

Package ‘ivbma’

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Type Package

Title Bayesian Instrumental Variable Estimation and Model
Determination via Conditional Bayes Factors

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Description This package allows one incorporate instrument and covariate uncertainty into instrumental variable regression.

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growth	<i>Macroeconomic growth and a variety of possible growth determinants</i>
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Description

This constitutes the growth determinant dataset used by Karl and Lenkoski

ivbma	<i>Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors</i>
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Description

This function estimates an Instrumental Variable (IV) system while incorporating model uncertainty and performing model averaging using an MC3-within-Gibbs Sampler.

Usage

```
ivbma(Y, X, Z, W, s = 1000, b = round(s/10), full = FALSE,
      odens = min(c(5000, s - b)), print.every = round(s/10), run.diagnostics = FALSE)
```

Arguments

Y	n x 1 matrix. Response variable
X	n x r matrix. Endogenous variables
W	n x p matrix. Further explanatory variables. You are responsible for including an intercept.
Z	n x q matrix. Instrumental variables
s	integer. Number of iterations
b	integer. Number of iterations to discard as burn-in.
full	If full is TRUE then model selection is not performed
odens	Output density. How many samples from the posterior should be returned? Note that posterior expectations are taken over every sample after burn-in
print.every	After how many iterations should the progress be printed?
run.diagnostics	If TRUE, this will compute experimental diagnostics to assess the validity of the instruments in use. Note that this adds a non-negligible amount of computing time.

Details

The function estimates the parameters based on the model

$$Y = [XW] * \rho + \epsilon$$

$$X = [ZW] * \lambda + \eta$$

with

$$(\epsilon_i, \eta_i)^T \sim N_2(0, \Sigma)$$

and its extension to multiple endogenous variables. If `full` is set to `FALSE` model uncertainty is included using conditional Bayes factors.

Value

<code>rho</code>	An odens x (r + p) matrix with sampled values for the outcome stage. Endogenous variables come first.
<code>rho.bar</code>	Posterior expectation of the outcome stage taken over all iterations
<code>lambda</code>	A (p + q) x r x odens array with sampled values for the parameters of the first stage regressions. Instruments come first.
<code>lambda.bar</code>	Posterior expectation of each first stage taken over all iterations
<code>Sigma</code>	odens sampled realizations of Sigma
<code>Sigma.bar</code>	Posterior expectation of Sigma taken over all iterations
<code>M</code>	Sampled first stage models
<code>M.bar</code>	Posterior first stage inclusion probabilities
<code>L</code>	Sampled second stage models
<code>L.bar</code>	Posterior second stage inclusion probabilities
If <code>run.diagnostics</code> was set to <code>TRUE</code> then you also receive	
<code>Sargan</code>	Model averaged Sargan p-values. Lower values indicate lack of instrument validity
<code>Bayesian.Sargan</code>	An <code>_Experimental_</code> Bayesian Sargan diagnostic based on Conditional Bayes Factors. Same direction as above

Author(s)

Alex Lenkoski (alex.lenkoski@uni-heidelberg.de)

References

Anna Karl and Alex Lenkoski (2012). "Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors" <http://arxiv.org/abs/1202.5846>

See Also

[summary.ivbma](#) [ivbma.cv.study](#)

Examples

```

set.seed(1)
data(growth)
attach(growth)
## To replicate KL, set s to 1e5
a <- ivbma(Y, X, Z, W, s = 1e2)
summary(a, nms.U = c(names(Z), names(W)), nms.V = c(names(X), names(W)))
detach(growth)

set.seed(1)
data(margarine)
attach(margarine)
## To replicate KL, set s to 2.5e5
a <- ivbma(Y, X, Z, W, s=1e2)
summary(a, nms.U = c(names(Z), names(W)), nms.V = c(names(X), names(W)))
detach(margarine)

```

ivbma.cv.study

Conducts a leave-one-out cross validation study using IVBMA

Description

This function allows one to conduct a leave-one-out cross validation study using IVBMA. It takes an appropriately constructed object and proceeds to drop each observation, fit IVBMA using the remaining observations, forms a posterior predictive distribution of the dropped observation and scores the predictive distribution along a number of metrics.

Usage

```
ivbma.cv.study(d, ...)
```

Arguments

d	Object containing data, d\$Y, d\$X, d\$W, d\$Z must all be defined
...	additional parameters to be passed to ivbma. In particular, you'll usually want to set s.

Value

This returns an n by 4 matrix. Row i of the matrix gives the squared error (SE), absolute error (AE), predictive variance (VAR) and continuous ranked probability score (CRPS) of the posterior predictive distribution leaving observation i out and subsequently using i as the verifying observation.

References

Anna Karl and Alex Lenkoski (2012). "Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors" <http://arxiv.org/abs/1202.5846>

See Also[ivbma](#)**Examples**

```
set.seed(1)
data(growth)
s <- 2e1 ##To replicate KL, set this to 2e5
a.bma <- ivbma.cv.study(growth, s = s, print.every = s)
a.full <- ivbma.cv.study(growth, s = s, print.every = s, full = TRUE)
print(rbind(colMeans(a.bma), colMeans(a.full)))
```

ivbma.sample.theta *Updates the IVBMA parameters*

Description

Runs one step of the Gibbs Sampler in IVBMA

Usage

```
ivbma.sample.theta(theta,D,full)
```

Arguments

theta	a list containing all the parameters in the IVBMA model
D	dataset
full	Indicator of whether model averaging is performed (FALSE)

Value

Returns an updated theta object

Author(s)

Alex Lenkoski (alex.lenkoski@uni-heidelberg.de)

References

Anna Karl and Alex Lenkoski (2012). "Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors" <http://arxiv.org/abs/1202.5846>

See Also[ivbma](#)

margarine	<i>Demand for Margarine Dataset</i>
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Description

This constitutes the margarine determinant dataset used by Karl and Lenkoski

summary.ivbma	<i>Generic summary function for object of class ivbma</i>
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Description

Generic summary function for object of class ivbma

Usage

```
## S3 method for class 'ivbma'
summary(object, nms.U=NULL, nms.V=NULL, ...)
```

Arguments

object	ivbma object returned by ivbma
nms.U	names for the parameter $\rho = (\delta, \tau)^T$
nms.V	names for the parameter $\lambda = (\beta, \gamma)^T$
...	additional parameters

References

Anna Karl and Alex Lenkoski (2012). "Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors" <http://arxiv.org/abs/1202.5846>

See Also

[ivbma](#)

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