Title

xtfrontier postestimation — Postestimation tools for xtfrontier

Postestimation commands

The following postestimation commands are available after `xtfrontier`:

Command	Description
contrast	contrasts and ANOVA-style joint tests of estimates
estat ic	Akaike's, consistent Akaike's, corrected Akaike's, and Schwarz's Bayesian information criteria (AIC, CAIC, AICc, and BIC)
estat summarize	summary statistics for the estimation sample
estat vce	variance–covariance matrix of the estimators (VCE)
estimates	cataloging estimation results
etable	table of estimation results
forecast	dynamic forecasts and simulations
hausman	Hausman's specification test
lincom	point estimates, standard errors, testing, and inference for linear combinations of coefficients
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 combinations of coefficients
predict	linear predictions and their SEs, technical efficiency
predictnl	point estimates, standard errors, testing, and inference for generalized predictions
pwcompare	pairwise comparisons of estimates
test	Wald tests of simple and composite linear hypotheses
testnl	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 $E\left(u_{it} \mid \epsilon_{it}\right)$
m	minus the natural log of the technical efficiency via $M\left(u_{it} \mid \epsilon_{it}\right)$
te	the technical efficiency via $E\left\{\exp(-su_{it}) \mid \epsilon_{it}\right\}$

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 $E\left(u_{it} \mid \epsilon_{it}\right)$.

m produces estimates of minus the natural log of the technical efficiency via the mode, $M\left(u_{it} \mid \epsilon_{it}\right)$.

te produces estimates of the technical efficiency via $E\left\{\exp(-su_{it}) \mid \epsilon_{it}\right\}$.

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

stata.com

▷ 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/r18/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 χ^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 $f(u|\epsilon)$.

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

$$M\left(u_{it} \mid \epsilon_{it}\right) = \begin{cases} -\widetilde{\mu}_i, & \text{if } \widetilde{\mu}_i >= 0 \\ 0, & \text{otherwise} \end{cases}$$

where

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

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

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

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

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