

Package ‘SystemicR’

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Type Package

Title Monitoring Systemic Risk

Version 0.1.0

Description The past decade has demonstrated an increased need to better understand risks leading to systemic crises. This framework offers scholars, practitioners and policymakers a useful toolbox to explore such risks in financial systems. Specifically, this framework provides popular econometric and network measures to monitor systemic risk and to measure the consequences of regulatory decisions. These systemic risk measures are based on the frameworks of Adrian and Brunnermeier (2016) <[doi:10.1257/aer.20120555](https://doi.org/10.1257/aer.20120555)> and Billio, Getmansky, Lo and Pelizzon (2012) <[doi:10.1016/j.jfineco.2011.12.010](https://doi.org/10.1016/j.jfineco.2011.12.010)>.

Depends R (>= 2.10)

License GPL-3

Encoding UTF-8

LazyData true

Imports igraph, Matrix, quantreg, xts

NeedsCompilation no

Author Jean-Baptiste Hasse [aut, cre]

Maintainer Jean-Baptiste Hasse <jb-hasse@hotmail.fr>

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data_state_variables *State variables*

Description

This dataset includes state variables data extracted from the FRED. Specifically, it includes data on credit spread, liquidity spread, yield spread, 3M Treasury bill and VIX.

Usage

```
data("data_state_variables")
```

Format

A data frame with 5030 observations on the following 7 variables.

Date a date vector

CRESPR a numeric vector

LIQSPR a numeric vector

YIESPR a numeric vector

TBR3M a numeric vector

RESI a numeric vector

VIX a numeric vector

Source

Federal Reserve Economic Data (FRED) St. Louis Fed

References

Hasse, Jean-Baptiste. "Systemic Risk: a Network Approach". AMSE Working Paper (2020) Hasse, Jean-Baptiste, and Quentin Lajaunie. "Does the Yield Curve Signal Recessions? New Evidence from an International Panel Data Analysis." AMSE Working Paper (2020).

Examples

```
data("data_state_variables")  
head(data_state_variables)
```

data_stock_returns	<i>Financial institutions (banks, insurers and asset managers) stock returns</i>
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Description

This dataset includes state variables data extracted from the FRED and Yahoo Finance. Specifically, it includes dates, MSCI STOXX Europe 600 Index returns and banks, insurers and asset managers stock returns.

Usage

```
data("data_stock_returns")
```

Format

A data frame with 5030 observations on the following 74 variables.

ACKB.BB.Equity a numeric vector
AGN.NA.Equity a numeric vector
AGS.BB.Equity a numeric vector
AIBG.ID.Equity a numeric vector
ALV.GY.Equity a numeric vector
AV..LN.Equity a numeric vector
BALN.SE.Equity a numeric vector
BARC.LN.Equity a numeric vector
BBVA.SQ.Equity a numeric vector
BIRG.ID.Equity a numeric vector
BKT.SQ.Equity a numeric vector
BNP.FP.Equity a numeric vector
BPE.IM.Equity a numeric vector
CBG.LN.Equity a numeric vector
CBK.GY.Equity a numeric vector
CNP.FP.Equity a numeric vector
CS.FP.Equity a numeric vector
CSGN.SE.Equity a numeric vector
DANSKE.DC.Equity a numeric vector
DBK.GY.Equity a numeric vector
DNB.NO.Equity a numeric vector
Date a date vector
EBS.AV.Equity a numeric vector

EMG.LN.Equity a numeric vector
G.IM.Equity a numeric vector
GBLB.BB.Equity a numeric vector
GLE.FP.Equity a numeric vector
HELN.SE.Equity a numeric vector
HNR1.GY.Equity a numeric vector
HSBA.LN.Equity a numeric vector
HSX.LN.Equity a numeric vector
ICP.LN.Equity a numeric vector
III.LN.Equity a numeric vector
INDUA.SS.Equity a numeric vector
INGA.NA.Equity a numeric vector
INVEB.SS.Equity a numeric vector
ISP.IM.Equity a numeric vector
JYSK.DC.Equity a numeric vector
KBC.BB.Equity a numeric vector
KINVB.SS.Equity a numeric vector
KN.FP.Equity a numeric vector
KOMB.CK.Equity a numeric vector
LGEN.LN.Equity a numeric vector
LLOY.LN.Equity a numeric vector
LUNDB.SS.Equity a numeric vector
MAP.SQ.Equity a numeric vector
MB.IM.Equity a numeric vector
MF.FP.Equity a numeric vector
MUV2.GY.Equity a numeric vector
NDA.SS.Equity a numeric vector
NXG.LN.Equity a numeric vector
OML.LN.Equity a numeric vector
PARG.SE.Equity a numeric vector
PRU.LN.Equity a numeric vector
RBS.LN.Equity a numeric vector
RF.FP.Equity a numeric vector
RSA.LN.Equity a numeric vector
SAMPO.FH.Equity a numeric vector
SAN.SQ.Equity a numeric vector
SCR.FP.Equity a numeric vector

SDR.LN.Equity a numeric vector
SEBA.SS.Equity a numeric vector
SHBA.SS.Equity a numeric vector
SLHN.SE.Equity a numeric vector
SREN.SE.Equity a numeric vector
STAN.LN.Equity a numeric vector
STB.NO.Equity a numeric vector
STJ.LN.Equity a numeric vector
SWEDA.SS.Equity a numeric vector
SXXP.Index a numeric vector
SYDB.DC.Equity a numeric vector
UBSG.SE.Equity a numeric vector
UCG.IM.Equity a numeric vector
ZURN.SE.Equity a numeric vector

Source

Federal Reserve Economic Data (FRED) St. Louis Fed and Yahoo Finance

References

Hasse, Jean-Baptiste. "Systemic Risk: a Network Approach". AMSE Working Paper (2020)

Examples

```
data("data_stock_returns")  
head(data_stock_returns)
```

`f_correlation_network_measures`

Dynamic systemic risk measures from correlation-based networks.

Description

This function provides methods to compute dynamic systemic risk measures from correlation-based networks.

Usage

```
f_correlation_network_measures(df_data_returns)
```

Arguments

`df_data_returns`
A dataframe including dates and stock returns

Value

Degree xts vector
 Closeness_Centrality
 xts vector
 Eigenvector_Centrality
 xts vector
 SR xts vector
 Volatility xts vector

Author(s)

Jean-Baptiste Hasse

References

Hasse, Jean-Baptiste. "Systemic Risk: a Network Approach". AMSE Working Paper (2020)

Examples

```
# Scale the entries of a vector to the interval [0,1]
# NOT RUN {

# Load data
data("data_stock_returns")

# Compute topological risk measures from correlation-based financial networks
l_result <- f_correlation_network_measures(data_stock_returns)

# Plot SR_t
f_plot(l_result$SR)

# }
```

f_CoVaR_Delta_CoVaR_i_q

Computing static CoVaR and Delta CoVaR

Description

This function computes the CoVaR and the Delta CoVaR of a given financial institution i for a given quantile q .

Usage

```
f_CoVaR_Delta_CoVaR_i_q(df_data_returns)
```

Arguments

```
df_data_returns  
                A dataframe including data: dates and stock returns
```

Value

```
CoVaR_i_q      A numeric matrix  
Delta_CoVaR_i_q  
                A numeric vector
```

Author(s)

Jean-Baptiste Hasse

References

Adrian, Tobias, and Markus K. Brunnermeier. "CoVaR". *American Economic Review* 106.7 (2016): , 106, 7, 1705-1741.

Examples

```
# Scale the entries of a vector to the interval [0,1]  
  
# NOT RUN {  
  
# Load data  
data("data_stock_returns")  
  
# Compute CoVaR_i_q and Delta_CoVaR_i_q  
f_CoVaR_Delta_CoVaR_i_q(data_stock_returns)  
  
# }
```

f_CoVaR_Delta_CoVaR_i_q_t

Computing dynamic CoVaR and Delta CoVaR

Description

This function computes the dynamic CoVaR and the Delta CoVaR of a given financial institution *i* for a given quantile *q* at time *t*. The dynamic and aggregate Delta CoVaR is also computed.

Usage

```
f_CoVaR_Delta_CoVaR_i_q_t(df_data_returns, df_data_state_variables)
```

Arguments

`df_data_returns`

A dataframe including data: dates and stock returns

`df_data_state_variables`

A dataframe including data: dates and macroeconomic variables

Value

`CoVaR_i_q_t` A xts matrix

`Delta_CoVaR_i_q_t`

A xts matrix

`Delta_CoVaR_t` A xts vector

Author(s)

Jean-Baptiste Hasse

References

Adrian, Tobias, and Markus K. Brunnermeier. "CoVaR". *American Economic Review* 106.7 (2016): , 106, 7, 1705-1741.

Examples

```
# Scale the entries of a vector to the interval [0,1]

# NOT RUN {

# Load data
data("data_stock_returns")
data("data_state_variables")

# Compute CoVaR_i_q_t , Delta_CoVaR_i_q_t and Delta_CoVaR_t
l_result <- f_CoVaR_Delta_CoVaR_i_q_t(data_stock_returns, data_state_variables)

# Plot Delta_CoVaR_t
f_plot(l_result$Delta_CoVaR_t)

# }
```

`f_plot`*Plot dynamic risk measures*

Description

This function provides a framework to plot xts time series.

Usage

```
f_plot(xts_index_returns)
```

Arguments

```
xts_index_returns  
    A xts vector
```

Value

No return value, called for side effects

Author(s)

Jean-Baptiste Hasse

Examples

```
# Plot a xts vector  
  
# NOT RUN {  
  
  # Generate data returns  
  v_returns <- numeric(10)  
  v_returns <- rnorm(10, 0, 0.01)  
  v_date <- seq(from = as.Date("2019-01-01"), to = as.Date("2019-10-01"), by = "month")  
  xts_returns <- xts(v_returns, order.by = v_date)  
  
  # Plot the xts vector of simulated returns  
  f_plot(xts_returns)  
  
# }
```

`f_scale`*Rescale*

Description

This function normalizes data to 0-1 range. Specifically, this function computes linearly rescaled values from a vector of numeric values.

Usage

```
f_scale(v_time_series)
```

Arguments

`v_time_series` Vector of numeric values

Value

A vector of numeric normalized values

Author(s)

Jean-Baptiste Hasse

References

Hasse, Jean-Baptiste. "Systemic Risk: a Network Approach". AMSE Working Paper (2020)

Examples

```
# Scale the entries of a vector to the interval [0,1]

# NOT RUN {

# Generate data
v_data <- numeric(10)
v_data <- c(1, 5, 3, 2, 15, 12, 9, 11, 7, 13)

# Rescale data
v_rescaled_data <- numeric(10)
v_rescaled_data <- f_scale(v_data)

# print rescaled data
print(v_rescaled_data)

# }
```

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