

# Package ‘HierPortfolios’

January 20, 2025

**Type** Package

**Title** Hierarchical Risk Clustering Portfolio Allocation Strategies

**Version** 1.0.1

**Date** 2024-08-18

**Description** Machine learning hierarchical risk clustering portfolio allocation strategies.

The implemented methods are:

Hierarchical risk parity (De Prado, 2016) <[DOI:10.3905/jpm.2016.42.4.059](https://doi.org/10.3905/jpm.2016.42.4.059)>.

Hierarchical clustering-based asset allocation (Raffinot, 2017)

<[DOI:10.3905/jpm.2018.44.2.089](https://doi.org/10.3905/jpm.2018.44.2.089)>.

Hierarchical equal risk contribution portfolio (Raffinot, 2018)

<[DOI:10.2139/ssrn.3237540](https://doi.org/10.2139/ssrn.3237540)>.

A Constrained Hierarchical Risk Parity Algorithm with Cluster-based Capital Allocation (Pfitzinger and Katzke, 2019)

<<https://www.ekon.sun.ac.za/wpapers/2019/wp142019/wp142019.pdf>>.

**License** GPL-2

**Depends** R (>= 3.6.0)

**Imports** fastcluster, cluster

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.2.1

**URL** <https://github.com/ctruciosm/HierPortfolios>

**BugReports** <https://github.com/ctruciosm/HierPortfolios/issues>

**NeedsCompilation** no

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**Repository** CRAN

**Date/Publication** 2024-08-18 13:10:05 UTC

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daily_returns	<i>Daily returns (in percentage) of 15 assets.</i>
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### Description

Dataset used to illustrate how to use the portfolio allocation strategies implemented in this package.

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DHRP_Portfolio	<i>Constrained Hierarchical Risk Parity</i>
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### Description

Performs the Constrained Hierarchical Risk Parity portfolio strategy proposed by Pfitzinger and Katzke (2019).

### Usage

```
DHRP_Portfolio(covar, graph = FALSE, tau = 1, UB = NULL, LB = NULL)
```

### Arguments

covar	Covariance matrix of returns. The covariance matrix will be transformed into correlation matrix and then into a distance matrix.
graph	To plot de dendrogram set this value to TRUE. By default this value is equal to FALSE.
tau	Parameter to evaluate asset similarity at the cluster edges. Default value is 1.
UB	Upper bound for weights. By default this value is equal to NULL
LB	Lower bound for weights. By default this value is equal to NULL

### Value

portfolio weights

**Author(s)**

Carlos Trucios and Moon Jun Kwon

**References**

Pfizinger, J., and Katzke, N. A constrained hierarchical risk parity algorithm with cluster-based capital allocation (2019). Working Paper.

**See Also**

HCAA\_Portfolio, HRP\_Portfolio and HERC\_Portfolio

**Examples**

```
covar <- cov(mldp_returns)
DHRP_Portfolio(covar)
```

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HCAA\_Portfolio      *Hierarchical Clustering-Based Asset Allocation*

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**Description**

Performs the Hierarchical Clustering-Based Asset Allocation strategy proposed by Raffinot (2017). Several linkage methods for the hierarchical clustering can be used, by default the "ward" linkage is used. The numbers of clusters is selected using the Gap index of Tibshirani et al. (2001).

**Usage**

```
HCAA_Portfolio(covar, linkage = "ward", graph = FALSE, clusters = NULL)
```

**Arguments**

covar	Covariance matrix of returns. The covariance matrix will be transformed into correlation matrix and then into a distance matrix.
linkage	Linkage method used in the hierarchical clustering. Allowed options are "single", "complete", "average" or "ward". Default option is "ward".
graph	To plot de dendrogram set this value to TRUE. By default this value is equal to FALSE.
clusters	Numbers of clusters. If NULL (default), the gap index is applied.

**Value**

portfolio weights.

**Author(s)**

Carlos Trucios

## References

Raffinot, Thomas. "Hierarchical clustering-based asset allocation." *The Journal of Portfolio Management* 44.2 (2017): 89-99.

Tibshirani, Robert, Guenther Walther, and Trevor Hastie. "Estimating the number of clusters in a data set via the gap statistic." *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 63.2 (2001): 411-423.

## See Also

HRP\_Portfolio, HERC\_Portfolio and DHRP\_Portfolio

## Examples

```
covar <- cov(daily_returns)
HCAA_Portfolio(covar)
```

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HERC\_Portfolio

*Hierarchical Equal Risk Contribution*

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## Description

Performs the Hierarchical Equal Risk Contribution portfolio strategy proposed by Raffinot (2018). Several linkage methods for the hierarchical clustering can be used, by default the "ward" linkage is used. This function uses the variance as risk measure. The number of clusters is selected using the Gap index of Tibshirani et al. (2001). The implementation follows Sjostrand and Nina (2020).

## Usage

```
HERC_Portfolio(covar, linkage = "ward", graph = FALSE, clusters = NULL)
```

## Arguments

covar	Covariance matrix of returns. The covariance matrix will be transformed into correlation matrix and then into a distance matrix.
linkage	Linkage method used in the hierarchical clustering. Allowed options are "single", "complete", "average" or "ward". Default option is "ward".
graph	To plot de dendrogram set this value to TRUE. By default this value is equal to FALSE.
clusters	Numbers of clusters. If NULL (default), the gap index is applied.

## Value

portfolio weights.

## Author(s)

Carlos Trucios and Moon Jun Kwon

## References

Raffinot, Thomas. "The hierarchical equal risk contribution portfolio." Available at SSRN 3237540 (2018).

Tibshirani, Robert, Guenther Walther, and Trevor Hastie. "Estimating the number of clusters in a data set via the gap statistic." *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 63.2 (2001): 411-423.

## See Also

HRP\_Portfolio, HCAA\_Portfolio and DHRP\_Portfolio

## Examples

```
covar <- cov(daily_returns)
HERC_Portfolio(covar)
```

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HRP_Portfolio	<i>Hierarchical Risk Parity</i>
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## Description

Performs the Hierarchical Risk Parity portfolio proposed strategy by De Prado (2016). Several linkage methods for the hierarchical clustering can be used, by default the "single" linkage is used.

## Usage

```
HRP_Portfolio(covar, linkage = "single", graph = FALSE)
```

## Arguments

covar	Covariance matrix of returns. The covariance matrix will be transformed into correlation matrix and then into a distance matrix.
linkage	Linkage method used in the hierarchical clustering. Allowed options are "single", "complete", "average" or "ward". Default option is "single".
graph	To plot de dendrogram set this value to TRUE. By default this value is equal to FALSE.

## Value

portfolio weights

## Author(s)

Carlos Trucios

**References**

De Prado, Marcos Lopez. "Building diversified portfolios that outperform out of sample." The Journal of Portfolio Management 42.4 (2016): 59-69.

**See Also**

HCAA\_Portfolio, HERC\_Portfolio and DHRP\_Portfolio

**Examples**

```
covar <- cov(mldp_returns)
HRP_Portfolio(covar)
```

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mldp_returns	<i>Returns of 10 simulated assets.</i>
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**Description**

This dataset contains the simulated returns used in the numerical example of Marcos Lopez de Prado's paper, hence the name `mldp_returns`. The Python code used to reproduce this simulated data is kindly provided by the author in the supplementary material of his paper.

**References**

De Prado, Marcos Lopez. "Building diversified portfolios that outperform out of sample." The Journal of Portfolio Management 42.4 (2016): 59-69.

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