Package 'nowcastDFM'

December 1, 2021

Title DFMs for Nowcasting

Version 1.0.0

Description Run dynamic factor models (DFM) in R. Adapted from Bok et al. (2017) <https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr830.pdf>. The package provides the ability to estimate a DFM model, obtain predictions from estimated models, and obtain the impact of new data releases on model predictions.

Depends R (>= 3.3.0), dplyr (>= 0.8.0.1), matlab (>= 1.0.2), pracma (>= 2.3.3), signal (>= 0.7-7)

License GPL-3

Encoding UTF-8

RoxygenNote 7.1.2

URL https://github.com/dhopp1/nowcastDFM/, https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr830.pdf, https://github.com/FRBNY-TimeSeriesAnalysis/Nowcasting

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

NeedsCompilation no

Author Daniel Hopp [aut, cre], Fernando Cantu [aut]

Maintainer Daniel Hopp <daniel.hopp@un.org>

Repository CRAN

Date/Publication 2021-12-01 10:00:07 UTC

R topics documented:

dfm *Estimating a dynamic factor model using the EM method.*

Description

Runs a DFM for the nowcast model on the transformed data at a certain data vintage. Your data may not be able to be estimated on due to issues with invertible matrices, etc. If you get errors like "non-invertible" or "not a matrix", try reordering the columns in your dataframe, or adding or removing variables from it. It uses an implementation through the EM algorithm. It relies on several functions to determine initial values, calculate the nowcaKF, the sequence of steps of the EM algorithm and criteria to determine convergence.

Usage

```
dfm(data, blocks = NA, p = 1, max_iter = 5000, threshold = 1e-05)
```

Arguments

`data`	matrix of variables, size (n_obs, n_variables). Must include in 1st column a series of type date, called "date", all data already stationary.
`blocks`	Dataframe, size (n_variables, n_blocks). Note don't include date column in n_variables. Matrix of 1s or 0s for block loadings, i.e. 1 = included in block. Default is one global block containing all variables.
`p`	number of lags in transition equation (AR element)
`max_iter`	maximum number of iterations for EM (if no convergence)
`threshold`	threshold for convergence of EM loop

Value

A `list` containing the following elements:

`Xsmooth_std`	standardized Kalman-smoothed data where missing values are replaced by their expectation
`Xsmooth`	Kalman-smoothed data where missing values are replaced by their expectation. In original input units.
`Z`	smoothed states, rows give time, and columns are organized according to matrix C.
`C`	measurement matrix, rows correspond to each series, and the columns are organized as, columns 1-20 give the factor loadings. For example, 1-5 give loadings for the first, and are organized in reverse-chronological order (f^G_t, f^G_t-1, f^G_t-2, f^G_t-3, f^G_t-4), Columns 6-10, 11-15, and 16-20 give loadings for the second, third, and fourth blocks respectively.
`R`	covariance for measurement matrix residuals.

A	transition matrix, a square matrix that follows the same organization scheme as matrix C's columns. Identity matrices are used to account for matching terms on the left and righthand side. For example, we place an I4 matrix to account for matching (f_t-1; f_t-2; f_t-3; f_t-4) terms.
Q	covariance for transition equation residuals
means	means of each column.
sdevs	standard deviations of each column.
Z0	initial value of state.
V0	initial value of covariance matrix
p	number of lags in transition equation (AR element).
model	names of features input to the model.
blocks	same as parameter passed in.
num_vars	number of features estimated in the model.
num_iter	number of iterations for log likelihood to converge or hit maximum.
convergence	1 if algorithm converged successfully (given max_iter).
loglik	log likelihood of last iteration.
LL	sequence of log likelihoods per iteration.
data	data passed to the model.

---

gen_news *Viewing the impact of new data on a nowcast.*

Description

given and old and new dataset, will calculate the impact data releases and revisions have on the estimate of a target variable.

Usage

```
gen_news(old_y, new_y, output_dfm, target_variable, target_period)
```

Arguments

old_y	dataframe of variables, size (n_obs, n_variables). Must include in 1st column a series of type date, called "date", all data already stationary.
new_y	dataframe of variables, size (n_obs, n_variables). Must include in 1st column a series of type date, called "date", all data already stationary. Must contain same columns as old_y.
output_dfm	list, the output of the `dfm()` function.
target_variable	name of the target column.
target_period	date of forecast to view impacts on.

Value

A `list` containing the following elements:

`target_period`	same as input.
`target_variable`	same as input.
`y_old`	forecast for target variable with old data.
`y_new`	forecast for target variable with new data.
`forecast`	forecast of variables for target period. Only shows for variables that were newly published between old and new dataset.
`actual`	actual published value of variables for target period. Only shows for variables that were newly published between old and new dataset.
`weight`	weight of each data release
`news_table`	table summarising forecast, actual, weight and impact of data releases
`impact_revisions`	impact of data revisions on nowcast.
`impact_releases`	impact of data releases on nowcast.
`impact_total`	total impact (from data revision and data releases).

`predict_dfm` *Predictions from an estimated dynamic factor model.*

Description

runs a dataset through a previously estimated DFM to obtain predictions for all missing values in the series.

Usage

```
predict_dfm(data, output_dfm, months_ahead = 3, lag = 0)
```

Arguments

`data`	matrix of variables, size (n_obs, n_variables). Must include in 1st column a series of type date, called "date", all data already stationary.
`output_dfm`	list, the output of the `dfm()` function.
`months_ahead`	number of months ahead to forecast.
`lag`	number of lags for the kalman filter

Value

dataframe with all missing values filled + predictions.

Index