Package ‘midasr’

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Title Mixed Data Sampling Regression

Description Methods and tools for mixed frequency time series data analysis.
Allows estimation, model selection and forecasting for MIDAS regressions.

URL http://mpiktas.github.io/midasr/

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Depends R (>= 2.11.0), sandwich, optimx, quantreg

Imports MASS, numDeriv, Matrix, forecast, zoo, stats, graphics, utils,
Formula, texreg, methods

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BugReports https://github.com/mpiktas/midasr/issues

Suggests testthat, lubridate, xts

RoxygenNote 7.1.1

Encoding UTF-8

Collate 'deriv.R' 'imidasreg.R' 'lagspec.R' 'midas_nlpr.R'
'midas_r_methods.R' 'midas_nlpr_methods.R' 'midas_qr_methods.R'
'midas_sp.R' 'midas_sp_methods.R' 'midaslag.R' 'midasqr.R'
'midasr-package.R' 'midasreg.R' 'modsel.R' 'nonparametric.R'
'simulate.R' 'tests.R'

NeedsCompilation no

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R topics documented:

midasr-package *Mixed Data Sampling Regression*

Description

Package for estimating, testing and forecasting MIDAS regression.

Details

Methods and tools for mixed frequency time series data analysis. Allows estimation, model selection and forecasting for MIDAS regressions.

Author(s)

Virmantas Kvedaras <virmantas.kvedaras@mif.vu.lt>, Vaidotas Zemlys (maintainer) <zemlys@gmail.com>

+.lws_table *Combine* lws_table *objects*

Description

Combines lws_table objects

Usage

```
## S3 method for class 'lws_table'
... + check = TRUE
```

Arguments

...	lws_table object
check	logical, if TRUE checks that the each lws_table object is named a list with names c("weights","lags","starts")

Details

The lws_table objects have similar structure to table, i.e. it is a list with 3 elements which are the lists with the same number of elements. The base function c would cbind such tables. This function rbinds them.

Value

lws_table object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
nlmn <- expand_weights_lags("nealmon",0,c(4,8),1,start=list(nealmon=rep(0,3)))
nbt <- expand_weights_lags("nbeta",0,c(4,8),1,start=list(nbeta=rep(0,4)))

nlmn+nbt
```

---

agk.test *Andreou, Ghysels, Kourtellos LM test*

Description

Perform the test whether hyperparameters of normalized exponential Almon lag weights are zero

Usage

```
agk.test(x)
```

Arguments

x	MIDAS regression object of class midas_r

Value

a htest object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Andreou E., Ghysels E., Kourtellos A. *Regression models with mixed sampling frequencies* Journal of Econometrics 158 (2010) 246-261

Examples

```
##' ##Load data
data("USunempr")
data("USrealgdp")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
t <- 1:length(y)

mr <- midas_r(y~t+fmls(x,11,12,nealmon),start=list(x=c(0,0,0)))

agk.test(mr)
```

almonp — *Almon polynomial MIDAS weights specification*

Description

Calculate Almon polynomial MIDAS weights

Usage

```
almonp(p, d, m)
```

Arguments

p	parameters for Almon polynomial weights
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

almonp_gradient — *Gradient function for Almon polynomial MIDAS weights*

Description

Calculate gradient for Almon polynomial MIDAS weights specification

Usage

```
almonp_gradient(p, d, m)
```

Arguments

p	vector of parameters for Almon polynomial specification
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Vaidotas Zemlys

`amidas_table` *Weight and lag selection table for aggregates based MIDAS regression model*

Description

Create weight and lag selection table for the aggregates based MIDAS regression model

Usage

```
amidas_table(
  formula,
  data,
  weights,
  wstart,
  type,
  start = NULL,
  from,
  to,
  IC = c("AIC", "BIC"),
  test = c("hAh_test"),
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

`formula`	the formula for MIDAS regression, the lag selection is performed for the last MIDAS lag term in the formula
`data`	a list containing data with mixed frequencies
`weights`	the names of weights used in Ghysels schema
`wstart`	the starting values for the weights of the firs low frequency lag
`type`	the type of Ghysels schema see amweights, can be a vector of types
`start`	the starting values for optimisation excluding the starting values for the last term
`from`	a named list, or named vector with high frequency (NB!) lag numbers which are the beginnings of MIDAS lag structures. The names should correspond to the MIDAS lag terms in the formula for which to do the lag selection. Value NA indicates lag start at zero
`to`	to a named list where each element is a vector with two elements. The first element is the low frequency lag number from which the lag selection starts, the second is the low frequency lag number at which the lag selection ends. NA indicates lowest (highest) lag numbers possible.

`IC`	the names of information criteria which should be calculated
`test`	the names of statistical tests to perform on restricted model, p-values are reported in the columns of model selection table
`Ofunction`	see midasr
`weight_gradients`	see midas_r
`...`	additional parameters to optimisation function, see midas_r

Details

This function estimates models sequentialy increasing the midas lag from `kmin` to `kmax` and varying the weights of the last term of the given formula

This function estimates models sequentially increasing the midas lag from `kmin` to `kmax` and varying the weights of the last term of the given formula

Value

a `midas_r_ic_table` object which is the list with the following elements:

`table`	the table where each row contains calculated information criteria for both restricted and unrestricted MIDAS regression model with given lag structure
`candlist`	the list containing fitted models
`IC`	the argument IC
`test`	the argument test
`weights`	the names of weight functions
`lags`	the lags used in models

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)

tb <- amidas_table(y~trend+fmls(x,12,12,nealmon),
                   data=list(y=y,x=x,trend=trend),
                   weights=c("nealmon"),wstart=list(nealmon=c(0,0,0)),
                   start=list(trend=1),type=c("A"),
                   from=0,to=c(1,2))
```

`amweights` *Weights for aggregates based MIDAS regressions*

Description

Produces weights for aggregates based MIDAS regression

Usage

```
amweights(p, d, m, weight = nealmon, type = c("A", "B", "C"))
```

Arguments

`p`	parameters for weight functions, see details.
`d`	number of high frequency lags
`m`	the frequency
`weight`	the weight function
`type`	type of structure, a string, one of A, B or C.

Details

Suppose a weight function $w(\beta, \theta)$ satisfies the following equation:

$$w(\beta, \theta) = \beta g(\theta)$$

The following combinations are defined, corresponding to structure types `A`, `B` and `C` respectively:

$$(w(\beta_1, \theta_1), ..., w(\beta_k, \theta_k))$$

$$(w(\beta_1, \theta), ..., w(\beta_k, \theta))$$

$$\beta(w(1, \theta), ..., w(1, \theta)),$$

where k is the number of low frequency lags, i.e. d/m. If the latter value is not whole number, the error is produced.

The starting values p should be supplied then as follows:

$$(\beta_1, \theta_1, ..., \beta_k, \theta_k)$$

$$(\beta_1, ..., \beta_k, \theta)$$

$$(\beta, \theta)$$

Value

a vector of weights

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`average_forecast` *Average forecasts of MIDAS models*

Description

Average MIDAS model forecasts using specified weighting scheme. Produce in-sample and out-of-sample accuracy measures.

Usage

```
average_forecast(
  modlist,
  data,
  insample,
  outsample,
  type = c("fixed", "recursive", "rolling"),
  fweights = c("EW", "BICW", "MSFE", "DMSFE"),
  measures = c("MSE", "MAPE", "MASE"),
  show_progress = TRUE
)
```

Arguments

`modlist`	a list of `midas_r` objects
`data`	a list with mixed frequency data
`insample`	the low frequency indexes for in-sample data
`outsample`	the low frequency indexes for out-of-sample data
`type`	a string indicating which type of forecast to use.
`fweights`	names of weighting schemes
`measures`	names of accuracy measures
`show_progress`	logical, TRUE to show progress bar, FALSE for silent evaluation

Details

Given the data, split it to in-sample and out-of-sample data. Then given the list of models, reestimate each model with in-sample data and produce out-of-sample forecast. Given the forecasts average them with the specified weighting scheme. Then calculate the accuracy measures for individual and average forecasts.

The forecasts can be produced in 3 ways. The `"fixed"` forecast uses model estimated with in-sample data. The `"rolling"` forecast reestimates model each time by increasing the in-sample by one low frequency observation and dropping the first low frequency observation. These reestimated models then are used to produce out-of-sample forecasts. The `"recursive"` forecast differs from `"rolling"` that it does not drop observations from the beginning of data.

Value

a list containing forecasts and tables of accuracy measures

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
set.seed(1001)
## Number of low-frequency observations
n<-250
## Linear trend and higher-frequency explanatory variables (e.g. quarterly and monthly)
trend<-c(1:n)
x<-rnorm(4*n)
z<-rnorm(12*n)
## Exponential Almon polynomial constraint-consistent coefficients
fn.x <- nealmon(p=c(1,-0.5),d=8)
fn.z <- nealmon(p=c(2,0.5,-0.1),d=17)
## Simulated low-frequency series (e.g. yearly)
y<-2+0.1*trend+mls(x,0:7,4)%*%fn.x+mls(z,0:16,12)%*%fn.z+rnorm(n)
mod1 <- midas_r(y ~ trend + mls(x, 4:14, 4, nealmon) + mls(z, 12:22, 12, nealmon),
                start=list(x=c(10,1,-0.1),z=c(2,-0.1)))
mod2 <- midas_r(y ~ trend + mls(x, 4:20, 4, nealmon) + mls(z, 12:25, 12, nealmon),
                start=list(x=c(10,1,-0.1),z=c(2,-0.1)))

##Calculate average forecasts
avgf <- average_forecast(list(mod1,mod2),
                        data=list(y=y,x=x,z=z,trend=trend),
                        insample=1:200,outsample=201:250,
                        type="fixed",
                        measures=c("MSE","MAPE","MASE"),
                        fweights=c("EW","BICW","MSFE","DMSFE"))
```

`check_mixfreq` *Check data for MIDAS regression*

Description

Given mixed frequency data check whether higher frequency data can be converted to the lowest frequency.

Usage

```
check_mixfreq(data)
```

Arguments

`data`	a list containing mixed frequency data

Details

The number of observations in higher frequency data elements should have a common divisor with the number of observations in response variable. It is always assumed that the response variable is of the lowest frequency.

Value

a boolean TRUE, if mixed frequency data is conformable, FALSE if it is not.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

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coef.midas_nlpr *Extract coefficients of MIDAS regression*

Description

Extracts various coefficients of MIDAS regression

Usage

```
## S3 method for class 'midas_nlpr'
coef(object, type = c("plain", "midas", "nlpr"), term_names = NULL, ...)
```

Arguments

`object`	`midas_nlpr` object
`type`	one of plain, midas, or nlpr. Returns appropriate coefficients.
`term_names`	a character vector with term names. Default is `NULL`, which means that coefficients of all the terms are returned
`...`	not used currently

Details

MIDAS regression has two sets of cofficients. The first set is the coefficients associated with the parameters of weight functions associated with MIDAS regression terms. These are the coefficients of the NLS problem associated with MIDAS regression. The second is the coefficients of the linear model, i.e the values of weight functions of terms, or so called MIDAS coefficients. By default the function returns the first set of the coefficients.

Value

a vector with coefficients

Author(s)

Vaidotas Zemlys

`coef.midas_r` *Extract coefficients of MIDAS regression*

Description

Extracts various coefficients of MIDAS regression

Usage

```
## S3 method for class 'midas_r'
coef(object, midas = FALSE, term_names = NULL, ...)
```

Arguments

`object`	`midas_r` object
`midas`	logical, if `TRUE`, MIDAS coefficients are returned, if `FALSE` (default), coefficients of NLS problem are returned
`term_names`	a character vector with term names. Default is `NULL`, which means that coefficients of all the terms are returned
`...`	not used currently

Details

MIDAS regression has two sets of cofficients. The first set is the coefficients associated with the parameters of weight functions associated with MIDAS regression terms. These are the coefficients of the NLS problem associated with MIDAS regression. The second is the coefficients of the linear model, i.e the values of weight functions of terms, or so called MIDAS coefficients. By default the function returns the first set of the coefficients.

Value

a vector with coefficients

Author(s)

Vaidotas Zemlys

Examples

```
#Simulate MIDAS regression
n<-250
trend<-c(1:n)
x<-rnorm(4*n)
z<-rnorm(12*n)
fn.x <- nealmon(p=c(1,-0.5),d=8)
fn.z <- nealmon(p=c(2,0.5,-0.1),d=17)
y<-2+0.1*trend+mls(x,0:7,4)%*%fn.x+mls(z,0:16,12)%*%fn.z+rnorm(n)
```

```
eqr<-midas_r(y ~ trend + mls(x, 0:7, 4, nealmon) +
             mls(z, 0:16, 12, nealmon),
             start = list(x = c(1, -0.5), z = c(2, 0.5, -0.1)))

coef(eqr)
coef(eqr, term_names = "x")
coef(eqr, midas = TRUE)
coef(eqr, midas = TRUE, term_names = "x")
```

`coef.midas_sp` *Extract coefficients of MIDAS regression*

Description

Extracts various coefficients of MIDAS regression

Usage

```
## S3 method for class 'midas_sp'
coef(object, type = c("plain", "midas", "bw"), term_names = NULL, ...)
```

Arguments

object	`midas_nlpr` object
type	one of plain, midas, or nlpr. Returns appropriate coefficients.
term_names	a character vector with term names. Default is `NULL`, which means that coefficients of all the terms are returned
...	not used currently

Details

MIDAS regression has two sets of cofficients. The first set is the coefficients associated with the parameters of weight functions associated with MIDAS regression terms. These are the coefficients of the NLS problem associated with MIDAS regression. The second is the coefficients of the linear model, i.e the values of weight functions of terms, or so called MIDAS coefficients. By default the function returns the first set of the coefficients.

Value

a vector with coefficients

Author(s)

Vaidotas Zemlys

deriv_tests — *Check whether non-linear least squares restricted MIDAS regression problem has converged*

Description

Computes the gradient and hessian of the optimisation function of restricted MIDAS regression and checks whether the conditions of local optimum are met. Numerical estimates are used.

Usage

```
deriv_tests(x, tol = 1e-06)

## S3 method for class 'midas_r'
deriv_tests(x, tol = 1e-06)
```

Arguments

x	midas_r object
tol	a tolerance, values below the tolerance are considered zero

Value

a list with gradient, hessian of optimisation function and convergence message

Author(s)

Vaidotas Zemlys

See Also

midas_r

deviance.midas_nlpr — *Non-linear parametric MIDAS regression model deviance*

Description

Returns the deviance of a fitted MIDAS regression object

Usage

```
## S3 method for class 'midas_nlpr'
deviance(object, ...)
```

Arguments

`object`	a `midas_r` object
`...`	currently nothing

Value

The sum of squared residuals

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`deviance.midas_r` *MIDAS regression model deviance*

Description

Returns the deviance of a fitted MIDAS regression object

Usage

```
## S3 method for class 'midas_r'
deviance(object, ...)
```

Arguments

`object`	a `midas_r` object
`...`	currently nothing

Value

The sum of squared residuals

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

deviance.midas_sp — *Semi-parametric MIDAS regression model deviance*

Description

Returns the deviance of a fitted MIDAS regression object

Usage

```
## S3 method for class 'midas_sp'
deviance(object, ...)
```

Arguments

object	a midas_r object
...	currently nothing

Value

The sum of squared residuals

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

dmls — *MIDAS lag structure for unit root processes*

Description

Prepares MIDAS lag structure for unit root processes

Usage

```
dmls(x, k, m, ...)
```

Arguments

x	a vector
k	maximal lag order
m	frequency ratio
...	further arguments used in fitting MIDAS regression

Value

a matrix containing the first differences and the lag k+1.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`expand_amidas` *Create table of weights, lags and starting values for Ghysels weight schema*

Description

Create table of weights, lags and starting values for Ghysels weight schema, see amweights

Usage

```
expand_amidas(weight, type = c("A", "B", "C"), from = 0, to, m, start)
```

Arguments

`weight`	the names of weight functions
`type`	the type of Ghysels schema, `"A"`, `"B"` or `"C"`
`from`	the high frequency lags from which to start the fitting
`to`	to a vector of length two, containing minimum and maximum lags, high frequency if `m=1`, low frequency otherwise.
`m`	the frequency ratio
`start`	the starting values for the weights of the one low frequency lag

Details

Given weight function creates lags starting from `kmin` to `kmax` and replicates starting values for each low frequency lag.

Value

a `lws_table` object, a list with elements `weights`, `lags` and `starts`

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
expand_amidas("nealmon","A",0,c(1,2),12,c(0,0,0))
```

expand_weights_lags *Create table of weights, lags and starting values*

Description

Creates table of weights, lags and starting values

Usage

```
expand_weights_lags(weights, from = 0, to, m = 1, start)
```

Arguments

weights	either a vector with names of the weight functions or a named list of weight functions
from	the high frequency lags from which to start the fitting
to	a vector of length two, containing minimum and maximum lags, high frequency if m=1, low frequency otherwise.
m	the frequency ratio
start	a named list with the starting values for weight functions

Details

For each weight function creates lags starting from kmin to kmax. This is a convenience function for easier work with the function midas_r_ic_table.

Value

a lws_table object, a list with elements weights, lags and starts.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
expand_weights_lags(c("nealmon","nbeta"),0,c(4,8),1,start=list(nealmon=rep(0,3),nbeta=rep(0,4)))
nlmn <- expand_weights_lags("nealmon",0,c(4,8),1,start=list(nealmon=rep(0,3)))
nbt <- expand_weights_lags("nbeta",0,c(4,8),1,start=list(nbeta=rep(0,4)))

nlmn+nbt
```

extract.midas_r *Extract coefficients and GOF measures from MIDAS regression object*

Description

Extract coefficients and GOF measures from MIDAS regression object

Usage

```
extract.midas_r(
  model,
  include.rsquared = TRUE,
  include.nobs = TRUE,
  include.rmse = TRUE,
  ...
)
```

Arguments

`model`	a MIDAS regression object
`include.rsquared`,	If available: should R-squared be reported?
`include.nobs`	If available: should the number of observations be reported?
`include.rmse`	If available: should the root-mean-square error (= residual standard deviation) be reported?
`...`	additional parameters passed to summary

Value

texreg object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

fitted.midas_nlpr *Fitted values for non-linear parametric MIDAS regression model*

Description

Returns the fitted values of a fitted non-linear parametric MIDAS regression object

Usage

```
## S3 method for class 'midas_nlpr'
fitted(object, ...)
```

Arguments

`object`	a `midas_r` object
`...`	currently nothing

Value

the vector of fitted values

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`fitted.midas_sp` *Fitted values for semi-parametric MIDAS regression model*

Description

Returns the fitted values of a fitted semi-parametric MIDAS regression object

Usage

```
## S3 method for class 'midas_sp'
fitted(object, ...)
```

Arguments

`object`	a `midas_r` object
`...`	currently nothing

Value

the vector of fitted values

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

fmls — *Full MIDAS lag structure*

Description

Create a matrix of MIDAS lags, including contemporaneous lag up to selected order.

Usage

```
fmls(x, k, m, ...)
```

Arguments

`x`	a vector
`k`	maximum lag order
`m`	frequency ratio
`...`	further arguments

Details

This is a convenience function, it calls `link{msl}` to perform actual calculations.

Value

a matrix containing the lags

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

See Also

mls

forecast.midas_r — *Forecast MIDAS regression*

Description

Forecasts MIDAS regression given the future values of regressors. For dynamic models (with lagged response variable) there is an option to calculate dynamic forecast, when forecasted values of response variable are substituted into the lags of response variable.

Usage

```
## S3 method for class 'midas_r'
forecast(
  object,
  newdata = NULL,
  se = FALSE,
  level = c(80, 95),
  fan = FALSE,
  npaths = 999,
  method = c("static", "dynamic"),
  insample = get_estimation_sample(object),
  show_progress = TRUE,
  add_ts_info = FALSE,
  ...
)
```

Arguments

`object`	midas_r object
`newdata`	a named list containing future values of mixed frequency regressors. The default is `NULL`, meaning that only in-sample data is used.
`se`	logical, if `TRUE`, the prediction intervals are calculated
`level`	confidence level for prediction intervals
`fan`	if TRUE, level is set to seq(50,99,by=1). This is suitable for fan plots
`npaths`	the number of samples for simulating prediction intervals
`method`	the forecasting method, either `"static"` or `"dynamic"`
`insample`	a list containing the historic mixed frequency data
`show_progress`	logical, if `TRUE`, the progress bar is shown if `se = TRUE`
`add_ts_info`	logical, if `TRUE`, the forecast is cast as `ts` object. Some attempts are made to guess the correct start, by assuming that the response variable is a `ts` object of `frequency` 1. If `FALSE`, then the result is simply a numeric vector.
`...`	additional arguments to `simulate.midas_r`

Details

Given future values of regressors this function combines the historical values used in the fitting the MIDAS regression model and calculates the forecasts.

Value

an object of class `"forecast"`, a list containing following elements:

`method`	the name of forecasting method: MIDAS regression, static or dynamic
`model`	original object of class `midas_r`
`mean`	point forecasts

`lower`	lower limits for prediction intervals
`upper`	upper limits for prediction intervals
`fitted`	fitted values, one-step forecasts
`residuals`	residuals from the fitted model
`x`	the original response variable

The methods `print`, `summary` and `plot` from package `forecast` can be used on the object.

Author(s)

Vaidotas Zemlys

Examples

```
data("USrealgdp")
data("USunempr")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr), start = 1949)
trend <- 1:length(y)

##24 high frequency lags of x included
mr <- midas_r(y ~ trend + fmls(x, 23, 12, nealmon), start = list(x = rep(0, 3)))

##Forecast horizon
h <- 3
##Declining unemployment
xn <- rep(-0.1, 12*h)
##New trend values
trendn <- length(y) + 1:h

##Static forecasts combining historic and new high frequency data
forecast(mr, list(trend = trendn, x = xn), method = "static")

##Dynamic AR* model
mr.dyn <- midas_r(y ~ trend + mls(y, 1:2, 1, "*")
                   + fmls(x, 11, 12, nealmon),
                  start = list(x = rep(0, 3)))

forecast(mr.dyn, list(trend = trendn, x = xn), method = "dynamic")

##Use print, summary and plot methods from package forecast

fmr <- forecast(mr, list(trend = trendn, x = xn), method = "static")
fmr
summary(fmr)
plot(fmr)
```

`genexp` *Generalized exponential MIDAS coefficients*

Description

Calculates the MIDAS coefficients for generalized exponential MIDAS lag specification

Usage

```
genexp(p, d, m)
```

Arguments

`p`	a vector of parameters
`d`	number of coefficients
`m`	the frequency, currently ignored

Details

Generalized exponential MIDAS lag specification is a generalization of exponential Almon lag. It is defined as a product of first order polynomial with exponent of the second order polynomial. This spefication was used by V. Kvedaras and V. Zemlys (2012).

Value

a vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Kvedaras V., Zemlys, V. *Testing the functional constraints on parameters in regressions with variables of different frequency* Economics Letters 116 (2012) 250-254

`genexp_gradient` *Gradient of generalized exponential MIDAS coefficient generating function*

Description

Calculates the gradient of generalized exponential MIDAS lag specification

Usage

```
genexp_gradient(p, d, m)
```

Arguments

p	a vector of parameters
d	number of coefficients
m	the frequency, currently ignored

Details

Generalized exponential MIDAS lag specification is a generalization of exponential Almon lag. It is defined as a product of first order polynomial with exponent of the second order polynomial. This spefication was used by V. Kvedaras and V. Zemlys (2012).

Value

a vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Kvedaras V., Zemlys, V. *Testing the functional constraints on parameters in regressions with variables of different frequency* Economics Letters 116 (2012) 250-254

get_estimation_sample *Get the data which was used to etimate MIDAS regression*

Description

Gets the data which was used to estimate MIDAS regression

Usage

```
get_estimation_sample(object)
```

Arguments

object	midas_r object

Details

A helper function.

Value

a named list with mixed frequency data

Author(s)

Vaidotas Zemlys

gompertzp *Normalized Gompertz probability density function MIDAS weights specification*

Description

Calculate MIDAS weights according to normalized Gompertz probability density function specification

Usage

```
gompertzp(p, d, m)
```

Arguments

p	parameters for normalized Gompertz probability density function
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

`gompertzp_gradient` *Gradient function for normalized Gompertz probability density function MIDAS weights specification*

Description

Calculate gradient function for normalized Gompertz probability density function specification of MIDAS weights.

Usage

```
gompertzp_gradient(p, d, m)
```

Arguments

`p`	parameters for normalized Gompertz probability density function
`d`	number of coefficients
`m`	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

`hAhr_test` *Test restrictions on coefficients of MIDAS regression using robust version of the test*

Description

Perform a test whether the restriction on MIDAS regression coefficients holds.

Usage

```
hAhr_test(x, PHI = vcovHAC(x$unrestricted, sandwich = FALSE))
```

Arguments

`x`	MIDAS regression model with restricted coefficients, estimated with `midas_r`
`PHI`	the "meat" covariance matrix, defaults to `vcovHAC(x$unrestricted, sandwich=FALSE)`

Details

Given MIDAS regression:

$$y_t = \sum_{j=0}^{k} \sum_{i=0}^{m-1} \theta_{jm+i} x_{(t-j)m-i} + u_t$$

test the null hypothesis that the following restriction holds:

$$\theta_h = g(h, \lambda),$$

where $h = 0, ..., (k+1)m$.

Value

a `htest` object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Kvedaras V., Zemlys, V. *The statistical content and empirical testing of the MIDAS restrictions*

See Also

hAh_test

Examples

```
##The parameter function
theta_h0 <- function(p, dk, ...) {
   i <- (1:dk-1)
   (p[1] + p[2]*i)*exp(p[3]*i + p[4]*i^2)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,0.1,-0.1,-0.001),4*12)

##Plot the coefficients
plot(theta0)

##Generate the predictor variable
set.seed(13)

xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))
##Fit restricted model
mr <- midas_r(y~fmls(x,4*12-1,12,theta_h0)-1,
              list(y=y,x=x),
              start=list(x=c(-0.1,0.1,-0.1,-0.001)))

##The gradient function
theta_h0_gradient <-function(p, dk,...) {
   i <- (1:dk-1)
   a <- exp(p[3]*i + p[4]*i^2)
   cbind(a, a*i, a*i*(p[1]+p[2]*i), a*i^2*(p[1]+p[2]*i))
}

##Perform test (the expected result should be the acceptance of null)

hAhr_test(mr)

mr <- midas_r(y~fmls(x,4*12-1,12,theta_h0)-1,
              list(y=y,x=x),
              start=list(x=c(-0.1,0.1,-0.1,-0.001)),
              weight_gradients=list())

##Use exact gradient. Note the
hAhr_test(mr)
```

---

hAh_test *Test restrictions on coefficients of MIDAS regression*

Description

Perform a test whether the restriction on MIDAS regression coefficients holds.

Usage

```
hAh_test(x)
```

Arguments

x	MIDAS regression model with restricted coefficients, estimated with `midas_r`

Details

Given MIDAS regression:

$$y_t = \sum_{j=0}^{k} \sum_{i=0}^{m-1} \theta_{jm+i} x_{(t-j)m-i} + u_t$$

test the null hypothesis that the following restriction holds:

$$\theta_h = g(h, \lambda),$$

where $h = 0, ..., (k+1)m$.

Value

a `htest` object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Kvedaras V., Zemlys, V. *Testing the functional constraints on parameters in regressions with variables of different frequency* Economics Letters 116 (2012) 250-254

See Also

hAhr_test

Examples

```
##The parameter function
theta_h0 <- function(p, dk, ...) {
   i <- (1:dk-1)
   (p[1] + p[2]*i)*exp(p[3]*i + p[4]*i^2)
}
```

```
##Generate coefficients
theta0 <- theta_h0(c(-0.1,0.1,-0.1,-0.001),4*12)

##Plot the coefficients
plot(theta0)

##Generate the predictor variable
set.seed(13)

xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))
##Fit restricted model
mr <- midas_r(y~fmls(x,4*12-1,12,theta_h0)-1,list(y=y,x=x),
              start=list(x=c(-0.1,0.1,-0.1,-0.001)))

##Perform test (the expected result should be the acceptance of null)

hAh_test(mr)

##Fit using gradient function

##The gradient function
theta_h0_gradient<-function(p, dk,...) {
   i <- (1:dk-1)
   a <- exp(p[3]*i + p[4]*i^2)
   cbind(a, a*i, a*i*(p[1]+p[2]*i), a*i^2*(p[1]+p[2]*i))
}

mr <- midas_r(y~fmls(x,4*12-1,12,theta_h0)-1,list(y=y,x=x),
              start=list(x=c(-0.1,0.1,-0.1,-0.001)),
              weight_gradients=list())

##The test will use an user supplied gradient of weight function. See the
##help of midas_r on how to supply the gradient.

hAh_test(mr)
```

harstep *HAR(3)-RV model MIDAS weights specification*

Description

HAR(3)-RV model MIDAS weights specification

Usage

```
harstep(p, d, m)
```

Arguments

p	parameters for Almon lag
d	number of the coefficients
m	the frequency, currently ignored.

Details

MIDAS weights for Heterogeneous Autoregressive model of Realized Volatilty (HAR-RV). It is assumed that month has 20 days.

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Corsi, F., *A Simple Approximate Long-Memory Model of Realized Volatility*, Journal of Financial Econometrics Vol. 7 No. 2 (2009) 174-196

---

harstep_gradient — *Gradient function for HAR(3)-RV model MIDAS weights specification*

Description

Gradient function for HAR(3)-RV model MIDAS weights specification

Usage

```
harstep_gradient(p, d, m)
```

Arguments

p	parameters for Almon lag
d	number of the coefficients
m	the frequency, currently ignored.

Details

MIDAS weights for Heterogeneous Autoregressive model of Realized Volatilty (HAR-RV). It is assumed that month has 20 days.

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Corsi, F., *A Simple Approximate Long-Memory Model of Realized Volatility*, Journal of Financial Econometrics Vol. 7 No. 2 (2009) 174-196

`hf_lags_table` *Create a high frequency lag selection table for MIDAS regression model*

Description

Creates a high frequency lag selection table for MIDAS regression model with given information criteria and minimum and maximum lags.

Usage

```
hf_lags_table(
  formula,
  data,
  start,
  from,
  to,
  IC = c("AIC", "BIC"),
  test = c("hAh_test"),
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

`formula`	the formula for MIDAS regression, the lag selection is performed for the last MIDAS lag term in the formula
`data`	a list containing data with mixed frequencies
`start`	the starting values for optimisation
`from`	a named list, or named vector with lag numbers which are the beginings of MIDAS lag structures. The names should correspond to the MIDAS lag terms in the formula for which to do the lag selection. Value NA indicates lag start at zero

to	a named list where each element is a vector with two elements. The first element is the lag number from which the lag selection starts, the second is the lag number at which the lag selection ends. NA indicates lowest (highest) lag numbers possible.
IC	the information criteria which to compute
test	the names of statistical tests to perform on restricted model, p-values are reported in the columns of model selection table
Ofunction	see midasr
weight_gradients	see midas_r
...	additional parameters to optimisation function, see midas_r

Details

This function estimates models sequentially increasing the midas lag from kmin to kmax of the last term of the given formula

Value

a midas_r_iclagtab object which is the list with the following elements:

table	the table where each row contains calculated information criteria for both restricted and unrestricted MIDAS regression model with given lag structure
candlist	the list containing fitted models
IC	the argument IC

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)

mlr <- hf_lags_table(y ~ trend + fmls(x, 12, 12,nealmon),
                     start = list(x=rep(0,3)),
                     data = list(y = y, x = x, trend = trend),
                     from=c(x=0),to=list(x=c(4,4)))
mlr
```

imidas_r *Restricted MIDAS regression with I(1) regressors*

Description

Estimate restricted MIDAS regression using non-linear least squares, when the regressor is I(1)

Usage

```
imidas_r(
  formula,
  data,
  start,
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

formula	formula for restricted MIDAS regression. Formula must include fmls function
data	a named list containing data with mixed frequencies
start	the starting values for optimisation. Must be a list with named elements.
Ofunction	the list with information which R function to use for optimisation. The list must have element named `Ofunction` which contains character string of chosen R function. Other elements of the list are the arguments passed to this function. The default optimisation function is optim with argument `method="BFGS"`. Other supported functions are nls
weight_gradients	a named list containing gradient functions of weights. The weight gradient function must return the matrix with dimensions $d_k \times q$, where d_k and q are the number of coefficients in unrestricted and restricted regressions correspondingly. The names of the list should coincide with the names of weights used in formula. The default value is NULL, which means that the numeric approximation of weight function gradient is calculated. If the argument is not NULL, but the name of the weight used in formula is not present, it is assumed that there exists an R function which has the name of the weight function appended with `.gradient`.
...	additional arguments supplied to optimisation function

Details

Given MIDAS regression:

$$y_t = \sum_{j=0}^{k} \sum_{i=0}^{m-1} \theta_{jm+i} x_{(t-j)m-i} + \mathbf{z_t}\beta + u_t$$

estimate the parameters of the restriction

$$\theta_h = g(h, \lambda),$$

where $h = 0, ..., (k+1)m$, together with coefficients β corresponding to additional low frequency regressors.

It is assumed that x is a I(1) process, hence the special transformation is made. After the transformation midas_r is used for estimation.

MIDAS regression involves times series with different frequencies.

The restriction function must return the restricted coefficients of the MIDAS regression.

Value

a `midas_r` object which is the list with the following elements:

`coefficients`	the estimates of parameters of restrictions
`midas_coefficients`	the estimates of MIDAS coefficients of MIDAS regression
`model`	model data
`unrestricted`	unrestricted regression estimated using `midas_u`
`term_info`	the named list. Each element is a list with the information about the term, such as its frequency, function for weights, gradient function of weights, etc.
`fn0`	optimisation function for non-linear least squares problem solved in restricted MIDAS regression
`rhs`	the function which evaluates the right-hand side of the MIDAS regression
`gen_midas_coef`	the function which generates the MIDAS coefficients of MIDAS regression
`opt`	the output of optimisation procedure
`argmap_opt`	the list containing the name of optimisation function together with arguments for optimisation function
`start_opt`	the starting values used in optimisation
`start_list`	the starting values as a list
`call`	the call to the function
`terms`	terms object
`gradient`	gradient of NLS objective function
`hessian`	hessian of NLS objective function
`gradD`	gradient function of MIDAS weight functions
`Zenv`	the environment in which data is placed
`use_gradient`	TRUE if user supplied gradient is used, FALSE otherwise
`nobs`	the number of effective observations
`convergence`	the convergence message
`fitted.values`	the fitted values of MIDAS regression
`residuals`	the residuals of MIDAS regression

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

See Also

midas_r.midas_r

Examples

```
theta.h0 <- function(p, dk) {
  i <- (1:dk-1)/100
  pol <- p[3]*i + p[4]*i^2
 (p[1] + p[2]*i)*exp(pol)
}

theta0 <- theta.h0(c(-0.1,10,-10,-10),4*12)

xx <- ts(cumsum(rnorm(600*12)), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))

imr <- imidas_r(y~fmls(x,4*12-1,12,theta.h0)-1,start=list(x=c(-0.1,10,-10,-10)))
```

---

lcauchyp — *Normalized log-Cauchy probability density function MIDAS weights specification*

Description

Calculate MIDAS weights according to normalized log-Cauchy probability density function specification

Usage

```
lcauchyp(p, d, m)
```

Arguments

p	parameters for normalized log-Cauchy probability density function
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

`lcauchyp_gradient` *Gradient function for normalized log-Cauchy probability density function MIDAS weights specification*

Description

Calculate gradient function for normalized log-Cauchy probability density function specification of MIDAS weights.

Usage

```
lcauchyp_gradient(p, d, m)
```

Arguments

`p`	parameters for normalized log-Cauchy probability density function
`d`	number of coefficients
`m`	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

`lf_lags_table` *Create a low frequency lag selection table for MIDAS regression model*

Description

Creates a low frequency lag selection table for MIDAS regression model with given information criteria and minimum and maximum lags.

Usage

```
lf_lags_table(
  formula,
  data,
  start,
  from,
  to,
  IC = c("AIC", "BIC"),
  test = c("hAh_test"),
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

formula	the formula for MIDAS regression, the lag selection is performed for the last MIDAS lag term in the formula
data	a list containing data with mixed frequencies
start	the starting values for optimisation
from	a named list, or named vector with high frequency (NB!) lag numbers which are the beginnings of MIDAS lag structures. The names should correspond to the MIDAS lag terms in the formula for which to do the lag selection. Value NA indicates lag start at zero
to	a named list where each element is a vector with two elements. The first element is the low frequency lag number from which the lag selection starts, the second is the low frequency lag number at which the lag selection ends. NA indicates lowest (highest) lag numbers possible.
IC	the information criteria which to compute
test	the names of statistical tests to perform on restricted model, p-values are reported in the columns of model selection table
Ofunction	see midasr
weight_gradients	see midas_r
...	additional parameters to optimisation function, see midas_r

Details

This function estimates models sequentially increasing the midas lag from kmin to kmax of the last term of the given formula

Value

a midas_r_ic_table object which is the list with the following elements:

table	the table where each row contains calculated information criteria for both restricted and unrestricted MIDAS regression model with given lag structure

candlist	the list containing fitted models
IC	the argument IC

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)

mlr <- lf_lags_table(y~trend+fmls(x,12,12,nealmon),
                     start=list(x=rep(0,3)),
                     from=c(x=0),to=list(x=c(3,4)))
mlr
```

---

lstr *Compute LSTR term for high frequency variable*

Description

Compute LSTR term for high frequency variable

Usage

```
lstr(X, theta, beta, sd_x = sd(c(X), na.rm = TRUE))
```

Arguments

X	matrix, high frequency variable embedded in low frequency, output of mls
theta	vector, restriction coefficients for high frequency variable
beta	vector of length 4, parameters for LSTR term, slope and 3 LSTR parameters
sd_x	vector of length 1, defaults to standard deviation of X.

Value

a vector

`midas_auto_sim` *Simulate simple autoregressive MIDAS model*

Description

Given the predictor variable, the weights and autoregressive coefficients, simulate MIDAS regression response variable.

Usage

```
midas_auto_sim(
  n,
  alpha,
  x,
  theta,
  rand_gen = rnorm,
  innov = rand_gen(n, ...),
  n_start = NA,
  ...
)
```

Arguments

`n`	sample size.
`alpha`	autoregressive coefficients.
`x`	a high frequency predictor variable.
`theta`	a vector with MIDAS weights for predictor variable.
`rand_gen`	a function to generate the innovations, default is the normal distribution.
`innov`	an optional time series of innovations.
`n_start`	number of observations to omit for the burn.in.
`...`	additional arguments to function `rand_gen`.

Value

a `ts` object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
theta_h0 <- function(p, dk) {
  i <- (1:dk-1)/100
  pol <- p[3]*i + p[4]*i^2
  (p[1] + p[2]*i)*exp(pol)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,10,-10,-10),4*12)

##Generate the predictor variable
xx <- ts(arima.sim(model = list(ar = 0.6), 1000 * 12), frequency = 12)

y <- midas_auto_sim(500, 0.5, xx, theta0, n_start = 200)
x <- window(xx, start=start(y))
midas_r(y ~ mls(y, 1, 1) + fmls(x, 4*12-1, 12, theta_h0), start = list(x = c(-0.1, 10, -10, -10)))
```

---

midas_lstr_plain *LSTR (Logistic Smooth TRansition) MIDAS regression*

Description

Function for fitting LSTR MIDAS regression without the formula interface

Usage

```
midas_lstr_plain(
  y,
  X,
  z = NULL,
  weight,
  start_lstr,
  start_x,
  start_z = NULL,
  method = c("Nelder-Mead"),
  ...
)
```

Arguments

y	model response
X	prepared matrix of high frequency variable lags for LSTR term
z	additional low frequency variables
weight	the weight function
start_lstr	the starting values for lstr term
start_x	the starting values for weight function

start_z	the starting values for additional low frequency variables
method	a method passed to optimx
...	additional parameters to optimx

Value

an object similar to midas_r object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

---

midas_lstr_sim — *Simulate LSTR MIDAS regression model*

Description

Simulate LSTR MIDAS regression model

Usage

```
midas_lstr_sim(
  n,
  m,
  theta,
  intercept,
  plstr,
  ar.x,
  ar.y,
  rand.gen = rnorm,
  n.start = NA,
  ...
)
```

Arguments

n	number of observations to simulate.
m	integer, frequency ratio
theta	vector, restriction coefficients for high frequency variable
intercept	vector of length 1, intercept for the model.
plstr	vector of length 4, slope for the LSTR term and LSTR parameters
ar.x	vector, AR parameters for simulating high frequency variable
ar.y	vector, AR parameters for AR part of the model
rand.gen	function, a function for generating the regression innovations, default is rnorm
n.start	integer, length of a 'burn-in' period. If NA, the default, a reasonable value is computed.
...	additional parameters to rand.gen

Value

a list

Examples

```
nnbeta <- function(p, k) nbeta(c(1,p),k)

dgp <- midas_lstr_sim(250, m = 12, theta = nnbeta(c(2, 4), 24),
                           intercept = c(1), plstr = c(1.5, 1, log(1), 1),
                           ar.x = 0.9, ar.y = 0.5, n.start = 100)
z <- cbind(1, mls(dgp$y, 1:2, 1))
colnames(z) <- c("Intercept", "y1", "y2")
X <- mls(dgp$x, 0:23, 12)

lstr_mod <- midas_lstr_plain(dgp$y, X, z, nnbeta,
                          start_lstr = c(1.5, 1, 1, 1),
                          start_x = c(2, 4), start_z=c(1, 0.5, 0))

coef(lstr_mod)
```

---

midas_mmm_plain   *MMM (Mean-Min-Max) MIDAS regression*

Description

Function for fitting MMM MIDAS regression without the formula interface

Usage

```
midas_mmm_plain(
  y,
  X,
  z = NULL,
  weight,
  start_mmm,
  start_x,
  start_z = NULL,
  method = c("Nelder-Mead"),
  ...
)
```

Arguments

y	model response
X	prepared matrix of high frequency variable lags for MMM term
z	additional low frequency variables

weight	the weight function
start_mmm	the starting values for MMM term
start_x	the starting values for weight function
start_z	the starting values for additional low frequency variables
method	a method passed to optimx
...	additional parameters to optimx

Value

an object similar to midas_r object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

---

midas_mmm_sim *Simulate MMM MIDAS regression model*

Description

Simulate MMM MIDAS regression model

Usage

```
midas_mmm_sim(
  n,
  m,
  theta,
  intercept,
  pmmm,
  ar.x,
  ar.y,
  rand.gen = rnorm,
  n.start = NA,
  ...
)
```

Arguments

n	number of observations to simulate.
m	integer, frequency ratio
theta	vector, restriction coefficients for high frequency variable
intercept	vector of length 1, intercept for the model.
pmmm	vector of length 2, slope for the MMM term and MMM parameter

`ar.x`	vector, AR parameters for simulating high frequency variable
`ar.y`	vector, AR parameters for AR part of the model
`rand.gen`	function, a function for generating the regression innovations, default is `rnorm`
`n.start`	integer, length of a 'burn-in' period. If NA, the default, a reasonable value is computed.
`...`	additional parameters to rand.gen

Value

a list

Examples

```
nnbeta <- function(p, k) nbeta(c(1,p),k)

dgp <- midas_mmm_sim(250, m = 12, theta = nnbeta(c(2, 4), 24),
                           intercept = c(1), pmmm = c(1.5, 1),
                           ar.x = 0.9, ar.y = 0.5, n.start = 100)
z <- cbind(1, mls(dgp$y, 1:2, 1))
colnames(z) <- c("Intercept", "y1", "y2")
X <- mls(dgp$x, 0:23, 12)

mmm_mod <- midas_mmm_plain(dgp$y, X, z, nnbeta,
                          start_mmm = c(1.5, 1),
                          start_x = c(2, 4), start_z=c(1, 0.5, 0))

coef(mmm_mod)
```

---

midas_nlpr — *Non-linear parametric MIDAS regression*

Description

Estimate restricted MIDAS regression using non-linear least squares.

Usage

```
midas_nlpr(formula, data, start, Ofunction = "optim", ...)
```

Arguments

`formula`	formula for restricted MIDAS regression or `midas_r` object. Formula must include `fmls` function
`data`	a named list containing data with mixed frequencies
`start`	the starting values for optimisation. Must be a list with named elements.

`Ofunction` the list with information which R function to use for optimisation. The list must have element named `Ofunction` which contains character string of chosen R function. Other elements of the list are the arguments passed to this function. The default optimisation function is `optim` with arguments `method="Nelder-Mead"` and `control=list(maxit=5000)`. Other supported functions are `nls`, `optimx`.

`...` additional arguments supplied to optimisation function

Details

Given MIDAS regression:

$$y_t = \sum_{j=1}^{p} \alpha_j y_{t-j} + \sum_{i=0}^{k} \sum_{j=0}^{l_i} \beta_j^{(i)} x_{tm_i-j}^{(i)} + u_t,$$

estimate the parameters of the restriction

$$\beta_j^{(i)} = g^{(i)}(j, \lambda).$$

Such model is a generalisation of so called ADL-MIDAS regression. It is not required that all the coefficients should be restricted, i.e the function $g^{(i)}$ might be an identity function. Model with no restrictions is called U-MIDAS model. The regressors $x_\tau^{(i)}$ must be of higher (or of the same) frequency as the dependent variable y_t.

Value

a `midas_r` object which is the list with the following elements:

`coefficients` the estimates of parameters of restrictions

`midas_coefficients` the estimates of MIDAS coefficients of MIDAS regression

`model` model data

`unrestricted` unrestricted regression estimated using `midas_u`

`term_info` the named list. Each element is a list with the information about the term, such as its frequency, function for weights, gradient function of weights, etc.

`fn0` optimisation function for non-linear least squares problem solved in restricted MIDAS regression

`rhs` the function which evaluates the right-hand side of the MIDAS regression

`gen_midas_coef` the function which generates the MIDAS coefficients of MIDAS regression

`opt` the output of optimisation procedure

`argmap_opt` the list containing the name of optimisation function together with arguments for optimisation function

`start_opt` the starting values used in optimisation

`start_list` the starting values as a list

`call` the call to the function

`terms`	terms object
`gradient`	gradient of NLS objective function
`hessian`	hessian of NLS objective function
`gradD`	gradient function of MIDAS weight functions
`Zenv`	the environment in which data is placed
`nobs`	the number of effective observations
`convergence`	the convergence message
`fitted.values`	the fitted values of MIDAS regression
`residuals`	the residuals of MIDAS regression

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`midas_nlpr.fit` *Fit restricted MIDAS regression*

Description

Workhorse function for fitting restricted MIDAS regression

Usage

```
midas_nlpr.fit(x)
```

Arguments

`x`	`midas_r` object

Value

`midas_r` object

Author(s)

Vaidotas Zemlys

midas_pl_plain *MIDAS Partialy linear non-parametric regression*

Description

Function for fitting PL MIDAS regression without the formula interface

Usage

```
midas_pl_plain(
  y,
  X,
  z,
  p.ar = NULL,
  weight,
  degree = 1,
  start_bws,
  start_x,
  start_ar = NULL,
  method = c("Nelder-Mead"),
  ...
)
```

Arguments

y	model response
X	prepared matrix of high frequency variable lags for MMM term
z	a vector, data for the non-parametric part
p.ar	length of AR part
weight	the weight function
degree	the degree of local polynomial
start_bws	the starting values bandwith
start_x	the starting values for weight function
start_ar	the starting values for AR part. Should be the same length as p
method	a method passed to optim
...	additional parameters to optim

Value

an object similar to midas_r object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

midas_pl_sim *Simulate PL MIDAS regression model*

Description

Simulate PL MIDAS regression model

Usage

```
midas_pl_sim(
  n,
  m,
  theta,
  gfun,
  ar.x,
  ar.y,
  rand.gen = rnorm,
  n.start = NA,
  ...
)
```

Arguments

n	number of observations to simulate.
m	integer, frequency ratio
theta	vector, restriction coefficients for high frequency variable
gfun	function, a function which takes a single index
ar.x	vector, AR parameters for simulating high frequency variable
ar.y	vector, AR parameters for AR part of the model
rand.gen	function, a function for generating the regression innovations, default is rnorm
n.start	integer, length of a 'burn-in' period. If NA, the default, a reasonable value is computed.
...	additional parameters to rand.gen

Value

a list

Examples

```
nnbeta <- function(p, k) nbeta(c(1,p),k)

dgp <- midas_pl_sim(250, m = 12, theta = nnbeta(c(2, 4), 24),
                           gfun = function(x) 0.25*x^3,
                           ar.x = 0.9, ar.y = 0.5, n.start = 100)
```

midas_qr *Restricted MIDAS quantile regression*

Description

Estimate restricted MIDAS quantile regression using nonlinear quantile regression

Usage

```
midas_qr(
  formula,
  data,
  tau = 0.5,
  start,
  Ofunction = "nlrq",
  weight_gradients = NULL,
  guess_start = TRUE,
  ...
)
```

Arguments

formula	formula for restricted MIDAS regression or midas_qr object. Formula must include mls function
data	a named list containing data with mixed frequencies
tau	quantile
start	the starting values for optimisation. Must be a list with named elements.
Ofunction	the list with information which R function to use for optimisation. The list must have element named Ofunction which contains character string of chosen R function. Other elements of the list are the arguments passed to this function. The default optimisation function is optim with argument method="BFGS". Other supported functions are nls
weight_gradients	a named list containing gradient functions of weights. The weight gradient function must return the matrix with dimensions $d_k \times q$, where d_k and q are the number of coefficients in unrestricted and restricted regressions correspondingly. The names of the list should coincide with the names of weights used in formula. The default value is NULL, which means that the numeric approximation of weight function gradient is calculated. If the argument is not NULL, but the name of the weight used in formula is not present, it is assumed that there exists an R function which has the name of the weight function appended with _gradient.
guess_start,	logical, if TRUE tries certain strategy to improve starting values
...	additional arguments supplied to optimisation function

Value

a midas_r object which is the list with the following elements:

- `coefficients` the estimates of parameters of restrictions
- `midas_coefficients` the estimates of MIDAS coefficients of MIDAS regression
- `model` model data
- `unrestricted` unrestricted regression estimated using midas_u
- `term_info` the named list. Each element is a list with the information about the term, such as its frequency, function for weights, gradient function of weights, etc.
- `fn0` optimisation function for non-linear least squares problem solved in restricted MIDAS regression
- `rhs` the function which evaluates the right-hand side of the MIDAS regression
- `gen_midas_coef` the function which generates the MIDAS coefficients of MIDAS regression
- `opt` the output of optimisation procedure
- `argmap_opt` the list containing the name of optimisation function together with arguments for optimisation function
- `start_opt` the starting values used in optimisation
- `start_list` the starting values as a list
- `call` the call to the function
- `terms` terms object
- `gradient` gradient of NLS objective function
- `hessian` hessian of NLS objective function
- `gradD` gradient function of MIDAS weight functions
- `Zenv` the environment in which data is placed
- `use_gradient` TRUE if user supplied gradient is used, FALSE otherwise
- `nobs` the number of effective observations
- `convergence` the convergence message
- `fitted.values` the fitted values of MIDAS regression
- `residuals` the residuals of MIDAS regression

Author(s)

Vaidotas Zemlys-Balevicius

Examples

```
##Take the same example as in midas_r

theta_h0 <- function(p, dk, ...) {
   i <- (1:dk-1)/100
   pol <- p[3]*i + p[4]*i^2
```

```
  (p[1] + p[2]*i)*exp(pol)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,10,-10,-10),4*12)

##Plot the coefficients
plot(theta0)

##Generate the predictor variable
xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))

##Fit quantile regression. All the coefficients except intercept should be constant.
##Intercept coefficient should correspond to quantile function of regression errors.
mr <- midas_qr(y~fmls(x,4*12-1,12,theta_h0), tau = c(0.1, 0.5, 0.9),
              list(y=y,x=x),
              start=list(x=c(-0.1,10,-10,-10)))

mr
```

`midas_r` *Restricted MIDAS regression*

Description

Estimate restricted MIDAS regression using non-linear least squares.

Usage

```
midas_r(
  formula,
  data,
  start,
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

`formula`	formula for restricted MIDAS regression or `midas_r` object. Formula must include `fmls` function
`data`	a named list containing data with mixed frequencies
`start`	the starting values for optimisation. Must be a list with named elements.

`Ofunction` the list with information which R function to use for optimisation. The list must have element named `Ofunction` which contains character string of chosen R function. Other elements of the list are the arguments passed to this function. The default optimisation function is `optim` with argument `method="BFGS"`. Other supported functions are `nls`

`weight_gradients`
a named list containing gradient functions of weights. The weight gradient function must return the matrix with dimensions $d_k \times q$, where d_k and q are the number of coefficients in unrestricted and restricted regressions correspondingly. The names of the list should coincide with the names of weights used in formula. The default value is NULL, which means that the numeric approximation of weight function gradient is calculated. If the argument is not NULL, but the name of the weight used in formula is not present, it is assumed that there exists an R function which has the name of the weight function appended with `_gradient`.

`...` additional arguments supplied to optimisation function

Details

Given MIDAS regression:

$$y_t = \sum_{j=1}^{p} \alpha_j y_{t-j} + \sum_{i=0}^{k} \sum_{j=0}^{l_i} \beta_j^{(i)} x_{tm_i-j}^{(i)} + u_t,$$

estimate the parameters of the restriction

$$\beta_j^{(i)} = g^{(i)}(j, \lambda).$$

Such model is a generalisation of so called ADL-MIDAS regression. It is not required that all the coefficients should be restricted, i.e the function $g^{(i)}$ might be an identity function. Model with no restrictions is called U-MIDAS model. The regressors $x_\tau^{(i)}$ must be of higher (or of the same) frequency as the dependent variable y_t.

MIDAS-AR* (a model with a common factor, see (Clements and Galvao, 2008)) can be estimated by specifying additional argument, see an example.

The restriction function must return the restricted coefficients of the MIDAS regression.

Value

a `midas_r` object which is the list with the following elements:

`coefficients` the estimates of parameters of restrictions

`midas_coefficients`
the estimates of MIDAS coefficients of MIDAS regression

`model` model data

`unrestricted` unrestricted regression estimated using `midas_u`

term_info	the named list. Each element is a list with the information about the term, such as its frequency, function for weights, gradient function of weights, etc.
fn0	optimisation function for non-linear least squares problem solved in restricted MIDAS regression
rhs	the function which evaluates the right-hand side of the MIDAS regression
gen_midas_coef	the function which generates the MIDAS coefficients of MIDAS regression
opt	the output of optimisation procedure
argmap_opt	the list containing the name of optimisation function together with arguments for optimisation function
start_opt	the starting values used in optimisation
start_list	the starting values as a list
call	the call to the function
terms	terms object
gradient	gradient of NLS objective function
hessian	hessian of NLS objective function
gradD	gradient function of MIDAS weight functions
Zenv	the environment in which data is placed
use_gradient	TRUE if user supplied gradient is used, FALSE otherwise
nobs	the number of effective observations
convergence	the convergence message
fitted.values	the fitted values of MIDAS regression
residuals	the residuals of MIDAS regression

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Clements, M. and Galvao, A., *Macroeconomic Forecasting With Mixed-Frequency Data: Forecasting Output Growth in the United States*, Journal of Business and Economic Statistics, Vol.26 (No.4), (2008) 546-554

Examples

```
##The parameter function
theta_h0 <- function(p, dk, ...) {
   i <- (1:dk-1)/100
   pol <- p[3]*i + p[4]*i^2
   (p[1] + p[2]*i)*exp(pol)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,10,-10,-10),4*12)
```

```
##Plot the coefficients
plot(theta0)

##Generate the predictor variable
xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))

##Fit restricted model
mr <- midas_r(y~fmls(x,4*12-1,12,theta_h0)-1,
              list(y=y,x=x),
              start=list(x=c(-0.1,10,-10,-10)))

##Include intercept and trend in regression
mr_it <- midas_r(y~fmls(x,4*12-1,12,theta_h0)+trend,
                 list(data.frame(y=y,trend=1:500),x=x),
                 start=list(x=c(-0.1,10,-10,-10)))

data("USrealgdp")
data("USunempr")

y.ar <- diff(log(USrealgdp))
xx <- window(diff(USunempr), start = 1949)
trend <- 1:length(y.ar)

##Fit AR(1) model
mr_ar <- midas_r(y.ar ~ trend + mls(y.ar, 1, 1) +
                 fmls(xx, 11, 12, nealmon),
                 start = list(xx = rep(0, 3)))

##First order MIDAS-AR* restricted model
mr_arstar <-  midas_r(y.ar ~ trend + mls(y.ar, 1, 1, "*")
                     + fmls(xx, 11, 12, nealmon),
                     start = list(xx = rep(0, 3)))
```

`midas_r.fit` *Fit restricted MIDAS regression*

Description

Workhorse function for fitting restricted MIDAS regression

Usage

```
midas_r.fit(x)
```

Arguments

x	midas_r object

Value

midas_r object

Author(s)

Vaidotas Zemlys

---

midas_r_ic_table *Create a weight and lag selection table for MIDAS regression model*

Description

Creates a weight and lag selection table for MIDAS regression model with given information criteria and minimum and maximum lags.

Usage

```
midas_r_ic_table(
  formula,
  data = NULL,
  start = NULL,
  table,
  IC = c("AIC", "BIC"),
  test = c("hAh_test"),
  Ofunction = "optim",
  weight_gradients = NULL,
  show_progress = TRUE,
  ...
)
```

Arguments

formula	the formula for MIDAS regression, the lag selection is performed for the last MIDAS lag term in the formula
data	a list containing data with mixed frequencies
start	the starting values for optimisation excluding the starting values for the last term
table	an wls_table object, see expand_weights_lags
IC	the names of information criteria which to compute
test	the names of statistical tests to perform on restricted model, p-values are reported in the columns of model selection table
Ofunction	see midasr

weight_gradients
: see midas_r

show_progress
: logical, TRUE to show progress bar, FALSE for silent evaluation

...
: additional parameters to optimisation function, see midas_r

Details

This function estimates models sequentially increasing the midas lag from `kmin` to `kmax` and varying the weights of the last term of the given formula

Value

a `midas_r_ic_table` object which is the list with the following elements:

table
: the table where each row contains calculated information criteria for both restricted and unrestricted MIDAS regression model with given lag structure

candlist
: the list containing fitted models

IC
: the argument IC

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)


mwlr <- midas_r_ic_table(y~trend+fmls(x,12,12,nealmon),
                   table=list(x=list(weights=
                   as.list(c("nealmon","nealmon","nbeta")),
                   lags=list(0:4,0:5,0:6),
                   starts=list(rep(0,3),rep(0,3,),c(1,1,1,0)))))

mwlr
```

midas_r_np *Estimate non-parametric MIDAS regression*

Description

Estimates non-parametric MIDAS regression

Usage

```
midas_r_np(formula, data, lambda = NULL)
```

Arguments

formula	formula specifying MIDAS regression
data	a named list containing data with mixed frequencies
lambda	smoothing parameter, defaults to NULL, which means that it is chosen by minimising AIC.

Details

Estimates non-parametric MIDAS regression accodring Breitung et al.

Value

a midas_r_np object

Author(s)

Vaidotas Zemlys

References

Breitung J, Roling C, Elengikal S (2013). *Forecasting inflation rates using daily data: A nonparametric MIDAS approach* Working paper, URL http://www.ect.uni-bonn.de/mitarbeiter/joerg-breitung/npmidas.

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)
midas_r_np(y~trend+fmls(x,12,12))
```

midas_r_plain *Restricted MIDAS regression*

Description

Function for fitting MIDAS regression without the formula interface

Usage

```
midas_r_plain(
  y,
  X,
  z = NULL,
  weight,
  grw = NULL,
  startx,
  startz = NULL,
  method = c("Nelder-Mead", "BFGS"),
  ...
)
```

Arguments

y	model response
X	prepared matrix of high frequency variable lags
z	additional low frequency variables
weight	the weight function
grw	the gradient of weight function
startx	the starting values for weight function
startz	the starting values for additional low frequency variables
method	a method passed to optimx
...	additional parameters to optimx

Value

an object similar to `midas_r` object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)

X<-fmls(x,11,12)

midas_r_plain(y,X,trend,weight=nealmon,startx=c(0,0,0))
```

---

midas_sim — *Simulate simple MIDAS regression response variable*

Description

Given the predictor variable and the coefficients simulate MIDAS regression response variable.

Usage

```
midas_sim(n, x, theta, rand_gen = rnorm, innov = rand_gen(n, ...), ...)
```

Arguments

n	The sample size
x	a ts object with MIDAS regression predictor variable
theta	a vector with MIDAS regression coefficients
rand_gen	the function which generates the sample of innovations, the default is rnorm
innov	the vector with innovations, the default is NULL, i.e. innovations are generated using argument rand_gen
...	additional arguments to rand_gen.

Details

MIDAS regression with one predictor variable has the following form:

$$y_t = \sum_{j=0}^{h} \theta_j x_{tm-j} + u_t,$$

where m is the frequency ratio and h is the number of high frequency lags included in the regression.

MIDAS regression involves times series with different frequencies. In R the frequency property is set when creating time series objects ts. Hence the frequency ratio m which figures in MIDAS regression is calculated from frequency property of time series objects supplied.

Value

a ts object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
##The parameter function
theta_h0 <- function(p, dk) {
   i <- (1:dk-1)/100
   pol <- p[3]*i + p[4]*i^2
   (p[1] + p[2]*i)*exp(pol)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,10,-10,-10),4*12)

##Plot the coefficients
plot(theta0)

##Generate the predictor variable, leave 4 low frequency lags of data for burn-in.
xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))
midas_r(y ~ mls(y, 1, 1) + fmls(x, 4*12-1, 12, theta_h0), start = list(x = c(-0.1, 10, -10, -10)))
```

---

midas_si_plain   *MIDAS Single index regression*

Description

Function for fitting SI MIDAS regression without the formula interface

Usage

```
midas_si_plain(
  y,
  X,
  p.ar = NULL,
  weight,
  degree = 1,
  start_bws,
  start_x,
```

```
  start_ar = NULL,
  method = "Nelder-Mead",
  ...
)
```

Arguments

y	model response
X	prepared matrix of high frequency variable lags for MMM term
p.ar	length of AR part
weight	the weight function
degree	the degree of local polynomial
start_bws	the starting values bandwith
start_x	the starting values for weight function
start_ar	the starting values for AR part. Should be the same length as p
method	a method passed to optim, defaults to Nelder-Mead
...	additional parameters to optim

Value

an object similar to `midas_r` object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`midas_si_sim` *Simulate SI MIDAS regression model*

Description

Simulate SI MIDAS regression model

Usage

```
midas_si_sim(
  n,
  m,
  theta,
  gfun,
  ar.x,
  ar.y,
  rand.gen = rnorm,
  n.start = NA,
  ...
)
```

Arguments

n	number of observations to simulate.
m	integer, frequency ratio
theta	vector, restriction coefficients for high frequency variable
gfun	function, a function which takes a single index
ar.x	vector, AR parameters for simulating high frequency variable
ar.y	vector, AR parameters for AR part of the model
rand.gen	function, a function for generating the regression innovations, default is `rnorm`
n.start	integer, length of a 'burn-in' period. If NA, the default, a reasonable value is computed.
...	additional parameters to rand.gen

Value

a list

Examples

```
nnbeta <- function(p, k) nbeta(c(1,p),k)

dgp <- midas_si_sim(250, m = 12, theta = nnbeta(c(2, 4), 24),
                            gfun = function(x) 0.03*x^3,
                            ar.x = 0.9, ar.y = 0.5, n.start = 100)
```

---

midas_sp *Semi-parametric MIDAS regression*

Description

Estimate semi-parametric MIDAS regression using non-linear least squares.

Usage

```
midas_sp(formula, data, bws, start, degree = 1, Ofunction = "optim", ...)
```

Arguments

formula	formula for restricted MIDAS regression or `midas_r` object. Formula must include `fmls` function
data	a named list containing data with mixed frequencies
bws	a bandwith specification. Note you need to supply logarithm value of the bandwith.

start	the starting values for optimisation. Must be a list with named elements.
degree	the degree of local polynomial. 0 corresponds to local-constant, 1 local-linear. For univariate models higher values can be provided.
Ofunction	the list with information which R function to use for optimisation. The list must have element named Ofunction which contains character string of chosen R function. Other elements of the list are the arguments passed to this function. The default optimisation function is optim with arguments method="Nelder-Mead" and control=list(maxit=5000). Other supported functions are nls, optimx.
...	additional arguments supplied to optimisation function

Details

Given MIDAS regression:

$$y_t = \sum_{j=1}^{p} \alpha_j y_{t-j} + \sum_{i=0}^{k} \sum_{j=0}^{l_i} \beta_j^{(i)} x_{tm_i-j}^{(i)} + u_t,$$

estimate the parameters of the restriction

$$\beta_j^{(i)} = g^{(i)}(j, \lambda).$$

Such model is a generalisation of so called ADL-MIDAS regression. It is not required that all the coefficients should be restricted, i.e the function $g^{(i)}$ might be an identity function. The regressors $x_\tau^{(i)}$ must be of higher (or of the same) frequency as the dependent variable y_t.

Value

a midas_sp object which is the list with the following elements:

coefficients	the estimates of parameters of restrictions
midas_coefficients	the estimates of MIDAS coefficients of MIDAS regression
model	model data
unrestricted	unrestricted regression estimated using midas_u
term_info	the named list. Each element is a list with the information about the term, such as its frequency, function for weights, gradient function of weights, etc.
fn0	optimisation function for non-linear least squares problem solved in restricted MIDAS regression
rhs	the function which evaluates the right-hand side of the MIDAS regression
gen_midas_coef	the function which generates the MIDAS coefficients of MIDAS regression
opt	the output of optimisation procedure
argmap_opt	the list containing the name of optimisation function together with arguments for optimisation function
start_opt	the starting values used in optimisation

start_list	the starting values as a list
call	the call to the function
terms	terms object
gradient	gradient of NLS objective function
hessian	hessian of NLS objective function
gradD	gradient function of MIDAS weight functions
Zenv	the environment in which data is placed
nobs	the number of effective observations
convergence	the convergence message
fitted.values	the fitted values of MIDAS regression
residuals	the residuals of MIDAS regression

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys-Balevičius

---

midas_u *Estimate unrestricted MIDAS regression*

Description

Estimate unrestricted MIDAS regression using OLS. This function is a wrapper for `lm`.

Usage

```
midas_u(formula, data, ...)
```

Arguments

formula	MIDAS regression model formula
data	a named list containing data with mixed frequencies
...	further arguments, which could be passed to `lm` function.

Details

MIDAS regression has the following form:

$$y_t = \sum_{j=1}^{p} \alpha_j y_{t-j} + \sum_{i=0}^{k} \sum_{j=0}^{l_i} \beta_j^{(i)} x_{tm_i-j}^{(i)} + u_t,$$

where $x_\tau^{(i)}$, $i = 0, ...k$ are regressors of higher (or similar) frequency than y_t. Given certain assumptions the coefficients can be estimated using usual OLS and they have the familiar properties associated with simple linear regression.

Value

lm object.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

References

Kvedaras V., Zemlys, V. *Testing the functional constraints on parameters in regressions with variables of different frequency* Economics Letters 116 (2012) 250-254

Examples

```
##The parameter function
theta_h0 <- function(p, dk, ...) {
   i <- (1:dk-1)/100
   pol <- p[3]*i + p[4]*i^2
   (p[1] + p[2]*i)*exp(pol)
}

##Generate coefficients
theta0 <- theta_h0(c(-0.1,10,-10,-10),4*12)

##Plot the coefficients
##Do not run
#plot(theta0)

##' ##Generate the predictor variable
xx <- ts(arima.sim(model = list(ar = 0.6), 600 * 12), frequency = 12)

##Simulate the response variable
y <- midas_sim(500, xx, theta0)

x <- window(xx, start=start(y))

##Create low frequency data.frame
ldt <- data.frame(y=y,trend=1:length(y))

##Create high frequency data.frame

hdt <- data.frame(x=window(x, start=start(y)))

##Fit unrestricted model
mu <- midas_u(y~fmls(x,2,12)-1, list(ldt, hdt))

##Include intercept and trend in regression

mu_it <- midas_u(y~fmls(x,2,12)+trend, list(ldt, hdt))

##Pass data as partialy named list
```

```
mu_it <- midas_u(y~fmls(x,2,12)+trend, list(ldt, x=hdt$x))
```

---

mls *MIDAS lag structure*

Description

Create a matrix of selected MIDAS lags

Usage

```
mls(x, k, m, ...)
```

Arguments

x	a vector
k	a vector of lag orders, zero denotes contemporaneous lag.
m	frequency ratio
...	further arguments used in fitting MIDAS regression

Details

The function checks whether high frequency data is complete, i.e. `m` must divide `length(x)`.

Value

a matrix containing the lags

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
## Quarterly frequency data
x <- 1:16
## Create MIDAS lag for use with yearly data
mls(x,0:3,4)

## Do not use contemporaneous lag
mls(x,1:3,4)

## Compares with embed when m=1
embed(x,2)
mls(x,0:1,1)
```

mlsd *MIDAS lag structure with dates*

Description

MIDAS lag structure with dates

Usage

```
mlsd(x, k, datey, ...)
```

Arguments

`x`	a vector
`k`	lags, a vector
`datey`	low frequency dates
`...`	further arguments used in fitting MIDAS regression

Value

a matrix containing the first differences and the lag k+1.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys-Balevičius

Examples

```
x <- c(1:144)
y <- c(1:12)
datey <- (y-1)*12+1

#msld and mls should give the same results

m1 <- mlsd(x, 0:5, datey)

m2 <- mls(x, 0:5, 12)

sum(abs(m1 - m2))
```

mmm *Compute MMM term for high frequency variable*

Description

Compute MMM term for high frequency variable

Usage

```
mmm(X, theta, beta, ...)
```

Arguments

X	matrix, high frequency variable embedded in low frequency, output of mls
theta	vector, restriction coefficients for high frequency variable
beta	vector of length 2, parameters for MMM term, slope and MMM parameter.
...,	currently not used

Value

a vector

modsel *Select the model based on given information criteria*

Description

Selects the model with minimum of given information criteria and model type

Usage

```
modsel(
  x,
  IC = x$IC[1],
  test = x$test[1],
  type = c("restricted", "unrestricted"),
  print = TRUE
)
```

Arguments

x	a midas_r_ic_table object
IC	the name of information criteria to base the choosing of the model
test	the name of the test for which to print out the p-value
type	the type of MIDAS model, either restricted or unrestricted
print	logical, if TRUE, prints the summary of the best model.

Details

This function selects the model from the model selection table for which the chosen information criteria achieves the smallest value. The function works with model tables produced by functions lf_lags_table, hf_lags_table, amidas_table and midas_r_ic_table.

Value

(invisibly) the best model based on information criteria, midas_r object

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)

mhfr <- hf_lags_table(y~trend+fmls(x,12,12,nealmon),
                      start=list(x=rep(0,3)),
                      from=list(x=0),to=list(x=c(4,6)))

mlfr <- lf_lags_table(y~trend+fmls(x,12,12,nealmon),
                      start=list(x=rep(0,3)),
                      from=list(x=0),to=list(x=c(2,3)))

modsel(mhfr,"BIC","unrestricted")

modsel(mlfr,"BIC","unrestricted")
```

`nakagamip` *Normalized Nakagami probability density function MIDAS weights specification*

Description

Calculate MIDAS weights according to normalized Nakagami probability density function specification

Usage

```
nakagamip(p, d, m)
```

Arguments

`p`	parameters for normalized Nakagami probability density function
`d`	number of coefficients
`m`	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

`nakagamip_gradient` *Gradient function for normalized Nakagami probability density function MIDAS weights specification*

Description

Calculate gradient function for normalized Nakagami probability density function specification of MIDAS weights.

Usage

```
nakagamip_gradient(p, d, m)
```

Arguments

`p`	parameters for normalized Nakagami probability density function
`d`	number of coefficients
`m`	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Julius Vainora

nbeta *Normalized beta probability density function MIDAS weights specification*

Description

Calculate MIDAS weights according to normalized beta probability density function specification

Usage

```
nbeta(p, d, m)
```

Arguments

p	parameters for normalized beta probability density function
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

nbetaMT *Normalized beta probability density function MIDAS weights specification (MATLAB toolbox compatible)*

Description

Calculate MIDAS weights according to normalized beta probability density function specification. Compatible with the specification in MATLAB toolbox.

Usage

```
nbetaMT(p, d, m)
```

Arguments

p	parameters for normalized beta probability density function
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`nbetaMT_gradient` *Gradient function for normalized beta probability density function MIDAS weights specification (MATLAB toolbox compatible)*

Description

Calculate gradient function for normalized beta probability density function specification of MIDAS weights.

Usage

```
nbetaMT_gradient(p, d, m)
```

Arguments

`p`	parameters for normalized beta probability density function
`d`	number of coefficients
`m`	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`nbeta_gradient` *Gradient function for normalized beta probability density function MIDAS weights specification*

Description

Calculate gradient function for normalized beta probability density function specification of MIDAS weights.

Usage

```
nbeta_gradient(p, d, m)
```

Arguments

p	parameters for normalized beta probability density function
d	number of coefficients
m	the frequency ratio, currently ignored

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`nealmon` *Normalized Exponential Almon lag MIDAS coefficients*

Description

Calculate normalized exponential Almon lag coefficients given the parameters and required number of coefficients.

Usage

```
nealmon(p, d, m)
```

Arguments

p	parameters for Almon lag
d	number of the coefficients
m	the frequency, currently ignored.

Details

Given unrestricted MIDAS regression

$$y_t = \sum_{h=0}^{d} \theta_h x_{tm-h} + \mathbf{z_t}\beta + u_t$$

normalized exponential Almon lag restricts the coefficients $theta_h$ in the following way:

$$\theta_h = \delta \frac{\exp(\lambda_1(h+1) + \ldots + \lambda_r(h+1)^r)}{\sum_{s=0}^{d} \exp(\lambda_1(s+1) + \ldots + \lambda_r(h+1)^r)}$$

The parameter δ should be the first element in vector p. The degree of the polynomial is then decided by the number of the remaining parameters.

Value

vector of coefficients

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
##Load data
data("USunempr")
data("USrealgdp")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
t <- 1:length(y)

midas_r(y~t+fmls(x,11,12,nealmon),start=list(x=c(0,0,0)))
```

`nealmon_gradient` *Gradient function for normalized exponential Almon lag weights*

Description

Gradient function for normalized exponential Almon lag weights

Usage

```
nealmon_gradient(p, d, m)
```

Arguments

p	hyperparameters for Almon lag
d	number of coefficients
m	the frequency ratio, currently ignored

Value

the gradient matrix

Author(s)

Vaidotas Zemlys

oos_prec — *Out-of-sample prediction precision data on simulation example*

Description

The code in the example generates the out-of-sample prediction precision data for correctly and incorrectly constrained MIDAS regression model compared to unconstrained MIDAS regression model.

Format

A `data.frame` object with four columns. The first column indicates the sample size, the second the type of constraint, the third the value of the precision measure and the fourth the type of precision measure.

Examples

```
## Do not run:
## set.seed(1001)

## gendata<-function(n) {
##     trend<-c(1:n)
##     z<-rnorm(12*n)
##     fn.z <- nealmon(p=c(2,0.5,-0.1),d=17)
##     y<-2+0.1*trend+mls(z,0:16,12)%*%fn.z+rnorm(n)
##     list(y=as.numeric(y),z=z,trend=trend)
## }

## nn <- c(50,100,200,300,500,750,1000)

## data_sets <- lapply(n,gendata)

## mse <- function(x) {
##     mean(residuals(x)^2)
## }
```

```
## bnorm <- function(x) {
##     sqrt(sum((coef(x, midas = TRUE)-c(2,0.1,nealmon(p=c(2,0.5,-0.1),d=17)))^2))
## }

## rep1 <- function(n) {
##     dt <- gendata(round(1.25*n))
##     ni <- n
##     ind <- 1:ni
##     mind <- 1:(ni*12)
##     indt<-list(y=dt$y[ind],z=dt$z[mind],trend=dt$trend[ind])
##     outdt <- list(y=dt$y[-ind],z=dt$z[-mind],trend=dt$trend[-ind])
##     um <- midas_r(y~trend+mls(z,0:16,12),data=indt,start=NULL)
##     nm <- midas_r(y~trend+mls(z,0:16,12,nealmon),data=indt,start=list(z=c(1,-1,0)))
##     am <- midas_r(y~trend+mls(z,0:16,12,almonp),data=indt,start=list(z=c(1,0,0,0)))
##     modl <- list(um,nm,am)
##     names(modl) <- c("um","nm","am")
##     list(norms=sapply(modl,bnorm),
##          mse=sapply(modl,function(mod)mean((forecast(mod,newdata=outdt)-outdt$y)^2)))
## }

## repr <- function(n,R) {
##     cc <- lapply(1:R,function(i)rep1(n))
##     list(norms=t(sapply(cc,"[[","norms")),mse=t(sapply(cc,"[[","mse")))
## }

## res <- lapply(nn,repr,R=1000)

## norms <- data.frame(nn,t(sapply(lapply(res,"[[","norms"),function(l)apply(l,2,mean))))
## mses <- data.frame(nn,t(sapply(lapply(res,"[[","mse"),function(l)apply(l,2,mean))))


## msd <- melt(mses[-1,],id=1)
## colnames(msd)[2] <- "Constraint"
## nmd <- melt(norms[-1,],id=1)
## colnames(nmd)[2] <- "Constraint"

## msd$Type <- "Mean squared error"
## nmd$Type <- "Distance from true values"
## oos_prec <- rbind(msd,nmd)
## oos_prec$Type <- factor(oos_prec$Type,levels=c("Mean squared error","Distance from true values"))
```

---

plot_lstr *Plot MIDAS coefficients*

Description

Plots logistic function for LSTR MIDAS regression

Usage

```
plot_lstr(x, term_name, title = NULL, compare = NULL, ...)
```

Arguments

x	midas_r object
term_name	the term name for which the coefficients are plotted. Default is NULL, which selects the first MIDAS term
title	the title string of the graph. The default is NULL for the default title.
compare	the parameters for weight function to compare with the model, default is NULL
...	not used

Details

Plots logistic function for LSTR MIDSAS regression of unrestricted MIDAS regression

Value

a data frame with restricted MIDAS coefficients, unrestricted MIDAS coefficients and lower and upper confidence interval limits. The data frame is returned invisibly.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

---

plot_midas_coef *Plot MIDAS coefficients*

Description

Plots MIDAS coefficients of a MIDAS regression for a selected term.

Usage

```
plot_midas_coef(x, term_name, title, ...)

## S3 method for class 'midas_r'
plot_midas_coef(
  x,
  term_name = NULL,
  title = NULL,
  vcov. = sandwich,
  unrestricted = x$unrestricted,
  ...
)
```

Arguments

`x`	`midas_r` object
`term_name`	the term name for which the coefficients are plotted. Default is `NULL`, which selects the first MIDAS term
`title`	the title string of the graph. The default is `NULL` for the default title.
`...`	additional arguments passed to `vcov`.
`vcov.`	the covariance matrix to calculate the standard deviation of the cofficients
`unrestricted`	the unrestricted model, the default is unrestricted model from the `x` object. Set NULL to plot only the weights.

Details

Plots MIDAS coefficients of a selected MIDAS regression term together with corresponding MIDAS coefficients and their confidence intervals of unrestricted MIDAS regression

Value

a data frame with restricted MIDAS coefficients, unrestricted MIDAS coefficients and lower and upper confidence interval limits. The data frame is returned invisibly.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USrealgdp")
data("USunempr")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr), start = 1949)
trend <- 1:length(y)

##24 high frequency lags of x included
mr <- midas_r(y ~ trend + fmls(x, 23, 12, nealmon), start = list(x = rep(0, 3)))

plot_midas_coef(mr)
```

`plot_midas_coef.midas_nlpr` *Plot MIDAS coefficients*

Description

Plots MIDAS coefficients of a MIDAS regression for a selected term.

Usage

```
## S3 method for class 'midas_nlpr'
plot_midas_coef(
  x,
  term_name = NULL,
  title = NULL,
  compare = NULL,
  normalize = FALSE,
  ...
)
```

Arguments

x	midas_r object
term_name	the term name for which the coefficients are plotted. Default is NULL, which selects the first MIDAS term
title	the title string of the graph. The default is NULL for the default title.
compare	the parameters for weight function to compare with the model, default is NULL
normalize	logical, if FALSE use the weight from the model, if TRUE, set the normalization coefficient of the weight function to 1.
...	not used

Details

Plots MIDAS coefficients of a selected MIDAS regression term together with corresponding MIDAS coefficients and their confidence intervals of unrestricted MIDAS regression

Value

a data frame with restricted MIDAS coefficients, unrestricted MIDAS coefficients and lower and upper confidence interval limits. The data frame is returned invisibly.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

---

plot_sp *Plot non-parametric part of the single index MIDAS regression*

Description

Plot non-parametric part of the single index MIDAS regression of unrestricted MIDAS regression

Usage

```
plot_sp(x, term_name, title = NULL, compare = NULL, ...)
```

Arguments

`x`	`midas_r` object
`term_name`	the term name for which the coefficients are plotted. Default is `NULL`, which selects the first MIDAS term
`title`	the title string of the graph. The default is `NULL` for the default title.
`compare`	the parameters for weight function to compare with the model, default is NULL
`...`	not used

Value

a data frame with restricted MIDAS coefficients, unrestricted MIDAS coefficients and lower and upper confidence interval limits. The data frame is returned invisibly.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

`polystep` *Step function specification for MIDAS weights*

Description

Step function specification for MIDAS weights

Usage

```
polystep(p, d, m, a)
```

Arguments

`p`	vector of parameters
`d`	number of coefficients
`m`	the frequency ratio, currently ignored
`a`	vector of increasing positive integers indicating the steps

Value

vector of coefficients

Author(s)

Vaidotas Zemlys

polystep_gradient — *Gradient of step function specification for MIDAS weights*

Description

Gradient of step function specification for MIDAS weights

Usage

```
polystep_gradient(p, d, m, a)
```

Arguments

p	vector of parameters
d	number of coefficients
m	the frequency ratio, currently ignored
a	vector of increasing positive integers indicating the steps

Value

vector of coefficients

Author(s)

Vaidotas Zemlys

predict.midas_nlpr — *Predict method for non-linear parametric MIDAS regression fit*

Description

Predicted values based on `midas_nlpr` object.

Usage

```
## S3 method for class 'midas_nlpr'
predict(object, newdata, na.action = na.omit, ...)
```

Arguments

object	`midas_nlpr` object
newdata	a named list containing data for mixed frequencies. If omitted, the in-sample values are used.
na.action	function determining what should be done with missing values in `newdata`. The most likely cause of missing values is the insufficient data for the lagged variables. The default is to omit such missing values.
...	additional arguments, not used

Details

predict.midas_nlpr produces predicted values, obtained by evaluating regression function in the frame newdata. This means that the appropriate model matrix is constructed using only the data in newdata. This makes this function not very convenient for forecasting purposes. If you want to supply the new data for forecasting horizon only use the function forecast.midas_r. Also this function produces only static predictions, if you want dynamic forecasts use the forecast.midas_r.

Value

a vector of predicted values

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

---

predict.midas_r — *Predict method for MIDAS regression fit*

Description

Predicted values based on midas_r object.

Usage

```
## S3 method for class 'midas_r'
predict(object, newdata, na.action = na.omit, ...)
```

Arguments

object	midas_r object
newdata	a named list containing data for mixed frequencies. If omitted, the in-sample values are used.
na.action	function determining what should be done with missing values in newdata. The most likely cause of missing values is the insufficient data for the lagged variables. The default is to omit such missing values.
...	additional arguments, not used

Details

predict.midas_r produces predicted values, obtained by evaluating regression function in the frame newdata. This means that the appropriate model matrix is constructed using only the data in newdata. This makes this function not very convenient for forecasting purposes. If you want to supply the new data for forecasting horizon only use the function forecast.midas_r. Also this function produces only static predictions, if you want dynamic forecasts use the forecast.midas_r.

Value

a vector of predicted values

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USrealgdp")
data("USunempr")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr), start = 1949)

##24 high frequency lags of x included
mr <- midas_r(y ~ fmls(x, 23, 12, nealmon), start = list(x = rep(0, 3)))

##Declining unemployment
xn <- rnorm(2 * 12, -0.1, 0.1)

##Only one predicted value, historical values discarded
predict(mr, list(x = xn))

##Historical values taken into account
forecast(mr, list(x = xn))
```

---

predict.midas_sp *Predict method for semi-parametric MIDAS regression fit*

Description

Predicted values based on `midas_sp` object.

Usage

```
## S3 method for class 'midas_sp'
predict(object, newdata, na.action = na.omit, ...)
```

Arguments

`object`	`midas_nlpr` object
`newdata`	a named list containing data for mixed frequencies. If omitted, the in-sample values are used.
`na.action`	function determining what should be done with missing values in `newdata`. The most likely cause of missing values is the insufficient data for the lagged variables. The default is to omit such missing values.
`...`	additional arguments, not used

Details

predict.midas_sp produces predicted values, obtained by evaluating regression function in the frame newdata. This means that the appropriate model matrix is constructed using only the data in newdata. This makes this function not very convenient for forecasting purposes. If you want to supply the new data for forecasting horizon only use the function forecast.midas_r. Also this function produces only static predictions, if you want dynamic forecasts use the forecast.midas_r.

Value

a vector of predicted values

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys-Balevičius

---

prep_hAh   *Calculate data for hAh_test and hAhr_test*

Description

Workhorse function for calculating necessary matrices for hAh_test and hAhr_test. Takes the same parameters as hAh_test

Usage

```
prep_hAh(x)
```

Arguments

x	midas_r object

Value

a list with necessary matrices

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

See Also

hAh_test, hAhr_test

rvsp500 *Realized volatility of S&P500 index*

Description

Realized volatility of S&P500(Live) index of the period 2000 01 03 - 2013 11 22

Format

A `data.frame` object with two columns. First column contains date id, and the second the realized volatility for S&P500 index.

Source

https://realized.oxford-man.ox.ac.uk/images/oxfordmanrealizedvolatilityindices-0.2-final.zip

References

Heber, Gerd and Lunde, Asger, and Shephard, Neil and Sheppard, Kevin *Oxford-Man Institute's realized library*, Oxford-Man Institute, University of Oxford (2009)

Examples

```
## Do not run:
## Download the data from
## https://realized.oxford-man.ox.ac.uk/images/oxfordmanrealizedvolatilityindices-0.2-final.zip
## It contains the file OxfordManRealizedVolatilityIndices.csv.

## rvi <- read.csv("OxfordManRealizedVolatilityIndices.csv",check.names=FALSE,skip=2)
## ii <- which(rvi$DateID=="20131112")
## rvsp500 <- na.omit(rvi[1:ii,c("DataID","SPX2.rv")]
```

select_and_forecast *Create table for different forecast horizons*

Description

Creates tables for different forecast horizons and table for combined forecasts

Usage

```
select_and_forecast(
  formula,
  data,
  from,
  to,
  insample,
  outsample,
  weights,
  wstart,
  start = NULL,
  IC = "AIC",
  seltype = c("restricted", "unrestricted"),
  test = "hAh_test",
  ftype = c("fixed", "recursive", "rolling"),
  measures = c("MSE", "MAPE", "MASE"),
  fweights = c("EW", "BICW", "MSFE", "DMSFE"),
  ...
)
```

Arguments

`formula`	initial formula for the
`data`	list of data
`from`	a named list of starts of lags from where to fit. Denotes the horizon
`to`	a named list for lag selections
`insample`	the low frequency indexes for in-sample data
`outsample`	the low frequency indexes for out-of-sample data
`weights`	names of weight function candidates
`wstart`	starting values for weight functions
`start`	other starting values
`IC`	name of information criteria to choose model from
`seltype`	argument to modsel, `"restricted"` for model selection based on information criteria of restricted MIDAS model, `"unrestricted"` for model selection based on unrestricted (U-MIDAS) model.
`test`	argument to modsel
`ftype`	which type of forecast to use.
`measures`	the names of goodness of fit measures
`fweights`	names of weighting schemes
`...`	additional arguments for optimisation method, see midas_r

Details

Divide data into in-sample and out-of-sample. Fit different forecasting horizons for in-sample data. Calculate accuracy measures for individual and average forecasts.

Value

a list containing forecasts, tables of accuracy measures and the list with selected models

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
### Sets a seed for RNG ###
set.seed(1001)
## Number of low-frequency observations
n<-250
## Linear trend and higher-frequency explanatory variables (e.g. quarterly and monthly)
trend<-c(1:n)
x<-rnorm(4*n)
z<-rnorm(12*n)
## Exponential Almon polynomial constraint-consistent coefficients
fn.x <- nealmon(p=c(1,-0.5),d=8)
fn.z <- nealmon(p=c(2,0.5,-0.1),d=17)
## Simulated low-frequency series (e.g. yearly)
y<-2+0.1*trend+mls(x,0:7,4)%*%fn.x+mls(z,0:16,12)%*%fn.z+rnorm(n)
##Do not run
## cbfc<-select_and_forecast(y~trend+mls(x,0,4)+mls(z,0,12),
## from=list(x=c(4,8,12),z=c(12,24,36)),
## to=list(x=rbind(c(14,19),c(18,23),c(22,27)),z=rbind(c(22,27),c(34,39),c(46,51))),
## insample=1:200,outsample=201:250,
## weights=list(x=c("nealmon","almonp"),z=c("nealmon","almonp")),
## wstart=list(nealmon=rep(1,3),almonp=rep(1,3)),
## IC="AIC",
## seltype="restricted",
## ftype="fixed",
## measures=c("MSE","MAPE","MASE"),
## fweights=c("EW","BICW","MSFE","DMSFE")
## )
```

---

simulate.midas_r *Simulate MIDAS regression response*

Description

Simulates one or more responses from the distribution corresponding to a fitted MIDAS regression object.

Usage

```
## S3 method for class 'midas_r'
simulate(
  object,
  nsim = 999,
  seed = NULL,
  future = TRUE,
  newdata = NULL,
  insample = NULL,
  method = c("static", "dynamic"),
  innov = NULL,
  show_progress = TRUE,
  ...
)
```

Arguments

object	midas_r object
nsim	number of simulations
seed	either NULL or an integer that will be used in a call to set.seed before simulating the time series. The default, NULL will not change the random generator state.
future	logical, if TRUE forecasts are simulated, if FALSE in-sample simulation is performed.
newdata	a named list containing future values of mixed frequency regressors. The default is NULL, meaning that only in-sample data is used.
insample	a list containing the historic mixed frequency data
method	the simulation method, if "static" in-sample values for dependent variable are used in autoregressive MIDAS model, if "dynamic" the dependent variable values are calculated step-by-step from the initial in-sample values.
innov	a matrix containing the simulated innovations. The default is NULL, meaning, that innovations are simulated from model residuals.
show_progress	logical, TRUE to show progress bar, FALSE for silent evaluation
...	not used currently

Details

Only the regression innovations are simulated, it is assumed that the predictor variables and coefficients are fixed. The innovation distribution is simulated via bootstrap.

Value

a matrix of simulated responses. Each row contains a simulated response.

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USrealgdp")
data("USunempr")

y <- diff(log(USrealgdp))
x <- window(diff(USunempr), start = 1949)
trend <- 1:length(y)

##24 high frequency lags of x included
mr <- midas_r(y ~ trend + fmls(x, 23, 12, nealmon), start = list(x = rep(0, 3)))

simulate(mr, nsim=10, future=FALSE)

##Forecast horizon
h <- 3
##Declining unemployment
xn <- rep(-0.1, 12*3)
##New trend values
trendn <- length(y) + 1:h

simulate(mr, nsim = 10, future = TRUE, newdata = list(trend = trendn, x = xn))
```

---

split_data *Split mixed frequency data into in-sample and out-of-sample*

Description

Splits mixed frequency data into in-sample and out-of-sample datasets given the indexes of the low frequency data

Usage

```
split_data(data, insample, outsample)
```

Arguments

data	a list containing mixed frequency data
insample	the low frequency indexes for in-sample data
outsample	the low frequency indexes for out-of-sample data

Details

It is assumed that data is a list containing mixed frequency data. Then given the indexes of the low frequency data the function splits the data into two subsets.

Value

a list with elements `indata` and `outdata` containing respectively in-sample and out-of-sample data sets

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
#Monthly data
x <- 1:24
#Quartely data
z <- 1:8
#Yearly data
y <- 1:2
split_data(list(y=y,x=x,z=z),insample=1,outsample=2)
```

---

update_weights — *Updates weights in MIDAS regression formula*

Description

Updates weights in a expression with MIDAS term

Usage

```
update_weights(expr, tb)
```

Arguments

`expr`	expression with MIDAS term
`tb`	a named list with redefined weights

Details

For a MIDAS term `fmls(x, 6, 1, nealmon)` change weight `nealmon` to another weight.

Value

an expression with changed weights

Author(s)

Vaidotas Zemlys

Examples

```
update_weights(y~trend+mls(x,0:7,4,nealmon)+mls(z,0:16,12,nealmon),list(x = "nbeta", z = ""))
```

UScpiqs — *US quartely seasonaly adjusted consumer price index*

Description

US quarterly CPI from 1960Q1 to 2017Q3s. Seasonaly adjusted, Index 2015=1

Format

A `data.frame` object.

Source

FRED

USeffrw — *US weekly effective federal funds rate.*

Description

US weekly effective federal funds rate from 1954-07-07 to 2017-12-13

Format

A `data.frame` object.

Source

FRED

USpayems — *United States total employment non-farms payroll, monthly, seasonally adjusted.*

Description

United States total employment non-farms payroll, monthly, seasonally adjusted. Retrieved from FRED, symbol "PAYEMS" at 2014-04-25.

Format

A `ts` object.

Source

FRED, Federal Reserve Economic Data, from the Federal Reserve Bank of St. Louis

Examples

```
## Do not run:
## library(quantmod)
## USpayems <- ts(getSymbols("PAYEMS",src="FRED",auto.assign=FALSE),start=c(1939,1),frequency=12)
```

USqgdp *United States gross domestic product, quarterly, seasonaly adjusted annual rate.*

Description

United States gross domestic product, quarterly, seasonaly adjusted annual rate. Retrieved from FRED, symbol "GDP" at 2014-04-25.

Format

A `ts` object.

Source

FRED, Federal Reserve Economic Data, from the Federal Reserve Bank of St. Louis

Examples

```
## Do not run:
## library(quantmod)
## USqgdp <- ts(getSymbols("GDP",src="FRED",auto.assign=FALSE),start=c(1947,1),frequency=4)
```

USrealgdp *US annual gross domestic product in billions of chained 2005 dollars*

Description

The annual gross domestic product in billions of chained 2005 dollars for US from 1948 to 2011. This data is kept for historical purposes, newer data is in 2012 chained dollars.

Format

A `ts` object.

Source

U.S. Department of Commerce, Bureau of Economic Analysis

USunempr *US monthly unemployment rate*

Description

The monthly unemployment rate for United States from 1948 to 2011.

Format

A ts object.

Source

FRED

weights_table *Create a weight function selection table for MIDAS regression model*

Description

Creates a weight function selection table for MIDAS regression model with given information criteria and weight functions.

Usage

```
weights_table(
  formula,
  data,
  start = NULL,
  IC = c("AIC", "BIC"),
  test = c("hAh_test"),
  Ofunction = "optim",
  weight_gradients = NULL,
  ...
)
```

Arguments

formula	the formula for MIDAS regression, the lag selection is performed for the last MIDAS lag term in the formula
data	a list containing data with mixed frequencies
start	the starting values for optimisation
IC	the information criteria which to compute
test	the names of statistical tests to perform on restricted model, p-values are reported in the columns of model selection table

Ofunction	see midasr
weight_gradients	see midas_r
...	additional parameters to optimisation function, see midas_r

Details

This function estimates models sequentially increasing the midas lag from kmin to kmax of the last term of the given formula

Value

a midas_r_ic_table object which is the list with the following elements:

table	the table where each row contains calculated information criteria for both restricted and unrestricted MIDAS regression model with given lag structure
candlist	the list containing fitted models
IC	the argument IC

Author(s)

Virmantas Kvedaras, Vaidotas Zemlys

Examples

```
data("USunempr")
data("USrealgdp")
y <- diff(log(USrealgdp))
x <- window(diff(USunempr),start=1949)
trend <- 1:length(y)
mwr <- weights_table(y~trend+fmls(x,12,12,nealmon),
                     start=list(x=list(nealmon=rep(0,3),
                     nbeta=c(1,1,1,0))))

mwr
```

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