> **irt nrm postestimation** — Postestimation tools for irt nrm

Postestimation commands

The following postestimation commands are of special interest after `irt nrm`:

Command	Description
estat report	report estimated IRT parameters
irtgraph icc	plot item characteristic curve (ICC)
irtgraph iif	plot item information function (IIF)
irtgraph tcc	plot test characteristic curve (TCC)
irtgraph tif	plot test information function (TIF)

The following standard postestimation commands are also available:

Command	Description
estat ic	Akaike's and Schwarz's Bayesian information criteria (AIC and BIC)
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
lincom	point estimates, standard errors, testing, and inference for linear combinations of coefficients
*lrtest	likelihood-ratio test
nlcom	point estimates, standard errors, testing, and inference for nonlinear combinations of coefficients
predict	predictions
predictnl	point estimates, standard errors, testing, and inference for generalized predictions
test	Wald tests of simple and composite linear hypotheses
testnl	Wald tests of nonlinear hypotheses

* `lrtest` is not appropriate with `svy` estimation results.

predict

Description for predict

predict creates a new variable containing predictions such as probabilities, linear predictions, and parameter-level scores.

Menu for predict

Statistics > Postestimation

Syntax for predict

Syntax for obtaining predictions of item probabilities and other statistics

> predict [*type*] *newvarsspec* [*if*] [*in*] [, *statistic item_options*]

Syntax for obtaining estimated latent variables and their standard errors

> predict [*type*] *newvarsspec* [*if*] [*in*] , latent [*latent_options*]

Syntax for obtaining parameter-level scores

> predict [*type*] *newvarsspec* [*if*] [*in*] , s̲cores

newvarsspec is *stub** or *newvarlist*.

statistic	Description
Main	
pr	probabilities; the default
xb	linear prediction

item_options	Description
Main	
†outcome(*item* [*#*])	specify item variable; default is all variables
c̲onditional(*ctype*)	compute *statistic* conditional on estimated latent variables; default is conditional(ebmeans)
marginal	compute *statistic* marginally with respect to the latent variables
Integration	
int_options	integration options

† outcome(*item #*) may also be specified as outcome(*#.item*) or outcome(*item ##*).
  outcome(*item #3*) means the third outcome value. outcome(*item #3*) would mean the same as
  outcome(*item 4*) if outcomes were 1, 3, and 4.

ctype	Description
<u>ebmeans</u>	empirical Bayes means of latent variables; the default
<u>ebmodes</u>	empirical Bayes modes of latent variables
<u>fixed</u>only	prediction for the fixed portion of the model only

latent_options	Description
Main	
<u>ebmeans</u>	use empirical Bayes means of latent trait; the default
<u>ebmodes</u>	use empirical Bayes modes of latent trait
se(*newvar*)	calculate standard errors
Integration	
int_options	integration options

int_options	Description
<u>intpoints</u>(*#*)	use *#* quadrature points to compute marginal predictions and empirical Bayes means
<u>iterate</u>(*#*)	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 ⌐

pr, the default, calculates the predicted probability.

xb specifies that the linear predictor be calculated.

outcome(*item* [*#*]) specifies that predictions for *item* be calculated. Use *#* to specify which outcome level to predict. Predictions for all observed response variables are computed by default.

conditional(*ctype*) and marginal specify how latent variables are handled in computing *statistic*.

  conditional() specifies that *statistic* will be computed conditional on specified or estimated latent variables.

    conditional(ebmeans), the default, specifies that empirical Bayes means be used as the estimates of the latent variables. These estimates are also known as posterior mean estimates of the latent variables.

    conditional(ebmodes) specifies that empirical Bayes modes be used as the estimates of the latent variables. These estimates are also known as posterior mode estimates of the latent variables.

    conditional(fixedonly) specifies that all latent variables be set to zero, equivalent to using only the fixed portion of the model.

  marginal specifies that the predicted *statistic* be computed marginally with respect to the latent variables, which means that *statistic* is calculated by integrating the prediction function with respect to all the latent variables over their entire support.

Although this is not the default, marginal predictions are often very useful in applied analysis. They produce what are commonly called population-averaged estimates.

latent specifies that the latent trait is predicted using an empirical Bayes estimator; see options ebmeans and ebmodes.

ebmeans specifies that empirical Bayes means are used to predict the latent variables.

ebmodes specifies that empirical Bayes modes are used to predict the latent variables.

se(*newvar*) calculates standard errors of the empirical Bayes estimator and stores the result in *newvar*. This option requires the latent option.

scores calculates the scores for each coefficient in e(b). This option requires a new variable list of the length equal to the number of columns in e(b). Otherwise, use *stub** to have predict generate enumerated variables with prefix *stub*.

                    ┌─────────────┐
──────────────────── Integration └───

intpoints(#) specifies the number of quadrature points used to compute marginal predictions and the empirical Bayes means; the default is the value from estimation.

iterate(#) specifies the maximum number of iterations when computing statistics involving empirical Bayes estimators; the default is the value from estimation.

tolerance(#) specifies convergence tolerance when computing statistics involving empirical Bayes estimators; the default is the value from estimation.

Methods and formulas

Empirical Bayes predictions of the latent trait are documented in *Methods and formulas* of [IRT] **irt hybrid postestimation**.

This section builds on the notation introduced in *Methods and formulas* of [IRT] **irt nrm**.

By default, or when the marginal option is specified, the predicted probability for item i, person j, and outcome k is computed as

$$\widehat{p}_{ijk} = \int_{-\infty}^{\infty} \Pr(Y_{ij} = k | \widehat{\boldsymbol{\alpha}}_i, \widehat{\boldsymbol{\beta}}_i, \theta_j) \phi(\theta_j) \, d\theta_j$$

where $\widehat{\boldsymbol{\alpha}}_i$ and $\widehat{\boldsymbol{\beta}}_i$ are the estimated parameters in the slope-intercept parameterization. The integral is approximated using standard Gauss–Hermite quadrature.

In what follows, we show formulas using the posterior means estimates of latent trait $\widetilde{\theta}_j$, which are computed by default or when the conditional(ebmeans) option is specified. If the conditional(ebmodes) option is specified, $\widetilde{\theta}_j$ are simply replaced with the posterior modes $\widetilde{\widetilde{\theta}}_j$ in these formulas.

For the response to item i from person j, the linear predictor is computed as

$$\widehat{z}_{ijk} = \widehat{\alpha}_{ik} \widetilde{\theta}_j + \widehat{\beta}_{ik}$$

If option marginal or conditional(fixedonly) is specified, the linear predictor is computed as

$$\widehat{z}_{ijk} = \widehat{\beta}_{ik}$$

The predicted probability, conditional on the predicted latent trait, is

$$\widehat{p}_{ijk} = \Pr(Y_{ij} = k | \widehat{\boldsymbol{\alpha}}_i, \widehat{\boldsymbol{\beta}}_i, \widetilde{\theta}_j)$$

Also see