

Package ‘DiversificationR’

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Type Package

Title Econometric Tools to Measure Portfolio Diversification

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Description

Diversification is one of the most important concepts in portfolio management. This framework offers scholars, practitioners and policymakers a useful toolbox to measure diversification. Specifically, this framework provides recent diversification measures from the recent literature. These diversification measures are based on the works of Rudin and Morgan (2006) <doi:10.3905/jpm.2006.611807>, Choueifaty and Coignard (2008) <doi:10.3905/JPM.2008.35.1.40>, Vermorken et al. (2012) <doi:10.3905/jpm.2012.39.1.067>, Flores et al. (2017) <doi:10.3905/jpm.2017.43.4.112>, Calvet et al. (2007) <doi:10.1086/524204>, and Candelon, Fuerst and Hasse (2020).

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data_efficient_portfolios_returns
Efficient portfolios returns

Description

This dataset includes efficient real estate portfolios returns from 1999 to 2018 (annual frequency). Overall, country- and -sector level portfolios are computed in both Markowitz and Black-Litterman frameworks.

Usage

```
data("data_efficient_portfolios_returns")
```

Format

The format is: num [1:19, 1:6] 7.87 6.93 6.32 6.92 7.1 ... - attr(*, "dimnames")=List of 2 ..\$: NULL ..\$: chr [1:6] "v_Overall_M" "v_Countries_M" "v_Sectors_M" "v_Overall_BL" ...

Source

Author's own calculations based on MSCI dataset.

References

Candelon, Bertrand, Franz Fuerst, and Jean-Baptiste Hasse. "Diversification Potential in Real Estate Portfolios." (2020) Cambridge Working Paper.

Examples

```
data(data_efficient_portfolios_returns)  
head(data_efficient_portfolios_returns)
```

f_circular_bloc_bootstrap
Function computing a circular block bootstrap

Description

This function computes a circular block-resampling bootstrap of a matrix of returns.

Usage

```
f_circular_bloc_bootstrap(m_input_data_series, input_c, input_b, input_prob)
```

Arguments

<code>m_input_data_series</code>	A matrix of assets or portfolios returns (one per column)
<code>input_c</code>	A numerical value (number of wrapping the data around in a circle)
<code>input_b</code>	A numerical value (length of block size - time dimension)
<code>input_prob</code>	A numerical value (probability)

Value

<code>RSRL</code>	A numerical value (bootstrapped RSRL)
<code>mRSRL</code>	A numerical value (bootstrapped mRSRL)
<code>bootstapped_series</code>	A matrix of numerical values (bootstrapped returns)

Author(s)

Jean-Baptiste Hasse

References

- Efron, B. "Bootstrap methods: another look at the jackknife." *The Annals of Statistics* 7 (1979): 1-26.
- Hall, Peter, Joel L. Horowitz, and Bing-Yi Jing. "On blocking rules for the bootstrap with dependent data." *Biometrika* 82.3 (1995): 561-574.
- Politis, Dimitris N., and Joseph P. Romano. "A circular block-resampling procedure for stationary data." *Exploring the limits of bootstrap* 2635270 (1992).

Examples

```
# NOT RUN {  
  
# Load data  
data("data_efficient_portfolios_returns")  
m_example_returns <- data_efficient_portfolios_returns[,1:2]  
  
# Compute Circular bootstap  
f_circular_bloc_bootstrap(m_example_returns, 10, 2, 0.95)  
  
# }
```

f_diversification_measurement

Function computing portfolio diversification measures

Description

This function computes several portfolio diversification measures: Portfolio Diversification Index (PDI), Diversification Ratio (DR), Diversification Delta (DD) and Diversification Delta Star (DD*).

Usage

```
f_diversification_measurement(v_input_weights, m_input_returns, c_input_method)
```

Arguments

`v_input_weights` A vector of numerical values (asset weights)
`m_input_returns` A matrix of numerical values (asset returns)
`c_input_method` A character value (name of the diversification measure)

Value

`result` A numeric value

Author(s)

Jean-Baptiste Hasse

References

- Rudin, Alexander M. "A portfolio diversification index." *The Journal of Portfolio Management* 32.2 (2006): 81-89.
- Choueifaty, Yves, and Yves Coignard. "Toward maximum diversification." *The Journal of Portfolio Management* 35.1 (2008): 40-51.
- Vermorken, Maximilian A., Francesca R. Medda, and Thomas Schroder. "The diversification delta: A higher-moment measure for portfolio diversification." *The Journal of Portfolio Management* 39.1 (2012): 67-74.
- Flores, Yuri Salazar, et al. "The diversification delta: A different perspective." *The Journal of Portfolio Management* 43.4 (2017): 112-124.

Examples

```
# NOT RUN {

# Load data
data("data_efficient_portfolios_returns")
m_assets_returns <- data_efficient_portfolios_returns
number_assets <- length(m_assets_returns[1,])
v_weights <- rep(1/number_assets, number_assets)

# Portfolio Diversification Index (PDI)
f_diversification_measurement(v_weights, m_assets_returns, "Portfolio_Diversification_Index")

# Diversification Ratio (DR)
f_diversification_measurement(v_weights, m_assets_returns, "Diversification_Ratio")

# Diversification Delta (DD)
f_diversification_measurement(v_weights, m_assets_returns, "Diversification_Delta")

# Diversification Delta Star (DD*)
f_diversification_measurement(v_weights, m_assets_returns, "Diversification_Delta_Star")

# }
```

f_RSRL

Function computing the RSRL or the mRSRL

Description

This function computes the relative Sharpe ratio loss (RSRL) or its modified version (mRSRL) from two vectors of financial returns (a given portfolio and its benchmark). RSRL and mRSRL are both (under)diversification measures. Compared to RSRL, mRSRL is robust to the non-normality of returns.

Usage

```
f_RSRL(v_input_data_portfolio, v_input_data_benchmark, b_input_RSRL_modified, input_prob)
```

Arguments

```
v_input_data_portfolio      A vector of returns
v_input_data_benchmark      A vector of returns
b_input_RSRL_modified       A boolean value
input_prob                  A numerical value
```

Value

result A numeric value

Author(s)

Jean-Baptiste Hasse

References

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. "Down or out: Assessing the welfare costs of household investment mistakes." *Journal of Political Economy* 115.5 (2007): 707-747.

Candelon, Bertrand, Franz Fuerst, and Jean-Baptiste Hasse. "Diversification Potential in Real Estate Portfolios." (2020) Cambridge Working Paper.

Examples

```
# NOT RUN {

# Load data
data("data_efficient_portfolios_returns")

# Prepare variables
v_port <- data_efficient_portfolios_returns[,2]
v_bench <- data_efficient_portfolios_returns[,1]

# Compute RSRL
f_RSRL(v_port, v_bench, FALSE, 0.95)

# Compute mRSRL
f_RSRL(v_port, v_bench, TRUE, 0.95)

# }
```

f_SR

Function computing the Sharpe ratio or one of its modified version

Description

This function computes the Sharpe ratio (SR) or one of its modified version (mSR) from two vectors of financial returns (a given portfolios and its benchmark).

Usage

```
f_SR(v_input_data_portfolio, v_input_data_benchmark, c_input_method, input_prob)
```

Arguments

v_input_data_portfolio A vector of numerical values (returns)
 v_input_data_benchmark A vector of numerical values (returns)
 c_input_method A vector of characters (method)
 input_prob A numerical value (probability)

Value

result A numeric value

Author(s)

Jean-Baptiste Hasse

References

Bali, Turan G., Stephen J. Brown, and K. Ozgur Demirtas. "Do hedge funds outperform stocks and bonds?." *Management Science* 59.8 (2013): 1887-1903.

Favre, Laurent, and José-Antonio Galeano. "Mean-modified value-at-risk optimization with hedge funds." *The journal of alternative investments* 5.2 (2002): 21-25.

Gregoriou, Greg N., and Jean-Pierre Gueyie. "Risk-adjusted performance of funds of hedge funds using a modified Sharpe ratio." *The Journal of wealth management* 6.3 (2003): 77-83.

Sharpe, William F. "The sharpe ratio." *Journal of Portfolio Management* 21.1 (1994): 49-58.

Sharpe, William F. "Mutual fund performance." *The Journal of business* 39.1 (1966): 119-138.

Examples

```
# NOT RUN {

# Load data
data("data_efficient_portfolios_returns")

# Prepare data
v_port <- data_efficient_portfolios_returns[,2]
v_bench <- data_efficient_portfolios_returns[,1]
v_rf <- v_bench

# Compute the Reward-to-Variability Ratio as in Sharpe (1966)
f_SR(v_port, v_rf, "", 0.95)

# Compute the Sharpe ratio as in Sharpe (1994)
f_SR(v_port, v_bench, "S", 0.95)

# Compute the modified Sharpe ratio as in Favre and Galeano (2002) and Gregoriou and Gueyie (2003)
f_SR(v_port, v_bench, "FG-GG", 0.95)
```

```
# Compute the modified Sharpe ratio as in Bali et al. (2013)
f_SR(v_port, v_bench, "BBD", 0.95)

# }
```

f_test_RSRL	<i>Function computing coefficients and significance levels of the RSRL and mRSRL</i>
-------------	--

Description

This function computes coefficients and significance levels of the RSRL and mRSRL. It performs the (under)diversification test of a given portfolio compared to its benchmark.

Usage

```
f_test_RSRL(v_input_p_r, v_input_b_r, input_c, input_b, input_sim, b_input_s, input_prob)
```

Arguments

v_input_p_r	A vector of portfolio returns
v_input_b_r	A vector of portfolio returns
input_c	A numerical value (number of data repetitions)
input_b	A numerical value (size of the block - time dimension)
input_sim	A numerical value (number of simulations)
b_input_s	A boolean value (percentile or studentized bootstrap)
input_prob	A numerical value (probability)

Value

RSRL	A numerical value (RSRL coefficient)
Signif_level_RSRL	Numerical value (RSRL significance level)
mRSRL	A numerical value (RSRL coefficient)
Signif_level_mRSRL	Numerical value (mRSRL significance level)

Author(s)

Jean-Baptiste Hasse

References

Candelon, Bertrand, Franz Fuerst, and Jean-Baptiste Hasse. "Diversification Potential in Real Estate Portfolios." (2020) Cambridge Working Paper.

Examples

```
# NOT RUN {  
  
# Load data  
data("data_efficient_portfolios_returns")  
  
# Prepare data  
v_port <- data_efficient_portfolios_returns[,2]  
v_bench <- data_efficient_portfolios_returns[,1]  
  
# Test RSRL and mRSRL  
f_test_RSRL(v_port, v_bench, 10, 2, 1000, TRUE, 0.95)  
  
# }
```

f_VaR

Function computing Value-at-Risk and modified Value-at-Risk

Description

This function computes the Value-at-Risk (VaR) or the modified Value-at-Risk (mVaR) from a vector of financial returns. mVaR is also called the Cornish-Fisher expansion of Value-at-Risk. Compared to classic VaR, mVaR adequately accounts for the non-normality of returns.

Usage

```
f_VaR(v_input_data, b_input_var_modified, input_prob)
```

Arguments

v_input_data A vector including an asset or portfolio returns
b_input_var_modified A boolean to compute VaR or mVaR
input_prob A numerical value (probability)

Value

result A numeric value

Author(s)

Jean-Baptiste Hasse

References

Cornish, Edmund A., and Ronald A. Fisher. "Moments and cumulants in the specification of distributions." *Revue de l'Institut international de Statistique* (1938): 307-320.
Jorion, Philippe. "Risk2: Measuring the risk in value at risk." *Financial analysts journal* 52.6 (1996): 47-56.

Examples

```
# NOT RUN {  
  
# Load data  
data("data_efficient_portfolios_returns")  
  
# Prepare variables  
v_port <- data_efficient_portfolios_returns[,1]  
  
# Compute VaR  
f_VaR(v_port, FALSE, 0.95)  
  
# Compute modified VaR  
f_VaR(v_port, TRUE, 0.95)  
  
# }
```

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