

Package ‘ecm’

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Type Package

Title Build Error Correction Models

Imports stats, zoo

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Description Functions for easy building of error correction models (ECM) for time series regression.

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ecm

*Build an error correction model***Description**

Builds an `lm` object that represents an error correction model (ECM) by automatically differencing and lagging predictor variables according to ECM methodology.

Usage

```
ecm(y, xeq, xtr)
```

Arguments

<code>y</code>	The target variable
<code>xeq</code>	The variables to be used in the equilibrium term of the error correction model
<code>xtr</code>	The variables to be used in the transient term of the error correction model

Details

The general format of an ECM is

$$\Delta y = \beta_0 + \beta_1 \Delta x_{1,t} + \dots + \beta_i \Delta x_{i,t} + \gamma(y_{t-1} - (x_{1,t-1} + \dots + x_{i,t-1})).$$

The `ecm` function here modifies the equation to the following:

$$\Delta y = \beta_0 + \beta_1 \Delta x_{1,t} + \dots + \beta_i \Delta x_{i,t} + \gamma y_{t-1} + \gamma_1 x_{1,t-1} + \dots + \gamma_i x_{i,t-1},$$

so it can be modeled as a simpler ordinary least squares (OLS) function using R's `lm` function.

Notice that an ECM models the change in the target variable (`y`). This means that the predictors will be lagged and differenced, and the model will be built on one observation less than what the user inputs for `y`, `xeq`, and `xtr`. If these arguments contain vectors with too few observations (eg. one single observation), the function will not work.

ECM models are used for time series data. This means the user may need to consider stationarity and/or cointegration before using the model.

Value

an `lm` object representing an error correction model

See Also

`lm`

Examples

```
#Use ecm to predict Wilshire 5000 index based on corporate profits,
#Federal Reserve funds rate, and unemployment rate
data(Wilshire)

#Use 2014-12-01 and earlier data to build models
trn <- Wilshire[Wilshire$date<='2014-12-01',]

#Assume all predictors are needed in the equilibrium and transient terms of ecm
xeq <- xtr <- trn[c('CorpProfits', 'FedFundsRate', 'UnempRate')]
model1 <- ecm(trn$Wilshire5000, xeq, xtr)

#Assume CorpProfits and FedFundsRate are in the equilibrium term,
#UnempRate has only transient impacts
xeq <- trn[c('CorpProfits', 'FedFundsRate')]
xtr <- trn['UnempRate']
model2 <- ecm(trn$Wilshire5000, xeq, xtr)
```

ecmback

Backwards selection to build an error correction model

Description

Much like the ecm function, this builds an error correction model. However, it uses backwards selection to select the optimal predictors based on lowest AIC or BIC, rather than using all predictors. ecmback has the same parameters and output as ecm.

Usage

```
ecmback(y, xeq, xtr, criterion = "AIC")
```

Arguments

y	The target variable
xeq	The variables to be used in the equilibrium term of the error correction model
xtr	The variables to be used in the transient term of the error correction model
criterion	Whether AIC (default) or BIC should be used to select variables

Value

an lm object representing an error correction model using backwards selection

See Also

lm

Examples

```
#Use ecm to predict Wilshire 5000 index based on corporate profits,  
#Federal Reserve funds rate, and unemployment rate  
data(Wilshire)  
  
#Use 2014-12-01 and earlier data to build models  
trn <- Wilshire[Wilshire$date<='2014-12-01',]  
  
#Use backwards selection to choose which predictors are needed  
xeq <- xtr <- trn[c('CorpProfits', 'FedFundsRate', 'UnempRate')]  
modelback <- ecmback(trn$Wilshire5000, xeq, xtr)  
print(modelback)  
#Backwards selection chose CorpProfits in the equilibrium term,  
#CorpProfits and UnempRate in the transient term.
```

ecmpredict

Predict using an ecm object

Description

Takes an ecm object and uses it to predict based on new data.

Usage

```
ecmpredict(ecm, newdata, init)
```

Arguments

ecm	ecm object used to make predictions
newdata	Data frame to on which to predict
init	Initial value for prediction

Details

Since error correction models only model the change in the target variable, an initial value must be specified.

Value

Numeric predictions on new data based ecm object

Examples

```

data(Wilshire)

#Rebuilding model1 from ecm example
trn <- Wilshire[Wilshire$date<='2014-12-01',]
xeq <- xtr <- trn[c('CorpProfits', 'FedFundsRate', 'UnempRate')]
model1 <- ecm(trn$Wilshire5000, xeq, xtr)

#Use 2014-12-01 and onwards data as test data to predict
tst <- Wilshire[Wilshire$date>='2014-12-01',]

#predict on tst using model1 and initial FedFundsRate
tst$model1Pred <- ecmpredict(model1, tst, tst$Wilshire5000[1])

```

lagpad

Lag a vector

Description

Create a vector of the lag of a variable and fill missing values with NA's.

Usage

```
lagpad(x, k = 1)
```

Arguments

x	A vector to be lagged
k	The number of lags to output

Value

The lagged vector with NA's in missing values

Wilshire

FRED data on the Wilshire 5000 index and other economic factors

Description

A dataset containing quarterly performance of the Wilshire 5000 index, corporate profits, Federal Reserve funds rate, and the unemployment rate.

Usage

```
data(Wilshire)
```

Format

A data frame with 182 rows and 6 variables:

date monthly date

Wilshire5000 quarterly Wilshire 5000 index, in value

CorpProfits quarterly corporate profits, in value

FedFundsRate quarterly federal funds rate, in percent

UnempRate quarterly unemployment rate, in percent

Source

<https://fred.stlouisfed.org/>

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