well as other well known backtests from the literature. Can be used to assess the correct-
ness of forecasts of the
expected shortfall risk measure which is e.g. used in the banking and finance industry for quanti-
fying the market risk
of investments. A special feature of the backtests of Bayer and Dimitri-
adis (2020) <doi:10.1093/jjfinec/nbaa013>
is that they only require forecasts of the expected shortfall, which is in striking con-
trast to all other existing
backtests, making them particularly attractive for practitioners.

License GPL-3

Encoding UTF-8

LazyData true

Depends R(>= 2.10.0)

Imports esreg

RoxygenNote 7.2.3

NeedsCompilation no

Author Sebastian Bayer [aut, cre],
Timo Dimitriadis [aut]

Maintainer Sebastian Bayer <sebastian.bayer@uni-konstanz.de>

Repository CRAN

Date/Publication 2023-09-03 19:10:05 UTC

R topics documented:

cc_backtest   *Conditional Calibration Backtest*

Description

The simple and general conditional calibration backtests of Nolde & Ziegel (2007).

Usage

```
cc_backtest(r, q, e, s = NULL, alpha, hommel = TRUE)
```

Arguments

r	A vector of returns.
q	A vector of Value-at-Risk forecasts.
e	A vector of Expected Shortfall forecasts.
s	A vector of volatility forecasts.
alpha	Scalar probability level in (0, 1).
hommel	If TRUE, use Hommels correction, otherwise use the classical Bonferroni correction.

Value

Returns a list with the following components:

- pvalue_twosided_simple
- pvalue_onesided_simple
- pvalue_twosided_general
- pvalue_onesided_general

References

Nolde & Ziegel (2007) doi:10.1214/17AOAS1041

Examples

```
data(risk_forecasts)
r <- risk_forecasts$r
q <- risk_forecasts$q
e <- risk_forecasts$e
s <- risk_forecasts$s
cc_backtest(r = r, q = q, e = e, s = s, alpha = 0.025)
```

---

er_backtest	*Exceedance Residuals Backtest*

Description

Tests whether the mean of the exceedance residuals, respectively the mean of the standardized exceedance residuals is zero.

Usage

```
er_backtest(r, q, e, s = NULL, B = 1000)
```

Arguments

r	A vector of returns.
q	A vector of Value-at-Risk forecasts.
e	A vector of Expected Shortfall forecasts.
s	A vector of volatility forecasts.
B	Number of bootstrap iterations

Value

Returns a list with the following components:

- pvalue_twosided_simple
- pvalue_onesided_simple
- pvalue_twosided_standardized
- pvalue_onesided_standardized

References

McNeil & Frey (2000) doi:10.1016/S09275398(00)000128

Examples

```
data(risk_forecasts)
r <- risk_forecasts$r
q <- risk_forecasts$q
e <- risk_forecasts$e
s <- risk_forecasts$s
er_backtest(r = r, q = q, e = e, s = s)
```

---

esback   *esback: A package for backtesting expected shortfall forecasts*

Description

The esback package contains functions for backtesting expected shortfall forecasts.

Available backtest functions

- [Exceedance Residuals Backtest (McNeil & Frey, 2000)]
- [Conditional Calibration Backtest (Nolde & Ziegel, 2017)]
- [Expeced Shortfall Regression Backtests (Bayer & Dimitriadis, 2018)]

Author(s)

Maintainer: Sebastian Bayer `<sebastian.bayer@uni-konstanz.de>`

Authors:

- Timo Dimitriadis `<timo.dimitriadis@awi.uni-heidelberg.de>`

---

esr_backtest   *Expected Shortfall Regression Backtest*

Description

This function implements multiple expected shortfall regression (esreg) based backtests. Using the `version` argument, the following backtests are available:

1. ("Strict ESR") Regresses the returns on the expected shortfall forecasts and tests the ES coefficients for (0, 1).

2. ("Auxiliary ESR") Regresses the returns on the quantile and the expected shortfall forecasts and tests the ES coefficients for (0, 1).

3. ("Strict Intercept") Tests whether the expected shortfall of the forecast error r - e is zero.

Usage

```
esr_backtest(
  r,
  q,
  e,
  alpha,
  version,
  B = 0,
  cov_config = list(sparsity = "nid", sigma_est = "scl_sp", misspec = TRUE)
)
```

Arguments

r	A vector of returns.
q	A vector of Value-at-Risk forecasts.
e	A vector of Expected Shortfall forecasts.
alpha	Scalar probability level in (0, 1).
version	Version of the backtest to be used
B	Number of bootstrap samples. Set to 0 to disable bootstrapping.
cov_config	a list with three components: sparsity, sigma_est, and misspec, see vcovA

Value

Returns a list with the following components:

- pvalue_two_sided_asymptotic
- pvalue_one_sided_asymptotic (for version 3)
- pvalue_two_sided_bootstrap
- pvalue_one_sided_bootstrap (for version 3)

References

Bayer & Dimitriadis (2020) doi:10.1093/jjfinec/nbaa013

Examples

```
data(risk_forecasts)
r <- risk_forecasts$r
q <- risk_forecasts$q
e <- risk_forecasts$e
esr_backtest(r = r, q = q, e = e, alpha = 0.025, version = 1)
```

---

risk_forecasts	*Returns and risk forecasts for the S&P 500 index*

Description

A dataset containing the daily log returns and risk forecasts for the S&P 500 index. The quantile and expected shortfall forecasts are for the probability level 2.5%.

Usage

```
data(risk_forecasts)
```

Format

A data.frame with 4396 rows and 4 variables

Details

Description of the variables:

r Daily log returns from January 3, 2000 to September 29, 2017 (4465 days)

q Value-at-Risk forecasts of the Historical Simulation approach

e Expected shortfall forecasts of the Historical Simulation approach

s Volatility forecasts of the Historical Simulation approach

Index