Package: ivx (via r-universe)

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Type Package

Title Robust Econometric Inference

Version 1.1.1

Description Drawing statistical inference on the coefficients of a short- or long-horizon predictive regression with persistent regressors by using the IVX method of Magdalinos and Phillips (2009) <doi:10.1017/S0266466608090154> and Kostakis, Magdalinos and Stamatogiannis (2015) <doi:10.1093/rfs/hhu139>.

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URL https://github.com/kvasilopoulos/ivx

BugReports https://github.com/kvasilopoulos/ivx/issues

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Imports methods, Rcpp (>= 0.12.18)

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Enhances texreg

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`ac_test` *Autocorrelation tests*

Description

Autocorrelation tests

Usage

```
ac_test(x, lag_max = 5)
```

Arguments

`x`	the residuals or an `ivx` object.
`lag_max`	the maximum length of lags.

Examples

```
obj <- ivx(hpi ~ cpi + def + int + log(res), data = ylpc)
lmtest::bgtest(hpi ~ cpi + def + int + log(res), data = ylpc)
ac_test(obj, 5)
```

ac_test_ *Tests for autocorrelation*

Description

- ac_test: For all tests
- ac_test_wald: Wald test
- ac_test_lb: Ljung-Box
- ac_test_bp: Box-Pierce
- ac_test_bg: Breusch-Godfrey

Usage

```
ac_test_wald(x, lag)

ac_test_lb(x, lag)

ac_test_bp(x, lag)

ac_test_bg(x, order, type, fill)
```

Arguments

x	an ivx model or a numeric vector, usually the residuals from an ols regression.
lag	the number of lags.
order	lag TODO
type	the type of test statistic to be returned. Either "Chisq" for the Chi-squared test statistic or "F" for the F test statistic.
fill	starting values for the lagged residuals in the auxiliary regression. By default 0 but can also be set to NA.

Details

If p-value < 0.051: You can reject the null hypothesis assuming a 5% chance of making a mistake. So you can assume that your values are showing dependence on each other.

Value

a numeric scalar or numeric vector.

See Also

Box.test lmtest::bgtest

Examples

```
mdl <- ivx(hpi ~ cpi + inv, data = ylpc)
ac_test_wald(mdl)

ac_test(mdl)
```

`delta` *Calculate the delta coefficient*

Description

Computes the long-run correlation coefficient between the residuals of the predictive regression and the autoregressive model for the regressor.

Usage

```
delta(object)
```

Arguments

`object`	on object of class "ivx"

Value

A vector of the estimated correlation coefficients. This should have row and column names corresponding to the parameter names given by the coef method.

Examples

```
mod <- ivx(Ret ~ LTY, data = monthly)

delta(mod)
```

`extract.ivx` `extract` *method for* `ivx` *objects*

Description

`extract` method for `ivx` objects

Usage

```
extract.ivx(
  model,
  include.wald = TRUE,
  include.nobs = TRUE,
  include.aic = FALSE,
  include.bic = FALSE,
  include.rsquared = FALSE,
  include.adjrs = FALSE,
  ...
)

extract.ivx_ar(
  model,
  include.wald = TRUE,
  include.nobs = TRUE,
  include.aic = FALSE,
  include.bic = FALSE,
  include.rsquared = FALSE,
  include.adjrs = FALSE,
  ...
)
```

Arguments

model	A statistical model object.
include.wald	Report the Wald statistic.
include.nobs	Report the number of observations in the GOF block?
include.aic	Report Akaike's Information Criterion (AIC) in the GOF block?
include.bic	Report the Bayesian Information Criterion (BIC) in the GOF block?
include.rsquared	Report the R-squared.
include.adjrs	Report the Adjusted R-squared.
...	Custom parameters, which are handed over to subroutines. Currently not in use.

---

ivx *Fitting IVX Models*

Description

ivx fits predictive regression models. The method allows standard chi-square testing for regressors with different degrees of persistence, from stationary to mildly explosive, and can be used for both short- and long-horizon predictive regressions.

Usage

```
ivx(
  formula,
  data,
  horizon,
  na.action,
  weights,
  contrasts = NULL,
  offset,
  model = TRUE,
  x = FALSE,
  y = FALSE,
  ...
)

## S3 method for class 'ivx'
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data	n optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which lm is called.
horizon	is the horizon (default horizon = 1 corresponds to a short-horizon regression).
na.action	a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options, and is na.fail if that is unset. The 'factory-fresh' default is na.omit. Another possible value is NULL, no action. Value na.exclude can be useful.
weights	an optional vector of weights to be used in the fitting process. Should be NULL or a numeric vector. If non-NULL, weighted least squares is used with weights weights (that is, minimizing sum(w*e^2)); otherwise ordinary least squares is used.
contrasts	an optional list. See the contrasts.arg of model.matrix.default.
offset	this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be NULL or a numeric vector or matrix of extents matching those of the response. One or more offset terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See model.offset
model	logical. If TRUE the model.frame of the fit is returned.
x	an object of class "ivx", usually, a result of a call to ivx.
y	logical. If TRUE the response of the fit is returned.
...	additional arguments to be passed to the low level regression fitting functions (see lm).

digits the number of significant digits to use when printing.

Value

an object of class "ivx".

References

Magdalinos, T., & Phillips, P. (2009). Limit Theory for Cointegrated Systems with Moderately Integrated and Moderately Explosive Regressors. Econometric Theory, 25(2), 482-526.

Kostakis, A., Magdalinos, T., & Stamatogiannis, M. P. (2014). Robust econometric inference for stock return predictability. The Review of Financial Studies, 28(5), 1506-1553.

Examples

```
# Univariate
ivx(Ret ~ LTY, data = kms)

# Multivariate
ivx(Ret ~ LTY + TBL, data = kms)

# Longer horizon
ivx(Ret ~ LTY + TBL, data = kms, horizon = 4)

wt <- runif(nrow(kms))
ivx(Ret ~ LTY, data = kms, weights = wt)
```

---

ivx_ar *Fitting IVX-AR Models*

Description

ivx_ar implements the Yang et al (2020) new instrumental variable based Wald statistic (IVX-AR) which accounts for serial correlation and heteroscedasticity in the error terms of the linear predictive regression model.

Usage

```
ivx_ar(
  formula,
  data,
  horizon,
  ar = "auto",
  ar_ic = c("bic", "aic", "aicc"),
  ar_max = 5,
  ar_grid = function(x) seq(x - 0.3, x + 0.3, by = 0.02),
  na.action,
```

```
  contrasts = NULL,
  offset,
  model = TRUE,
  x = FALSE,
  y = FALSE,
  ...
)

## S3 method for class 'ivx_ar'
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data	n optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which lm is called.
horizon	is the horizon (default horizon = 1 corresponds to a short-horizon regression).
ar	Method to include the autoregressive terms. "auto" find the optimal ar order by using the information criteria. ar = 0 reduces to simple ivx. ar > 1 uses a fixed order to estimate the model.
ar_ic	Information criterion to be used in model selection.
ar_max	Maximum ar order of model to fit.
ar_grid	The ar grid sequence of which to iterate.
na.action	a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options, and is na.fail if that is unset. The 'factory-fresh' default is na.omit. Another possible value is NULL, no action. Value na.exclude can be useful.
contrasts	an optional list. See the contrasts.arg of model.matrix.default.
offset	this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be NULL or a numeric vector or matrix of extents matching those of the response. One or more offset terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See model.offset
model	logical. If TRUE the model.frame of the fit is returned.
x	an object of class "ivx_ar", usually, a result of a call to ivx_ar.
y	logical. If TRUE the response of the fit is returned.
...	additional arguments to be passed to the low level regression fitting functions (see lm).
digits	the number of significant digits to use when printing.

References

Yang, B., Long, W., Peng, L., & Cai, Z. (2020). Testing the Predictability of US Housing Price Index Returns Based on an IVX-AR Model. Journal of the American Statistical Association, 1-22. DOI: 10.1080/01621459.2019.1686392

Examples

```
ivx_ar(hpi ~ log(res) + cpi, ylpc)

ivx_ar(hpi ~ log(res) + cpi, ylpc, ar_ic = "aic")

ivx_ar(hpi ~ log(res) + cpi, ylpc, ar = 1)
```

---

ivx_ar_fit *Fitter Functions for IVX-AR Models*

Description

Basic function called by `ivx_ar` to fit predictive models. These should only be used directly by experienced users.

Usage

```
ivx_ar_fit(
  y,
  x,
  horizon = 1,
  offset = NULL,
  ar = "auto",
  ar_max = 5,
  ar_ic = "bic",
  ar_grid = function(x) seq(x - 0.3, x + 0.3, by = 0.02),
  ...
)
```

Arguments

`y`	vector of observations of length `n`, or a matrix with `n` rows.
`x`	design matrix of dimension `n * p`.
`horizon`	is the horizon (default horizon = 1 corresponds to a short-horizon regression).
`offset`	(numeric of length `n`). This can be used to specify an *a priori* known component to be included in the linear predictor during fitting.
`ar`	Method to include the autoregressive terms. "auto" find the optimal ar order by using the information criteria. `ar = 0` reduces to simple `ivx`. `ar > 1` uses a fixed order to estimate the model.

ar_max	Maximum ar order of model to fit.
ar_ic	Information criterion to be used in model selection.
ar_grid	The ar grid sequence of which to iterate.
...	Further arguments passed to the function which is fitting the best AR model. If ar = "auto" then the internal function auto_ar is used, if ar = "forecast" then the the function forecast::auto.arima is used. If ar is of fixed length then arima is used.

Examples

```
ivx_ar_fit(monthly$Ret, as.matrix(monthly$LTY))

ivx_ar_fit(monthly$Ret, as.matrix(monthly$LTY), ar = 1)
```

---

ivx_fit *Fitter Functions for IVX Models*

Description

Basic function called by ivx to fit predictive models. These should only be used directly by experienced users.

Usage

```
ivx_fit(y, x, horizon = 1, offset = NULL, ...)

ivx_wfit(y, x, w, horizon = 1, offset = NULL, ...)
```

Arguments

y	vector of observations of length n, or a matrix with n rows.
x	design matrix of dimension n * p.
horizon	is the horizon (default horizon = 1 corresponds to a short-horizon regression).
offset	(numeric of length n). This can be used to specify an *a priori* known component to be included in the linear predictor during fitting.
...	currently disregarded.
w	vector of weights (length n) to be used in the fitting process for the wfit functions. Weighted least squares is used with weights w, i.e., sum(w * e^2) is minimized.

Examples

```
ivx_fit(monthly$Ret, as.matrix(monthly$LTY))
```

`kms` *KMS Monthly data*

Description

The dataset that was used in Kostakis et al (2015), containing a range of financial variables.

- Date: year-month-date (monthly frequency)
- DE: dividend payout ratio
- LTY: long-term yield
- DY: dividend yield
- DP: dividend-price ratio
- TBL: T-bill rate
- EP: earnings-price ratio
- BM: book-to-market value ratio
- INF: inflation rate
- DFY: default yield spread
- NTIS: net equity expansion
- TMS: term spread
- Ret: S&P 500 value-weighted log excess returns

Usage

```
kms
```

Format

A data.frame with 13 variables and 1,033 observations.

Source

https://drive.google.com/open?id=1FdT2STHO2Lnlweom4AwICVf-rpVMfgV4

`kms_quarterly` *KMS Quarterly data*

Description

The dataset that was used in Kostakis et al (2015), containing a range of financial variables.

- Date: year-month-date
- DE: dividend payout ratio
- LTY: long-term yield
- DY: dividend yield
- DP: dividend-price ratio
- TBL: T-bill rate
- EP: earnings-price ratio
- BM: book-to-market value ratio
- INF: inflation rate
- DFY: default yield spread
- NTIS: net equity expansion
- TMS: term spread
- Ret: S&P 500 value-weighted log excess returns

Usage

```
kms_quarterly
```

Format

A data.frame with 13 variables and 345 observations.

Source

https://drive.google.com/open?id=1FdT2STHO2Lnlweom4AwICVf-rpVMfgV4

summary.ivx *Summarizing IVX Model Fits*

Description

summary method for class "ivx".

Usage

```
## S3 method for class 'ivx'
summary(object, ...)

## S3 method for class 'summary.ivx'
print(
  x,
  digits = max(3L, getOption("digits") - 3L),
  signif.stars = getOption("show.signif.stars"),
  ...
)
```

Arguments

object	object of class "ivx", usually, a result of a call to ivx.
...	further arguments passed to or from other methods.
x	an object of class "summary.lm", usually, a result of a call to summary.lm.
digits	the number of significant digits to use when printing.
signif.stars	logical. If TRUE, 'significance stars' are printed for each coefficient.

Examples

```
mod <- ivx(Ret ~ LTY, data = monthly)

summary(mod)
```

summary.ivx_ar *Summarizing IVX-AR Model Fits*

Description

summary method for class "ivx".

Usage

```
## S3 method for class 'ivx_ar'
summary(object, ...)

## S3 method for class 'summary.ivx_ar'
print(
  x,
  digits = max(3L, getOption("digits") - 3L),
  signif.stars = getOption("show.signif.stars"),
  ...
)
```

Arguments

object	object of class "ivx_ar", usually, a result of a call to ivx_ar.
...	further arguments passed to or from other methods.
x	an object of class "summary.lm", usually, a result of a call to summary.lm.
digits	the number of significant digits to use when printing.
signif.stars	logical. If TRUE, 'significance stars' are printed for each coefficient.

Examples

```
mod <- ivx_ar(Ret ~ LTY, data = kms)

summary(mod)
```

---

vcov.ivx *Calculate Variance-Covariance Matrix for a Fitted Model Object*

Description

Calculate Variance-Covariance Matrix for a Fitted Model Object

Usage

```
## S3 method for class 'ivx'
vcov(object, complete = TRUE, ...)

## S3 method for class 'summary.ivx'
vcov(object, complete = TRUE, ...)
```

Arguments

object	a fitted ivx and summary.ivx object.
complete	logical indicating if the full variance-covariance matrix should be returned. When complete = TRUE, vcov() is compatible with coef().
...	additional arguments for method functions.

Value

A matrix of the estimated covariances between the parameter estimates of the model. This should have row and column names corresponding to the parameter names given by the coef method.

Examples

```
mod <- ivx(Ret ~ LTY, data = monthly)

vcov(mod)
```

`ylpc` *YLPC Quarterly data*

Description

The dataset that was used in ..., containing a range of variables.

Usage

```
ylpc
```

Format

An object of class `spec_tbl_df` (inherits from `tbl_df`, `tbl`, `data.frame`) with 174 rows and 12 columns.

Source

Yang, B., Long, W., Peng, L., and Cai, Z. (2020). Autoregressive-model-based inference for predictive regressions with persistent predictors. Journal of the American Statistical Association, 115(530), 1029-1039. DOI: 10.1080/01621459.2019.1686392

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