### mepoisson postestimation — Postestimation tools for mepoisson

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# **Postestimation commands**

The following postestimation command is of special interest after mepoisson:

Command	Description
estat group	summarize the composition of the nested groups
estat sd	display variance components as standard deviations and correlations

The following standard postestimation commands are also available:

Command	Description
contrast	contrasts and ANOVA-style joint tests of parameters
estat ic	Akaike's, consistent Akaike's, corrected Akaike's, and Schwarz's Bayesian in- formation criteria (AIC, CAIC, AICc, and BIC, respectively)
estat summarize	summary statistics for the estimation sample
estat vce	variance-covariance matrix of the estimators (VCE)
estat (svy)	postestimation statistics for survey data
estimates	cataloging estimation results
etable	table of estimation results
* hausman	Hausman's specification test
lincom	point estimates, standard errors, testing, and inference for linear combinations of parameters
* lrtest	likelihood-ratio test
margins	marginal means, predictive margins, marginal effects, and average marginal effects
marginsplot	graph the results from margins (profile plots, interaction plots, etc.)
nlcom	point estimates, standard errors, testing, and inference for nonlinear combina- tions of parameters
predict	means, probabilities, densities, REs, residuals, etc.
predictnl	point estimates, standard errors, testing, and inference for generalized predic- tions
pwcompare	pairwise comparisons of parameters
test	Wald tests of simple and composite linear hypotheses
testnl	Wald tests of nonlinear hypotheses

\*hausman and lrtest are not appropriate with svy estimation results.

# predict

### **Description for predict**

predict creates a new variable containing predictions such as mean responses; linear predictions; density and distribution functions; standard errors; and Pearson, deviance, and Anscombe residuals.

#### Menu for predict

Statistics > Postestimation

#### Syntax for predict

Syntax for obtaining predictions of the outcome and other statistics

```
predict [type] { stub* | newvarlist } [if ] [in ] [, statistic options ]
```

Syntax for obtaining estimated random effects and their standard errors

predict [type] { stub\* | newvarlist } [if ] [in ], reffects [re\_options]

Syntax for obtaining ML scores

predict [type] { stub\* | newvarlist } [if ] [in], scores

statistic	Description	
Main		
mu	mean response; the default	
eta	fitted linear predictor	
xb	linear predictor for the fixed portion of the model only	
stdp	standard error of the fixed-portion linear prediction	
density	predicted density function	
<u>dist</u> ribution	predicted distribution function	
pearson	Pearson residuals	
deviance	deviance residuals	
<u>ans</u> combe	Anscombe residuals	

These statistics are available both in and out of sample; type predict ... if e(sample) ... if wanted only for the estimation sample.

options	Description
Main	
<pre>conditional(ctype)</pre>	compute <i>statistic</i> conditional on estimated random effects; default is conditional(ebmeans)
marginal	compute statistic marginally with respect to the random effects
<u>nooff</u> set	make calculation ignoring offset or exposure
Integration	
int_options	integration options
pearson, deviance, anscombe	may not be combined with marginal.
ctype	Description
<u>ebmean</u> s	empirical Bayes means of random effects; the default
<u>ebmode</u> s	empirical Bayes modes of random effects
<u>fixed</u> only	prediction for the fixed portion of the model only
re_options	Description
Main	
<u>ebmean</u> s	use empirical Bayes means of random effects; the default
<u>ebmode</u> s	use empirical Bayes modes of random effects
reses( <i>stub</i> *  <i>newvarlist</i> )	calculate standard errors of empirical Bayes estimates
Integration	
int_options	integration options
int_options	Description
<pre>intpoints(#)</pre>	use # quadrature points to compute marginal predictions and empirical Bayes means
<u>iter</u> ate(#)	set maximum number of iterations in computing statistics involving empirical Bayes estimators
<u>tol</u> erance(#)	set convergence tolerance for computing statistics involving empirical Bayes estimators

#### **Options for predict**

Main

mu, the default, calculates the predicted mean, that is, the predicted number of events.

eta, xb, stdp, density, distribution, pearson, deviance, anscombe, scores, conditional(), marginal, and nooffset; see [ME] meglm postestimation.

reffects, ebmeans, ebmodes, and reses(); see [ME] meglm postestimation.

Integration

intpoints(), iterate(), and tolerance(); see [ME] meglm postestimation.

# margins

#### **Description for margins**

margins estimates margins of response for mean responses and linear predictions.

#### Menu for margins

Statistics > Postestimation

### Syntax for margins

margins [ <i>marginlist</i> ][	, options ]
margins [marginlist],	<pre>predict(statistic) [predict(statistic)] [options]</pre>
statistic	Description
mu	mean response; the default
eta	fitted linear predictor
xb	linear predictor for the fixed portion of the model only
stdp	not allowed with margins
<u>den</u> sity	not allowed with margins
<u>dist</u> ribution	not allowed with margins
pearson	not allowed with margins
deviance	not allowed with margins
<u>ans</u> combe	not allowed with margins
reffects	not allowed with margins
scores	not allowed with margins

Options conditional(ebmeans) and conditional(ebmodes) are not allowed with margins. Option marginal is assumed where applicable if conditional(fixedonly) is not specified.

Statistics not allowed with margins are functions of stochastic quantities other than e(b).

For the full syntax, see [R] margins.

# **Remarks and examples**

Various predictions, statistics, and diagnostic measures are available after fitting a mixed-effects Poisson model with mepoisson. For the most part, calculation centers around obtaining estimates of the subject/group-specific random effects. Random effects are not estimated when the model is fit but instead need to be predicted after estimation.

Here we show a short example of predicted counts and predicted random effects; refer to [ME] **meglm postestimation** for additional examples applicable to mixed-effects generalized linear models.

#### Example 1: Predicting counts and random effects

In example 2 of [ME] **mepoisson**, we modeled the number of observed epileptic seizures as a function of treatment with the drug progabide and other covariates,

$$\begin{split} \log(\mu_{ij}) &= \beta_0 + \beta_1 \texttt{treat}_{ij} + \beta_2 \texttt{lbas}_{ij} + \beta_3 \texttt{lbas\_trt}_{ij} + \\ & \beta_4 \texttt{lage}_{ii} + \beta_5 \texttt{visit}_{ij} + u_j + v_j \texttt{visit}_{ij} \end{split}$$

where  $(u_i, v_i)$  are bivariate normal with 0 mean and variance-covariance matrix

$\boldsymbol{\Sigma} = \mathrm{Var}$	$\begin{bmatrix} u_j \\ v_j \end{bmatrix}$	=	$\begin{bmatrix} \sigma_u^2 \\ \sigma_{uv} \end{bmatrix}$	$\left[ \begin{array}{c} \sigma_{uv} \\ \sigma_{v}^{2} \end{array} \right]$
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. use https:// (Epilepsy data	'www.stata-pre a; progabide d	ss.com/data rug treatme	/r19/epi] nt)	Lepsy		
. mepoisson se > cov(unstruct	eizures treat cured) intpoin	lbas lbas_t ts(9)	rt lage v	visit	subject: visi	t,
(iteration log or	nitted)					
Mixed-effects	Poisson regre	ssion		Number	of obs =	236
Group variable	e: subject			Number	of groups =	59
				Obs per	group:	
				F	min =	4
					avg =	4.0
					max =	4
Integration me	thod: mvagher	mite		Integra	tion pts. =	9
				Wald ch	- 	115 56
Log likelihood	1 = -655.68103			Prob >	chi2 =	0.0000
seizures	Coefficient	Std. err.	z	P> z	[95% conf.	interval]
treat	9286592	.4021715	-2.31	0.021	-1.716901	1404175
lbas	.8849762	.1312535	6.74	0.000	.627724	1.142228
lbas_trt	.3379759	.2044471	1.65	0.098	062733	.7386849
lage	.4767192	.3536276	1.35	0.178	2163781	1.169817
visit	2664098	.1647098	-1.62	0.106	5892352	.0564156
_cons	2.099555	.2203749	9.53	0.000	1.667629	2.531482
subject						
var(visit)	.5314803	.229385			.2280928	1.238405
<pre>var(_cons)</pre>	.2514923	.0587902			.1590534	.3976549
subject						
cov(visit, _cons)	.0028715	.0887037	0.03	0.974	1709846	.1767276
LR test vs. Po	oisson model:	chi2(3) = 3	24.54		Prob > chi	2 = 0.0000

Note: LR test is conservative and provided only for reference.

The purpose of this model was to allow subject-specific linear log trends over each subject's four doctor visits, after adjusting for the other covariates. The intercepts of these lines are distributed  $N(\beta_0, \sigma_u^2)$ , and the slopes are distributed  $N(\beta_5, \sigma_v^2)$ , based on the fixed effects and assumed distribution of the random effects.

We can use predict to obtain estimates of the random effects  $u_j$  and  $v_j$  and combine these with our estimates of  $\beta_0$  and  $\beta_5$  to obtain the intercepts and slopes of the linear log trends.

```
. predict re_visit re_cons, reffects
(calculating posterior means of random effects)
(using 9 quadrature points)
```

- . generate b1 = \_b[visit] + re\_visit
- . generate b0 = \_b[\_cons] + re\_cons
- . by subject, sort: generate tolist = \_n==1
- . list subject treat b1 b0 if tolist & (subject <=5 | subject >=55)

	subject	treat	b1	b0
1. 5.	1 2 2	Placebo Placebo Placebo	428854 2731013	2.13539 2.149744
9. 13. 17.	3 4 5	Placebo Placebo Placebo	3197094 .6082718	2.238224 2.110739
217. 221. 225. 229. 233.	55 56 57 58 59	Progabide Progabide Progabide Progabide Progabide	2308834 .2912798 4828764 2519466 1269573	2.282539 3.19678 1.423153 1.131373 2.171541

We list these slopes (b1) and intercepts (b0) for five control subjects and five subjects on the treatment.

```
. count if tolist & treat
31
. count if tolist & treat & b1 < 0
25
. count if tolist & !treat
28
. count if tolist & !treat & b1 < 0
20</pre>
```

We also find that 25 of the 31 subjects taking progabide were estimated to have a downward trend in seizures over their four doctor visits, compared with 20 of the 28 control subjects.

We also obtain predictions for number of seizures, and unless we specify the conditional(fixedonly) option, these predictions will incorporate the estimated subject-specific random effects.

```
. predict n
(option mu assumed)
(predictions based on fixed effects and posterior means of random effects)
(using 9 quadrature points)
```

	subject	treat	visit	seizures	n
1.	1	Placebo	3	5	3.775774
2.	1	Placebo	1	3	3.465422
3.	1	Placebo	.1	3	3.18058
4.	1	Placebo	.3	3	2.919151
5.	2	Placebo	3	3	3.598805
6.	2	Placebo	1	5	3.40751
7.	2	Placebo	.1	3	3.226382
8.	2	Placebo	.3	3	3.054883
229.	58	Progabide	3	0	.9611137
230.	58	Progabide	1	0	.9138838
231.	58	Progabide	.1	0	.8689747
232.	58	Progabide	.3	0	.8262726
233.	59	Progabide	3	1	2.40652
234.	59	Progabide	1	4	2.346184
235.	59	Progabide	.1	3	2.287361
236.	59	Progabide	.3	2	2.230013

. list subject treat visit seizures n if subject <=  $2 \mid$  subject >= 58, sep(0)

### Methods and formulas

Methods and formulas for predicting random effects and other statistics are given in Methods and formulas of [ME] meglm postestimation.

#### Also see

[ME] mepoisson — Multilevel mixed-effects Poisson regression

[ME] meglm postestimation — Postestimation tools for meglm

[U] 20 Estimation and postestimation commands

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