Package 'genDFM'

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Type Package

Title General package to estimate dynamic factor models

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Description genDFM is a general package to estimate dynamic factor models in R. We provide a set of functions to estimate the model, plot the components or compute forecasts. We provide a wide range of information criteria for the choice of the factors. In addition, the package allows for estimation of Factor Augmented Vector Autoregressions and computation of the IRFs. The core of the package is written in C++ and uses the Armadillo library.

License GPL (>= 2)

Imports Rcpp (>= 1.0.12), dfms, fnets

LinkingTo Rcpp, RcppArmadillo

Encoding UTF-8

RoxygenNote 7.3.2

R topics documented:

genDFM-package *A short title line describing what the package does*

Description

A more detailed description of what the package does. A length of about one to five lines is recommended.

Details

This section should provide a more detailed overview of how to use the package, including the most important functions.

Author(s)

Your Name, email optional.

Maintainer: Your Name <your@email.com>

References

This optional section can contain literature or other references for background information.

See Also

Optional links to other man pages

Examples

```
  ## Not run:
     ## Optional simple examples of the most important functions
     ## These can be in \dontrun{} and \donttest{} blocks.

## End(Not run)
```

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determine_number_of_dynamic_factors
Determine Number of Dynamic Factors

Description

This function determines the number of dynamic factors in the data using specified methods.

Usage

```
determine_number_of_dynamic_factors(data, method = "av", max_factors = 10)
```

Arguments

data	A matrix of data to be analyzed.
method	Method to determine factors. Must be one of "on", "av", or "hl". Default is "av".
max_factors	Maximum number of factors. Default is 10.

Details

This function uses the following methods to determine the number of dynamic factors:

- "on": Onatski (2009) test.
- "av": Avarucci et al. (2022) test - relies on the 'fnets' package.
- "hl": Hallin & Liska (2007) test - relies on the 'fnets' package.

Value

The number of dynamic factors.

References

Onatski, A. (2009). Testing hypotheses about the number of factors in large factor models. Econometrica, 77(5), 1447–1479. Avarucci, M., Cavicchioli, M., Mario, F., & Zaffaroni, P. (2021, 01). The main business cycle shock(s). frequency-band estimation of the number of dynamic factors. Hallin, M., & Liska, R. (2007, 02). Determining the number of factors in the general dynamic factor model. Journal of the American Statistical Association, 102,603-617.

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determine_number_of_static_factors

Determine Number of Static Factors

Description

This function determines the number of static factors in the data using specified methods.

Usage

```
determine_number_of_static_factors(data, method = "on", max_factors = 10)
```

Arguments

data	A matrix of data to be analyzed.
method	Method to determine factors. Must be one of "on", "al", "ah", or "bn". Default is "on".
max_factors	Maximum number of factors. Default is 10.

Details

This function uses the following methods to determine the number of static factors:

- "on": Onatski (2010) test.
- "al": Alessi, Barigozzi and Capasso (2010) test - relies on the 'fnets' package.
- "ah": Ahn and Horenstein (2013) test - relies on the 'fnets' package.
- "bn": Bai and Ng (2002) test - relies on the 'dfms' package.

Value

The number of static factors.

References

Onatski, A. (2010). Determining the number of factors from empirical distribution of eigenvalues. The Review of Economics and Statistics, 92(4), 1004–1016. Alessi, L., Barigozzi, M., & Capasso, M. (2010, December 1). Improved penalization for determining the number of factors in approximate factor models. Statistics Probability Letters, 80(23-24), 1806–1813 Ahn, S., & Horenstein, A. (2013, May 1). Eigenvalue ratio test for the number of factors. Econometrica, 81(3), 1203–1227 Bai, J., & Ng, S. (2003). Determining the number of factors in approximate factor models.

`dfms_ic_wrapper` *Wrap DFMS IC Results*

Description

This function wraps the results from the DFMS IC method into a data frame.

Usage

```
dfms_ic_wrapper(dfms_ic)
```

Arguments

`dfms_ic`	A list containing the DFMS IC results, specifically the "r.star" element.

Value

A data frame with the number of factors determined by the DFMS IC method.

References

Bai, J., & Ng, S. (2002). Determining the Number of Factors in Approximate Factor Models. *Econometrica*, 70(1), 191-221.

`estimate_DFM` *Estimate Dynamic Factor Model (DFM)*

Description

This function estimates a Dynamic Factor Model (DFM) using various methods.

Usage

```
estimate_DFM(
  data,
  r = NULL,
  q = NULL,
  q_max = 10,
  M = NULL,
  model = "fhlr_2000"
)
```

Arguments

data	A matrix of data to be analyzed.
r	Number of static factors. If NULL, it will be determined automatically. Default is NULL.
q	Number of dynamic factors. If NULL, it will be determined automatically. Default is NULL.
q_max	Maximum number of dynamic factors to consider. Default is 10.
M	Number of lags for the spectral density matrix. If NULL, it will be calculated as (2/3) * length(data[,1])^(1/3). Default is NULL.
model	The model to use for estimation. Must be one of "fhlr_2000", "fhlr_2005", "sw_2002", "doz_2011", "doz_2012", or "BM_2014". Default is "fhlr_2000".

- `"fhlr_2000"`: Forni, Hallin, Lippi, and Reichlin (2000).
- `"fhlr_2005"`: Forni, Hallin, Lippi, and Reichlin (2005).
- `"sw_2002"`: Stock and Watson (2002).
- `"doz_2011"`: Doz, Giannone, and Reichlin (2011) - relies on the ‘dfms‘ package.
- `"doz_2012"`: Doz, Giannone, and Reichlin (2012) - relies on the ‘dfms‘ package.
- `"BM_2014"`: Banbura and Modugno (2014) - relies on the ‘dfms‘ package.

Value

A list containing the results of the DFM estimation. The structure of the list depends on the chosen model.

References

Forni, M., Hallin, M., Lippi, M., & Reichlin, L. (2000). The generalized dynamic-factormodel: Identification and estimation. The Review of Economics and Statistics. Forni, M., Hallin, M., Lippi, M., & Reichlin, L. (2005). The generalized dynamicfactor model. Journal of the American Statistical Association, 100(471), 830–840. Stock, J. H., & Watson, M. W. (2002a). Forecasting using principal componentsfrom a large number of predictors. Journal of the American Statistical Association, 97(460), 1167–1179. Doz, C., Giannone, D., & Reichlin, L. (2011). A two-step estimator for large ap-proximate dynamic factor models based on kalman filtering. Journal of Econometrics, 164(1), 188-205. Doz, C., Giannone, D., & Reichlin, L. (2012, 11). A Quasi–Maximum LikelihoodApproach for Large, Approximate Dynamic Factor Models. The Review of Economics and Statistics, 94(4), 1014-1024. Banbura, M., & Modugno, M. (2013). Maximum likelihood estimation of large factor model on datasets with arbitrary pattern of missing data. Journal of Applied Econometrics.

FAVAR *Estimate Factor-Augmented Vector Autoregression (FAVAR)*

Description

This function estimates a Factor-Augmented Vector Autoregression (FAVAR) model.

Usage

```
FAVAR(data, r = 3, n_lags = 13, slow_indices = NULL, direct_indices)
```

Arguments

data	A data frame or matrix of data to be analyzed.
r	Number of static factors. Default is 3.
n_lags	Number of lags in the VAR model. Default is 13.
slow_indices	Indices of slow-moving variables. Default is NULL.
direct_indices	Indices of directly observed variables.

Value

A list containing the FAVAR model components:

- data_for_var: Data prepared for VAR.
- var: VAR model.
- factors: Estimated factors.
- loadings: Factor loadings.

References

Bernanke, B. S., Boivin, J., & Eliasz, P. (2005, 02). Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach*. The Quarterly Journal of Economics, 120(1), 387-422

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favar_IRF *Compute Impulse Response Functions (IRFs) for FAVAR*

Description

This function computes the Impulse Response Functions (IRFs) for a Factor-Augmented Vector Autoregression (FAVAR) model.

Usage

```
favar_IRF(
  favar,
  shock_variable,
  response_variable = NULL,
  n_ahead = 49,
  n_boot = 500,
  cumulative = FALSE,
  shock = "unit",
  plot = TRUE,
  alpha = 0.05
)
```

Arguments

favar	An object of class "FAVAR".
shock_variable	The variable to shock.
response_variable	The variable to respond. Default is NULL.
n_ahead	Number of periods ahead to compute the IRF. Default is 49.
n_boot	Number of bootstrap samples. Default is 500.
cumulative	Whether to compute cumulative IRFs. Default is FALSE.
shock	The type of shock ("unit" or "sd"). Default is "unit".
plot	Whether to plot the IRF. Default is TRUE.
alpha	Significance level for the confidence intervals. Default is 0.05.

Value

A list containing the IRF and bootstrapped IRF:

- irf: The impulse response function.
- boot: The bootstrapped impulse response function.

References

Bernanke, B. S., Boivin, J., & Eliasz, P. (2005, 02). Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach*. The Quarterly Journal of Economics, 120(1), 387-422

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fnets_ic_wrapper *Wrap FNets IC Results*

Description

This function wraps the results from the FNets IC method into a data frame.

Usage

```
fnets_ic_wrapper(fnets_ic)
```

Arguments

fnets_ic	A list or matrix containing the FNets IC results.

Value

A data frame with the number of factors determined by the FNets IC method.

References

Avarucci, M., Cavicchioli, M., Mario, F., & Zaffaroni, P. (2021, 01). The main business cycle shock(s). frequency-band estimation of the number of dynamic factors.

onatski_2009_test_r *Test k=k_0 vs k_0<k<=k_1*

Description

This function performs the Onatski (2009) test to compare k=k_0 vs k_0<k<=k_1.

Usage

```
onatski_2009_test_r(
  data,
  omega0 = NULL,
  sequence = NULL,
  k0 = 1,
  k1 = 5,
  test_size = 5
)
```

Arguments

data	A matrix of data to be tested.
omega0	Optional parameter omega0. Default is NULL.
sequence	Optional parameter sequence. Default is NULL.
k0	Parameter k0. Default is 1.
k1	Parameter k1. Default is 5.
test_size	Size of the test. Default is 5.

Value

The result of the Onatski (2009) test.

References

Onatski, A. (2009). Testing hypotheses about the number of factors in large factor models. Econometrica, 77(5), 1447–1479.

plot.DFM *Plot Dynamic Factor Model (DFM)*

Description

This function plots the components of a Dynamic Factor Model (DFM) based on its class type.

Usage

```
## S3 method for class 'DFM'
plot(x, ...)
```

Arguments

x	An object of class "generalized_dfm", "restricted_gdfm", "dfm", or "sw_2002".
...	Additional arguments passed to the plot function.

Value

A plot of the DFM components.

---

plot_IRF *Plot Impulse Response Functions (IRFs)*

Description

This function plots the Impulse Response Functions (IRFs) along with their confidence intervals.

Usage

```
plot_IRF(irf, boot_irf, alpha = 0.05)
```

Arguments

irf	The impulse response function.
boot_irf	The bootstrapped impulse response function.
alpha	Significance level for the confidence intervals. Default is 0.05.

Value

A plot of the IRFs with confidence intervals.

---

predict.DFM *Predict Dynamic Factor Model (DFM)*

Description

This function makes predictions based on a Dynamic Factor Model (DFM) object.

Usage

```
## S3 method for class 'DFM'
predict(dfm, h)
```

Arguments

dfm	An object of class "generalized_dfm", "restricted_gdfm", "dfm", or "sw_2002".
h	The forecast horizon.

Value

The forecasted values or a message indicating that prediction is not supported for the given class type.

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