Package ‘ivbma’

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Type  Package
Title  Bayesian Instrumental Variable Estimation and Model Determination via Conditional Bayes Factors
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Author  Alex Lenkoski, Anna Karl, Andreas Neudecker
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Description  This package allows one incorporate instrument and covariate uncertainty into instrumental variable regression.
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LazyLoad  yes
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<td>Macroeconomic growth and a variety of possible growth determinants</td>
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Description

This constitutes the growth determinant dataset used by Karl and Lenkoski
**ivbma**  
*Instrumental Variable Bayesian Model Averaging via Conditional Bayes Factors*

**Description**

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

**Usage**

```r
ivbma(yL xL ZL wL s = 1000L b = round(s/10)L full = falseL
odens = min(c(U000L s M b))L printNevery = round(s/10)L 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

\[ (\epsilon, \eta)^T \sim N_2(0, \Sigma) \]

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

\texttt{rho}\begin{itemize}
\item An odens \((r + p)\) matrix with sampled values for the outcome stage. Endogenous variables come first.
\end{itemize}

\texttt{rho.bar}\begin{itemize}
\item Posterior expectation of the outcome stage taken over all iterations
\end{itemize}

\texttt{lambda}\begin{itemize}
\item A \((p + q) \times r \times \text{odens}\) array with sampled values for the parameters of the first stage regressions. Instruments come first.
\end{itemize}

\texttt{lambda.bar}\begin{itemize}
\item Posterior expectation of each first stage taken over all iterations
\end{itemize}

\texttt{Sigma}\begin{itemize}
\item \text{odens}\ sampled realizations of \(\Sigma\)
\end{itemize}

\texttt{Sigma.bar}\begin{itemize}
\item Posterior expectation of \(\Sigma\) taken over all iterations
\end{itemize}

\texttt{M}\begin{itemize}
\item Sampled first stage models
\end{itemize}

\texttt{M.bar}\begin{itemize}
\item Posterior first stage inclusion probabilities
\end{itemize}

\texttt{L}\begin{itemize}
\item Sampled second stage models
\end{itemize}

\texttt{L.bar}\begin{itemize}
\item Posterior second stage inclusion probabilities
\end{itemize}

If \texttt{run.diagnostics} was set to \texttt{TRUE} then you also receive

\texttt{Sargan}\begin{itemize}
\item Model averaged Sargan p-values. Lower values indicate lack of instrument validity
\end{itemize}

\texttt{Bayesian.Sargan}\begin{itemize}
\item An \texttt{Experimental Bayesian} Sargan diagnostic based on Conditional Bayes Factors. Same direction as above
\end{itemize}

Author(s)

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

References


See Also

\texttt{summary.ivbma ivbma.cv.study}

Examples

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

set.seed(1)
data(margarine)
attach(margarine)
\end{verbatim}
## To replicate KL, set s to 2.5e5
```r
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

```r
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


#### See Also

- `ivbma`

#### Examples

```r
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


See Also

ivbma

margarine  Demand for Margarine Dataset

Description

This constitutes the margarine determinant dataset used by Karl and Lenkoski
Generic summary function for object of class ivbma

Description

Generic summary function for object of class ivbma

Usage

## sS 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


See Also

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