

# Package ‘fbi’

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**Type** Package

**Title** Factor-Based Imputation and FRED-MD Data Set

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**Description** The fbi package contains functions to estimate factor models and impute missing data based on factor models. It also includes functions to load and prepare the FRED-MD data set.

**Depends** R (>= 3.5.0)

**Imports** stats, readr, pracma

**License** GPL-3 + file LICENSE

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.1

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

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fbi-package

*Factor-Based Imputation and FRED-MD Data Set***Description**

The fbi package contains functions to estimate factor models and impute missing data based on factor models. It also includes functions to load and prepare the FRED-MD data set.

**Details**

See `vignette("factor_fred", package = "fbi")` for an example using the FRED-MD dataset (<https://research.stlouisfed.org/econ/mccracken/fred-databases/>).

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**References**

Jushan Bai and Serena Ng (2002), *Determining the number of factors in approximate factor models*. <https://onlinelibrary.wiley.com/doi/pdf/10.1111/1468-0262.00273>

Jushan Bai and Serena Ng (2017), *Rank regularized estimation of approximate factor models*. <https://www.sciencedirect.com/science/article/pii/S0304407619300764>

apc

*Factor Model of Balanced Panel Data***Description**

apc estimates the factor model of a given balanced panel data.

**Usage**

```
apc(X, r)
```

**Arguments**

X a matrix of size T by N.

r integer, indicating the maximum number of factors.

**Value**

a list of elements:

Fhat

Lamhat

d

d0

ehat

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**References**

Jushan Bai and Serena Ng (2019), *Matrix Completion, Counterfactuals, and Factor Analysis of Missing Data*. <https://arxiv.org/abs/1910.06677>

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describe

*Describe selected variables in the FRED-MD Data Set*

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**Description**

describe provides a description of the selected variables in the FRED-MD data set.

**Usage**

```
describe(varname, name.only = TRUE, verbose = FALSE)
```

**Arguments**

varname	string or a vector strings of the format "X1" to "X135".
name.only	logical. If TRUE, return a dataframe with variable names and types of transformation only; if FALSE, return a dataframe with more details.
verbose	logical, indicating whether or not descriptions should be printed.

**Value**

a vector of variable names, or a data frame with detailed descriptions.

**Author(s)**

Yankang (Bennie) Chen <yankang.chen@columbia.edu>

**References**

Michael W. McCracken and Serena Ng (2015), *FRED-MD Updated Appendix*. [https://s3.amazonaws.com/files.fred.stlouisfed.org/fred-md/Appendix\\_Tables\\_Update.pdf](https://s3.amazonaws.com/files.fred.stlouisfed.org/fred-md/Appendix_Tables_Update.pdf)

**Examples**

```
library(fbi)
varnames <- describe(c("X32", "X56"), name.only = TRUE, verbose = FALSE)
```

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`fredmd`*Loading FRED-MD Data Set*

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## Description

`fredmd` loads the official FRED-MD data set and provides a few tools to manipulate the data set.

## Usage

```
fredmd(date_start = NULL, date_end = NULL, transform = TRUE,  
       local = FALSE)
```

## Arguments

<code>date_start</code>	Date or NULL, the start date (included) of the data selection. If NULL, select till the latest data available.
<code>date_end</code>	Date or NULL, the end date (included) of the data selection. If NULL, select up to the earliest data available.
<code>transform</code>	logical, indicating Whether or not the FRED-MD data set should be transformed according to the transformation code.
<code>local</code>	logical, indicating Whether or not the FRED-MD data set should be loaded from the local files or downloaded online

## Value

a subset of the (transformed) FRED-MD data of class `fredmd`.

## Author(s)

Yankang (Bennie) Chen <yankang.chen@columbia.edu>

## References

Michael W. McCracken and Serena Ng (2015), *FRED-MD and FRED-QD: Monthly and Quarterly Databases for Macroeconomic Research*. <https://research.stlouisfed.org/econ/mccracken/fred-databases/>

## Examples

```
library(fbi)  
data <- fredmd(date_start = NULL, date_end = NULL, transform = TRUE, local = FALSE)
```

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fredmd_description	<i>FRED-MD Data Set Description</i>
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### Description

A description of the FRED-MD data set.

### Usage

```
data(fredmd_description)
```

### Format

A data frame with 135 rows and 9 variables. The variables are as follows:

**id** series ID number

**tcode** type of transformation

**fred** variable name used in the FRED-MD data set

**description** description of the series

**gsi** variable name used in the Global Insights Basic Economics Database (GSI)

**gsi:description** description of the series in GSI

**group** group of the series

**edited** logical, indicating if the data has been edited

**varname** "X" + id

### Source

The fredmd\_description data were obtained from Michael W. McCracken and Serena Ng (2015), *FRED-MD Updated Appendix*. [https://s3.amazonaws.com/files.fred.stlouisfed.org/fred-md/Appendix\\_Tables\\_Update.pdf](https://s3.amazonaws.com/files.fred.stlouisfed.org/fred-md/Appendix_Tables_Update.pdf)

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rm_outliers.fredmd	<i>Remove outliers of the FRED-MD Data Set</i>
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### Description

rm\_outliers.fredmd removes outliers of the FRED-MD data set produced by the [fredmd](#) function.

### Usage

```
rm_outliers.fredmd(object)
```

### Arguments

**object** an object of class [fredmd](#).

### Value

FRED-MD data of class fredmd with outliers removed.

**Author(s)**

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**References**

Michael W. McCracken and Serena Ng (2015), *FRED-MD and FRED-QD: Monthly and Quarterly Databases for Macroeconomic Research*. <https://research.stlouisfed.org/econ/mccracken/fred-databases/>

**Examples**

```
library(fbi)
data <- fredmd(date_start = NULL, date_end = NULL, transform = TRUE)
newdata <- rm_outliers.fredmd(data)
```

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rpca

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*Estimation of Approximate Factor Models*


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**Description**

rpca estimates the approximate factor models of the given matrix.

**Usage**

```
rpca(X, kmax, standardize = FALSE, tau = 0)
```

**Arguments**

X	a matrix of size T by N.
kmax	integer, indicating the maximum number of factors.
standardize	logical, indicating Whether or not X should be centered and scaled.
tau	numeric, specifying the parameter in the rank-regularized estimation. If tau = 0, then rank regularization is not used.

**Value**

a list of elements:

```
X
kmax
standardize
tau
ic2
pc2k
pc20
Fhat
Lamhat
Chat
```

Sigma  
 IC2  
 PC2k  
 PC20  
 fhat  
 lamhat  
 d  
 d0

### Author(s)

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### References

Jushan Bai and Serena Ng (2002), *Determining the number of factors in approximate factor models*.  
<https://onlinelibrary.wiley.com/doi/pdf/10.1111/1468-0262.00273>  
 Jushan Bai and Serena Ng (2017), *Rank regularized estimation of approximate factor models*.  
<https://www.sciencedirect.com/science/article/pii/S0304407619300764>

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se.rpca	<i>Standard Error of <math>C^{\text{hat}}</math></i>
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### Description

se.rpca produces the estimated standard error of  $C^{\text{hat}}$  produced by the `rpca` function.

### Usage

```
se.rpca(object, xpoints, qq)
```

### Arguments

object	an object of class <code>rpca</code> .
xpoints	placeholder.
qq	placeholder.

### Value

standard error of  $C^{\text{hat}}$

### Author(s)

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<https://www.sciencedirect.com/science/article/pii/S0304407619300764>

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 tp\_apc

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*Tall-Project Imputation of Missing Value in Panel Data*


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## Description

tp\_apc imputates the missing values in a given panel data using the method of "Tall-Project".

## Usage

```
tp_apc(X1, r1, center = FALSE, standardize = FALSE)
```

## Arguments

X1	a matrix of size T by N.
r1	integer, indicating the maximum number of factors.
center	logical, indicating Whether or not X1 should be demeaned
standardize	logical, indicating Whether or not X1 should be scaled.

## Value

a list of elements:

Fhat  
 Lamhat  
 Chat  
 data

## Author(s)

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## References

Cahan, E., Bai, J. and Ng, S. 2019, Factor Based Imputation of Missing Data and Covariance Matrix Estimation. unpublished manuscript, Columbia University



tw\_apc

*Tall-Wide Imputation of Missing Value in Panel Data***Description**

tw\_apc imputates the missing values in a given panel data using the method of "Tall-Wide".

**Usage**

```
tw_apc(X1, r1, center = FALSE, standardize = FALSE)
```

**Arguments**

X1	a matrix of size T by N.
r1	integer, indicating the maximum number of factors.
center	logical, indicating Whether or not X1 should be demeaned
standardize	logical, indicating Whether or not X1 should be scaled.

**Value**

a list of elements:

Fhat  
Lamhat  
Chat  
data

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**References**

Jushan Bai and Serena Ng (2019), *Matrix Completion, Counterfactuals, and Factor Analysis of Missing Data*. <https://arxiv.org/abs/1910.06677>

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