Package 'wex'

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Type Package

Title Exact Observation Weights for the Kalman Filter and Smoother

Version 0.1.1

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Description Computes exact observation weights for the Kalman filter and smoother, following Koopman and Harvey (2003) <www.sciencedirect.com/science/article/pii/S0165188902000611>. The package provides tools for analyzing linear Gaussian state-space models, allowing users to quantify the contribution of individual observations to filtered and smoothed state estimates. These weights can be used for interpretation, decomposition, and diagnostic analysis in time series models, including applications such as dynamic factor models. See the README for examples.

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Encoding UTF-8

Imports FKF, KFAS

LazyData true

URL https://github.com/timginker/wex

BugReports https://github.com/timginker/wex/issues

RoxygenNote 7.3.3

NeedsCompilation no

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Depends R (>= 3.5.0)

Repository CRAN

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indicators *Sample Data with 10 Economic Indicators*

Description

A dataset containing 10 monthly economic indicators, covering the period from January 2000 to November 2021. All variables have been log-differenced, when necessary, to achieve stationarity.

Usage

```
indicators
```

Format

A data frame with 263 rows and 11 variables:

date Date values (format: YYYY-MM-DD)

total_production Total industrial production in Israel

retail_revenue Trade revenue

services_revenue Service revenue

employment Employment (excluding absent workers)

export_services Exports of services

building_starts Building starts

import_consumer_goods Imports of consumer goods

import_production_inputs Imports of production inputs

export_goods Exports of goods

job_openings Job openings

Source

Public data from various sources

wex *Exact observation weights for the Kalman filter and smoother*

Description

Computes the exact observation weights for the Kalman filter and smoother, following Koopman and Harvey (2003). The implementation in wex builds on the functionality provided by the FKF and KFAS packages. These packages rely on different computational approaches: FKF uses routines from BLAS and LAPACK, whereas KFAS uses sequential processing, which allows the prediction error variance matrices to be singular.

Usage

```
wex(a0 = NULL, P0 = NULL, Tt, Zt, HHt, GGt, yt, t, package = "FKF")
```

Arguments

a0	A numeric vector specifying the initial state estimate. Defaults to a vector of zeros.
P0	A numeric matrix specifying the covariance matrix of the initial state. Defaults to a diagonal matrix with large values (e.g., 1e6) on the diagonal.
Tt	An array specifying the transition matrix of the state equation (see **Details**).
Zt	An array specifying the observation matrix of the measurement equation (see **Details**).
HHt	An array specifying the covariance matrix of the state disturbances (see **Details**).
GGt	An array specifying the covariance matrix of the observation disturbances (see **Details**).
yt	An $d \times n$ matrix of observations, where rows correspond to variables and columns to time points. Missing values (NA) are allowed.
t	An integer specifying the time index for which the observation weights are evaluated.
package	A character string indicating which backend to use ("FKF" or "KFAS"). Defaults to "FKF".

Details

State space form

$$\alpha_{t+1} = T_t \alpha_t + H_t \eta_t,$$

$$y_t = Z_t \alpha_t + G_t \epsilon_t,$$

where y_t represents the observed data (possibly with NA's), and α_t is the state vector.

Value

A list with two components:

- Wt: An array of filtering weights with dimensions $m \times d \times n$, , where m is the state dimension, d is the observation dimension, and n is the number of time points.
- WtT: An array of smoothing weights with the same dimensions as Wt.

Author(s)

Tim Ginker

References

Koopman, S. J., and Harvey, A. (2003). Computing observation weights for signal extraction and filtering. *Journal of Economic Dynamics and Control*, **27**(7), 1317-1333.

Helske, J. (2017). KFAS: Exponential family state space models in R. *Journal of Statistical Software*, **78**, 1-39.

Examples

```
# Decompose a local level model (Nile data set)
data(Nile)
y <- Nile
wts <- wex(Tt=matrix(1),
Zt=matrix(1),
HHt = matrix(1385.066),
GGt = matrix(15124.13),
yt = t(y),
t=50)
```

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