Package ‘AFR’

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Type Package
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Description Tool is created for regression, prediction and forecast analysis of macroeconomic and credit data. The package includes functions from existing R packages adapted for banking sector of Kazakhstan. The purpose of the package is to optimize statistical functions for easier interpretation for bank analysts and non-statisticians.
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| adf | Augmented Dickey Fuller Test |

Description

ADF test are used to test stationarity of a time-series data

Usage

```
adf(x, k = trunc((length(x) - 1)^(1/3)))
```

Arguments

- `x` time-series vector
- `k` the lag order to calculate the test statistic.

References

Trapletti, A., Augmented Dickey-Fuller Test Trapletti, A., KPSS Test for Stationarity

Examples

```r
data(macroKZ)
adf(macroKZ)
```
Description

BG test is used to test for autocorrelation in the errors of a regression model

Usage

bg(
  model,
  order = 1,
  order.by = NULL,
  type = c("Chisq", "F"),
  data = list(),
  fill = 0
)

Arguments

model is a (generalized)linear regression model
order integer. maximal order of serial correlation to be tested.
order.by Either a vector z or a formula with a single explanatory variable like ~ z
type the type of test statistic to be returned
data an optional data frame containing the variables in the model
fill starting values for the lagged residuals in the auxiliary regression. By default 0 but can also be set to NA.

References

Mitchel, D. and Zeileis, A. Published 2021-11-07. lmtest package

Examples

model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
bg(model)
Breusch-Pagan test

Breusch-Pagan test is used to test against heteroskedasticity of a time-series

Usage

bp(model, varformula = NULL, studentize = TRUE, data = list())

Arguments

- **model**: is a (generalized)linear regression model
- **varformula**: a formula describing only the potential explanatory variables for the variance (no dependent variable needed). By default the same explanatory variables are taken as in the main regression model.
- **studentize**: logical. If set to TRUE Koenker’s studentized version of the test statistic will be used.
- **data**: an optional data frame containing the variables in the model

References


Examples

```r
model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
bp(model)
```

Data check for errors

Preliminary check of data frame for missing values, wrong format, outliers.

Usage

checkdata(x)

Arguments

- **x**: is a data frame
check_betas

Examples

   data(macroKZ)
   checkdata(macroKZ)

check_betas

All possible regression variable coefficients

Description

Returns the coefficients for each variable from each model.

Usage

   check_betas(object, ...)

Arguments

   object  An object of class \texttt{lm}.
   ...     Other arguments.

Value

   check_betas returns a \texttt{data.frame} containing:

   \begin{itemize}
     \item \texttt{x} \quad \texttt{model}
   \end{itemize}

References

   Hebbali, Aravind. Published 2020-02-10. olsrr package

Examples

   model <- \texttt{lm(real_gdp~imp+exp+usdkzt+eurkzt, data = macroKZ)}
   check_betas(model)
corsel  \hspace{1cm} \textit{Multicollinearity test}

\textbf{Description}

multicollinearity is the occurrence of high interrelations among two or more independent variables in a multiple regression.

\textbf{Usage}

corsel(x, thrs, num)

\textbf{Arguments}

- \textit{x} \hspace{1cm} is a numeric vector or matrix
- \textit{thrs} \hspace{1cm} threshold set to calculate correlation above
- \textit{num} \hspace{1cm} logical

\textbf{Examples}

data(macroKZ)
corsel(macroKZ, num=FALSE, thrs=0.65)

dec_plot  \hspace{1cm} \textit{Decomposition plot}

\textbf{Description}

The function depicts decomposition of regressors as a stacked barplot.

\textbf{Usage}

dec_plot(model, dataset, print_plot = TRUE)

\textbf{Arguments}

- \textit{model} \hspace{1cm} An object of class \texttt{lm}.
- \textit{dataset} \hspace{1cm} A dataset based on which model was built
- \textit{print_plot} \hspace{1cm} logical

\textbf{Author(s)}

The Agency of the Republic of Kazakhstan for Regulation and Development of Financial Market (AFR)
References
Hebbali, Aravind. Published 2020-02-10. olsr package

Examples
```r
model <- lm(real_gdp ~ usdkzt + eurkzt + imp+exp, data = macroKZ)
dec_plot(model, macroKZ)
```

---

difflog

Transforming time-series data to stationary

Description
Difference of logarithms is finding the difference between two consecutive logarithm values of a time-series

Usage
```r
difflog(x, lag = 1, difference = 1)
```

Arguments
- `x`: time-series vector
- `lag`: lagged period
- `difference`: difference between x items

Examples
```r
data (macroKZ)
new<-.pct1(macroKZ)
```

---

gq

Godfrey-Quandt test

Description
Godfrey-Quandt test is used to test against heteroskedasticity of a time-series

Usage
```r
gq(
  model,
  point = 0.5,
  fraction = 0,
  alternative = c("greater", "two.sided", "less"),
  order.by = NULL,
  data = list()
)
```
Arguments

- **model**: is a (generalized) linear regression model.
- **point**: numerical. If point is smaller than 1 it is interpreted as percentages of data.
- **fraction**: numerical. The number of central observations to be omitted.
- **alternative**: a character string specifying the alternative hypothesis.
- **order.by**: Either a vector z or a formula with a single explanatory variable like ~ z.
- **data**: an optional data frame containing the variables in the model.

References


Examples

```r
model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
gq(model)
```

---

**HP**

*Hodrick-Prescott filter*

Description

Hodrick-Prescott filter is a data smoothing technique that removes trending in time series data frame.

Usage

```r
HP(x, freq = NULL, type = c("lambda", "frequency"), drift = FALSE)
```

Arguments

- **x**: time-series vector
- **freq**: integer
- **type**: character, indicating the filter type
- **drift**: logical

Examples

```r
data (macroKZ)
HP(macroKZ[,2])
```
Description

macroKZ dataset

Usage

macroKZ

Format

A time series data frame of 50 quarterly observations of 50 macroeconomic and 10 financial parameters for 2010-2022 period.

*real_gdp*  Real GDP

*GDD_Agr_R*  Real gross value added Agriculture

*GDD_Min_R*  Real gross value added Mining

*GDD_Man_R*  Real gross value added Manufacture

*GDD_Elc_R*  Real gross value added Electricity

*GDD_Con_R*  Real gross value added Construction

*GDD_Trd_R*  Real gross value added Trade

*GDD_Trn_R*  Real gross value added Transportation

*GDD_Inf_R*  Real gross value added Information

*GDD_Est_R*  Real gross value added for Real estate

*GDD_R*  Real gross value added

*GDP_DEF*  GDP deflator

*Rincpop_q*  Real population average monthly income

*Rexppop_q*  Real population average monthly expenses

*Rwage_q*  Real population average monthly wage

*imp*  Import

*exp*  Export

*cpi*  Inflation

*realest_resed_prim*  Real price for estate in primary market

*realest_resed_sec*  Real price for estate in secondary market

*realest_comm*  Real price for commercial estate

*index_stock_weighted*  Change in stock value for traded companies

*ntrade_Agr*  Change in stock value for non-traded companies Agriculture

*ntrade_Min*  Change in stock value for non-traded companies Mining
ntrade_Man Change in stock value for non-traded companies Manufacture
ntrade_Elc Change in stock value for non-traded companies Electricity
ntrade_Con Change in stock value for non-traded companies Construction
ntrade_Trd Change in stock value for non-traded companies Trade
ntrade_Trn Change in stock value for non-traded companies Transportation
ntrade_Inf Change in stock value for non-traded companies Information
fed_fund_rate Federal Funds Rate
govsec_rate_kzt_3m Return on government securities in KZT, 3 m
govsec_rate_kzt_1y Return on government securities in KZT, 1 year
govsec_rate_kzt_7y Return on government securities in KZT, 7 years
govsec_rate_kzt_10y Return on government securities in KZT, 10 years
tonia_rate TONIA
rate_kzt_mort_0y_1y Weighted average mortgage lending rate for new loans, less than a year
rate_kzt_mort_1y_iy Weighted average mortgage lending rate for new loans, more than a year
rate_kzt_corp_0y_1y Weighted average mortgage lending rate for new loans to non-financial organizations in KZT, less than a year
rate_usd_corp_0y_1y Weighted average mortgage lending rate for new loans to non-financial organizations in CKB, less than a year
rate_kzt_corp_1y_iy Weighted average mortgage lending rate for new loans to non-financial organizations in KZT, more than a year
rate_usd_corp_1y_iy Weighted average mortgage lending rate for new loans to non-financial organizations in CKB, more than a year
rate_kzt_indv_0y_1y Weighted average mortgage lending rate for consumer loans in KZT, less than a year
rate_kzt_indv_1y_iy Weighted average mortgage lending rate for consumer loans in KZT, more than a year
usdkzt USD KZT exchange rate
eurkzt EUR KZT exchange rate
rurkzt RUB KZT exchange rate
poil Price for Brent
realest_resed_prim_rus Real price for estate in primary market in Russia
realest_resed_sec_rus Real price for estate in secondary market in Russia
cred_portfolio credit portfolio
coef_k1 k1 prudential coefficient
coef_k3 k3 prudential coefficient
provisions provisions
percent_margin percent margin
com_inc commissionary income
com_exp commissionary expenses
oper_inc operational income
oth_inc other income
DR default rate
Source

Bureau of National statistics, Agency for Strategic planning and reforms of the Republic of Kaza-
khstan

References


**ols_test_normality**

Test for normality Test for detecting violation of normality assumption.

**Description**

Test for normality Test for detecting violation of normality assumption.

**Usage**

```r
ols_test_normality(model, ...)
```

## S3 method for class 'lm'

```r
ols_test_normality(model, ...)
```

**Arguments**

- `model` an object of class `lm`.
- `...` Other arguments.

**Value**

`ols_test_normality` is a list containing the following components:

- `kolmogorv` kolmogorov smirnov statistic
- `shapiro` shapiro wilk statistic
- `cramer` cramers von mises statistic
- `anderson` anderson darling statistic

**Examples**

```r
model <- lm(real_gdp ~ imp + exp + usdkzt + poil, data = macroKZ)
ols_test_normality(model)
```
opt_size

Necessary size of the time-series dataset

Description

Estimates number of models generated from given number of regressors x

Usage

opt_size(model)

Arguments

model is a linear regression model a class lm.

Examples

model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
opt_size(model)

pct1

Transforming time-series data to stationary

Description

Percent change is a change between two consecutive terms,

Usage

pct1(x)

Arguments

x time-series vector(s)

Examples

data (macroKZ)
new<-pct1(macroKZ)
**pct4**

**Transforming time-series data to stationary**

**Description**

Percent change is a change between a term and its lagged value for prior period.

**Usage**

\[ \text{pct4}(x) \]

**Arguments**

- \( x \): time-series vector(s)

**Examples**

```r
data(macroKZ)
new <- pct4(macroKZ)
```

---

**regsel_f**

**Regressors selection**

**Description**

The function allows to choose regressors based on multiple criteria as AIC, RMSE etc

**Usage**

```r
regsel_f(
  model,
  pval = 0.3,
  metric = "adjr" & "aic",
  progress = FALSE,
  details = FALSE,
  ...
)
```

```
## S3 method for class 'regsel_f'
plot(x, model = NA, print_plot = TRUE, ...)
```
Arguments

- `model` is a linear regression model
- `pval` p value; variables with p value less than `pval` will enter into the model
- `metric` statistical metrics used to estimate the best model
- `progress` Logical; if TRUE, will display variable selection progress.
- `details` Logical; if TRUE, will print the regression result at each step.
- `...` other arguments
- `x` An object.
- `print_plot` logical; if TRUE, prints the plot else returns a plot object.

References

Hebbali, Aravind. Published 2020-02-10. olsr package

Examples

```r
model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
regsel_f(model)
```

---

**reg_plot**

Regression forecast plot

Description

The function depicts forecast and actual data.

Usage

```r
reg_plot(model, dataset)
```

Arguments

- `model` An object of class `lm`.
- `dataset` A dataset based on which model was built.

Author(s)

The Agency of the Republic of Kazakhstan for Regulation and Development of Financial Market (AFR)

Examples

```r
model <- lm(real_gdp ~ usdkzt + eurkzt + imp + exp, data = macroKZ)
reg_plot(model, macroKZ)
```
reg_test

Test for detecting violation of Gauss-Markov assumptions.

Description
Test for detecting violation of Gauss-Markov assumptions.

Usage
reg_test(y)

Arguments
y A numeric vector or an object of class lm.

Value
reg_test returns an object of class "reg_test". An object of class "reg_test" is a list containing the following components:

bp Breusch-Pagan statistic
bg Breusch-Godfrey statistic
dw Durbin-Watson statistic
gq Godfrey-Quandt statistic

Examples
model <- lm(real_gdp~ imp + exp + poil + eurkzt + usdkzt, macroKZ)
reg_test(model)

vif_reg

VIF by variable

Description
Calculates the variation inflation factors of all predictors in regression models

Usage
vif_reg(model)

Arguments
model is a linear regression model
References

Petrie, Adam. Published 2020-02-21. regclass package

Examples

model <- lm(real_gdp ~ imp + exp + poil + eurkzt + tonia_rate, data = macroKZ)
vif_reg(model)
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