xtdpd postestimation — Postestimation tools for xtdpd

Description

The following postestimation commands are of special interest after `xtdpd`:

Command	Description
`estat abond`	test for autocorrelation
`estat sargan`	Sargan test of overidentifying restrictions

The following standard postestimation commands are also available:

Command	Description
`estat summarize`	summary statistics for the estimation sample
`estat vce`	variance–covariance matrix of the estimators (VCE)
`estimates`	cataloging estimation results
`forecast`	dynamic forecasts and simulations
`lincom`	point estimates, standard errors, testing, and inference for linear combinations of coefficients
`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`	predictions, residuals, influence statistics, and other diagnostic measures
`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

Special-interest postestimation commands

`estat abond` reports the Arellano–Bond test for serial correlation in the first-differenced residuals.

`estat sargan` reports the Sargan test of the overidentifying restrictions.

Syntax for predict

`predict [type] newvar [if] [in] [, xb e stdp difference]`

Menu for predict

Statistics > Postestimation > Predictions, residuals, etc.

Options for predict

Main

xb, the default, calculates the linear prediction.

e calculates the residual error.

stdp calculates the standard error of the prediction, which can be thought of as the standard error of the predicted expected value or mean for the observation's covariate pattern. The standard error of the prediction is also referred to as the standard error of the fitted value. stdp may not be combined with difference.

difference specifies that the statistic be calculated for the first differences instead of the levels, the default.

Syntax for estat

Test for autocorrelation

`estat abond [, artests(#)]`

Sargan test of overidentifying restrictions

`estat sargan`

Menu for estat

Statistics > Postestimation > Reports and statistics

Option for estat abond

artests(*#*) specifies highest order of serial correlation to be tested. By default, the tests computed during estimation are reported. The model will be refit when artests(*#*) specifies a higher order than that computed during the original estimation. The model can only be refit if the data have not changed.

Remarks and examples

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Remarks are presented under the following headings:

estat abond
estat sargan

estat abond

The moment conditions used by `xtdpd` are valid only if there is no serial correlation in the idiosyncratic errors. Testing for serial correlation in dynamic panel-data models is tricky because one needs to apply a transform to remove the panel-level effects, but the transformed errors have a more complicated error structure than the idiosyncratic errors. The Arellano–Bond test for serial correlation reported by `estat abond` tests for serial correlation in the first-differenced errors.

Because the first difference of independently and identically distributed idiosyncratic errors will be autocorrelated, rejecting the null hypothesis of no serial correlation at order one in the first-differenced errors does not imply that the model is misspecified. Rejecting the null hypothesis at higher orders implies that the moment conditions are not valid. See example 5 in [XT] **xtdpd** for an alternative estimator that allows for idiosyncratic errors that follow a first-order moving average process.

After the one-step system estimator, the test can be computed only when `vce(robust)` has been specified.

estat sargan

Like all GMM estimators, the estimator in `xtdpd` can produce consistent estimates only if the moment conditions used are valid. Although there is no method to test if the moment conditions from an exactly identified model are valid, one can test whether the overidentifying moment conditions are valid. `estat sargan` implements the Sargan test of overidentifying conditions discussed in Arellano and Bond (1991).

Only for a homoskedastic error term does the Sargan test have an asymptotic chi-squared distribution. In fact, Arellano and Bond (1991) show that the one-step Sargan test overrejects in the presence of heteroskedasticity. Because its asymptotic distribution is not known under the assumptions of the `vce(robust)` model, `xtdpd` does not compute it when `vce(robust)` is specified.

Methods and formulas

The notation for $\widehat{\boldsymbol{\epsilon}}^*_{1i}$, $\widehat{\boldsymbol{\epsilon}}_{1i}$, $\mathbf{H}_{1i}$, $\mathbf{H}_{2i}$, $\mathbf{X}_i$, $\mathbf{Z}_i$, $\mathbf{W}_1$, $\mathbf{W}_2$, $\widehat{\mathbf{V}}_*[\widehat{\boldsymbol{\beta}}_*]$, $\mathbf{A}_1$, $\mathbf{A}_2$, $\mathbf{Q}_{xz}$, and $\widehat{\sigma}^2_1$ has been defined in *Methods and formulas* of [XT] **xtdpd**.

The Arellano–Bond test for zero mth-order autocorrelation in the first-differenced errors is given by

$$A(m) = \frac{s_0}{\sqrt{s_1 + s_2 + s_3}}$$

where the definitions of s_0, s_1, s_2, and s_3 vary over the estimators and transforms.

We begin by defining $\widehat{\mathbf{u}}^*_{1i} = \mathrm{L}m.\widehat{\boldsymbol{\epsilon}}^*_{1i}$, with the missing values filled in with zeros. Letting $j = 1$ for the one-step estimator, $j = 2$ for the two-step estimator, $c =$ GMM for the GMM VCE estimator, and $c =$ robust for the robust VCE estimator, we can now define s_0, s_1, s_2, and s_3:

$$s_0 = \sum_i \widehat{\mathbf{u}}^{*\prime}_{ji} \widehat{\boldsymbol{\epsilon}}^*_{ji}$$

$$s_1 = \sum_i \widehat{\mathbf{u}}^{*\prime}_{ji} \mathbf{H}_{ji} \widehat{\mathbf{u}}^*_{ji}$$

$$s_2 = -2\mathbf{q}_{ji} \mathbf{W}_j^{-1} \mathbf{Q}_{xz} \mathbf{A}_j \mathbf{Q}_{zu}$$

$$s_3 = \mathbf{q}_{jx} \widehat{\mathbf{V}}_c \left[\widehat{\boldsymbol{\beta}}_j \right] \mathbf{q}'_{jx}$$

where

$$\mathbf{q}_{jx} = \left(\sum_i \widehat{\mathbf{u}}^{*\prime}_{ji} \mathbf{X}_i \right)$$

and $\mathbf{Q}_{zu}$ varies over estimator and transform.

For the Arellano–Bond estimator with the first-differenced transform,

$$\mathbf{Q}_{zu} = \left(\sum_i \mathbf{Z}'_i \mathbf{H}_{ji} \widehat{\mathbf{u}}^{*}_{ji} \right)$$

For the Arellano–Bond estimator with the FOD transform,

$$\mathbf{Q}_{zu} = \left(\sum_i \mathbf{Z}'_i \mathbf{Q}_{\mathrm{fod}} \right)$$

where

$$\mathbf{Q}_{\mathrm{fod}} = \begin{pmatrix} -\sqrt{\frac{T_i+1}{T_i}} & 0 & \cdots & 0 \\ \sqrt{\frac{T_i-1}{T_i}} & \sqrt{\frac{T_i}{T_i-1}} & \cdots & 0 \\ 0 & & \ddots & \vdots \\ 0 & \cdots & \sqrt{\frac{1}{2}} & -\sqrt{\frac{2}{1}} \end{pmatrix} \widehat{\mathbf{u}}^{*}_{ji}$$

and * implies the first-differenced transform instead of the FOD transform.

For the Arellano–Bover/Blundell–Bond system estimator with the first-differenced transform,

$$\mathbf{Q}_{zu} = \left(\sum_i \mathbf{Z}'_i \widehat{\boldsymbol{\epsilon}}_{ji} \widehat{\boldsymbol{\epsilon}}^{*\prime}_{ji} \widehat{\mathbf{u}}^{*}_{ji} \right)$$

After a one-step estimator, the Sargan test is

$$S_1 = \frac{1}{\widehat{\sigma}_1^2}\left(\sum_i \widehat{\boldsymbol{\epsilon}}'_{1i}\mathbf{Z}_i\right)\mathbf{A}_1\left(\sum_i \mathbf{Z}'_i\widehat{\boldsymbol{\epsilon}}_{1i}\right)$$

The transformed two-step residuals are given by

$$\widehat{\boldsymbol{\epsilon}}^*_{2i} = \mathbf{y}^*_i - \widehat{\boldsymbol{\beta}}_2\mathbf{X}^*_i$$

and the level two-step residuals are given by

$$\widehat{\boldsymbol{\epsilon}}^L_{2i} = \mathbf{y}^L_i - \widehat{\boldsymbol{\beta}}_2\mathbf{X}^L_i$$

Stacking the residual vectors yields

$$\widehat{\boldsymbol{\epsilon}}_{2i} = \begin{pmatrix}\widehat{\boldsymbol{\epsilon}}^*_{2i}\\ \widehat{\boldsymbol{\epsilon}}^L_{2i}\end{pmatrix}$$

After a two-step estimator, the Sargan test is

$$S_2 = \left(\sum_i \widehat{\boldsymbol{\epsilon}}'_{2i}\mathbf{Z}_i\right)\mathbf{A}_2\left(\sum_i \mathbf{Z}'_i\widehat{\boldsymbol{\epsilon}}_{2i}\right)$$

Reference

Arellano, M., and S. Bond. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58: 277–297.

Also see

[XT] **xtdpd** — Linear dynamic panel-data estimation

[U] **20 Estimation and postestimation commands**