

# Package ‘SystemicR’

May 8, 2020

**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> and Billio, Getmansky, Lo and Pelizzon (2012) <doi: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

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data\_state\_variables *State variables*

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### 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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