xtdata — Faster specification searches with xt data

Description

xtdata produces a transformed dataset of the variables specified in varlist or of all the variables in the data. Once the data are transformed, Stata’s regress command may be used to perform specification searches more quickly than xtreg; see [R] regress and [XT] xtreg. Using xtdata, re also creates a variable named constant. When using regress after xtdata, re, specify noconstant and include constant in the regression. After xtdata, be and xtdata, fe, you need not include constant or specify regress’s noconstant option.

Quick start

Convert data to a form suitable for random-effects estimation using xtset data
   xtdata, re

As above, but convert only variables v1, v2 and v3
   xtdata v1 v2 v3, re

Convert all variables beginning with prefix to a form suitable for fixed-effects estimation
   xtdata prefix*, fe

Convert data for between estimation if the dataset has changed since last save
   xtdata, be clear

Menu

Statistics  >  Longitudinal/panel data  >  Setup and utilities  >  Faster specification searches with xt data
Syntax

```
xtdata [varlist] [if] [in] [ , options ]
```

<table>
<thead>
<tr>
<th>options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main</strong></td>
<td></td>
</tr>
<tr>
<td><code>re</code></td>
<td>convert data to a form suitable for random-effects estimation</td>
</tr>
<tr>
<td><code>ratio(#)</code></td>
<td>ratio of random effect to pure residual (standard deviations)</td>
</tr>
<tr>
<td><code>be</code></td>
<td>convert data to a form suitable for between estimation</td>
</tr>
<tr>
<td><code>fe</code></td>
<td>convert data to a form suitable for fixed-effects (within) estimation</td>
</tr>
<tr>
<td><code>nodouble</code></td>
<td>keep original variable type; default is to recast type as double</td>
</tr>
<tr>
<td><code>clear</code></td>
<td>overwrite current data in memory</td>
</tr>
</tbody>
</table>

A panel variable must be specified; use `xtset`; see [XT] `xtset`.

**Options**

`re` specifies that the data be converted into a form suitable for random-effects estimation. `re` is the default if `be`, `fe`, or `re` is not specified. `ratio()` must also be specified.

`ratio(#)` (use with `xtdata, re` only) specifies the ratio \( \frac{\sigma_v}{\sigma_\epsilon} \), which is the ratio of the random effect to the pure residual. This is the ratio of the standard deviations, not the variances.

`be` specifies that the data be converted into a form suitable for between estimation.

`fe` specifies that the data be converted into a form suitable for fixed-effects (within) estimation.

`nodouble` specifies that transformed variables keep their original types, if possible. The default is to recast variables to `double`.

Remember that `xtdata` transforms variables to be differences from group means, pseudodifferences from group means, or group means. Specifying `nodouble` will decrease the size of the resulting dataset but may introduce roundoff errors in these calculations.

`clear` specifies that the data may be converted even though the dataset has changed since it was last saved on disk.

**Remarks and examples**

If you have not read [XT] `xt` and [XT] `xtreg`, please do so.

The formal estimation commands of `xtreg`—see [XT] `xtreg`—do not produce results instantaneously, especially with large datasets. Equations (2), (3), and (4) of [XT] `xtreg` describe the data necessary to fit each of the models with OLS. The idea here is to transform the data once to the appropriate form and then use `regress` to fit such models more quickly.

**Example 1**

We will use the example in [XT] `xtreg` demonstrating between-effects regression. Another way to estimate the between equation is to convert the data in memory to the between data:
. use https://www.stata-press.com/data/r16/nlswork
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
. generate age2=age^2
(24 missing values generated)
. generate ttl_exp2 = ttl_exp^2
. generate tenure2=tenure^2
(433 missing values generated)
. generate byte black = race==2
. xtdata ln_w grade age* ttl_exp* tenure* black not_smsa south, be clear
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south

Source | SS df MS Number of obs = 4,697
--------+---------------------------------------------
Model | 415.021613 10 41.5021613 Prob > F = 0.0000
Residual | 431.954995 4,686 .092179896 R-squared = 0.4900
--------+---------------------------------------------
Total | 846.976608 4,696 .180361288 Root MSE = .30361

| ln_wage | Coef.     | Std. Err. | t     | P>|t| | [95% Conf. Interval] |
--------+----------+-----------+-------+-------+---------------------|
grade   | .0607602 | .0020006  | 30.37 | 0.000 | .0568382 -.0646822 |
age     | .0323158 | .0087251  | 3.70  | 0.000 | .0152105 -.0494211 |
age2    | -.0005997| .0001429  | -4.20 | 0.000 | -.0008799 -.0003194|
south   | -.0993378| .010136   | -9.80 | 0.000 | -.1192091 -.0794665|
_cons   | .3339113 | .1210434  | 2.76  | 0.006 | .0966093 .5712133  |

The output is the same as that produced by `xtreg`, `be`; the reported $R^2$ is the $R^2$ between. Using `xtdata` followed by just one `regress` does not save time. Using `xtdata` is justified when you intend to explore the specification of the model by running many alternative regressions.

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## Technical note

When using `xtdata`, you must eliminate any variables that you do not intend to use and that have missing values. `xtdata` follows a casewise-deletion rule, which means that an observation is excluded from the conversion if it is missing on any of the variables. In the example above, we specified that the variables be converted on the command line. We could also drop the variables first, and it might even be useful to preserve our estimation sample:

. use https://www.stata-press.com/data/r16/nlswork, clear
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
. generate age2=age^2
(24 missing values generated)
. generate ttl_exp2 = ttl_exp^2
. generate tenure2=tenure^2
(433 missing values generated)
. generate byte black = race==2
. keep id year ln_w grade age* ttl_exp* tenure* black not_smsa south
. save xtdatasmpl
file xtdatasmpl.dta saved

---


Example 2

`xtdata` with the `fe` option converts the data so that results are equivalent to those from estimating by using `xtreg` with the `fe` option.

```
. xtdta, fe
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south
```  

```
Note: grade omitted because of collinearity
Note: black omitted because of collinearity

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 28,091</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>412.44381</td>
<td>8</td>
<td>51.5554852</td>
<td>F(8, 28082) = 732.64</td>
</tr>
<tr>
<td>Residual</td>
<td>1976.12232</td>
<td>28,082</td>
<td>.070369714</td>
<td>Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td>Total</td>
<td>2388.5662</td>
<td>28,090</td>
<td>.085032617</td>
<td>R-squared = 0.1724</td>
</tr>
</tbody>
</table>

| ln_wage      | Coef.       | Std. Err. | t   | P>|t| | [95% Conf. Interval] |
|--------------|-------------|------------|-----|---|---|---------------------|
| grade        | 0 (omitted) |            |     |   |   |                     |
| age          | .0359987    | .0030903   | 11.65 | 0.000 | .0299415 | .0420558 |
| age2         | -.000723    | .0000486   | -14.88 | 0.000 | -.0008183 | -.0006277 |
| ttl_exp      | .0334668    | .0027061   | 12.37 | 0.000 | .0281627 | .0387708 |
| ttl_exp2     | .0002163    | .0001166   | 1.86  | 0.064 | -.0000122 | .0004447 |
| tenure       | .0357539    | .0016871   | 21.19 | 0.000 | .0324472 | .0390606 |
| tenure2      | -.0019701   | .0001141   | -17.27 | 0.000 | -.0021937 | -.0017465 |
| black        | 0 (omitted) |            |     |   |   |                     |
| not_smsa     | -.0890108   | .0086982   | -10.23 | 0.000 | -.1060597 | -.0719619 |
| south        | -.0606309   | .0099761   | -6.08  | 0.000 | -.0801845 | -.0410772 |
| _cons        | 1.03732     | .0443093   | 23.41 | 0.000 | .9504716 | 1.124168 |

The coefficients reported by `regress` after `xtdata, fe` are the same as those reported by `xtreg, fe`, but the standard errors are slightly smaller. This is because no adjustment has been made to the estimated covariance matrix for the estimation of the person means. The difference is small, however, and results are adequate for a specification search.

Example 3

To use `xtdata, re`, you must specify the ratio \( \frac{\sigma_v}{\sigma_\epsilon} \), which is the ratio of the standard deviations of the random effect and pure residual. Merely to show the relationship of `regress` after `xtdata, re` to `xtreg, re`, we will specify this ratio as \( \frac{0.25790526}{0.29068923} = 0.88721987 \), which is the number `xtreg` reports when the model is fit from the outset; see the random-effects example in [XT] `xtreg`. For specification searches, however, it is adequate to specify this number more crudely, and, when performing the specification search for this manual entry, we used `ratio(1)`.

```
. use https://www.stata-press.com/data/r16/xtdatasmpl, clear
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
. xtdta, clear re ratio(.88721987)
```

<table>
<thead>
<tr>
<th>theta</th>
<th>min</th>
<th>5%</th>
<th>median</th>
<th>95%</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.2520</td>
<td>0.2520</td>
<td>0.5499</td>
<td>0.7016</td>
<td>0.7206</td>
</tr>
</tbody>
</table>

`xtdata` reports the distribution of \( \theta \) based on the specified ratio. If these were balanced data, \( \theta \) would have been constant.
When running regressions with these data, you must specify the `noconstant` option and include the variable `constant`:

```
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south constant, >  noconstant
```

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 28,091</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>13271.7208</td>
<td>11</td>
<td>1206.52007</td>
<td>F(11, 28080) = 14302.56</td>
</tr>
<tr>
<td>Residual</td>
<td>2368.74223</td>
<td>28,080</td>
<td>.084356917</td>
<td>R-squared = 0.8486</td>
</tr>
<tr>
<td>Total</td>
<td>15640.463</td>
<td>28,091</td>
<td>.556778435</td>
<td>Adj R-squared = 0.8485</td>
</tr>
</tbody>
</table>

Results are the same coefficients and standard errors that `xtreg, re` estimated in example 4 of [XT] `xtreg`. The summaries at the top, however, should be ignored, as they are expressed in terms of (4) of [XT] `xtreg`, and, moreover, for a model without a constant.

#### Technical note

Using `xtdata` requires some caution. The following guidelines may help:

1. `xtdata` is intended for use only during the specification search phase of analysis. Results should be estimated with `xtreg` on unconverted data.

2. After converting the data, you may use `regress` to obtain estimates of the coefficients and their standard errors. For `regress` after `xtdata, fe`, the standard errors are too small, but only slightly.

3. You may loosely interpret the coefficient’s significance tests and confidence intervals. However, for results after `xtdata, fe` and `re`, an incorrect (but close to correct) distribution is assumed.

4. You should ignore the summary statistics reported at the top of `regress`'s output.

5. After converting the data, you may form linear, but not nonlinear, combinations of regressors; that is, if your data contained `age`, it would not be correct to convert the data and then form `age` squared. All nonlinear transformations should be done before conversion. (For `xtdata, be`, you can get away with forming nonlinear combinations ex post, but the results will not be exact.)
Technical note

The `xtdata` command can be used to help you examine data, especially with `scatter`.

```
use https://www.stata-press.com/data/r16/xtdatasmpl, clear
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
xtdata, be
scatter ln_wage age, title(Between data) msymbol(o) msize(tiny)
```

```
use https://www.stata-press.com/data/r16/xtdatasmpl, clear
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
xtdata, fe
.scatter ln_wage age, title(Within data) msymbol(o) msize(tiny)
```
. use https://www.stata-press.com/data/r16/xtdatasmpl, clear
(National Longitudinal Survey. Young Women 14-26 years of age in 1968)
. scatter ln_wage age, title(Overall data) msymbol(o) msize(tiny)

![Overall data graph]

**Methods and formulas**

(This section is a continuation of the *Methods and formulas* of [XT] *xtreg.*)

`xtdata`, *be*, *fe*, and *re* transform the data according to (2), (3), and (4), respectively, of [XT] *xtreg*, except that `xtdata, fe` adds back in the overall mean, thus forming the transformation

\[ x_{it} - x_i + \bar{x} \]

`xtdata, re` requires the user to specify *r* as an estimate of \( \sigma_\nu/\sigma_\epsilon \). \( \theta_i \) is calculated from

\[ \theta_i = 1 - \frac{1}{\sqrt{T_i r^2 + 1}} \]

**Also see**

[XT] *xtsum* — Summarize xt data