

## Postestimation commands

The following postestimation commands are available after `xtfrontier`:

Command	Description
<code>contrast</code>	contrasts and ANOVA-style joint tests of parameters
<code>estat ic</code>	Akaike's, consistent Akaike's, corrected Akaike's, and Schwarz's Bayesian information criteria (AIC, CAIC, AICc, and BIC, respectively)
<code>estat summarize</code>	summary statistics for the estimation sample
<code>estat vce</code>	variance–covariance matrix of the estimators (VCE)
<code>estimates</code>	cataloging estimation results
<code>etable</code>	table of estimation results
<code>forecast</code>	dynamic forecasts and simulations
<code>hausman</code>	Hausman's specification test
<code>lincom</code>	point estimates, standard errors, testing, and inference for linear combinations of parameters
<code>lrtest</code>	likelihood-ratio test
<code>margins</code>	marginal means, predictive margins, marginal effects, and average marginal effects
<code>marginsplot</code>	graph the results from margins (profile plots, interaction plots, etc.)
<code>nlcom</code>	point estimates, standard errors, testing, and inference for nonlinear combinations of parameters
<code>predict</code>	linear predictions and their SEs, technical efficiency
<code>predictnl</code>	point estimates, standard errors, testing, and inference for generalized predictions
<code>pwcompare</code>	pairwise comparisons of parameters
<code>test</code>	Wald tests of simple and composite linear hypotheses
<code>testnl</code>	Wald tests of nonlinear hypotheses

# predict

## Description for predict

predict creates a new variable containing predictions such as linear predictions, standard errors, and technical efficiencies.

## Menu for predict

Statistics > Postestimation

## Syntax for predict

```
predict [type] newvar [if] [in] [ , statistic]
```

statistic	Description
Main	
xb	linear prediction; the default
stdp	standard error of the linear prediction
u	minus the natural log of the technical efficiency via $E(u_{it} \mid \epsilon_{it})$
m	minus the natural log of the technical efficiency via $M(u_{it} \mid \epsilon_{it})$
te	the technical efficiency via $E\{\exp(-su_{it}) \mid \epsilon_{it}\}$

where

$$s = \begin{cases} 1, & \text{for production functions} \\ -1, & \text{for cost functions} \end{cases}$$

## Options for predict

Main

- xb, the default, calculates the linear prediction.
- stdp calculates the standard error of the linear prediction.
- u produces estimates of minus the natural log of the technical efficiency via  $E(u_{it} \mid \epsilon_{it})$ .
- m produces estimates of minus the natural log of the technical efficiency via the mode,  $M(u_{it} \mid \epsilon_{it})$ .
- te produces estimates of the technical efficiency via  $E\{\exp(-su_{it}) \mid \epsilon_{it}\}$ .

# margins

## Description for margins

margins estimates margins of response for linear predictions.

## Menu for margins

Statistics > Postestimation

## Syntax for margins

```
margins [marginlist] [ , options ]
margins [marginlist] , predict(statistic ...) [options]
```

statistic	Description
xb	linear prediction; the default
stdp	not allowed with margins
u	not allowed with margins
m	not allowed with margins
te	not allowed with margins

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

For the full syntax, see [R] margins.

## Remarks and examples

### ► Example 1

A production function exhibits *constant returns to scale* if doubling the amount of each input results in a doubling in the quantity produced. When the production function is linear in logs, constant returns to scale implies that the sum of the coefficients on the inputs is one. In [example 2](#) of [\[XT\] xtfrontier](#), we fit a time-varying decay model. Here we test whether the estimated production function exhibits constant returns:

```
. use https://www.stata-press.com/data/r19/xtfrontier1
. xtfrontier lnwidgets lnmachines lnworkers, tvd
(output omitted)
. test lnmachines + lnworkers = 1
( 1) [lnwidgets]lnmachines + [lnwidgets]lnworkers = 1
      chi2( 1) = 331.55
      Prob > chi2 = 0.0000
```

The test statistic is highly significant, so we reject the null hypothesis and conclude that this production function does not exhibit constant returns to scale.

The previous Wald  $\chi^2$  test indicated that the sum of the coefficients does not equal one. An alternative is to use `lincom` to compute the sum explicitly:

```
. lincom lnmachines + lnworkers
( 1)  [lnwidgets]lnmachines + [lnwidgets]lnworkers = 0
```

lnwidgets	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
(1)	.5849967	.0227918	25.67	0.000	.5403256	.6296677

The sum of the coefficients is significantly less than one, so this production function exhibits *decreasing returns to scale*. If we doubled the number of machines and workers, we would obtain less than twice as much output.

◀

## Methods and formulas

Continuing from the [Methods and formulas](#) section of [XT] **xtfrontier**, estimates for  $u_{it}$  can be obtained from the mean or the mode of the conditional distribution  $f(u|\epsilon)$ .

$$E(u_{it} | \epsilon_{it}) = \tilde{\mu}_i + \tilde{\sigma}_i \left\{ \frac{\phi(-\tilde{\mu}_i/\tilde{\sigma}_i)}{1 - \Phi(-\tilde{\mu}_i/\tilde{\sigma}_i)} \right\}$$

$$M(u_{it} | \epsilon_{it}) = \begin{cases} -\tilde{\mu}_i, & \text{if } \tilde{\mu}_i \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

where

$$\tilde{\mu}_i = \frac{\mu\sigma_v^2 - s \sum_{t=1}^{T_i} \eta_{it} \epsilon_{it} \sigma_u^2}{\sigma_v^2 + \sum_{t=1}^{T_i} \eta_{it}^2 \sigma_u^2}$$

$$\tilde{\sigma}_i^2 = \frac{\sigma_v^2 \sigma_u^2}{\sigma_v^2 + \sum_{t=1}^{T_i} \eta_{it}^2 \sigma_u^2}$$

These estimates can be obtained from `predict newvar, u` and `predict newvar, m`, respectively, and are calculated by plugging in the estimated parameters.

`predict newvar, te` produces estimates of the technical-efficiency term. These estimates are obtained from

$$E\{\exp(-su_{it}) | \epsilon_{it}\} = \left[ \frac{1 - \Phi\{s\eta_{it}\tilde{\sigma}_i - (\tilde{\mu}_i/\tilde{\sigma}_i)\}}{1 - \Phi(-\tilde{\mu}_i/\tilde{\sigma}_i)} \right] \exp\left(-s\eta_{it}\tilde{\mu}_i + \frac{1}{2}\eta_{it}^2\tilde{\sigma}_i^2\right)$$

Replacing  $\eta_{it} = 1$  and  $\eta = 0$  in these formulas produces the formulas for the time-invariant models.

## Also see

[XT] [xtfrontier](#) — Stochastic frontier models for panel data

[U] [20 Estimation and postestimation commands](#)

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