Package 'epmrob'

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Type Package

Title Robust Estimation of Probit Models with Endogeneity

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Description

Package provides a set of tools for robust estimation and inference for probit model with endogenous covariates. The current version contains a robust two-step estimator. For technical details, see Naghi, Varadi and Zhelonkin (2022), <doi:10.1016/j.ecosta.2022.05.001>.

License GPL-2

Imports robustbase, MASS

Suggests mvtnorm

NeedsCompilation no

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Contents

`epmrob-package` *Robust estimation of probit models with endogeneity*

Description

Package provides a set of tools for robust estimation of probit models with endogeneity.

Details

Package:	epmrob
Type:	Package
Version:	1.0
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License:	GPL-2

Author(s)

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References

Naghi, A. A., Varadi, M., & Zhelonkin, M. (2022). Robust Estimation of Probit Models with Endogeneity. *Econometrics and Statistics*. doi:10.1016/j.ecosta.2022.05.001

See Also

`epmrob`, `IVProbitRob`

`coef.epmrob` *Extract Coefficients from the Robust Endogenous Probit Model Fit*

Description

Returns the coefficients of the robust two-stage estimator for endogenous probit model.

Usage

```
## S3 method for class 'epmrob'
coef(object, ...)
```

Arguments

object	object of class "epmrob".
...	currently not used.

Value

Returns a list of two vectors of parameters of two stages.

R	coefficients of the reduced equation.
O	coefficients of the outcome equation.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

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epmrob *Robust Fit of Probit Model with Endogeneity*

Description

Fits the endogenous probit model using a robust two-stage estimator.

Usage

```
epmrob(reduced, outcome, data, control = rob.control())
```

Arguments

reduced	formula, the reduced equation.
outcome	formula, the outcome equation.
data	an optional 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 epmrob is called.
control	a list of parameterse for controlling the fitting process.

Details

Compute robust two-step estimates of the endogenous probit model. The robust linear regression is fitted in the first stage. In the second stage a Mallows-type M-estimator is used instead of the probit MLE. The values of the tuning constants and the robustness weights can be modified in rob.control.

Value

Object of class "epmrob".

`coefficients`	a named vector of coefficients
`stage1`	object of class `rlm` that contains first stage robust fit
`stage2`	object of class `glmrob` that contains second stage robust probit fit. Note that the standard errors in this object are biased, since they are not corrected for the uncertainty in the first estimation step. Use `vcov` below
`vcov`	variance matrix of the second stage
`call`	the matched call

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

References

Naghi, A. A., Varadi, M., and Zhelonkin, M. (2022). Robust Estimation of Probit Models with Endogeneity. *Econometrics and Statistics*. doi:10.1016/j.ecosta.2022.05.001

See Also

`rlm`, `rob.control`

`epmrob.vcov` *Extract Asymptotic Variance Covariance Matrix*

Description

Extracts the variance covariance matrix of the robust endogenous probit model fit by applying a bootstrap.

Usage

```
epmrob.vcov(object, B = 200, control = rob.control())
```

Arguments

`object`	object of class "`epmrob`".
`B`	the number of samples used in the bootstrapping process used to calculate the variance covariance matrix.
`control`	a list of parameters for controlling the fitting process.

Details

The variance covariance matrix is estimated by applying a bootstrap

Value

Variance covariance matrix of the entire estimation procedure. Variance covariance matrix of the reduced stage or outcome stage can be extracted using the vcov function for the corresponding stage estimator, e.g. `vcov(epmrob.object$stage1)` or `vcov(epmrob.object$stage2)`.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

`IVProbitRob` *Robust Probit Model with Endogeneity*

Description

Compute robust two-stage estimates of probit model with endogeneity.

Usage

```
IVProbitRob(reduced, outcome, data, control = rob.control())
```

Arguments

`reduced`	formula, the reduced function.
`outcome`	formula, the outcome function.
`data`	an optional data fram containing the varaibles in the model. If not found in data, the variables are taken from `environment(formula)`, typically the environment from which `IVProbitRob` is called.
`control`	a list of parameters for controlling the fitting process.

Details

Compute robust two-step estimates of the endogenous probit model.

Value

Object of class "epmrob".

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

References

Naghi, A. A., Varadi, M., & Zhelonkin, M. (2022). Robust Estimation of Probit Models with Endogeneity. *Econometrics and Statistics*. doi:10.1016/j.ecosta.2022.05.001

See Also

epmrob

Examples

```
library(mvtnorm)
N <- 2000
M <- 500
cont.frac = 0.01
rho = 0.5
sigma = matrix(c(1, rho, rho, 1), 2, 2)
gamma1 = 1
gamma2 = c(0.6, 0.4)
alpha1 = c(0.5)
beta1 = 0.5

set.seed(123)
X1 = rnorm(N,0,1)
X2 = rnorm(N,0,1)
X3 = rnorm(N,0,1)
eps = rmvnorm(N, mean =rep(0,2), sigma = sigma)
Y1 = X1*gamma1 + X2*gamma2[1] + X3*gamma2[2]  + eps[,1]
Y2 = ifelse(X1*beta1 + Y1*alpha1 + eps[,2] > 0, 1, 0)

dat.exmpl <- data.frame(Y2, Y1, X1, X2, X3)
names(dat.exmpl) <- c("int", "endo", "exo", "ivrbl", "ivrbl2")
ivp.fit <- IVProbitRob(endo ~ exo + ivrbl + ivrbl2, int ~ endo + exo, data = dat.exmpl,
                       control = rob.control(weights.x1 = "hat", weights.x2 = "hat"))
ivp.fit
```

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print.epmrob *Print a* epmrob *object*

Description

Print an object generated by epmrob.

Usage

```
## S3 method for class 'epmrob'
print(x, digits = 4, ...)
```

Arguments

x	object of epmrob class.
digits	number of significant digits to be printed.
...	currently not used.

Value

No return value.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

See Also

epmrob

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print.summary.epmrob *Print Function for* summary.epmrob

Description

Print a summary.epmrob object.

Usage

```
## S3 method for class 'summary.epmrob'
print(x, digits = 4, ...)
```

Arguments

x	object of class summary.epmrob returned by a summary function.
digits	number of nonzero digits after comma.
...	currently not used.

Value

No return value.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

rob.control *Auxiliary for Controlling Robust Fitting*

Description

Auxiliary function used for fitting the endogenous probit models. Contains control sequences, tuning constants and robustness weight functions.

Usage

```
rob.control(acc = 1e-04, maxit = 50, weights.x1 = c("none", "hat", "robCov", "covMcd"),
     weights.x2 = c("none", "hat", "robCov", "covMcd"), clevel1 = 0.95, tcc = 1.345)
```

Arguments

acc	positive convergence level.
maxit	integer giving the maximum number of iterations.
weights.x1	vector of robustness weights controlling for the leverage effect in the reduced equation.
weights.x2	vector of robustness weights controlling for the leverage effect in the outcome equation.
clevel1	value for the critical level for the first stage.
tcc	tuning constant c for Huber's psi-function for the first, reduced, stage.

Value

A list with the arguments as components.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

summary.epmrob *Summarizing Robust Fits of Endogenous Probit Models*

Description

Summarizes robust fit of endogenous probit models.

Usage

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

Arguments

object	object of class "epmrob".
...	currently not used.

Value

object of class "summary.epmrob".

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

See Also

epmrob

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xweights *Robustness Weights*

Description

Auxiliary function. Computation of the leverage weights based on robust Mahalanobis distance.

Usage

```
xweights(X, weight, clevel1)
```

Arguments

X	matrix of explanatory variables.
weight	method used to calculated the weighting.
clevel1	the critical level used for calculating the Mahalanobis distance.

Value

Vector of weights.

Author(s)

Mikhail Zhelonkin, Andre Bik, Andrea Naghi

See Also

cov.rob

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