Description

bmastats pip reports posterior inclusion probabilities (PIPs) and grouping information for predictors specified with the bmaregress command.

Quick start

Show predictors with PIP above 0.01, ordered by highest to lowest PIP

    bmastats pip

Same as above, but report predictors in their input order in bmaregress

    bmastats pip, inputorder

Show PIP for predictors x1 and x2

    bmastats pip x1 x2

Show predictors with PIP above 0.5

    bmastats pip, cutoff(0.5)

Show PIP for all predictors

    bmastats pip, all

Menu

Statistics > Bayesian model averaging > Posterior inclusion probabilities

Syntax

> `bmastats pip` [*varlist*] [, *options*]

options	Description
Main	
<u>inputorder</u>	display results in a variable input order; default is descending order of PIP
<u>cut</u>off(#)	suppress predictors with PIP less than #; default is # = 0.01
display_options	control spacing, line width, and base and empty cells
all	show PIP for all predictors
[<u>no</u>]<u>table</u>	display or suppress table output

varlist may contain factor variables; see [U] 11.4.3 Factor variables.

`collect` is allowed; see [U] 11.1.10 Prefix commands.

`all`, `table`, and `notable` do not appear in the dialog box.

Options

> Main

inputorder specifies that the results be displayed in the same order the predictors are specified in *varlist* or, if *varlist* is not specified, with bmaregress. By default, the results are displayed in the descending order of PIP of predictors.

cutoff(#) specifies that predictors with PIP less than # not be shown. The default is cutoff(0.01). This option is useful when there are many predictors with small PIPs.

display_options: vsquish, <u>noemptycells</u>, <u>base</u>levels, <u>allbase</u>levels, <u>nofvlab</u>el, fvwrap(#), fvwrapon(*style*), and nolstretch; see [R] Estimation options.

The following options are available with bmastats pip but are not shown in the dialog box:

all shows PIPs and grouping information for all predictors or for all predictors in *varlist* if specified with bmastats pip. all is equivalent to cutoff(0).

table and notable display or suppress the table output. The table is shown by default. This option is useful with many predictors when you wish to see only the number of reported predictors in the header.

Remarks and examples

PIPs are used in Bayesian model averaging (BMA) inference to investigate the importance of various predictors in explaining the outcome. A PIP is the probability that a predictor is included in a regression model, given the observed data and prior inclusion probability. High PIP values indicate strong (more important) predictors, and low PIP values indicate weak predictors.

bmaregress reports PIPs as part of its output. bmastats pip provides the same PIP and grouping information but displays it more concisely—without the posterior coefficient summaries. bmastats pip also allows you to investigate PIPs of specific predictors more easily.

Let's see an example.

We will use the `auto` dataset to fit a BMA linear regression of car prices on various car characteristics such as mileage, weight, and whether a car is foreign or domestic. And we will use `bmastats pip` to explore PIPs.

```
. use https://www.stata-press.com/data/r19/auto
(1978 automobile data)

. order make price foreign rep78

. describe

Contains data from https://www.stata-press.com/data/r19/auto.dta
 Observations:            74                  1978 automobile data
    Variables:            12                  13 Apr 2024 17:45
                                              (_dta has notes)
```

Variable name	Storage type	Display format	Value label	Variable label
make	str18	%-18s		Make and model
price	int	%8.0gc		Price
foreign	byte	%8.0g	origin	Car origin
rep78	int	%8.0g		Repair record 1978
mpg	int	%8.0g		Mileage (mpg)
headroom	float	%6.1f		Headroom (in.)
trunk	int	%8.0g		Trunk space (cu. ft.)
weight	int	%8.0gc		Weight (lbs.)
length	int	%8.0g		Length (in.)
turn	int	%8.0g		Turn circle (ft.)
displacement	int	%8.0g		Displacement (cu. in.)
gear_ratio	float	%6.2f		Gear ratio

```
Sorted by: foreign
```

```
. bmaregress price i.foreign##i.rep78 mpg-gear_ratio, rseed(18)

Burn-in ...
Simulation ...
Computing model probabilities ...
```

Bayesian model averaging		No. of obs	=	69
Linear regression		No. of predictors	=	16
MC3 sampling		Groups	=	16
Heredity: Strong		Always	=	0
		No. of models	=	105
		For CPMP >= .9	=	14
Priors:		Mean model size	=	2.625
Models: Beta-binomial(1, 1)		Burn-in	=	2,500
Cons.: Noninformative		MCMC sample size	=	10,000
Coef.: Zellner's g		Acceptance rate	=	0.2686
g: Benchmark, g = 256		Shrinkage, g/(1+g)	=	0.9961
sigma2: Noninformative		Mean sigma2	=	4.239e+06

Sampling correlation = 0.9962

price	Mean	Std. dev.	Group	PIP
foreign				
Foreign	3597.21	733.8864	1	.99846
weight	3.504294	2.315263	12	.78147
length	-33.74574	49.96541	13	.35377
displacement	6.896085	11.95028	15	.27357
headroom	-32.06511	153.7326	10	.0575
turn	-6.257741	40.06633	14	.037379
gear_ratio	-40.80854	290.5467	16	.031843
rep78				
5	12.02161	138.5304	5	.020152
trunk	-.3727775	12.85491	11	.018163
rep78				
4	-4.524674	82.48986	4	.015373
3	1.565563	67.56235	3	.013669
2	-1.818892	97.07111	2	.013639
Always				
_cons	-115.0626	5192.111	0	1

Note: Coefficient posterior means and std. dev. estimated from 105 models.
Note: Default priors are used for models and parameter *g*.
Note: 4 predictors with PIP less than .01 not shown.

Let's start with the default specification:

```
. bmastats pip
Posterior inclusion probability (PIP)

No. of obs          =      69
No. of predictors  =      16
           Groups  =      16
           Always  =       0
         Reported  =      12
No. of models      =     105
Mean model size    = 2.625
```

	PIP	Group
foreign		
Foreign	.99846	1
weight	.78147	12
length	.35377	13
displacement	.27357	15
headroom	.0575	10
turn	.037379	14
gear_ratio	.031843	16
rep78		
5	.020152	5
trunk	.018163	11
rep78		
4	.015373	4
3	.013669	3
2	.013639	2
Always		
_cons	1	0

```
Note: Using analytical PMPs.
Note: 4 predictors with PIP less than
      .01 not shown.
```

As we already mentioned, by default, bmastats pip reports the same PIP and grouping information as bmaregress.

By default, the results are displayed in the decreasing order of PIP. We can use the `inputorder` option to display the results in the order in which the predictors were specified with `bmaregress`. The command also suppresses results for predictors with PIP less than 0.01. If desired, we can use the `all` option to display the results for all predictors.

```
. bmastats pip, inputorder all

Posterior inclusion probability (PIP)

No. of obs        =      69
No. of predictors =      16
          Groups =      16
          Always =       0
        Reported =      16
No. of models     =     105
Mean model size   = 2.625
```

	PIP	Group
foreign		
Foreign	.99846	1
rep78		
2	.013639	2
3	.013669	3
4	.015373	4
5	.020152	5
foreign#rep78		
Foreign#1	(empty)	
Foreign#2	(empty)	
Foreign#3	0	6
Foreign#4	.0002665	7
Foreign#5	0	8
mpg	.0094456	9
headroom	.0575	10
trunk	.018163	11
weight	.78147	12
length	.35377	13
turn	.037379	14
displacement	.27357	15
gear_ratio	.031843	16
Always		
_cons	1	0

Note: Using analytical PMPs.

We can identify a set of more influential predictors by specifying a higher PIP cutoff:

```
. bmastats pip, cutoff(0.5)

Posterior inclusion probability (PIP)

No. of obs          =      69
No. of predictors   =      16
          Groups    =      16
          Always    =       0
        Reported    =       2
No. of models       =     105
Mean model size     = 2.625
```

	PIP	Group
foreign		
Foreign	.99846	1
weight	.78147	12
Always		
_cons	1	0

```
Note: Using analytical PMPs.
Note: 14 predictors with PIP less than
      .5 not shown.
```

And we can investigate PIPs for specific predictors:

```
. bmastats pip i.rep78

Posterior inclusion probability (PIP)

No. of obs          =      69
No. of predictors   =      16
          Groups    =      16
          Always    =       0
        Reported    =       4
No. of models       =     105
Mean model size     = 2.625
```

	PIP	Group
rep78		
5	.020152	5
4	.015373	4
3	.013669	3
2	.013639	2
Always		
_cons	1	0

```
Note: Using analytical PMPs.
```

Stored results

bmastats pip stores the following in r():

Scalars
r(N)	number of observations
r(p)	number of predictors
r(p_groups)	number of groups of predictors
r(p_always)	number of predictors always in the model
r(p_rpt)	number of reported predictors
r(k_models)	number of models
r(msize_mean)	posterior mean model size

Macros
r(varnames)	specified variables
r(pmptype)	analytical or frequency

Matrices
r(summary)	PIP and group summary

Methods and formulas

For definitions of PIPs, see *Posterior inclusion probability* in *Methods and formulas* of [BMA] **bmaregress**.

Also see

[BMA] **bmagraph varmap** — Variable-inclusion map after BMA regression

[BMA] **bmastats** — Summary for models and predictors after BMA regression

[BMA] **bmaregress** — Bayesian model averaging for linear regression

[BMA] **BMA postestimation** — Postestimation tools for Bayesian model averaging

[BMA] **Glossary**